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THE LORNEX DEPOSIT

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ABSTRACT

The Lornex copper-molybdenum deposit is situated in the Highland Valley of British Columbia, 42 kilometers southeast of Ashcroft. This zoned, structurally controlled, porphyry deposit is entirely within Skeena quartz diorite. The host rock, a variety of the Bethlehem phase of the Upper Triassic Guichon Creek Batholith, is intruded by a pre-mineral quartz porphyry dyke. The dyke trends northwesterly and is most prominent in the southern portion of the ore zone. The Lornex Fault, a north striking, west dipping, regional structure, is the northwestern boundary of the orebody and separates the host rock from younger, virtually barren Bethsaida granodiorite west of the orebody.

The ore zone is approximately 1900 metres long, 500 metres wide, and geological interpretations suggest the orebody plunges 30° to 40° towards the northwest. Mineralization is fracture controlled and commonly occurs as fracture coatings or veins. The major sulphides, in order of abundance, are chalcopyrite, bornite, molybdenite and pyrite.

These sulphide minerals and hydrothermal alteration zones are distributed in a roughly concentric pattern. The bornite core is surrounded by a zone of chalcopyrite and molybdenite mineralization; pyrite is peripheral. Phyllic and pervasive argillic alterations occupy the ore zone and propylitic alteration occurs in the peripheral zone of pyrite and lower copper grades. Intensity of hydrothermal alteration increases with higher fracture density and higher total sulphide content.

The Lornex orebody is considered to have formed at the intersection of regional structures. Tectonic stresses developed conjugate shears at this intersection which were subsequently mineralized by the injection of hydrothermal fluids. Reactivation of stresses caused rupture, displacement and tilting of the mineralized zone along the Lornex fault. Minor faulting and fracturing of the mineralized zone occurred after relaxation of major tectonic forces.

LOCATION

The Lornex copper-molybdenum deposit is located in the interior plateau of British Columbia on the southern slope of the Highland Valley, on National Topographic Sheet 92 I/6E, at

latitude 50° 27' north and longitude 121° 03' west. The orebody is 1550 metres above sea level. The property is 42 kilometres by road southeast from Ashcroft or 72 kilometres by road from Kamloops.

HISTORY

Copper mineralization was discovered in bulldozer trenches by Egil Lorentzen in 1964. Mr. Lorentzen formed Lornex Mining Corporation, and in 1965 under agreement with Lornex, Rio Tinto Canadian Exploration Limited began an investigation of the property. A program of geochemical, induced polarization (I.P.), magnetometer and geological surveys was implemented. The I.P. survey outlined two zones where chargeabilities were in excess of twice mean background (ie. chargeabilities in excess of 5 milli-seconds). Subsequent diamond drilling of the anomolous zones returned encouraging copper grades. A total of 26,200 metres of surface diamond drilling and 27,700 metres of percussion drilling was completed by 1967. An underground bulk sampling program and a small open pit provided feed for a 90 tonne per day pilot mill. The mine was put into production in the spring of 1972.

The developed orebody contained an estimated 266 million metric tonnes of mineable ore averaging 0.427% copper and 0.014% molybdenum at a cut-off grade of 0.26% copper and a waste to ore ratio of 1.2:1. During the period 1973 to 1974 an additional 20,700 metres of diamond drilling was completed. Drill indicated reserves, within a single open pit, as of December 31, 1974, were estimated to be 425 million metric tonnes of proven ore grading 0.412% copper and 0.014% molybdenum at a 0.26% copper cut-off grade and a 2:1 waste to ore ratio.

The mill was designed to process 34,500 metric tonnes of ore per day. Actual throughput, however, has been such that, for planning purposes, the mill capacity is now rated at 43,500 metric tonnes per day.

The property is operated by Lornex Mining Corporation Limited, which is controlled by Rio Algom Mines Limited.

REGIONAL GEOLOGY

The Lornex ore deposit occurs within the composite, concentrically zoned, Upper Triassic, Guichon Creek Batholith (see McMillan, this volume).

The batholith which is approximately 65 kilometers long and 30 kilometers wide, trends in a north-northwesterly direction. The batholith has been divided into four phases which are compositionally and texturally distinguishable. From oldest to youngest the phases are:

1.) The Hybrid phase is peripheral and is generally a mafic rich quartz diorite to diorite in composition.

