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Geological and Rock Geochemical
Report on Pioneer #1 and #2,
Jura area, 92 H 9/W.
Similkameen M.D.

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INTRODUCTION

Summary: Pioneer 1 is underlain by a faulted copper gold porphyry alteration zone that appears to be exposed near the original top of significant mineralization. Outcrop is sparce; grades up to 0.4% Cu have been found. The well defined portion of the mineralized zone appears to be not larger than 250 m x 400 m in plan. This area, while small, is sufficient to contain a surface minerable deposit if above average porphyry grades exist. The potential of the fault offset portion of the zone is unkown, but appears to be as good as or better than that of the well defined portion.

The surface mineable potential should be tested, by percussion drilling if possible. Very careful consideration should also be given to deeper drilling to test the possibility that grades will increase downward, towards a postulated potassic and/or porphyry intrusive core.

Location and access: Pioneer #1 and #2 are located adjacent to the Osprey Lake road and the C.P.R., 10 km N 25^0 E of Princeton, in the vicinity of Christian Creek, NTS 92 H 9/W. Elevation is about 1000m; the property lies mainly in open grasslands. Access is by auto from Princeton. A 4 x 4 is useful on the property.

Work done: Geological mapping and rock geochemical sampling was conducted from May 9 - 19, 1977, on Pioneer #1, owned by Corbin J. Robertson. Operator was Quintana Minerals Corp. All rock, alteration, and mineral names are based only on hand specimen examination with a 20x lens.

GEOLOGY

Regional geology is portrayed in G.S.C. Memoir 243, Princeton Area, Rice, 1947. In this report, the Pioneer area is shown to be underlain by Nicola Group rocks and Summers Creek intrusives.

Rock Units: Eight igneous rock units, seven of which are intrusive, have been identified on Pioneer 1.

The oldest rock unit (Unit 1) on the property includes green (minor red) andesite flows and breccias of the Nicola Group. Remote from areas of strong alteration, in the southeast corner of the claim, breccias predominate. Within areas of strong alteration, rocks mapped as andesite include some breccia, as well as probable plagioclase porphyry flows. Andesite shown on the geology map is likely to include some microdiorite (Unit 2) and felsite (Unit 5). Only one bedding attitude was obtained, in the southeast corner of Pioneer 1, where a thin bedded tuff unit about 0.2 m thick trends 065/65 SE.

Micro~~doirite~~diorite was mapped in the central portion of the outcrop area. This unit was defined wherever a substantial area seemed to be underlain by a uniform textured rock, dark green in color, with 50% to 75% of stubby euhedral plagioclase grains about 1 x 1½mm in size, interstitial chlorite and rare chloritized hornblende phenocrysts about 1 x 3mm. Although field relationships, plan distribution, and uniformity of texture all indicate that most microdiorite is intrusive into andesite, possibly as hypabysal dikes and sills, some rocks mapped as microdiorite are probably thick flows.

Monzodiorite, which forms a large, probably continuous body in the northeast part of Pioneer 1 is not seen in contact with microdiorite or andesite, but one small outcrop of metaandesite, between the new road and the railroad, north of Christian Creek, is probably an inclusion of Nicola rocks in monzodiorite. Typically, monzodiorite (Unit 3) contains 50% euhedral plagioclase ranging from ½ x 1½ mm to 1½ x 3 mm, average about 2mm long; 15% subhedral to anhedral pink feldspar average 1mm in diameter, set in a fine grain matrix which is now about half chlorite. There is 1-2% disseminated magnetite, and a trace of disseminated pyrite. Fabric is random.

On the new road, south of Christian Creek, at sample site 45, a dark green aphanitic rock with 20% pink feldspar phenocrysts 1 x 3mm, oriented randomly is cut by younger (quartz) monzonite porphyry. This pink feldspar porphyry (Unit 4) may be a chilled or marginal phase of monzodiorite.

A mass of felsite (Unit 5) is exposed in scattered outcrops at the eastern limit of exposures, north of the Alfalfa fault. This light colored very fine grained rock with pink mottling almost certainly intrudes diorite. Some felsite is probably present in the area shown as strongly altered andesite south of the Alfalfa fault.

(Quartz) monzonite porphyry (Unit 6) is comprised of 20% to 30% stubby to equant plagioclase crystals ranging from ½mm to 2 mm in large dimension, in a fine grain pink matrix. The matrix contains chlorite and, locally, up to 5% quartz as ½mm grains. Remote from contacts, this rock type contains 5% to 10% pink feldspar phenocrysts up to 3 x 6mm in size. Near contacts, there is 1 to 2% disseminated pyrite, and a trace of disseminated chalcopyrite.

