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BRALORNE RESOURCES LTD.

EXPLORATION POTENTIAL

BRALORNE PIONEER MINES

Bridge River, B. C.

February 1, 1973

Douglas D. Campbell Consultant Vancouver, Canada

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SUMMARY & RECOMMENDATIONS

The price of gold has increased from $35 (U.S.) per ounce to $65/oz. since the Bralorne gold mine in the Bridge River district was closed. At the time of closing there was a reserve of about 1 million tons of marginal ore left in the mine. Scattered, as it is, throughout the mine this reserve is not economic even at the increased price for gold; however, if it could be combined with a large reserve of entirely new ore, with the potential for finding continuing reserves, in the mine the increased price of gold could render the reserves profitable and warrant reopening the mine.

This report discusses the geological possibilities for the existence in the Bralorne mines of unmined and/or unknown major tonnages of gold-quartz (vein) ore. It is concluded that there are excellent possibilities for such ore below the Bralorne 20th Level but the cost of rehabilitating the mine and exploring the target areas is prohibitive at this time. It is also concluded that there are fairly good possibilities for finding such ore on and above the Bralorne 8th Level. Since the 8th Level is readily accessible the exploration costs will be reasonable, therefore a program of underground diamond drill exploration for new gold ore is recommended for that level.

The drill targets are in three areas of favourable geology where, if quartz veins do occur within them, gold orebodies may have been formed in accordance with the controls exhibited in the rest of the mine. Each of the three areas is large enough to provide major tonnages of vein ore should it occur in them.

RECOMMENDATIONS:

The writer has recommended a minimum diamond drill program consisting of 12 preliminary holes totalling 12,100 feet to explore for the possible ore that may exist in the three target areas on the 8th Level. All holes are designed to probe specific major areas therefore no part of the program can be considered to be contingent on results from other parts.

The total cost of the above program is estimated to be $130,000.00; however, items related to the rehabilitation of the mine and the provision of

Rec. 12000' DD
@ 130,000
8th level

services to it must be resolved before a final budget can be compiled. A stage of follow-up drilling, to check encouraging results of the first holes, is estimated to cost $ 65,000.00, but its implementation will be contingent on the results of the first stage.

Comparison of the geological settings of the known orebodies in the mines with those existing in the drill target areas suggests that the recommended program has a better than even chance of success.

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INTRODUCTION

Since the Bralorne Mine ceased production of gold ore about two years ago the price of gold has increased from $35.00 (U.S.) per ounce to the present $65.00, and in 1972 reached a high of $70.00. It is likely that the price will remain as high as the present levels and there is a possibility that it may eventually increase to $75.00 (U.S.) or $100.00 (U.S.) per ounce.

When the Bralorne Mine closed down there was a listed reserve of about one million tons of (then) marginal ore remaining in various parts of the mine. It is doubtful if this ore will ever be profitable to recover even at a price of $100 per ton for gold because it will require the rehabilitation of the entire mine and mill plants as well as many widely separated parts of the mine. However, if a potential reserve of several years of entirely new ore could be found in the mine area to supplement the existing remnant ore then a profitable mining operation may once more be possible at Bralorne.

The writer was engaged by the president of Bralorne Resources Ltd., Mr. F. W. Fitzpatrick, to conduct a study of the Bralorne-Pioneer maps and records to determine the following:

1/ Are there any places in the mine area wherein the possibility of major reserves of undiscovered ore exists?

2/ Is it possible to explore any of such targets without major expenditures in mine rehabilitation?

and 3/ What would be the nature, cost and approximate chances of success of such an exploration program?

This report records the results of the above assignment.

As background for the present study the writer made a similar analysis of the "Ore Potential" of the Bralorne-Pioneer mines in 1964, when the Bralorne Mine was in full production. The objective of that study was to determine the most promising areas for exploration within the mine area at that time. Most of the recommended targets in 1964 were relatively close to the

to the operating workings in the mid-lower levels of the mine. The present study has concentrated more on shallow than deep targets since they would be the easiest to explore and develop at this time.

In 1964 the writer examined most of the then current operating workings in the Bralorne mine as well as many surface exposures and surrounding properties. In addition, all of the technical data at the mine was examined and the members of the geological staff were interviewed in extended discussions. For the present study the writer further examined the technical records at the Bralorne Mine office twice, in November, 1972, and in January, 1973, and prepared the report in Vancouver with selected data from the mine and the 1964 study.

In the present report the writer has briefly summarized the background geological data that was presented and discussed in considerable detail in the 1964 report. If clarification on any of the assumptions or recommendations presented here is desired it is suggested that the reader refer to the 1964 report.

ORE DEPOSITS

The only mineral deposits in the Cadwallader Creek area of the Bridge River district that have proven to be economic are the gold ore shoots in the quartz veins of the Bralorne and Pioneer mines. Mercury and tungsten deposits are widespread north of the Bridge River and in the Bralorne mine some attention was paid to tungsten recovery as a by-product during the war, however these occurrences are minor in value to the gold.

All of the quartz veins in the district are more or less sheared and/or closely fractured, also, many of them merge into shear zones and/or are cut off by unmineralized faults, therefore the final stages of mineralization by quartz was preceded and followed by movement along the fault and fracture systems that were themselves hosts to the mineralization. Generally speaking the "lean" or non-productive quartz veins are those which are essentially mineralized shears or fault zones, the productive quartz veins are those which are fillings of fractures that have been opened more by tension than by shear.

MINERALIZATION:

The vein mineralization in the Bridge River district is relatively simple, consisting mostly of white, dense, fine crystalline quartz with which are associated minor quantities of chlorite, carbonate, scheelite, mariposite, sulphides and altered wallrock. The foreign material in the quartz has locally been restricted to fine bands parallel to the vein walls. These bands are dark grey to black in colour and razor thin to as much as an inch in width and represent the concentration of later minerals along fracture planes within the earlier quartz. Generally there is a persistent fracture set along the dark bands. A less obvious but equally persistent fracture set within the quartz of the veins is a more or less flat one at right angles to the vein walls. A third, and still weaker, fracture set is a vertical one that is at right angles to the vein walls. It is obvious from these features that the quartz veins have been subjected to shear and tensile stresses subsequent to solidification and that these stresses have developed fine fractures in the quartz. Later or contemporaneous solutions have used these fractures when and where they were opened by relaxation of pressures and have introduced into them quartz, carbonate, sulphides and gold.

