DOLMAGE, CAMPBELL & ASSOCIATES
CONSULTING GEOLOGICAL & MINING ENGINEERS
808 BANK OF CANADA BUILDING
VANCOUVER I, B.C.

Mastodon Highland Bell Ltd.
(Mr. E.R. Wozniak)

MINERALOGICAL EXAMINATION OF SPECIMENS L.G. 1-8 INCLUSIVE

Aug. 21, 1969.

J.A. Chamberlain Consultant Vancouver, Canada.

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INTRODUCTION

At the request of Mr. E.R. Wozniak of Mastodon Highland Bell Ltd., the writer agreed to perform a mineralogical examination on a group of rock specimens from the Smithers area. On August 4, eight specimens arrived at this office and were immediately dispatched for sectioning. The present report is the result of a brief microscopic examination of these sections.

PURPOSE OF INVESTIGATION:

The purposes of the investigation were set out as follows:

1. To identify the ore minerals present in Specimens L.G. 1-3 inclusive, particularly those which are responsible for assay values in copper and titanium.

2. To identify the pale reddish mineral in L.G. 3.

3. From a study of the petrography of the samples to draw conclusions regarding possible inter-relationship of rock-types and to consider the origin of the prevalent clay alteration.

SAMPLE PREPARATION:

Thin sections were made from each of the 8 samples received. Polished sections were made from sulphide-bearing specimens L.G. 1,2 & 3, using a superior technique of mounting in cold-setting plastic and impregnating the porous material with warm epoxy under vacuum. This technique insures that sulphides are not lost in subsequent stages of grinding and polishing.

The following table lists the various sections that were prepared for this project:

Highland Bell Specimen Number	Dolmage-Campbell Section Number	Thin Section	Polished Section
L.G. 1	112		x
L.G. 1	115	x	
L.G. 2	113		x
L.G. 2	116	x	
L.G. 3	114		x
L.G. 3	117	x	
L.G. 4	118	x	
L.G. 5	119	x	
L.G. 6	120	x	
L.G. 7	121	x	
L.G. 8	122	x	

METHOD OF INVESTIGATION:

Sections were examined in transmitted and reflected light using a Leitz Ortholux microscope, with both air and oil immersion objectives. An x-ray powder diffraction pattern was obtained of the red, earthy mineral to arrive at a positive identification.

INTER-OFFICE

TO: Files - Exploration
FROM: R. J. Springer
SUBJECT:

COMPANY: Mastodon-Highland Bell Mines Ltd.
DATE: September 4, 1969

Identification of Lou Group Specimens

Identification of Lou Group specimens LG 1-8, collected by E.R. Wozniak with petrographic work done by J. Chamberlain:-

- LG 1 - Line 60 E, north end.
- LG 2 - Line 60 E, from area which gave copper assay 1.39%
- LG 3 - Line 60 E, south end.
- LG 4 - 52 E, from approximately the middle.
- LG 5 - A piece of bleached float found near the trench area.
- LG 6 - Cut off from a large outcrop on the north side of Louise Lake above the cat trail.
- LG 7 - From an outcropping 2,000 feet west of the trenches, close to the base line.
- LG 8 - From an agglomerate outcrop 500 feet west of the west end of Louise Lake.

RJS:ge

John Springer

MINERALOGY AND TEXTURES

ROCK-FORMING MINERALS:

L.G.-1 (Section 115): Comprises a fine aggregate of intergrown and interlocked quartz grains averaging 0.1 mm in diameter. Texture moderately uniform. Large irregular patches of sericite plus kaolin occupy 50% of area of section. No relict feldspar grains are present to indicate a replacement origin for this extensive alteration. Opaque grains (sulphides) occupy about 5% of the section and are scattered randomly through the section. Individual sulphide grains show no reaction rims or border effects of any kind with the silicates, nor any preferential associations. The sulphides are discussed in more detail below.

Tentative rock name: altered chert.

L.G.-2 (Section 116): Fine aggregate of quartz grains in the 0.1 mm diameter range showing similar interlocked textures as noted in L.G.-1, but now having intervening bands or zones of coarser-grained quartz with individual grains up to 1 mm in diameter. Sericite-kaolin alteration is present in restricted (approximately 40% of section) patches within the fine grained quartz zones, but absent in the coarser quartz. Mafic minerals absent.