One small outcrop of quartz - pink feldspar porphyry was noted north of Switchback Creek.

North of the Alfalfa fault, on the west edge of exposures and on the new road, a granodiorite (Unit 8) dike is exposed. This intrudes diorite. Age relations to other rock types are not clear, but apparent age relationships to alteration, and the absence of sulphides suggest that granodiorite is younger than other major rock types. Granodiorite is an hypidiomorphic granular rock with about 20% pink feldspar, 50% plagiclase, 20% quartz, and 10% biotite.

Structure:

Pre-mineral structures are difficult to map; the linear nature of the alteration zone suggests structural control, and a narrow zone of alteration trending easterly and dipping $20^0 \pm$ to the north, exposed in a road cut north of Christian Creek, is clearly structurally controlled. Premineral diorite dikes trend north at the south end of the alteration zone. Post mineral crushing and shearing are abundant in a zone trending roughly west to just north of west in Switchback Creek. Individual shear planes trend north and dip steeply west, or are flat and undulating. Although there is massive evidence of faulting in this zone, it is questionable whether the altered and mineralized zone has been offset laterally. Perhaps the most likely explanation for this zone is that it is a steeply dipping? structure, trending westerly, with only dip slip movement.

Fault gouge and breccia exists in new road cuts south of Christian Creek, at the contact between Unit 6 and Unit 4. However, dikes of 6 clearly cut 4 south of the fault, making major displacement unlikely.

The most westerly exposures of unit 3, on the railroad north of Christian Creek, are crushed and sheared. A connection between this obvious fault zone, and the one in the new road cut, as shown on the geology map, is conjectural.

The most important structure on the claim is that shown as the Alfalfa fault on the geology map. The presence of this fault is indicated by the juxtaposition of the most strongly altered and best mineralized outcrop on the property at sample 29, with very weakly altered and mineralized rock at sample 38. Although other explanations could account for these factors, the apparent offset of the west limit of epidote and the west limit of 1% sulphides adds to the credibility of the fault hypothesis. The apparent movement of the alteration zone is at least 400m right lateral. The existence of more felsite, and more quartz rich alteration north of the fault suggests the possiblity of substantial vertical movement also.

The I.P. results shown in assessment report # 318 are consistent with the Alfalfa fault as postulated.

Alteration and mineralization:

With the possible exception of a quartz - pink feldspar dike, there are no un-altered rocks on the claim. However, andesite east and southeast of the southeast corner of the claim, as well as andesite in Christian Creek towards the northwest corner, have only been subjected to pervasive propylitization, without any significant concentration of sulphides. Similarly, most monzodiorite in the northeast, most (quartz) monzonite porphyry, and all exposures of granodiorite have been subjected to alteration which has chloritized mafics and softened (sericitized?) plagioclase without developing significant sulphide mineralization.

It was found useful to define three alteration/mineralization boundaries in the vicinity of the better copper mineralization. One of these boundaries, the outer limit of estimated one percent total sulphide, encloses all significant sulphide mineralization. The second boundary, mainly coincident with the first, is the inner limit of pervasive epidote alteration. Interior to these, and enclosing all rock geochemical samples containing more than 1500 ppm cu, is a boundary defined by the inner limit of chlorite.

Sulphides, mainly pyrite, increase northerly from 1% by volume to a maximum of about 5% by volume in exposures south of the Alfalfa fault along the new road. The only sulphide other than pyrite occuring in any significant quantity is chalcopyrite. Pyrite/chalcopyrite ratios appear to vary fairly systematically from 100 to 1 or so in the zone where epidote is present to about 5/1 in the best mineralized outcrop. Careful mapping of this ratio was not possible because of weathering, and because of the very fine grain size and somewhat erratic distribution of chacopyrite.

A weak, but real, trend in the percentage of total sulphide controlled by fractures is defined from an estimated 5% to 10% fracture control near the limit of pervasive epidote, to 20% fracture control near samples 29 and 30. Chalcopyrite is more strongly fracture controlled than pyrite, but even near sample 29 or 30, not more than 50% is fracture controlled.

In addition to pyrite and chalcopyrite, wide spread but minor amounts of supergene "chalcocite" and covelite, and a few grains of hypogene bornite near sample 29, were noted. Iron oxides, mainly or entirely of syngenetio origin , include magnetite outside, and hematite (after magnetite) inside, the inner limit of chlorite.

Although poorly exposed, the offset portion of the alteration zone north of the Alfalfa fault seems to exhibit similar zoning. It is interesting to note that the epidote boundary transgresses the felsite contact on the north, and that pink mottling (K-spar?) inside the boundary is soft, while that outside is fresh.