2.) The Highland Valley phase consists of the Guichon and Chataway granodiorites.

3.) The Bethlehem phase is generally granodiorite, but the Skeena variety, the host rock for the orebody, is a medium to coarse-grained quartz diorite.

4.) The central Bethsaida phase is coarse-grained granodiorite to quartz monzonite.

The batholith intrudes sedimentary and volcanic rocks of the Permian Cache Creek Group and Late Triassic Nicola Group.

Middle Jurassic sedimentary rocks and Cretaceous volcanic and sedimentary rocks unconformably overlie the batholith. The orebody and most of the batholith were mantled with a veneer of pleistocene glacial deposits.

Structural zones cross-cut the Guichon Creek Batholith and are considered to be the result of regional tectonic stresses which created a series of block faults (Carr et al, 1970). Predominant trends in the batholith are north, northwest and to a lesser extent east-west and northeast. According to McMillan, (pers. comm., 1974), the Lornex orebody is located in a horst bounded on the north by the Highland Valley fault and on the south by the Skuhun Creek fault. The horst is cross-cut by the north striking Lornex fault. This regional fault forms the contact between the Bethsaida and Bethlehem phases in the vicinity of the Lornex orebody and truncates mineralization in the ore zone. Cumulative movement on this west dipping fault is apparently right lateral and reverse (McMillan, pers. comm., 1974).

GEOLOGY OF THE ORE DEPOSIT

The Lornex copper-molybdenum deposit is approximately 1900 metres long, 500 metres wide and plunges northwesterly to a depth in excess of 750 metres (below 850 metres A.S.L.). The ore deposit is mantled by 2 to 75 metres of overburden. It reaches its maximum depth in Award Creek Valley which is the surface expression of the Lornex fault, and gradually thins eastward. The orebody occurs within Skeena quartz diorite, a slightly porphyritic, medium to coarse grained rock (figure 1). It consists of quartz (20%), plagioclase (50%), orthoclase (10%), biotite (5 - 10%), hornblende (5 - 10%), and accessory sphene, apatite, zircon, and magnetite. Quartz is subhedral to anhedral, interstitial with undulatory extinction. Plagioclase exhibits oscillatory zoning and is twinned. Composition of crystal centres is about An_{30-35}. Orthoclase is interstitial and perthitic. Biotite is subhedral to euhedral. Hornblende is irregular anhedral and commonly has a poikilitic texture.

A pre-mineral quartz porphyry dyke (figure 1), which is probably related to the Bethsaida phase (McMillan, pers. comm., 1974), trends northwesterly through the Highmont property, and into the Lornex orebody.

Contacts of the dyke are indistinct because of silicification and sericitization of adjoining Skeena quartz diorite. The dyke is presumed to have intruded along one of a series of structural zones parallel to Highland Valley (Bergey, et al, 1970). Typically, quartz phenocrysts compose 20 to 25% of the dyke, but locally plagioclase phenocrysts have been observed. The grey aphanitic matrix is composed of 60 to 70% plagioclase (An_{40}) and 10% quartz.

Ages of Rock Types and Mineralization

All phases of the Guichon Creek Batholith have been dated at 198 $\pm$8 m.y. (Northcote, 1969), but geologic evidence indicates that relative age decreases from the periphery to the core. Hydrothermal alteration products, from the Lornex orebody were dated at 190 $\pm$4 m.y. (Jones et al, 1974). This and geological evidence indicates that Lornex mineralization is slightly younger than the youngest intrusive phase of the batholith.

Structure

Mineralization at Lornex is controlled by fracture density and distribution.

Mineralized and post mineral fractures were formed during at least three periods of deformation. In order to facilitate the study of more than 11,000 structural measurements from the Lornex pit, a computerized stereo-plot program was utilized. This program plots poles to planes on a lower hemisphere, equal-area net. As illustrated in figure 3a contoured plots of percent density indicate three major attitudes for copper-molybdenum veins; 022° /55° S.E., 064° /57° S.E. and 090° /58° S. Certain of these veins are dominant in distinct zones of the orebody. The 022° striking veins are common in the northern zone, whereas the 090° striking veins concentrate in the south and southeast zones. In the central and western zones there is an overlap of all three vein attitudes which result in a greater concentration of veins and high copper grades (figure 2).

