



BRITISH COLUMBIA

Ministry of Energy and Mines



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To: Pat McCandless  
Imperial Metals

From: Loie McMillan

Comments: As discussed.

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Number of Pages Sent Including Cover Sheet: 7

Mr. Gary Stewart  
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Calgary, Alberta T2P 0Z3

23 March, 1998

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" T2T 5R6

Dear Gary:

I have reviewed the samples you sent me some time ago and also two samples that I collected when we looked at the drill core in Merritt. I apologize for the delay in completing this review, it has been a busy.

Notes on the individual samples are appended. I also compared my findings with those from Vancouver Petrographics. In summary, five of the samples are porphyritic granitic rocks that are probably dikes or small intrusions; six are quartz diorite to granodiorites of various types (Guichon batholith); four are ?Tertiary volcanics or tuffs. The mineralized sample has chalcopyrite, bornite and molybdenite mineralization and Vancouver Petrographics reported a grain of electrum in one sample. Judging from the thin section data, moderate hydrothermal alteration is widespread, and it is strong in some samples.

The regional mapping indicated that the granitic country rock should be dominantly fine grained Guichon granodiorite and a granodiorite with a transitional texture (generally more leucocratic and coarser). The thin sections are compatible with these rock types but textures are masked somewhat by alteration. Outcrop is poor on the property and we did not see porphyry dike rocks during the regional mapping. The Tertiary rocks, based on the maps we saw during the property visit, seem to be in a fault-bounded area. Elsewhere in the Highland Valley camp such faults have been reactivated structures, for example, the Lornex fault bounds a small Tertiary basin adjacent to the Valley mine. During regional mapping of the area, we found a small ?Tertiary volcanic center northeast of Gypsum Lake, which is the likely source area for these rocks.

Overall, the presence of altered porphyry dikes, which are important at Bethlehem Copper for example, the widespread hydrothermal alteration and the mineralization cut during drilling are all positive indicators that the property is worthy of more work. I would suggest that you relog the existing core with the purpose of identifying porphyry dikes and their relationship, if any, to mineralized intervals.

Sincerely,

W.J.McMillan.

Appended: rock description notes; under separate cover - rock samples

Copy: Larry Ovington

## ROCK SAMPLES EXAMINED

### A. Probable dikes:

- 97C-02-01: 110.3m

Texture is sub-aplitic, phenocrysts are salmon pink (hematite?) and strongly altered to sericite and carbonate. The matrix feldspar is also shows strong carbonate-sericite alteration. Mafic minerals are variably altered. Biotite is partly to completely chloritized; amphibole is replaced by chlorite, carbonate and clay or sericite. Local muscovite grains are either alteration minerals or are pseudomorphs after biotite. There is no potassic feldspar in the rock. Accessory minerals are sphene, apatite and magnetite.

**Name:** altered sub-aplitic Biotite amphibole plagioclase porphyry.

Vancouver Petrographics: describe plagioclase phenocrysts in a fine matrix and clay as well as sericite alteration in plagioclase

- 97C-05-2: 109.6m

Plagioclase porphyritic rock that staining shows to be free of potassic feldspar. The fine grained matrix consists of quartz and plagioclase, which looks zoned. In thin section, the feldspar is strongly altered to sericite and carbonate. Alteration is 30% of the crystal in places. Everywhere, alteration masks plagioclase zoning patterns. Alteration in the matrix is to sericite, ?hydromica (clay?) carbonate and an amorphous yellow-brown mixture (iron oxide).

**Name:** altered plagioclase porphyry

Vancouver Petrographics: describe feldspar crystals in a matrix of small quartz grains and interpret the rock to be a dacite dike

- 97C-05-3: 245.3

A nearly seriate textured porphyritic rock crowded with plagioclase phenocrysts in a quartz-potassic feldspar matrix. Mafic minerals (amphibole) are locally altered to leucoxene. In thin section, plagioclase is seen to be altered to sericite and epidote and mafic minerals to chlorite (biotite) and tremolite, carbonate and iron oxide or epidote and chlorite (amphibole). Plagioclase zoning is relatively strong and normal with alteration more intense along the boundary between the older core than the younger more sodic overgrowth of the rim. Locally there are small fresh-looking biotite crystals. There is accessory magnetite and sphene.