Rock name: altered chert.

L.G.-3 (Section 117): Intergrowth of fine quartz grains similar to L.G.-1, and containing roughly the same amount of sericite-kaolin alteration; i.e. 50%. Mafic minerals absent. The reddish-brown pulverent mineral in this sample was x-rayed and proved to be kaolin, presumably stained by iron oxide.

Rock name: altered chert.

L.G.-4 (Section 118): Very fine uniform felted mosaic of quartz grains in the 0.02 to 0.05 mm range with 50% sericite-kaolin type alteration, similar to above. Alteration occurs as distinct, irregular patches, with intervening areas being relatively "clean", though less so than in previous sections. Rare, scattered sulphides, no mafic minerals.

Rock name: altered chert.

L.G.-5 (Section 119): Quartz grains in the 0.1 to 0.3 mm range have a less uniform appearance than in above sections. Degree of sericitic alteration here approaches 75% of area of section in large irregular to wispy, difused patches. Some of the sericite zones have a vague rectangular outline, suggestive of relict plagioclase crystals. Sulphides are fairly abundant. No mafic minerals present.

Rock name: altered chert.

L.G.-6 (Section 120): Rock is sericitized relatively uniformly, perhaps 40 percent overall. Groundmass is principally fine grained quartz, but textures are semi-obliterated by the alteration effects. Abundant large grains of zoned plagioclase measuring from 1 to 3 mm in diameter are scattered through the section. These show about the same degree of alteration as the groundmass.

Rock name: altered feldspar porphyry.

L.G.-7 (Section 121): Degree of alteration is severe. Groundmass is almost 100 percent sericitized, and large relict porphyroblasts of feldspar are present but scarecely recognizable. The porphyroblasts are somewhat less altered than the groundmass.

Rock name: altered feldspar porphyry.

L.G.-8 (Section 122): This rock is made up of angular rock fragments most of which consist of extremely fine, uniform-textured quartz (?) grains having average diameters on the order of a few microns. Rare porphyroblasts of quartz up to 0.5 mm are present locally, as well as zones of brown alteration along microfractures. The degree of sericitic alteration appears to be low.

Rock name: chert agglomerate

SULPHIDES:

L.G.-1 (Section 112): Sulphides constitute 10-15 percent of the section and are made up of the following:

pyrite:	92%
tetrahedrite:	6%
chalcopyrite	<1%
ilmenite:	<1%
graphite:	<1%

The pyrite occurs as subhedral grains disseminated through the rock. In this section, no structural controls or replacement textures are evident, though the tetrahedrite grains show ragged contacts against the silicates. A few minute grains of chalcopyrite are present in the tetrahedrite (Figure 1). Rare ilmenite laths were observed in pyrite grains (Figure 2), but these would appear to be present in quantities too low to account for any significant amount of titanium in assays. A single grain of graphite was observed.

L.G.-2 (Section 113): Suophides constitute 15 percent of the section, very similar to the preceding section, as follows:

pyrite:	90% (t)
tetrahedrite:	5-8%
chalcopyrite:	<1%
pyrrhotite:	<1%

Pyrite in this section is distinctly more vein-like in habit, though perhaps 25% of the sulphide is still disseminated through the rock in a random fashion. Chalcopyrite occurs in a few places as minute grains in tetrahedrite. Pyrrhotite was observed as a small rounded bleb within a larger pyrite grain. The tetrahedrite is similar in abundance and appearance to that of L.G.-1.

L.G.-3 (Section 114): Sulphides in this section constitute only about 8 percent of the rock, but the ratio of tetrahedrite to pyrite is now close to 50:50. The pyrite occurs principally as veinlets, usually surrounded and commonly invaded by tetrahedrite along microfractures (Figure 4). Elsewhere in the section, tetrahedrite occurs as anhedral grains, usually with some associated chalcopyrite (Figure 3).