Two post-mineral fracture systems have been recognized in the open pit. One system of faults and fractures trend 094° /52° S.W. to 092° /62° S.W. and 021° /46° S.E. to 032° /54 S.E. (figure 3b and 3c), sub-parallel to the 022° and 090° striking copper-molybdenum veins. A second system, as illustrated in figures 3b and 3c, has three dominant trends:

	Fractures	Faults
1.)	112° /69° S.W.	117° /57° S.W.
2.)	136° /66° S.W.	
3.)	172° /68° S.W.	172° /64° S.W.

Where faults cross-cut vein mineralization displacements are from 1 centimeter to 2 metres.

In summary, three distinct structural systems, one mineralized and two unmineralized, have been recognized in the orebody. They are, from oldest to youngest:

1.) Mineralized fractures striking 022° , 064° and 090°.

2.) Post-mineral faults and fractures which strike 092° to 094° and 021° to 032°.

3.) Faults and fractures which strike 112° to 117° , 136° and 172°.

The most prominent structural feature is the Lornex fault illustrated in figures 1 and 2a. It has been exposed by mining and intersected by diamond drill holes. The fault truncates the northwestern part of the ore deposit and juxtaposes Bethsaida granodiorite and Skeena quartz diorite in the vicinity of the orebody.

The fault strikes north and dips 55° to 85° toward the west. It is generally flatter dipping in the south and steepens toward the north. Black gouge, which forms on the footwall of the fault zone, varies in thickness from 10 centimetres to 1½ metres. Mylonite, which forms discontinuous pods 1 to 50 metres wide in the hanging wall of the fault zone, has been exposed in the pit over a strike length of 75 metres.

Mineralization

The predominant hypogene sulphide minerals in order of abundance are, chalcopyrite, bornite, molybdenite and pyrite. Minor amounts of sphalerite, galena, tetrahedrite, and pyrrhotite also occur. Total sulphide content averages one to one and one-half weight percent in the ore zone, but gradually decreases from the central part of the orebody towards its periphery. Common gangue minerals include quartz, calcite, epidote, hematite, magnetite and gypsum.

Sulphide mineralization occurs primarily as fracture infillings intimately associated with quartz and as fracture coatings.

An estimated five percent of the total bornite, chalcopyrite and pyrite mineralization occurs as disseminations or as partial replacements of mafic constituents of the host rock. Veins average 5 to 15 millimeters in width, but vary in width from a hairline to more than a metre. The larger veins, some of which have been mapped along strike lengths of over 200 metres, are commonly quartz, molybdenite and chalcopyrite. Occasionally, molybdenite occurs as rosettes in vuggy quartz veins, but commonly molybdenite occurs as thin laminae in quartz giving the vein a banded appearance. Kimura and Drummond (1968) describe similar veins at the Endako ore deposit and suggest that repetitive pulses of mineralization occurred along these types of vein structures. Molybdenite veins more than a metre in width are prominent on the eastern side of the orebody (figure 2a). Post-ore faults are prevalent along these veins.

An erratic band of late stage gypsum occurs at elevations below approximately 1100 metres (figure 7b). The gypsum is generally at a higher level on the fringe of the orebody and deeper in its center. Gypsum mineralization is post-ore and occurs in veins 5 to 10 millimeters thick.

Trace element studies of the orebody, surrounding rocks and the Lornex fault zone indicate anomalous values of several elements. Anomalously high amounts of Zn, Ag and Bi and, according to Olade (1974) Pb, Mn, Hg, Cd and Ca exist in the Lornex fault where it truncates the orebody. Zinc values as high as 1200 p.p.m. have been determined from analyses of Lornex fault gouge. Sphalerite and discontinuous pods of massive pyrite occur in the Lornex fault zone, but chalcopyrite, bornite and molybdenite have not been observed. Assays over 70 p.p.m. Bi in the fault are probably due to the presence of bismuthinite which was identified by microprobe analyses of copper concentrate. The orebody is enriched in B, Ti, and V but anomolously low in Mn, Sn and Ba.