The commonest sulphides in the veins are pyrite and arsenopyrite. Free, visible gold is reasonably common in the ore sections and probably comprises the bulk of the ore material.

The gold tends to be concentrated along fractures in the quartz, either the dark banding fractures or the incipient cross features. The significance of this feature is that the introduction of the gold into the quartz was dependent on specific structural situations that were imposed on the solid veins at some particular time or times. From this knowledge it has been deduced that the orebodies occur in unique structural situations in certain places on certain veins, therefore if such situations can be duplicated in, as yet, undiscovered veins the ore potential of the mine area could possibly be increased sufficiently to warrant resumption of production.

GRADE:

In the Bralorne and Pioneer veins there is generally a sharp drop-off from appreciable (economic) gold values to nil or trace gold. There are generally fringes of marginal gold values around the edges of the orebodies but these are narrow when compared to the entire body and have themselves sharp cut-offs against barren quartz.

The general tenor of the mill feed ore in both mines has ranged between 0.50 and 1.0 oz/ton across an average 3-5 ft. width. Higher grade sections have been exploited as sweeteners and lower grade sections as tonnage fatteners.

The occurrences of reasonably definite and localized orebodies indicates that the emplacement of the gold into the quartz was controlled by rather rigid physico-chemical conditions that should be reflected in the structural nature of the veins.

SIZE:

As mentioned above, the average stoping widths have ranged from 3 to 5 feet; however, the widths of ore-mineralized veins have ranged from less than one foot to an excess of 20 feet, at local junctions and swellings. In horizontal lengths the orebodies have ranged from less than 100 feet

to as much as 1,200 feet. On the Pioneer 8th Level the merging of the Main orebody with the 27 orebody, separated by a barren section 100 feet in length, resulted in a more or less continuous ore section 1,600 feet in length. The major orebodies; Bralorne 77 and 79, Pioneer Main and 27, had considerable sections in excess of 700 feet in length; however the rest of the orebodies were generally less than 500 feet in length.

With no exceptions the 30 some odd known orebodies rake vertically to steeply to the northwest down veins that dip predominantly to the north and northeast. This rake is down toward the Cadwallader Shear, the western member of the Cadwallader Fault Zone, and suggests a rising of the ore solutions from that structure.

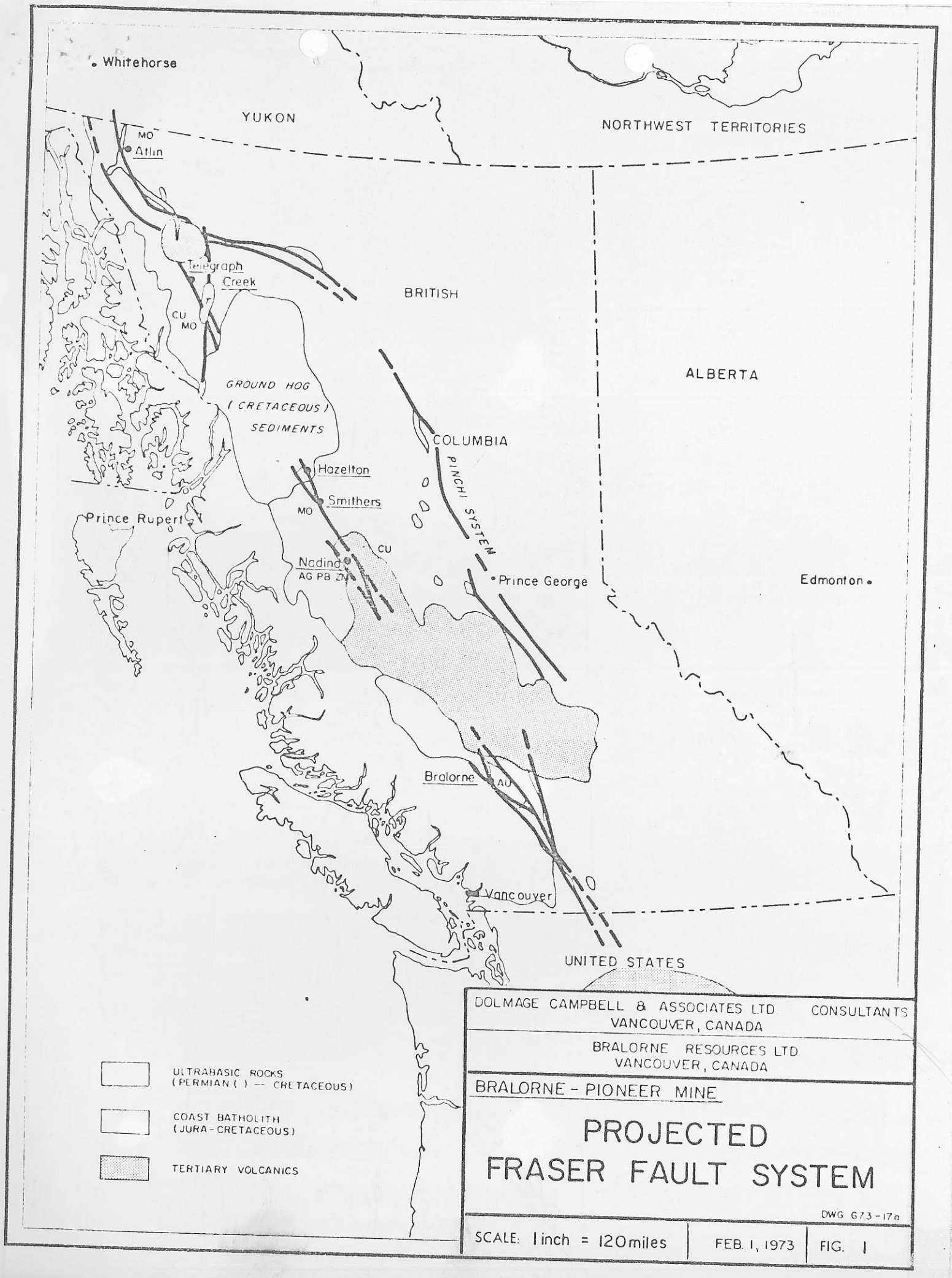
From the above-described characteristics of the Bralorne-Pioneer orebodies it is evident that the search for new orebodies by reconnaissance diamond drilling will be faced with the task of attempting to intersect:

1/ New veins, or wider or richer sections of known veins, in favourable structural locations.

2/ Orebodies that are relatively short in horizontal length within the veins.

3/ Gold that may be erratically distributed as free gold within the quartz vein and thus be missed by the diamond drill, yet be within an orebody.