DISCUSSION & CONCLUSIONS

It should be quite clear that discussion of the inter-relationships of any suite of rocks without the benefit of any field knowledge is conjectural at best. The following remarks should therefore be taken as suggestions only, subject to revision and re-interpretation in the light of field relationships.

Rocks L.G.-1 to 5 appear to belong to a single genetic type. The rocks are cherts which have been subjected to considerable sericitization and kaolinization. The absence of relict feldspar grains and the ubiquitous distribtuion of the alteration suggests that it formed as a result of addition of such elements as Al and K to the rock during a period of general hydrothermal alteration: It is unlikely that the alteration is related to processes of weathering. L.G.-4 with its particularly fine-grained groundmass is most characteristic of normal tuffaceous textures.

The fresh appearance of the suophides suggests that they were deposited at the same time, and in equilibrium with the alteration event. However, this argument could be refuted by field relationships in a less altered part of the zone where, for example, it could be evident that sulphides are of later origin than the alteration event. It seems unlikely on the basis of the present study that the sulphides pre-date the alteration.

Rocks L.G.-6 and 7 are of similar origin, L.G.-7 being a somewhat more severely altered version. The same alteration event has apparently involved all rocks from L.G.-1 to L.G.-7 inclusive.

Rock L.G.-8 should probably be studied in greater detail. The petrography of other fragments could point to a close relationship between this rock and others in the suite. However, on the basis of the single section cut from L.G.-8 for the present study, such a kinship is not obvious. The fragments examined do not have the pronounced porphyritic character of L.G.-6 and 7, and this seriously weakens any argument for a genetic relationship between these units. L.G.-8 groundmass is ultra fine-grained, more so than observed in L.G. 1-4 inclusive, but the pre-alteration aspect of say L.G.-4 may have been very similar to that of L.G.-8. A kinship between L.G.-8 fragments and L.G.-4 would therefore not be unreasonable.

Copper assays up to perhaps 2 percent could be accounted for by the tetrahedrite observed in samples L.G.-1 to 3 inclusive. The small amount of ilmenite observed would only account for a few tens of parts per million titanium. Similarly, chalcopyrite is too scarce to be of much significance in regards to copper values.

Respectfully submitted,

DOLMAGE-CAMPBELL & ASSOCIATES LTD.

J.A. Chamberlain

J.A. Chamberlain, P.Eng, Ph.D.

Vancouver, Canada.

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CERTIFICATE

I, Joseph A. Chamberlain of West Vancouver, Canada, do hereby certify that:

1. I am a consulting geological engineer.

2. I am a graduate of the University of British Columbia, (B.A. Honours Geology, 1955), and of the Harvard University, (M.A., Ph.D., in Structural and Economic Geology, 1957, 1958).

3. I am a registered Professional Engineer of the provinces of Ontario and British Columbia.

4. From 1952 until the present, I have been engaged in regional geological studies, mining and mining exploration, engineering geology, and geological research for various companies and government institutions. I was Geologist and Research Scientist for the Geological Survey of Canada for nine years specializing on the geology of nickel, copper and uranium.

5. I have personally examined the 11 sections investigated and described in this report.

6. I have not, nor do I expect to receive, any interest, directly or indirectly, in the property from which the investigated and described sections were derived.