All strongly altered rock has a post sulphide stockwork of 1-5mm gypsum veinlets, accounting for up to 5% of rock volume.

In summary, all rocks on the property have been subjected to an alteration event which produced hydrous minerals. The weakest effects include pervasive chloritization of mafics, and softening (phylosilicate alteration?) of plagioclase. Epidote was developed in more calcic rocks. Stronger alteration zones exhibit characteristic porphyry copper zoning in silicate mineralogy, and in pyrite/chalcopyrite ratios. The strongest alteration exposed has a high pyrite/chalcopyrite ratio, and is probably K-feldspar destructive rather than constructive. No secondary biotite was observed.

There is no obvious, central, genetically important porphyry intrusive. Disseminate, as opposed to fracture mode of occurence of sulphides dominates.

Taken together, these observations suggest that 1) this is a porphyry copper alteration zone, perhaps imposed on weak, pre-existing hydrous alteration and 2) the level of exposure may be nearer the original top than the bottom of the mineralized zone.

GEOCHEMISTRY

A bedrock geochemical survey was undertaken concurrently with the geological survey, to confirm copper values in areas of interest, to assist in interpreting zoning, and to assist in determining the significance of leached or oxidized outcrops.

Sampling: Chips from 1/2 to 2 cm in size were collected within 5m of the sample site indicated on the geology and geochemistry map. About 500 g of the least oxidized material available, including only the rock type indicated on the map, was collected at each site, bagged in paper or plastic, and delivered to the laboratory.

Sample preparation: Sample preparation and analyses were carried out by Min-En Laboratories Ltd., 705 W. 15th Street, North Vancouver, B.C. All samples were crushed to minus 1/4", and split down to a 200 g. to 250 g. sub-sample. The sub-sample was pulverized to minus 100 mesh, and re-sampled for analysis.

Analytical samples of about 10 grams were digested in concentrated nitric-perchloric acid for Cu, Mo, and As determination. Cu and Mo were analyzed on an atomic absorbtion spectrophotometer; As on a spectrophotometer (colorimeter). Samples analysed for gold were digested in aqua regia, extracted with MIBK, and analysed on an atomic absorbtion spectrophotometer.

Results and discussion: Results are attached as Appendix I.

Copper values, with the exception of sample 22, vary consistently with alteration intensity. The best values are found just south of the Alfalfa fault on the new road, and along the eastern limit of exposures north of the Alfalfa fault. These latter samples (40,41,42) are all oxidized; there is no sulphide. The presence of malachite suggests that there may be enough calcite present to sharply limit transport of copper in solution. The values are probably roughly representative of unoxidized rock. Copper values are consistent with observed copper mineralization, with the exception of sample 22, which has no sulphide or blue/green oxide. No field test for acid soluble copper was performed on this sample.

Gold values show a fair to good correlation with copper values. In general, samples containing both copper in excess of 200 ppm and gold in excess of 0.03 ppm lie within or just outside the inner limit of chlorite, and these values are arbitrarily called anomalous. Almost all samples within the limit of chlorite excede these limits.

The presence of anomalous to strongly anomalous gold in oxidized samples 40, 41, and 42 lends weight to the conclusion that the present oxidized copper content is roughly comparable to the original sulphide copper content. Sample 43, from a seemingly isolated occurence of altered rock, has all the geological and geochemical characteristics of exposures to the south and east in apparently more extensive areas of alteration. Sample 44 is of sericite-chlorite altered (quartz) monzonite porphyry. The presence of anomalous copper and gold in this rock type near the contact suggests that there may be some relationship between the main area of mineralization and the porphyry.

A few samples anomalous for only one of Cu or Au deserve discussion. Sample 22, which contains no obvious copper mineralization but 1060 ppm Cu is weakly altered and contains less than 0.005 ppm Au. The copper is probably exotic. Sample 24 is an unoxidized one. There is no ready explanation for the lack of gold accomanying the 820 ppm of copper in well altered rock. However, copper here was observed to accompany minor amounts of fracture controlled epidote. Samples 12 to 15, taken north of most faulting in Switchback Creek, are erratically and weakly anomalous in copper but carry no anomalous gold. This pattern is consistent with the geological interpretation of decreasing alteration and mineralization intensity to the south, again suggesting that the Swithback Creek faulting need not represent any significant strike slip movement.

Molybdenum values vary approximately with copper, but are more erratic than gold values. Molybendum is not particularly useful in interpretation of important geological or geochemical patterns.