Because of these factors it will be necessary to study each intersection of vein material carefully for width, nature and structure even though no gold may be present in the intersection. If all other geological features are encouraging but no gold is present such an intersection may still warrant the drilling of an additional check hole.



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BRALORNE - PIONEER MINE

PROJECTED FRASER FAULT SYSTEM

DWG G73-17a

SCALE: 1 inch = 120 miles | FEB. 1, 1973 | FIG. 1

GEOLOGICAL SETTING

REGIONAL STRUCTURE:

The Bridge River gold-quartz veins occur within or adjacent to a major, regional northwest-striking fault zone that trends along the eastern flank of the main body of the Coast Range Batholith. Immediately east of the Bralorne-Pioneer mines an outlying body of Coast Range granodiorite intrusive, approximately five miles in width and fifteen miles in length in a northwest direction, forms an eastern buttress to the belt of older rocks which are hosts to the ore deposits. The belt of older rocks lying between the granodiorite intrusive bodies is comprised of regionally faulted and locally contorted Mesozoic sedimentary and volcanic rocks. Along the regional fault zone these rocks have been intricately invaded and locally metamorphosed by a variety of small intrusive bodies which range in composition from granite to ultrabasic.

The regional fault structure that is the primary control for ore mineralization in this mining camp is the Cadwallader Fault Zone which is comprised of interlacing reverse, normal and strike faults that form an intricate pattern of structural failures in a belt up to two miles in width. Attendant to this major fault zone are numerous ancillary shears and branching tension fractures.

The Cadwallader Fault Zone is now believed to be the principal member of the Fraser Fault System which is becoming to be recognized as an ancient, crustal break that trends along the eastern flank of the Coast Range Batholith from Washington State north westward nearly to the Yukon, (Figure 1). The salient features of this continental fault structure are:

1/ A length of about 1000 miles and widths up to several miles.

2/ A history of repeated opening and displacements dating back at least to the Triassic Age (200 million years) and possibly earlier. The dominant displacement appears to be west side (Coast Ranges) up.

3/ A complex history of the intrusion of magmas into

and up this plumbing (fault) system to either be extruded on the surface as volcanic rocks on and along the fault zone or to be solidified within the zone as intrusive bodies.

4/ A persistent occurrence of economic mineral deposits along or near the fault system. Those discovered to date, from south to north include the following: Bralorne (gold), Goosly (copper), Nadina (copper, lead, zinc), Smithers (molybdenum), Hazelton (silver, lead) and Stikine (copper).

The remarkable depth persistence of the gold ore at Bralorne is probably related to the fact that the Cadwallader Fault System, as part of the Fraser Fault System, is a deep-seated crustal structure with a protracted history of reopening and invasion by intrusive rocks and mineralizing solutions.

DISTRICT STRUCTURE: (Figure 2)

The main structure of the Cadwallader Fault Zone is a fault zone ranging from 50 to 1,000 feet in width comprised of gouge-covered shear planes flanking and interlacing slickensided serpentine. This zone dips vertically to steeply to the west and southwest. Hangingwall branches from this shear zone are relatively uncommon but major and minor shears, faults and fractures are widespread on the footwall side for a width of a mile or more. The ultimate displacement along the Cadwallader zone is difficult to determine because the zone trends more or less parallel to the surrounding formations and also because the zone itself has been invaded by numerous irregular bodies of masking intrusive rocks. It would appear that the extensive development of serpentine in shears, and the steep dip of the zone as well as its complexity, particularly in the footwall, most strongly suggest that the zone represents a regional wrench fault on which local thrust and normal displacements have accommodated vertical adjustments.

The spatial coincidence of the Cadwallader Fault Zone and the belt of intrusive dioritic and ultrabasic bodies, plus fault exposures in the mines, indicate that the intrusives probably were introduced along an early regional fracture system which subsequently evolved into a major regional shear zone along which later breaks cut or embraced the intrusive bodies, (Figure 2). Thus the Cadwallader Zone is somewhat unique in the area in

that it contains a concentration of complexly fractured older and younger rocks which are less common outside the zone.

Because the Cadwallader shear generally trends parallel to the enclosing formations ancillary fractures themselves take the form of gouge planes or shear zones unless local geological conditions provide unique situations for tension fractures. It is the development of such tension fractures that has provided sites for the quartz veins that are economically gold-bearing. Throughout the 20 miles of length of the Cadwallader Zone that is exposed in the Bridge River valley, (Figure 2), the zone is principally comprised of a vertical to steeply eastward-dipping fault zone that is occupied by intrusive ultrabasic rock that has been dynamically and hydrothermally altered to serpentine. This serpentine zone ranges from a few hundred to one thousand feet in width and is somewhat sinuous in its trend; however, it exhibits a sharp change in direction a few miles south of the Bridge River. From many miles south of the Bridge River the Cadwallader Fault zone strikes generally northwestward; at Bralorne the zone turns sharply to a north-northwest strike. At this bend in the fault zone the rocks inside the bend (northeast side) are cut by a complex system of supplementary faults, shears and cross fractures all within a lense-shaped piece of ground that measures about three miles in length and 1/2-3/4 miles in width and is bounded to the northeast by a major, steep fault that branches off the main Cadwallader System at the south end of the Pioneer Mine and rejoins it at the north end of the Bralorne Mine, (Figure 2).

Examination and data study of all of the known vein occurrences in the Bridge River district have indicated that, with few exceptions, all of the quartz veins outside of the Bralorne-Pioneer fault lense are generally narrow and lensey and occupy relatively tight shear zones that are parallel to the Cadwallader Fault System. None of these veins has proven to be sufficiently gold-bearing to be profitable to mine; despite most extensive exploration both from surface and underground. The only gold-quartz veins in the Bridge River district that have proven to be large enough and rich enough to mine profitably are those contained within the Bralorne-Pioneer fault lense, (Figure 2). The one distinctive feature about the ore-bearing veins within this lense is that they all occupy tension fractures that cross the lense at various angles and none of the ore veins occupies shear zones parallel to the main Cadwallader faults.

WALLROCK FORMATIONS:

Within the Bralorne-Pioneer fault lense the quartz veins are richer in gold within certain particular wallrocks than in others; therefore, for a clear understanding of the distribution of the orebodies in the mines the wallrock formations are briefly described below:

The Fergusson Series represents the oldest rocks in the district, probably late Paleozoic in age, and is made up principally of argillites and intercalated chert with minor lenses and bands of limestone and volcanic flows. The formations comprising the Fergusson Series have been intensely folded and faulted and, because of the large amount of thin bedded, crumpled rocks that comprise them, they are incompetent and have not sustained the long, open fractures necessary for the formation of wide quartz veins.