Respectfully submitted,

J. A. Chamberlain

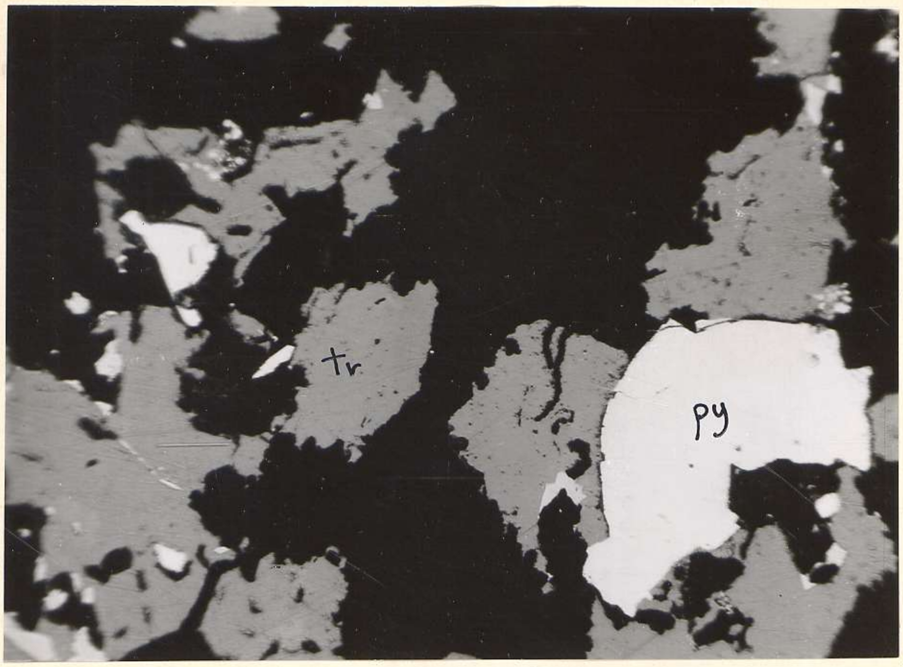
J.A. Chamberlain, P.Eng., Ph.D.

Vancouver, Canada.

ILLUSTRATIONS

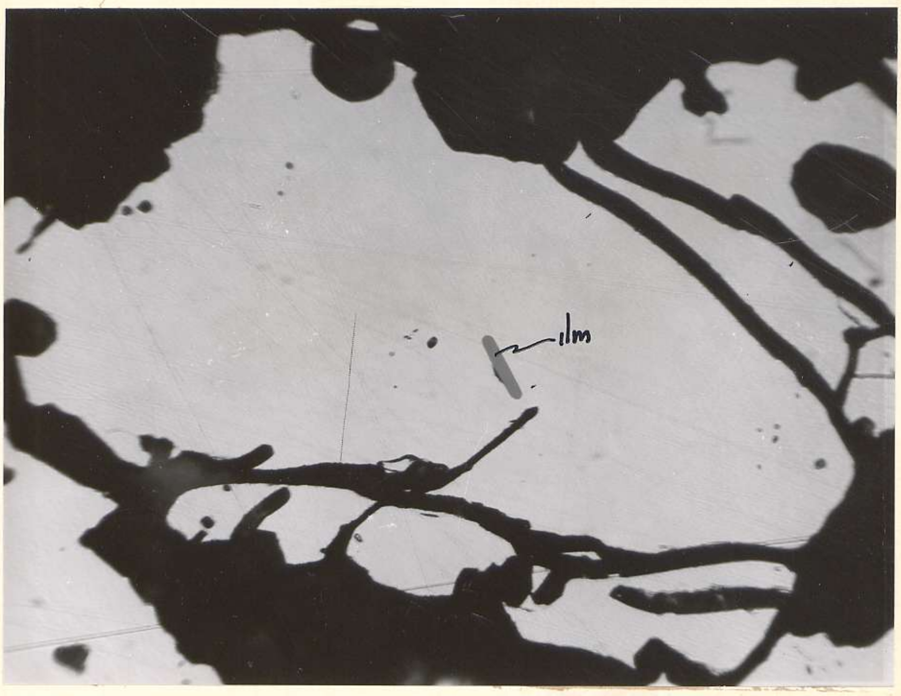
Abbreviations Used

py =	pyrite
cp =	chalcopyrite
tr =	tetrahedrite
ilm =	ilmenite



0.0 0.1 mm
SECTION No. 112

Figure 1 Mag. 316x. Photomicrograph of a polished section showing angular grain of py (white) adjacent to ragged grains tr (med. gray) in altered silicate matrix (black).



0.0 0.1 mm
SECTION No. 112

Figure 2 Mag. 316x. Photomicrograph of a polished section of py (pale grey) containing small inclusion of ilm (dark grey) in gangue (black).

