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PETROGRAPHIC REPORT: SPECIMENS 81-1 - 172.5,
FL81-1 - 193.77, 81-1 - 242.8, FISH LAKE PROPERTY
SUBMITTED BY C.M. LaLONDE, BETHLEHEM COPPER CORPORATION.

February 9, 1981
David W. Klepacki

GEOTEX CONSULTANTS **LIMITED** CONSULTING GEOLOGISTS

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Petrographic Report: Specimens 81-1 - 172.5,

EL81-1 - 193.77, 81-1 - 242.8, Fish Lake Property

Submitted by C.M. Lalonde, Bethlehem Copper Corporation

Three samples, 81-1 - 172.5, FL81-1 - 193.77, 81-1 - 242.8, submitted C.M. Lalonde of Bethlehem Copper Corporation, have been examined with the petrographic microscope. Two of the specimens are propylitically altered, plagioclase porphyritic quartz diorite. The third specimen, 81-1 - 242.8, is a fine grained andesite, also propylitically altered. This specimen has textures produced by crystallization in situ, but can be interpreted as a lava flow or shallow intrusion. Alteration of the country rock consist of carbonate, quartz, sericite, albite, apatite, and minor clay minerals replace plagioclase phenocrysts. The matrix of the specimens contains the pervasive alteration mineralogy but less than that of the clouded phenocrysts. Quartz-carbonate-chlorite-gypsum veinlets cut specimens 193.77 and 242.8. These have clots of gypsum and minor opaques proximal to the veinlet. Carbonate-opaque veinlets cut earlier quartz-carbonate-chlorite-gypsum veinlets. Carbonate-opaque veinlets have sericite envelopes ^{that} grade into clay-carbonate-opaque-apatite clots several millimeters from the veinlets. Smaller carbonate branch veinlets, continuous with carbonate-opaque veinlet, have no sercite envelope. Sulphide-oxide mineralization is best developed with carbonate-opaque veinlets.

All specimens have experienced hydrothermal alteration, usually associated with nearby intrusions. Granoblastic textures (equidimensional unoriented porphyroblasts with sutured boundaries) are absent, magmatic zoning remains in plagioclase, and magmatic crystallization textures are preserved. Indications of a thermal event other than hydrothermal alteration are missing.

Rock types
- two porphyries
- one alt. volc?

propylitic
veinlets/carbonate

carb + sp 01 2015 AC
+ 9495. in 193 97
qtz-gypsum
in 242.8

Estimated Modes:

	81-1 - 172.5	81-1 - 193.77	81-1 - 242.8
Quartz	43	24	30
Plagioclase	35	27	47
Anorthite % ¹	An32-30	An0	An4-0
Chlorite	5	-	6
Carbonate	7	12	4
Sericite	5	15	8
Opaques	3	6	3
Apatite	x	1	-
Clays ²	2	14	x
Gypsum	-	x	2
Relict Plagioclase Phenocrysts	20	37	45
Relict Quartz Phenocrysts	10	-	-
Relict Biotite Phenocrysts	5	-	-
Qtz-carb-sulfate Veinlets	-	x	x
Carb-opaque Veinlets	x	x	x

¹Plagioclase determinations from flat stage, La method. 81-1 - 193.77 determination is based on maximum extinction angle and negative relief.

²Kaolinite and Illite: clay minerals cannot be positively identified with optical techniques, X-ray methods must be used for positive determination.

x=present in trace amounts.

Thin Section Descriptions:

81-1 -172.5: The thin section is composed of moderately altered plagioclase phenocrysts, fresh quartz phenocrysts, and replaced biotite phenocrysts. Plagioclase phenocrysts are altered to muscovite (sericite), quartz, albite, carbonate, and clays. The alteration is most intense proximal to a carbonate veinlet. Whereas distal plagioclase grains are barely altered and show original magmatic zoning (oscillatory An₃₂₋₃₀). Quartz phenocrysts have embayed rims and unaltered interiors. Chlorite has fine opaques and some carbonate along cleavage planes, and ragged edges, but is not superposed on other magmatic minerals. This suggests chlorite replaced magmatic biotite during hydrothermal alteration. The groundmass is composed of 40% quartz, 40% altered plagioclase and 10% disseminated carbonate. Small radial sprays of muscovite, associated with the carbonate veinlet, are found in the groundmass. This rock is best classified as a quartz diorite.