The Fergusson Series rocks underlie most of the Bridge River area beyond those rocks that form a belt along the Cadwallader Fault System. Fergusson rocks lie northeast of the major fault that forms the northeast boundary of the Bralorne-Pioneer fault lense. There are no Fergusson rocks within the lense; therefore, no ore veins cut them.

The Hurley-Noel Formations form a complex sequence of Triassic-Jurassic sedimentary and volcanic rocks that is localized in a belt 1-3 miles in width that lies along, on either side of, the Cadwallader Fault System. The predominant rock types in these formations are finely banded argillites, water-lain tuffs, limestones and conglomerates. These formations, together with the Pioneer Greenstone, are of moderate competency and have tended to sustain open fractures along which wide, ore-bearing quartz veins have formed within the Bralorne-Pioneer lense.

The bottom half of the Hurley-Noel sequence has been termed the Noel Formation and the top half the Hurley; between these two formations in the Pioneer Mine is a relatively thick section of volcanic rocks termed the Pioneer Greenstone.

The Pioneer Greenstone is evidently the same general age as the Hurley-Noel formations and, with them, comprises the second-most common host rock for ore veins. The Pioneer volcanics appear to be comprised of flows and pyroclastics which have been metamorphosed and locally recrystallized to such an extent that they have formed a more or less homogenous, fine grained to crystalline green rock. This massive rock, where recrystallized, is of considerably

greater competence than any of the surrounding sedimentary rocks. The Pioneer Greenstone sequence is thought to be about 1,000 feet in thickness in the Pioneer Mine but is absent from the Bralorne Mine unless it is in a (re) crystalized form as the rock mapped as Bralorne Diorite.

Intrusive Rocks: A wide range of intrusive rocks occur in the vicinity of the Cadwallader Fault System and all are younger in age than the above-described formations.

Coast Range granodiorite stocks lie immediately east of as well as several miles west of the Cadwallader Fault Zone and, whereas they no doubt have profoundly influenced the structure of the area and possibly have a genetic relation to the ore deposits, they are of no concern in the present consideration of ore potential. The rocks of this suite are termed the Bendor Intrusives in the Bridge River area.

The intrusive rocks which directly concern the study of the Bridge River ore deposits belong to two suites, both of which occur as isolated, relatively small bodies distributed along the trend of the Cadwallader Fault Zone, either in it or adjacent to it and invariably elongated parallel to the shear zone. The first suite includes the Bralorne Diorite and Soda Granite, and the second suite is made up of the ultrabasic intrusives known as the President Intrusives.

The Bralorne Diorites occur in an elongate swarm trending north-northwest between the two batholithic bodies of granodiorite. Most of these diorite plugs or bosses are immediately adjacent to or in the general vicinity of the Cadwallader Fault Zone. In many places where the shear zone splits into widely separated branches the bodies of diorite in that area are wholly encompassed within the zone.

The diorite is a medium crystalline, augite-amphibole meta-diorite that is laced with lighter coloured tightly frozen veinlets of minerals such as epidote, chlorite, carbonate, etc., all of which also occur as rock minerals within the rock itself. The rock ranges from fine crystalline greenstone to mottled, granitoid coarsely crystalline diorite. It is both intrusive and gradational into the Pioneer Greenstone and where it becomes intimately mixed with the latter rock the two are practically impossible to sort out and

have commonly been grouped as "Greenstone diorite". The diorite definitely intrudes the Hurley-Noel and the Fergusson sedimentary formations.

The petrologic similarity between the Pioneer Greenstone and the Bralorne Diorite in the same geological province suggests that they were both derived from the same magmatic source but at different times. The distribution of the Bralorne Diorite bodies suggests that they were injected into the Cadwallader zone of weakness after it had deformed the earlier Hurley-Noel rocks but before it has assumed its final shape and character.

The Bralorne Diorite intrusives form massive bodies of much higher competency than the surrounding sedimentary rocks and generally similar competency to the Pioneer Greenstone.

The Bralorne Soda Granite occurs only within the Cadwallader Fault Lense as a vertical dike-like body of intrusive rock, 1.5 miles in length and up to 2,000 feet in width, which trends tangentially to the shear zone from hangingwall to footwall. This rock is sharply intrusive into Pioneer Greenstone to the east and into Bralorne Diorite to the west.

Lenses of "porphyry bodies" of granitic composition occur locally within the Pioneer Greenstone in subparallel swarms and are apparently forerunners of the main soda granite intrusion.