Hydrothermal Alteration

X-ray diffraction (McMillan, pers. comm., 1974), megascopic and microscopic studies were conducted to classify intensities and types of hydrothermal alteration. Four types of alteration which are related to quartz and sulphide mineralization have been recognized in the open pit. A fifth type of alteration, silicification, is not detailed since the zone of silicification appears related to the pre-mineral quartz porphyry dyke.

The four alteration types, potassic, phyllic, argillic and propylitic are generally weak in the quartz porphyry dyke but the skeena quartz diorite host rock was very susceptable to hydrothermal alteration.

Potassic Alteration

Hydrothermal K-feldspar occurs primarily as veins which average approximately 5 millimeters in width. Potassic alteration is erratically distributed and no well defined potassic zone exists at the levels explored in the Lornex orebody.

Phyllic Alteration

Quartz-sericite envelopes comprise phyllic alteration in the orebody. This grey mixture of quartz and sericite commonly forms borders on quartz-copper sulphide and quartz-molybdenite veins within the argillic alteration zone (plates I and II). These envelopes often form sharp boundaries with moderate to intense argillic alteration and average approximately 3 centimeters, in width.

Argillic Alteration

Argillic alteration which is pervasive throughout the ore zone, is characterized by the presence of quartz, sericite, kaolinite, montmorillonite and chlorite. Sericite and kaolinite with minor montmorillonite and chlorite form pseudomorphs after plagioclase. The core of the plagioclase crystals are more intensely altered than the rims, but in the intense stage of argillic alteration the entire plagioclase crystal is replaced by sericite and clays. Kaolinite, sericite and minor monmorillonite replace orthoclase. Alteration of these crystals progresses from the rim towards the core with increasing intensity of argillic alteration. Biotite and hornblende alter to chlorite and sericite. Argillic alteration of the Skeena quartz diorite is cream-coloured to bleached or apple green. In the cream-coloured to bleached variety kaolinite predominates over sericite, but in the apple green variety sericite predominates over kaolinite.

Classification of the intensity of argillic alteration is based upon the degree of alteration of feldspars and mafics. Figure 4 illustrates the variations in amounts of rock-forming and alteration minerals with increasing intensity of argillic alteration.

Generally total copper grades increase as the intensity of argillic alteration increases.

Propylitic Alteration

The typical propylitic alteration assemblage consits of epidote (zoisite), chlorite, carbonates (calcite) and minor sericite, and hematite. Epidote and calcite are most common as veins. Quartz and orthoclase are fresh, but plagioclase, which has a fresher appearance than in the argillic alteration zone, alters to calcite and epidote with minor amounts of sericite and chlorite. Mafics alter to chlorite, calcite and sericite with minor hematite and epidote.

Paragenesis and Zoning

Relative ages of mineralization have been determined from cross-cutting relationships, such as are illustrated in plates I and II, polished section exsolution features, and vein zoning. The stages of mineralization and the related alteration types for each stage are illustrated in figure 5. Quartz is ubiquitous in all but the two youngest stages of mineralization. Molybdenite occurs in stages 2 to 5, but is most abundant in stages 4 and 5.

Copper mineralization is generally confined to stages 3, 4 and 5. Pyrite mineralization is insignificant in the ore zone. It is probable that calcite veining associated with propylitic alteration is an alteration product rather than a late stage product of hydrothermal fluid fractionation, but no definite relationship has been determined. The final stage of mineralization, gypsum, has no associated alteration. The concave line below the 1200 metre (approximately 4000 foot) elevation on figure 7b is the "gypsum line".

Concentric horizontal (figure 6) and vertical (figures 7a and b) zonal distributions of principal sulphides and major hydrothermal alteration phases have been determined. Sulphide and alteration zones plunge northwesterly 30° to 40° and terminate abruptly against the footwall of the Lornex fault. Bottoms of zones have been determined in the south-central portion of the orebody and tops have been interpreted in the northern part. The shallow depth of the zones in the south-central area coincide with the highest level of quartz porphyry dyke intrusion.