0.0 0.1 mm
SECTION No. 114

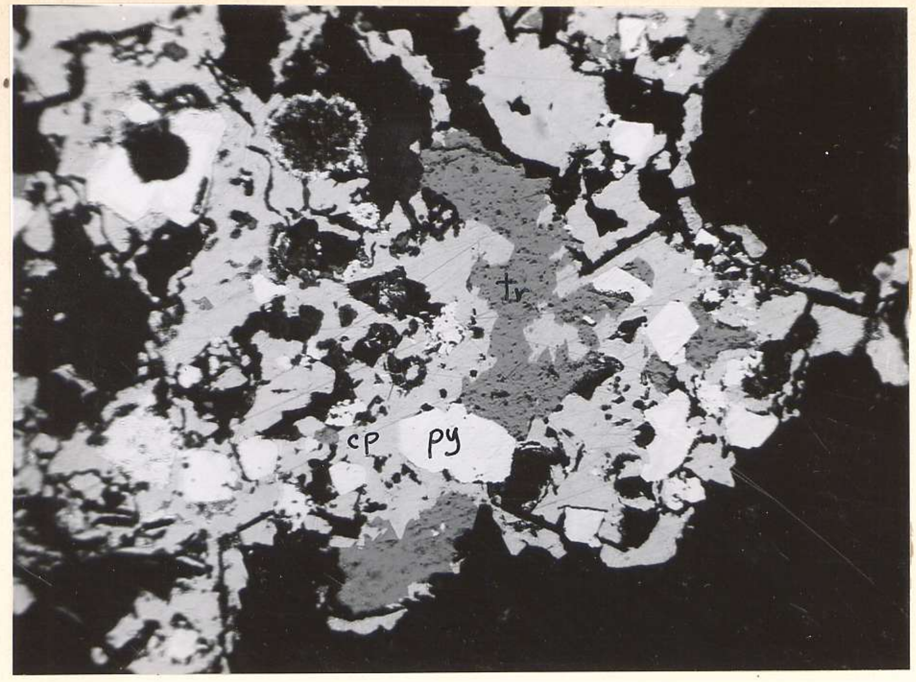


Figure 3 Mag. 316x. Photomicrograph of a polished section showing irregular distribution of py (white), cp (pale grey), tr (darker grey) in silicate gangue (black).

0.0 0.1 mm
SECTION No. 114

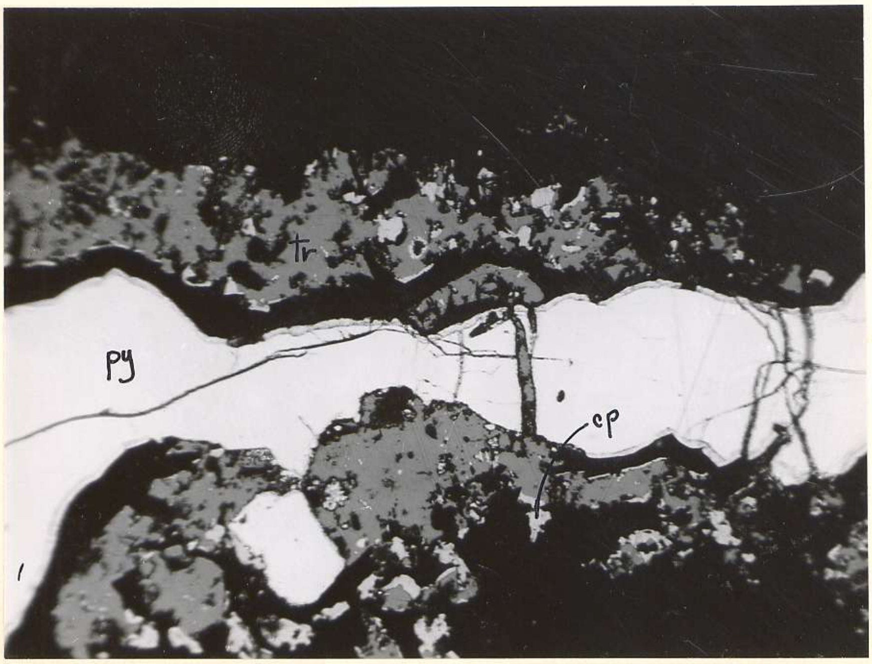


Figure 4 Mag. 316x. Photomicrograph of a polished section of a py veinlet (pale grey-white) bordered by ragged tr (dark grey) containing minor cp. Black matrix is altered silicate gangue.