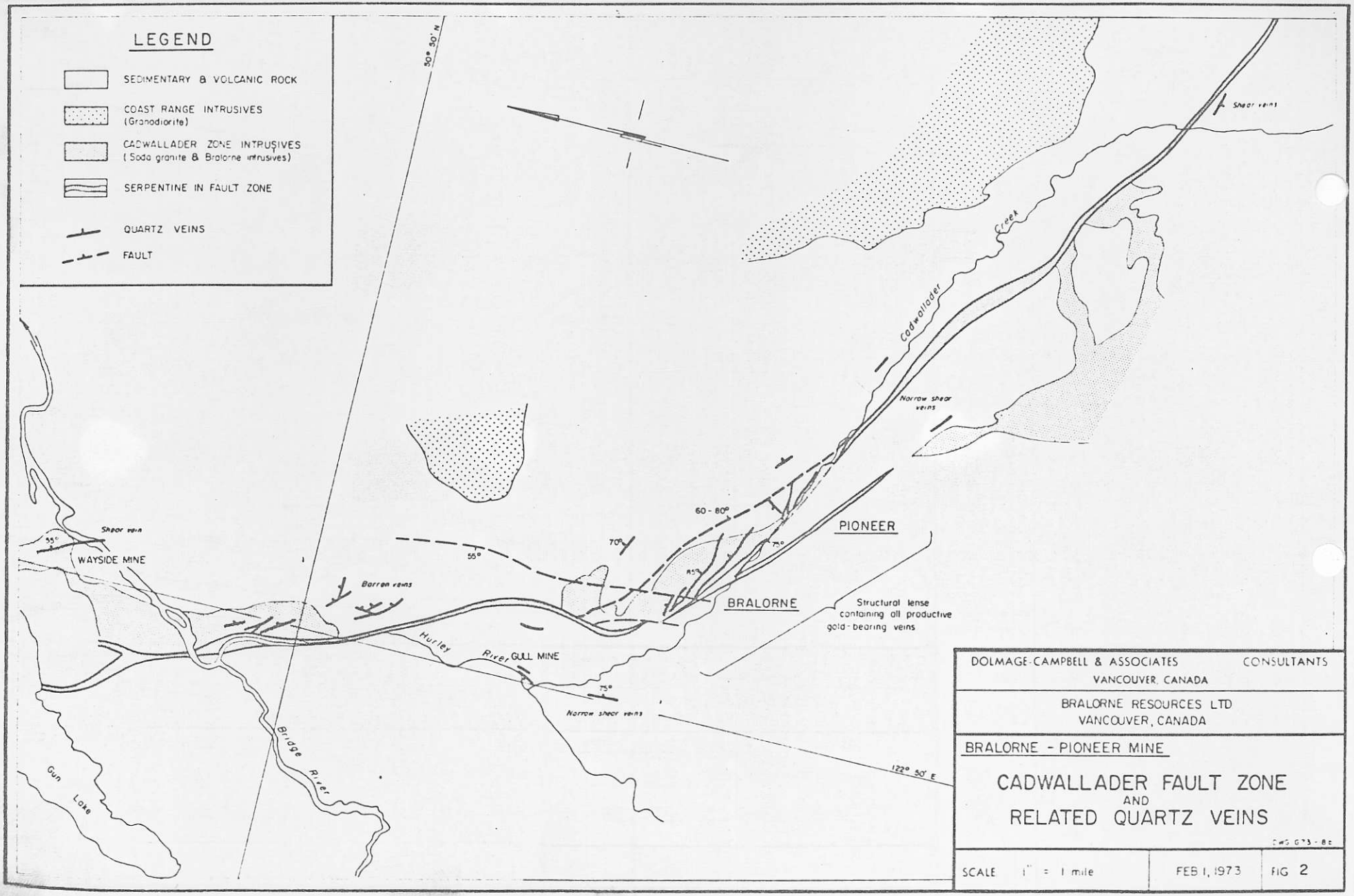
The northern nose of the soda granite body is blunt and plunges steeply to the northwest whereas the southern end tapers into a persistent, narrow dike that plunges down to the southeast.

The rock is a massive, fine to coarsely crystalline, high albite granite which commonly grades into aphanitic albitite dikes. These rocks are unmetamorphosed and are only locally altered and are so competent that they are brittle. They are persistently cut by tight joints which have the general pattern of fractures derived from contraction during cooling. Ore-bearing veins are neither common nor persistent within the Soda Granite.

The President Intrusives crop out for 25 miles along Cadwallader Creek and across Gunn Lake as isolated large and small bodies of dunite, pyroxenite and gabbro in a belt more or less parallel to the Cadwallader Shear Zone. This belt of ultrabasics is directly in line with the belt of ultrabasic

rocks that crosses the Fraser Canyon at North Bend and is no doubt genetically related to it. The ultrabasic bodies are not as deformed as the diorite bodies but they are all extensively serpentinized.

The serpentine in the fault zone that forms the main structure of the Cadwallader Shear is probably related to the President ultrabasic intrusives.


LEGEND
SEDIMENTARY & VOLCANIC ROCK
COAST RANGE INTRUSIVES (Granodiorite)
CADWALLADER ZONE INTRUSIVES (Soda granite & Bralorne intrusives)
SERPENTINE IN FAULT ZONE
QUARTZ VEINS
FAULT
50° 30' N
Shear vein
Cadwallader Creek
Narrow shear veins
60 - 80°
PIONEER
70°
55°
85°
75°
Shear vein
55°
WAYSIDE MINE
Barren veins
BRALORNE
Structural lense containing all productive gold-bearing veins
Hurley River
GULL MINE
75°
Narrow shear veins
Bridge River
Gun Lake
122° 50' E
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BRALORNE - PIONEER MINE
CADWALLADER FAULT ZONE
AND
RELATED QUARTZ VEINS
SCALE 1" = 1 mile
FEB 1, 1973
FIG 2

ORE CONTROLS

Detailed study of the Bridge River gold veins has indicated that the only productive veins with substantial tonnage potential are those that occur within the Bralorne-Pioneer fault lense at the bend in the Cadwallader Fault System. For this reason the exploration for new productive veins should be confined to the Bralorne-Pioneer fault lense to ensure a maximum chance of success.

Because of the varied stresses imposed upon the rocks within the Bralorne-Pioneer fault lense the enclosed rocks failed further by tangential fractures which diverged from the Cadwallader Shear at low angles and, trending southeastward across the lense, tended to join the Fergusson Thrust at larger angles. This set of shear fractures was supplemented by northeast-southwest tensional fractures which opened and later became irregular gash veins. This complex system of fracture sets was adjusted and reopened repeatedly, as evidenced by the many ages of sheared and fractured quartz existing within the fractures. This repeated reopening of the veins within the fault lense permitted the introduction of gold-bearing solutions to the veins where they were most open and fractured.

WALLROCKS:

In the Bridge River district the physical nature of the wallrocks has had a profound influence on the formation of the quartz veins as well as on the concentration of gold within the veins. To sustain an open fracture a rock must first have sufficient competency and second have the proper orientation to the stresses that caused the fracturing. These conditions will of course vary but generally an homogenous, incompetent, soft rock will flow or shear rather than fracture. The opposite is the case for a competent, hard rock. If a rock is very competent and occurs in a massive body then the fractures will either break around it or fray out within it.

Along the Cadwallader Fault Zone the cherts and argillites of the Fergusson Series, the argillites and lesser rocks of the Hurley-Noel Series and all of the serpentine rocks are too incompetent to sustain open fractures. In addition, in most places their bedding planes are nearly parallel to the direction of major shearing, (the fault zone), and these rocks

have therefore tended to fail by shear themselves. Thus we find that of the innumerable properties prospected along the zone within the Fergusson and the Hurley-Noel rocks no productive veins were found. All of the exposed structures are shears that have been sparsely mineralized with quartz for short, narrow sections.

In contrast to the above situation, the intrusive bodies of soda granite within the Bralorne-Pioneer fault lense are too competent (brittle) for continuous, single fractures to form within them for more than relatively short distances.

In summary, the wallrock formations that have been most favourable to the formation of continuous open fractures, and consequent wide quartz veins, are:

1/ The non-argillite portions of the Hurley-Noel formations.
2/ The Pioneer Greenstone.
and 3/ The Bralorne Diorite.