Weak hydrothermal alteration and lower sulphide content in the dyke, relative to the Skeena quartz diorite, may be due in part to the very fine grained nature of the dyke matrix, and to the halo of silicified rock surrounding the dyke. That is, progress of hydrothermal fluid would be impeded in the dyke.

The sulphide zones illustrated in figures 6 and 8 are defined as follows:

Bornite Zone: Bornite > Chalcopyrite > Pyrite

Chalcopyrite Zone: Chalcopyrite > Bornite > Pyrite

Pyrite Zone: Pyrite $\geq$ 0.05%; total copper $<$ 0.26% Cu.

Molybdenite Zone: Molybdenum $\geq$ 0.02% Mo.

Total sulphide content in the bornite, chalcopyrite and molybdenite zones averages 1 to 1½ percent, but only ¼ to ½ percent in the pyrite zone. According to Olade (1974) an increase in pH could cause the sulphide zonation, if the rate of decrease of copper, caused by deposition of copper sulphide, was less than the rate of decrease of H^+ activity caused by hydrothermal alteration.

The alteration maps (figures 6 and 7a) illustrate zones of pervasive argillic and propylitic alteration. The argillic alteration has been divided into three degrees of intensity as defined in figure 4. A phyllic alteration zone which is not detailed on the maps, generally coincides with zones of moderate to intense argillic alteration.

The following general statements regarding the mineral and alteration zoning of the orebody can be made:

1.) The principal sulphides form a concentric pattern with bornite in the centre, chalcopyrite outside bornite and a molybdenite zone overlapping portions of the bornite and chalcopyrite zones. Pyrite forms a "halo" around the ore zone.

2.) Copper grades and total sulphide content decrease outward from the core of the orebody to its periphery.

3.) Sulphide and alteration zones are deep in the north and shallow in the southern portions of the orebody indicating a 30° to 40° northwest plunge to the orebody.

4.) Zones of moderate to intense argillic alteration correspond to grades higher than 0.26% copper and total sulphide content greater than 1%.

5.) The propylitic alteration zone which occurs on the margin of the orebody is associated with sub-economic copper grades, the pyrite zone and total sulphide content less than one-half of one percent.

Weathering and Supergene Characteristics

The oxide zone averages only 3 to 30 metres in thickness and contains only minor amounts of recoverable copper sulphides. It is thickest on the west side of the orebody and thins towards the east. The depth of the zone is irregular, apparently controlled by local fracture density. Malachite is the predominant copper mineral in the oxide cap, but azurite, cuprite, chalcocite, covellite and native copper are common. Limonite and pyrolusite are also abundant in this zone. No molybdenum oxide minerals have been identified. Enrichment in the oxide zone is not economically important, although a discontinuous layer of chalcocite, averaging about 5 to 10 centimeters thick occurs at the oxide-sulphide interface.

GENESIS OF THE ORE DEPOSIT

Interpretation of the genesis of the orebody has been based upon the following criteria:

1.) The age of 198 ±8 m.y. for the batholith and 190 ±4 m.y. for the mineralization.

2.) The intersection of the Lornex fault and the zones of weakness along which the quartz porphyry dyke intruded.

3.) Truncation of the Skeena quartz diorite and the ore zone by the Lornex fault.

4.) The interpreted right lateral and reverse movement on the Lornex fault.

5.) Sulphide mineralization occurs primarily as fracture infillings.

6.) The 022° /55° S.E., 064° /57° S.E. and 090° /58° S. orientations of copper-molybdenum veins.

7.) The density and spacial distribution of veins in the orebody.

8.) The presence and orientation of two post-mineral structural systems. Faults and fractures in the first set strike 093° and 026°. The youngest faults strike 115° and 172° and fractures strike 136°.

9.) The relative ages of mineralization and related hydrothermal alteration.

10.) Hydrothermal alteration is weaker and sulphide content is less in the quartz porphyry dyke, relative to the Skeena quartz diorite.

11.) The concentric, zonal distribution of sulphides and hydrothermal alteration.

12.) The interpreted 30° to 40° northwest plunge of the ore deposit.

Emplacement of the Lower Jurassic Guichon Creek Batholith into Permian and Triassic rocks of the Cache Creek and Nicola Groups appears to have been controlled by major, deep-seated zones of weakness (Carr and McMillan, 1970).