FL81-1 - 193.77: The thin section is composed of highly altered plagioclase phenocrysts in a groundmass of quartz and alteration minerals. Small white mica flakes with fine opaque dust on cleavage surfaces may be the alteration of magmatic biotite or hydrothermal chlorite. Distinction is not possible. These white micas are identified as kaolinite and/or illite. Plagioclase is entirely altered to sericite-quartz-carbonate-albite-clays. This thin section is cut by a small quartz-carbonate veinlet containing a single clot of gypsum. This veinlet is cut by a carbonate-opaque veinlet with a muscovite envelope. Muscovite is sparse a couple of millimeters from the veinlet and grades into clay-carbonate-opaque-apatite clots a few millimeters from the

veinlet. Disseminated carbonate-clay-sericite compose the pervasive background alteration. Timing of these alteration events is an intense propylitic alteration (with minor clay) superposed by the phyllic-argillic-propylitically altered envelope of the carbonate-opaque veinlet. The quartz-carbonate-sulphate veinlet has no envelope more intense than the background alteration. Small carbonate veinlets branch off the main carbonate-opaque veinlet but have no associated muscovite envelope. No textures indicative of an earlier thermal event were observed

81-1 - 242.8: The thin section is composed of fine grained, weakly zoned plagioclase phenocrysts in a matrix of quartz and plagioclase. Plagioclase phenocrysts have corroded rims and subhedral to euhedral outlines, accommodating neighbouring grains during crystallization. Plagioclase is altered to muscovite (sericite) and carbonate. A background, moderate propylitic alteration is composed of carbonate, sericite, quartz, and albite. A quartz-carbonate-chlorite-gypsum veinlet has a weak propylitic envelope, and is characterized by clots of gypsum-chlorite-opaques proximal to the veinlet. This veinlet is cut by small carbonate veinlets with no alteration envelopes. This rock has textures typical of in situ crystallization and can be interpreted as a lava flow or shallow intrusive of andesitic composition. Granoblastic textures are absent, only hydrothermal alteration of a primary igneous rock is observed so no intense thermal event is evident.

Appendix: Summary response to questions in letter of C. M. Lalonde of
January 23, 1981.

Sample 81-1 - 172.5: Is there any sericite, biotite, or chlorite?

Sericite is found as part of the propylitic alteration assemblage, particularly in plagioclase phenocrysts. Chlorite is interpreted to be a replacement of primary magmatic biotite.

Sample 81-1 - 193.77: Alteration is probably silicification, possibly sericitization- please verify.

The alteration assemblage is typical of propylitic hydrothermal alteration characterized by the breakdown of plagioclase to quartz-sericite-carbonate-albite. Alteration associated with the carbonate veinlet is more intense and represents addition of carbonate and metals to the rock with associated fluids reacting with the wall rock to form muscovite and carbonate close to the veinlet and kaolinite-illite-opaques-apatite further away. Quartz-carbonate veinlets may be adding or removing silica from the system.

Are there any other alteration minerals?

The total alteration assemblage is carbonate-quartz-sericite-opaques-kaolinite-illite-apatite-gypsum.

Could this rock be classified as a hornfels?

No, this rock has textures produced by hydrothermal alteration only. No granoblastic textures, associated with contact metamorphism, are seen.

Sample 81-1 - 242.8: What is the mineral assemblage and what is your opinion on the genesis of this rock? The original mineral assemblage is overprinted by alteration but is interpreted to be plagioclase-quartz.

Original mafics are absent or obliterated in this thin section. Crystallization textures suggest this is a volcanic rock or shallow intrusion of andesite composition (equivalent to quartz diorite).

Does this rock show any signs of hornfelsing?

Original crystallization textures would be obliterated in any hornfels event. This ^{rock} has experienced no such event. Propylitic hydrothermal alteration is the sole metamorphic agent.

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March 2, 1981.

Dr. W. J. McMillan,
Geological Division,
B.C. Ministry of Energy Mines
Petroleum Resources,
Parliament Buildings,
Victoria, B.C.

LOG NO:	3.5	T 3
ACTION:		
FILE NO:		

Dear Bill:

Enclosed is a copy of a petrographic report by Geotec Consultants on the Fish Lake thin sections that I loaned to you on February 25.

We would appreciate any comments you can offer after examining these thin sections.

Andre Pauwels will be phoning you this week to arrange to meet you on March 9 when you will accompany him to the Fish Lake property.

Best regards,

Yours truly,

BETHLEHEM COPPER CORPORATION



C. M. Lalonde
Exploration Manager

CML/mg.