The major known ore control of the veins within the Bralorne-Pioneer lense is that most of the major gold orebodies occur on those portions of the veins within diorite or greenstone at or near the contact of a rock type of markedly different competency; i.e., the soda granite. It would appear that the fracture patterns or internal structures within the veins were altered where the wall rock competency changed appreciably and that such locations are where the veins pass from diorite or greenstone into soda granite. A study of such sites indicates that at these contacts the veins structures are invariably buckled or refracted so that there is a marked change in strike and/or dip crossing from one rock type to the other. Generally the veins steepen at the soda-granite contact and tend to deflect along it.

VEIN ORE CONTROLS:

In detail the veins are both horizontally and vertically broken into segments which are generally comprised of one or two fracture directions, Each segment is thus a curving or bent lense. The length of these segments in any one direction ranges from 300 to as much as 1000 feet depending on

the type of vein. The shear (southeast, east) veins tend to be in long and merging segments whereas the tension (northeast) veins are broken into short segments which may not merge with one another. (Five main segments made up 27 vein, three occurring between the 21st and the 26th levels). As already mentioned, the vein segments are generally in echelon to one another in that the end of one tends to curve away from the end of the next. The ends of adjacent segments are most generally interconnected by tangential shears and/or cross-over fractures both of which pass from the hanging wall of one segment to the footwall of the next, or vice-versa, and any of which may or may not be mineralized with quartz, but seldom with gold. From a point of view of ore controls this feature of the structure of the veins is noteworthy in that the steep portions of the vein segments are generally more richly mineralized with gold than are the flatter portions and also, laterally, the ore shoots in most places terminate at direction changes within or at the ends of vein segments.

The gold concentrations occur within those sections of the quartz veins that were abundantly internally fractured and that which were relaxed and open at the time of passage of gold-bearing solutions. The internal fractures were opened by tension or relaxation at the time of gold mineralization only in those very particular sites that now comprise the orebodies. The effect of tension or gravity relaxation on dipping veins and fracture systems is an opening of the steeper portions of the structures and a tightening of the less steep or flatter portions; therefore, the steepest portions of the Bralorne-Pioneer veins are the richest in gold.

DISTRIBUTION OF VEINS:

The writer studied many plans in an attempt to determine if there is an obvious preferred distribution or arrangement of the veins at any particular portion or portions of the Bralorne-Pioneer structural lense. There doesn't appear to be any particular favoured site for veins within the lense. There appears to be about the same concentration of veins at the Taylor-Bridge, the Bralorne and the Pioneer sections of the lense. There is a suggestion of a higher number of productive veins occurring nearer the Cadwallader Shear side of the lense but this impression is greatly influenced by the very much greater amount of development in the mines along the Cadwallader Shear.

find new veins then explore them in favourable host rocks

EXPLORATION POTENTIAL

From the preceding discussion it is evident that exploration for new gold ore at Bralorne-Pioneer should be directed first to finding new quartz veins and then to exploring those veins in the most favourable ground, i.e., within the greenstone and the diorite near the soda granite contacts. To make the project worthwhile it is necessary to find one or more major veins in a relatively large, unexplored favourable area. It is unlikely that the exploration of undeveloped bits and pieces of known veins will uncover a major new orebody.

There are a relatively large number of areas within the Bralorne-Pioneer fault lense that have not been explored in the development of the mines and which have or may have favourable wallrock geology. Most of these areas are in the lower levels of the mines, where development headings become successively less extensive with each new deeper level. Although it is not practical at this time to explore these areas in the deeper levels of the mines it is important to appreciate that the depth potential for new ore is very considerably unexplored; therefore, if new ore is found in the upper levels there would be a better than average chance of depth continuity to it.

A brief review of the unexplored areas favourable for ore exploration in the lower levels of the mines, within the Bralorne-Pioneer fault lense, is given below, proceeding from north to south from the King Mine to the Bralorne Mine to the Pioneer:

DEPTH ORE POTENTIAL:

KING MINE: Five orebodies of moderate size were exploited in the King Mine north of Bralorne. These are clustered within diorite along the contact with the Hurley-Noel sedimentary rocks. The orebodies extended over a total vertical interval of 1500 feet. These five orebodies compare very closely in size, shape, rake and distribution to those occurring in the same vertical interval at Bralorne, about one mile to the south. The Hurley-Noel contact plunges down to the north and the orebodies are definitely following it. There has been virtually no exploration of this area below the Bralorne 20 level, where it was extensively drilled and drifted. The veins in this area on the 20 level were non-productive, few in number and scattered, and therefore presented no encouragement for further exploration; nonetheless, the 20 level

was relatively lean at Pioneer and Bralorne as well and there arises the possibility that the King Mine could be favourable for ore at depth and further north.

Practically, the only way to explore this vast area would be to advance suitable headings from one of the more extensive Bralorne levels such as the 26, 28 or 38. Such exploration could not be done quickly or cheaply; however, it does comprise one of the very major areas of favourable ground left unexplored in the Bralorne-Pioneer lense.

BRALORNE MINE: Below the 24 Level exploration in the Bralorne mine became increasingly confined to the 77 Vein vicinity with depth, leaving vast favourable areas open to the northwest and southeast along the soda granite contact. The most extensively explored levels are the 31-32 and the 38, and even these levels are relatively sparsely covered. Long drill holes aimed to explore the diorite immediately adjacent to the soda granite contact should be drilled on several levels below the 24 Level. Below the 24 Level the soda granite contact is parting from the Cadwallader Shear to the southeast and large areas of favourable diorite along the contact have opened up.

Specific examples of possible exploration targets in the deep Bralorne levels are given in the 1964 report.

PIONEER MINE: The major orebodies in the Pioneer Mine occurred on veins within the greenstone between the soda granite intrusive and the northeast side of the fault lense, (the Fergusson Thrust Fault). Since this wedge of favourable ground is widening and lengthening with depth it follows that the exploration potential within it is progressively better with depth.

Specific examples of possible exploration targets in the lower Pioneer levels are described in the 1964 report but one is particularly encouraging, namely; northwest of the 27 Vein there is a large area of good ore potential, only sparsely explored, between the 15 and 29 levels.