Arsenic values are low and erratic. This element is sometimes concentrated in the upper parts of porphyry deposits. There is no suggestion of such concentration here.

Conclusions

Pioneer 1 is underlain by a complex assemblage of volcanic and plutonic rocks. The intrusives, with the exception of a large granodiorite dike, are probably co-magnetic with the volcanics, and are therefore presumably of late Triassic to early Jurassic age. The volcanics, and some of the more hypabysal appearing intrusives are involved in a porphyry copper type alteration zone. This zone is characterized by high pyrite-chalcopyrite ratios, anomalous gold, dominantly disseminate sulphides, strong sericite, negative correlation between epidote and copper, and by the absence of both a potassic core and a central porphyry intrusive. This zone trends north, and the area which might contain 0.2% to 0.5% cu widens northerly from 75 m to about 250 m over 400 m of strike length. At this point, the alteration zone is offset at least 400 m by an apparent right lateral fault. Only the west edge of the northern, offset, part of the alteration zone crops out. The remainder, with unknown but most interesting potential, lies under cover to the east. The zone is probably the upper part of a porphyry copper alteration system.

The following exploration should be carried out.

Stage I: Test, by percussion drilling if possible, the near surface grade of the zone south of the Alfalfa fault, the limits and near surface grade of the zone north of the Alfalfa fault, and the limits and near surface grade of the zone exposed at sample 43.

If no economic deposit is discovered by this program, then careful consideration should be given to one or two deep (say greater than 500 m) holes to test the possibility of an increase in grade with depth.

COMPANY: Quintana Minerals

PROJECT No.:

ATTENTION: M. Wolfhard

GEOCHEMICAL ANALYSIS DATA SHEET

MIN - EN Laboratories Ltd.

705 WEST 15th ST., NORTH VANCOUVER, B.C. V7M 1T2
PHONE (604) 980-5814

FILE No. 4137

DATE: May 19, 1977.

Sample Number	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Co ppm	Ag ppm	Fe ppm	Hg ppb	As ppm	Mn ppm	Au ppb
77W1	0.7	82								1		5
2	1.1	60								3		10
3	6.7	78								7		20
4	2.8	865								13		30
5	0.7	440								7		30
6	48.0	295								10		80
7	30.0	205								13		35
8	8.0	245								7		50
9	0.9	330								2		5
10	4.3	2850								2		170
11	2.1	66								5		10
12	5.8	188								5		20
13	1.4	355								5		5
14	1.2	103								5		5
15	1.1	290								2		<5
16	0.4	12								4		<5
17	1.3	200								10		25
18A	24.0	95								2		10
18B	1.0	31								2		5
19	1.2	52								5		<5
20	0.9	390								2		5
21	1.9	143								2		5
22	2.4	1060								6		<5
23	1.3	136								18		30
24	1.6	820								3		<5
25	1.1	1890								7		35
26	0.5	3600								2		100
27	3.7	440								18		85
28	3.6	205								14		15
77W29	25.0	4100								18		260

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COMPANY: Quintana Minerals

PROJECT No.:

ATTENTION: M. Wolfhard

GEOCHEMICAL ANALYSIS DATA SHEET

MIN - EN Laboratories Ltd.

705 WEST 15th ST., NORTH VANCOUVER, B.C. V7M 1T2
PHONE (604) 980-5814

FILE No. 4155

DATE: May 26, 1977.

Sample Number	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Co ppm	Ag ppm	Fe ppm	Hg ppb	As ppm	Mn ppm	Au ppb			
77W38	0.2	41								3		5			
39	0.7	100								3		20			
40	8.1	242								4		35			
41	5.9	3400								9		365			
42	10.2	1975								3		420			
43	2.9	675								5		55			
44	2.0	246								3		75			
45	5.4	228								4		5			
46	1.4	61								4		15			
77W47	0.7	57								10		25			

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COMPANY: Quintana Minerals

PROJECT No.:

ATTENTION: M. Wolfhard

GEOCHEMICAL ANALYSIS DATA SHEET

MIN - EN Laboratories Ltd.
705 WEST 15th ST., NORTH VANCOUVER, B.C. V7M 1T2
PHONE (604) 980-5814

FILE No. 4137

DATE: May 19, 1977.

Sample Number	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Co ppm	Ag ppm	Fe ppm	Hg ppb	As ppm	Mn ppm	Au ppb			
77W30	5.6	1810								7		45			
31	3.7	445								10		15			
32	1.5	220								10		10			
33	6.1	139								10		<5			
34	4.3	130								10		20			
35	0.8	74								19		10			
36	0.9	126								4		5			
77W37	no sample														

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