**Name:** Crowded biotite amphibole plagioclase porphyry.

Vancouver Petrographics: describe larger plagioclase and hornblende in finer potassium feldspar and quartz matrix but call the rock quartz monzonite

- **McMillan sample:** Dot 96-11: 59.1m

The hand sample is porphyritic with about 25% plagioclase phenocrysts in the 2 to 6 mm size range and 5% chloritized mafic phenocrysts in a matrix of quartz and potassic feldspar. Cut by carbonate veins (2 generations). In thin section, plagioclase crystals are 30 to 80% sericitized and biotite, which forms clumps of small crystals (possibly secondary after amphibole?) is 25 to 100% chloritized. Quartz-potassic feldspar intergrowths comprise the matrix. Potassic feldspar is dusted with alteration. Accessory minerals are apatite and magnetite. Carbonate-chlorite zones intergrown with chloritized biotite may be replacing amphibole.

**Name:** Altered crowded mafic plagioclase porphyry

- **McMillan sample 96-16: 194m**

Similar texturally to 96-11:59.1m. Cut by quartz-carbonate veins and with bleaching adjacent to veins and fractures. Plagioclase has a greenish cast (sericitized?). In thin section, plagioclase is variably sericitized and carbonate altered. Quartz in the matrix is coarser than that in 96-11 and deformed. Potassic feldspar in the matrix is also locally sericite-altered. Sericite as relatively coarse mats locally. Mafics are altered to sericite and chlorite. Veins are quartz, carbonate and green acicular crystals (tremolite-actinolite?).

**Name:** Altered crowded mafic feldspar porphyry

**B. Granodiorites:**

- 97C-01-2: 119.6m

Gray biotite amphibole quartz plagioclase granodiorite. Quartz is interstitial and angular between plagioclase crystals; potassic feldspar is minor and interstitial. In thin section, biotite is slightly chloritized with ragged edges; it seems partly resorbed by quartz. Amphibole is probably hornblende with inclusions of plagioclase, apatite, magnetite and sphene; it is subhedral and partially chloritized. Plagioclase is subhedral and weakly to moderately sericitized. It has weak normal zoning.

**Name:** Mafic Guichon quartz diorite

Vancouver Petrographics: call it biotite hornblende quartz diorite

- 97C-01-1: 48.9m

Relatively leucocratic-looking quartz mafic granodiorite (color index about 15). The stained slab shows angular to ameboid interstitial quartz and interstitial potassic feldspar. Plagioclase is slightly yellowed by the stain (sericite). In thin section biotite is intergrown with amphibole. Biotite is strongly chloritized and the amphibole is altered to chlorite +/- epidote. Plagioclase is normally zoned and moderately to strongly sericite altered. Potassic feldspar is weakly altered; it locally replaces plagioclase. Accessory minerals are apatite, sphene and magnetite. Locally, biotite replaces amphibole, then is itself replaced by chlorite.

**Name:** Altered biotite amphibole granodiorite: transitional textures between Guichon and Chataway varieties

Vancouver Petrographics: describe primary muscovite (I did not see it) and call the rock hornblende quartz monzonite

- 97C-02-02: 112.7m

Clouded zoned plagioclase with salmon pink alteration (not potassic feldspar) and green chloritic mafic mineral in hand specimen with interstitial potassic feldspar and quartz. Quartz veins carry chalcopyrite with intergrowths and rims of ?bornite or chalcocite and have potassic feldspar alteration envelopes. Sulphides are also disseminated in the altered mafics. Locally plagioclase is bleached adjacent to mafic minerals. In thin section biotite is chloritized or locally sericitized. Quartz grains clump together to form amoeboid shapes and are intergrown with potassic feldspar. Plagioclase crystals, with local normal zoning, and to a lesser extent potassic feldspar are altered to sericite and carbonate. The opaque minerals are associated with quartz, chlorite and sericite. Apatite, sphene and zircon are accessory minerals.

**Name:** altered mineralized biotite transitional textured granodiorite with potassic alteration on quartz mineralized veins. Some of the quartz enlargement may be due to silicification.

Vancouver Petrographics: call the rock silicified and sericitized hornblende granodiorite. They describe copper sulphide mineralization with the quartz veins and a grain of electrum

- 97C-02-5: 191.5m

The rock has a dominantly grey-green color. Staining show relatively abundant interstitial quartz and potassic feldspar. It also reveals multiple zones in the plagioclase. Plagioclase and some quartz are relatively euhedral (early phases). In thin section, plagioclase is altered and normally zoned; crystals have sodic rims. Amphibole is pleochroic from almost turquoise to pale green; it is relatively unaltered and encloses opaque (magnetite) and apatite grains. Biotite is generally one-third altered to chlorite but alteration intensely varies to complete replacement by chlorite and epidote.

**Name:** Biotite hornblende granodiorite - *this could be a dike rock*: the texture is somewhat porphyritic, quartz is relative abundant and poikilitic potassic feldspar encloses other components.