SHALLOW ORE POTENTIAL: (Figure 3)

The basic prerequisite of this study was that any recommended exploration program must be able to be accomplished from either the surface or one of the accessible upper levels of the mines. The high cost of rehabilitating the lower levels of the mines for a preliminary exploration program would make such a program impractical. It was reasoned that if no major undiscovered ore exists in the upper levels then the likelihood of finding such ore at even reasonable depths is lessened considerably. For this reason the writer has examined in detail all data pertaining to possible undiscovered ore veins only on those levels above the Bralorne 8th Level, the deepest accessible level. The results of this study are summarized here and are illustrated in the composite plan of the complete Bralorne-Pioneer fault lense on the Bralorne 8th Level presented as Figure 3 accompanying this report.

In Figure 3 all of the underground development and diamond drilling are shown for that level. The development coverage on the three principal levels above the 8th are approximately the same as that shown on the 8th. Below the 8th Level (Bra.) the development in the Bralorne and Pioneer Mines remains about the same as that on the 8th, but there is no development in the King Mine until the 20th level, then none below that. Therefore, from a point of view of extent of workings and completeness of geological knowledge the Bralorne 8th level is the best above the 20th level by a wide margin. If major new ore is discovered on the 8th level it has unlimited potential up to the surface and down to depth.

GEOLOGY, 8 LEVEL: (Figure 3)

The geology of the 8th Level as shown on Figure 3 is essentially representative of that on all levels except that there is a general shift of all rock formations to the northwest (left) with depth. The geology on Figure 3 has been simplified to show only the soda granite bodies and the serpentine fault zone within and around the Bralorne-Pioneer fault lense. The other formations within the fault lense are roughly distributed as follows: the Pioneer Greenstones at the southeast end, the diorite in the centre and the Hurley-Noel formations at the northwest end. The argillites of the Fergusson Series lie along the northeast side of the lense on the other side of the Fergusson Thrust Fault.

The quartz veins within the fault lense trend roughly east-west across the lense and dip steeply to the north. With minor exceptions they are only ore-bearing at or approaching the contacts with more competent (brittle) wallrock such as the soda granite bodies in Bralorne and Pioneer and the diorites in the King Mine.

The outlines of the soda granite bodies are highly irregular, with sharp changes in directions and with common breaking up of the intrusive into dike-like fingers. For this reason it has been difficult for the mine geologists to project the soda granite contacts for any distances greater than a few hundred feet without one or two confirmatory drill holes. Generally such exploratory drill holes are relatively few and widely scattered on any level, indeed the 8th level is probably the most densely drilled level in the mine; therefore, the location of the contacts of the various soda granite bodies can only be conjectured in most cases.

TARGET AREAS, 8 LEVEL: (Figure 3)

The obvious target areas for exploratory drilling within the fault lense are any places where known or unknown veins might be approaching the contact of a soda granite body. The next priority of type of target is any large area of generally favourable rock types within the lense where little or no exploration has been done and thus little is known of the area. On the 8th level there are three general areas that fall into this category; as shown on Figure 3 they are:

Area A - A very large area of diorite and Hurley-Noel rocks lies between the King and the Bralorne Mines. It has only been explored by crosscuts on the 8 and 20 Levels and by the few drill holes shown in Figure 3. The main crosscut on 8 level intersected 16 quartz veins with favourable east-west strikes but only three holes were drilled to explore the extensions of these veins.

This large area has been divided by the crosscutt into two sub-areas, A1 to the north and A2 to the south. In A1 the drill targets are the projections of veins approaching the Fergusson side of the fault lense where favourable geological conditions might exist in this essentially unknown area. In A2 the drill targets are the projections of veins to the southwest side of the lense.

The writer estimates from the geology that the chances of intersecting encouraging (wide and/or gold-bearing) veins in A1 are possibly 50:50; in A2 the chances are probably less.

Area B - Immediately southeast of the Bralorne Mine, in the vicinity of the Empire Shaft, is an area comparable in size to Area A that has been only sparsely explored, even on the 8th Level which is the most extensive, yet holds the most promise for containing major new ore tonnages. The reason for this encouraging situation is that it is an area in which rich gold veins occur in the vicinity of soda granite bodies yet the contacts of these bodies have not been located nor the projections of known quartz veins been explored in the possible vicinity of the intrusive contacts. The reason for this anomalous situation is probably a simple one, namely; the early operators began mining the rich 51 vein near the Empire Shaft and, with no ore found on the veins near the Crown Shaft, they made only a gesture at further exploration and concentrated on 51 Vein.

(By the 20 Level, 1700 feet below the 8 Level, this area (B) has become more constricted and no longer encouraging for exploration; however, in contrast the size and exploration potential of Area A has increased markedly by the 20 Level.)

Area B has been divided into sub-area B1, north of the crosscut, and B2 to the south. The chances for finding, quartz veins next to the intrusive contacts, with room enough for large tonnages of ore, in sub-area B1 are considered to be very good. In B2 they are considered fair.

Area C -Between the Bralorne and Pioneer Mines is a large area of ground that has been unexplored on any level. The 8 and 20 levels reached this area but in both cases the headings were in the soda granite rather than in the favourable greenstone.

This area is completely unexplored and unknown but would appear to have excellent potential for large new veins on the southwest side of the soda granite intrusive body, particularly

since ore-bearing veins enter the northeast side of the intrusives from Pioneer Mine and can be projected through it to Area C. Unfortunately Area C may not be feasible to explore by drilling since the crosscut from the Empire Shaft may be caved.

The above-described areas, (A, B, and C), are the only ones within the Bralorne-Pioneer fault lense on the 8th Level that have sufficient size and sufficiently encouraging geology to warrant the exploration for major gold-bearing quartz veins.

CONCLUSIONS

The exploration of the target areas A, B, and C on the 8th Level at Bralorne is a geologically reasonable project with a good chance for success. However, when it is realized that the search will be for ore vein lengths of probably less than 500 feet in areas where vein lengths will reach several thousands of feet it can be appreciated that the judgement of what would comprise a minimum program is a critical one. Accordingly, the writer has laid out a series of 12 flat diamond drill holes which he considers to be the absolute minimum that is required to do justice to the program. These holes are 800 feet apart in the target areas, so obviously they cannot be considered to be at optimum spacing for intersecting orebodies a few hundreds of feet in length; however, their prime objective will be to intersect new veins that will show sufficient widths and some gold values to indicate that they comprise valid targets for further exploration by another stage of drilling.

All previous diamond drilling in the Bralorne-Pioneer Mines was done with small core, conventional equipment which traditionally recovers low percentages of core within incompetent or fractured rocks, such as vein zones. (It is very probable that some of the old holes may have intersected ore veins but did not return enough gold-bearing core to be recognized or assayed and therefore the intersections were not followed up.) For this reason it is imperative that the drill exploration recommended in this report be done by BQ wireline equipment to ensure maximum core recovery as well as expeditious drilling.

From his study of the Bralorne-Pioneer Mines the writer considers that the exploration for new ore-bearing veins by drilling on the Bralorne 800 Level, in the three target areas designated, is a valid conception based on existing data and few assumptions. It would appear from a detailed study of the geology and existing drill hole intersections that the recommended drill program has about a 50 percent chance of intersecting ore-type quartz veins that will warrant follow-up drilling. If the program returns completely negative results then the only remaining potential for new ore in the mines must be considered to be below the 20th level.

DRILL PROGRAM

The writer has laid out 12 [illegible] first stage holes, shown in Figure 3, designed to explore the three target areas as follows

A1	1600 ft.	to Fergusson Series
	1200 ft.	to Fergusson Series
	1300 ft.	to Fergusson Series
	4100 ft.	
A2	800 ft.	to Serpentine Zone
	800 ft.	to Serpentine Zone
	1600 ft.	
B1	1500 ft.	to Fergusson Series
	1100 ft.	to Fergusson Series
	700 ft.	to Fergusson Series
	3300 ft.	
B2	400 ft.	to Serpentine Zone
	800 ft.	to Serpentine Zone
	1200 ft.	
C	800 ft.	to Serpentine Zone
	1100 ft.	to Serpentine Zone
	1900 ft.	

TOTAL = 12,100 feet

[illegible]ond stage drilling, if warranted, has been estimated to require approximately 5700 feet for Area A and [illegible] feet for Area B, for a total of 10,200 feet. No second stage has been estimated for Area C because there is some doubt if even the first stage will be possible to do.

The cost of the first stage drilling for BQ wireline has been estimated for the writer by a drill company as $7-8/ft. if 25 feet of pull room is provided and $8-9/ft. for only 15 feet. This is just a drill cost, with air provided, and no provision made for rehabilitation etc. The writers' total cost estimate is as follows:

COST ESTIMATE:

Rehabilitation, services, etc.	$ 20,000.
1st Phase diamond drilling	
12,000 ft. @ $8.00 (?) per ft.	$ 96,000.
Supervision, core logging	$ 6,000.
Transportation, communications	$ 2,000.
Travel	$ 1,000.
Accommodation	$ 1,000.
Consulting, engineering, draughting	$ 4,000.
	$ 130,000. =($10.83/ft.)
2nd Phase diamond drilling	
6,000 ft. @ total cost of $10.83/ft.	$ 65,000.
TOTAL	$ 125,000.

The above is a preliminary estimate that has been biased on the conservative side. For a more detailed budget the following items will have to be resolved:

1/ Availability of air and water for drill.
2/ Extent of rehabilitation of workings, including ventilation.
3/ Crew accommodation and board.
4/ Underground transportation.
5/ Speed of program (1 or 2 drills).
6/ Method of supervision.

Nevertheless, it is not anticipated that any of the above items will require any major adjustment in the total cost estimated.

Respectfully submitted,
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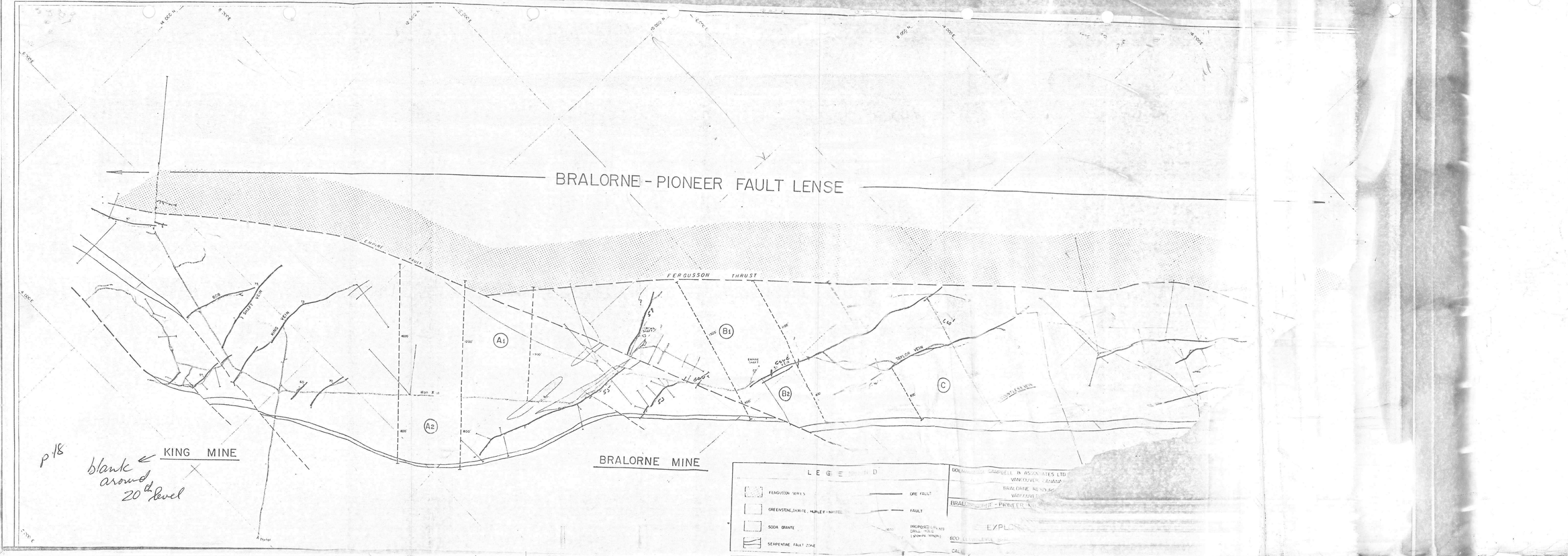
BRALORNE - PIONEER FAULT LENSE
EMPIRE FAULT
FERGUSSON THRUST
A1
A2
B1
B2
C
KING MINE
BRALORNE MINE
LEGEND
FERGUSSON SERIES
GREENSTONE, DIORITE, HURLEY
SODA GRANITE
SERPENTINE FAULT ZONE
ORE FAULT
FAULT
PROPOSED DRILL HOLE (SHOWING DIRECTION)
EXPLO
p 18
blank around 20th level