Vancouver Petrographics: call the rock chloritized, intensely sericitized hornblende biotite quartz monzonite

- 97C-04-1: 206.3m

The specimen looks porphyritic but alteration blurs the texture. Plagioclase grains have white rims due to weak argillic alteration and biotite and hornblende? look chloritized. In thin section, plagioclase crystals have altered cores and more sodic much less unaltered rims. Cores are sericitized with local chlorite(?) alteration; they *may have oscillatory zoning*. Quartz is interstitial and amoeboid. Potassic feldspar is interstitial and intergrown with quartz. Quartz-potassic feldspar poikilitically enclose plagioclase locally. Biotite is 60% chloritized and amphibole is completely replaced by chlorite, epidote, carbonate, magnetite and apparently biotite (earlier than the others). Accessory minerals are apatite, sphene and magnetite.

**Name:** altered granodiorite that may have Chataway affinities (textures indicate not Border or Guichon phases)

Vancouver Petrographics: called it altered hornblende biotite quartz monzonite

- 97C-05-1: 48.3m

The slab was not stained but is granodiorite with relatively fresh-looking but partly chloritized amphibole and chlorite-magnetite altered biotite. In thin section, plagioclase crystals are sericitized, especially adjacent to quartz +/- carbonate veinlets. Potassic feldspar is interstitial, relatively coarse and less altered than the plagioclase. Mafics (amphiboles) are partly altered to actinolite? and locally epidote; biotite is partly altered to chlorite. Quartz is crackled, and ameboid to angular between plagioclase crystals. It is intergrown with potassic feldspar.

**Name:** altered biotite amphibole granodiorite that may be Guichon variety

Vancouver Petrographics: called it altered hornblende granodiorite

### C. Mineralization:

- 97C-02-3: 113.4m

A large bleb of chalcopyrite and small apparently disseminated chalcopyrite grains. The small amount of rock seen looks sericitized and has molybdenite mineralization. In thin section, relatively coarse sericite (muscovite) is intergrown with the sulphide and locally replaces biotite. It also occurs as radial crystals in veins. Remnants of narrow prisms are now Fe-carbonate and quartz - may have been rutile

Vancouver Petrographics: describe chlorite alteration, bornite and a trace of sphalerite in an uncertain host rock

### D. ?Tertiary Volcanics:

- 97C-02-4: 145.3m

The fine grained rhyolitic-looking hand specimen has disseminated and networks of potassic feldspar. In thin section, fine grained plagioclase is dusted with alteration and zoned, but the pattern of zoning is unclear. The matrix is very fine grained with carbonate and lesser sericite alteration. Potassic feldspar partly replaces plagioclase. Accessory minerals are sphene and a ragged opaque mineral. Fractures have sericite coatings.

**Conclude:** altered Tertiary plagioclase porphyritic felsic volcanic rock or dike

Vancouver Petrographics: called it a carbonate-altered felsite dike.

- 97C-03-1: 28.5m

Pebbly fault gouge, or possibly ?Tertiary fragmental volcanic rock.. The "clasts" are angular to rounded and consist of quartz and rock fragments. In thin section, the clasts are seen to be quartz, fine spherulitic volcanics, plagioclase phyric basalts (carbonate altered), quartz-plagioclase intergrowths (granitic rocks) with weak sericite alteration, and some plagioclase clasts. The matrix is very fine and carbonate altered. Clasts are derived from the Guichon batholith and ?Tertiary volcanic sources,

**Conclude:** probably an altered Tertiary multilithic volcanoclastic rock. (tuff)

Vancouver Petrographics: called it slightly reworked altered tuff

- 97CC-03-2: 62.6m

Pinkish brown, finely plagioclase porphyritic dacite?; probably Tertiary. In thin section, plagioclase forms microlites and fine grained phenocrysts. Fractures show carbonate and iron oxide alteration. The groundmass has local carbonate alteration. Altered mafic minerals are now carbonate and iron oxide but may have been pyroxene.

**Name:** Altered Tertiary porphyritic dacitic volcanic rock (but could be a high level shallow intrusive).

Vancouver Petrographics: called it an altered microporphyritic tuff

- 97C03-3: 149.4m

Hand specimen is crumbly and carbonate-cemented gray-tan rock with no mafics remaining that looks like multilithic volcanic breccia under the hand lens. In thin section, clasts partly devitrified plagioclase phyric mafic volcanic rock, quartz fragments (vein material?), amygdaloidal mafic volcanic clasts, carbonate-altered felsic-looking clast (volcanic?), and partially carbonate-altered, normally zoned plagioclase crystals within a granitic clast. The matrix is fragmental, fine grained and carbonate altered.

**Conclusion:** Tertiary fragmental lithic crystal volcanoclastic rock (tuff)

Vancouver Petrographics: called it altered pebbly tuff