The Lornex fault may be the rejuvenated supracrustal expression of one of these deep-seated structures. The quartz porphyry dyke, probably related to intrusion of the Bethsaida phase, was emplaced along a northwest trending zone of weakness which intersects the Lornex fault.

Figure 9 illustrates the proposed genetic model of the orebody as described below.

Pre-mineral tectonic stresses are thought to have formed a conjugate shear system at the intersection of the Lornex fault and the quartz porphyry dyke. Maximum principal stresses from the east-north-east and west-south-west produced the fracture pattern illustrated in figure 8a. These shear fractures strike 022° and 090° and extension fractures strike 064°. Assuming that the maximum principle stresses were vertical, fractures developed at this time would also be vertical.

Ore bearing, hydrothermal fluids, which may have developed as a late-stage fractionation of the magma which formed the batholith, migrated along the fractures. The result was an epithermal ore deposit with a concentric zonal distribution of sulphide minerals and hydrothermal alteration (concentric rings in figure 9). The bornite-rich central core has associated phyllic and moderate to intense argillic alteration.

Successively outward is a chalcopyrite zone with phyllic and moderate to intense argillic alteration, and a peripheral zone of pyrite mineralization with associated weak argillic and propylitic alteration. A zone of high total sulphide content developed in the zone of most intense fracturing (stippled area on figure 9).

Following mineralization it is thought that regional stresses, with maximum principle stresses from the east-north-east and west-south-west produced further shearing subparallel to and along 022° and 090° striking veins (figure 8b). It is probable that during this period of deformation apparent right lateral displacement took place on the Lornex fault. Apparently, the Lornex orebody (the portion east of the fault) was tilted down in the north and relatively up in the south at this time. This 30° to 40° tilt is invoked to explain why mineralized fracture now dip in a southerly direction and why sulphide and alteration zones plunge northwesterly.

A late stage deformation produced by maximum principal stresses oriented from the northwest and southeast, developed a conjugate shear set (figure 8c). Conjugate shears are oriented 115° and 172° , and extension fractures strike 136°.

Displacements related to this period of deformation are generally minor.

Pleistocene glaciation and other geomorphological processes developed the present oxide cap and cover of glacial, fluvial and lacustrine sediments.

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CAPTIONS FOR ILLUSTRATIONS

Figure 1. General Geology of the Lornex Deposit.

Figure 2. Composite maps of 4712 and 5000 benches illustrating: (a) structural geology and (b) copper-grade distributions.

Figure 3. Lower hemisphere, equal area, Stereographic projections of structures mapped in the open pit.

Figure 4. Abundance of minerals which define zones of varying intensity of argillic alteration.

Figure 5. Paragenetic sequence and relative abundance of mineralization and related hydrothermal alteration.

Figure 6. Hydrothermal alteration and sulphide mineral zoning at the 1370 metre (4500 foot) level.

Figure 7. Section A - A' looking north showing: (a) zonation of hydrothermal alteration and (b) sulphide mineralization.

Figure 8. Interpreted principal stress directions and structures developed during the three periods of deformation.

Figure 9. Schematic plans illustrating the interpreted genesis of the orebody.

Plate I. A stage 2 quartz-molybdenite vein with associated argillic alteration is cross-cut by stage 3 quartz-chalcopyrite-molybdenite veins with associated phyllic alteration and a stage 4 quartz-chalcopyrite-bornite vein with associated phyllic alteration.

Plate II. Left Sample

A stage 3 quartz-chalcopyrite vein with associated phyllic alteration is cross-cut by a stage 4 quartz-chalcopyrite-bornite vein with associated phyllic alteration. A stage 5 (or stage 6) vein composed of quartz-chalcopyrite with minor bornite and molybdenite and associated argillic alteration cross-cuts the stage 3 and 4 mineralization.

Right Sample

A stage 4 (or 3) quartz-chalcopyrite vein with minor

bornite and associated phyllic alteration cross-cuts argillic alteration associated with a barren, stage 1 quartz vein and a stage 2 quartz-chalcopyrite-molybdenite-bornite vein.

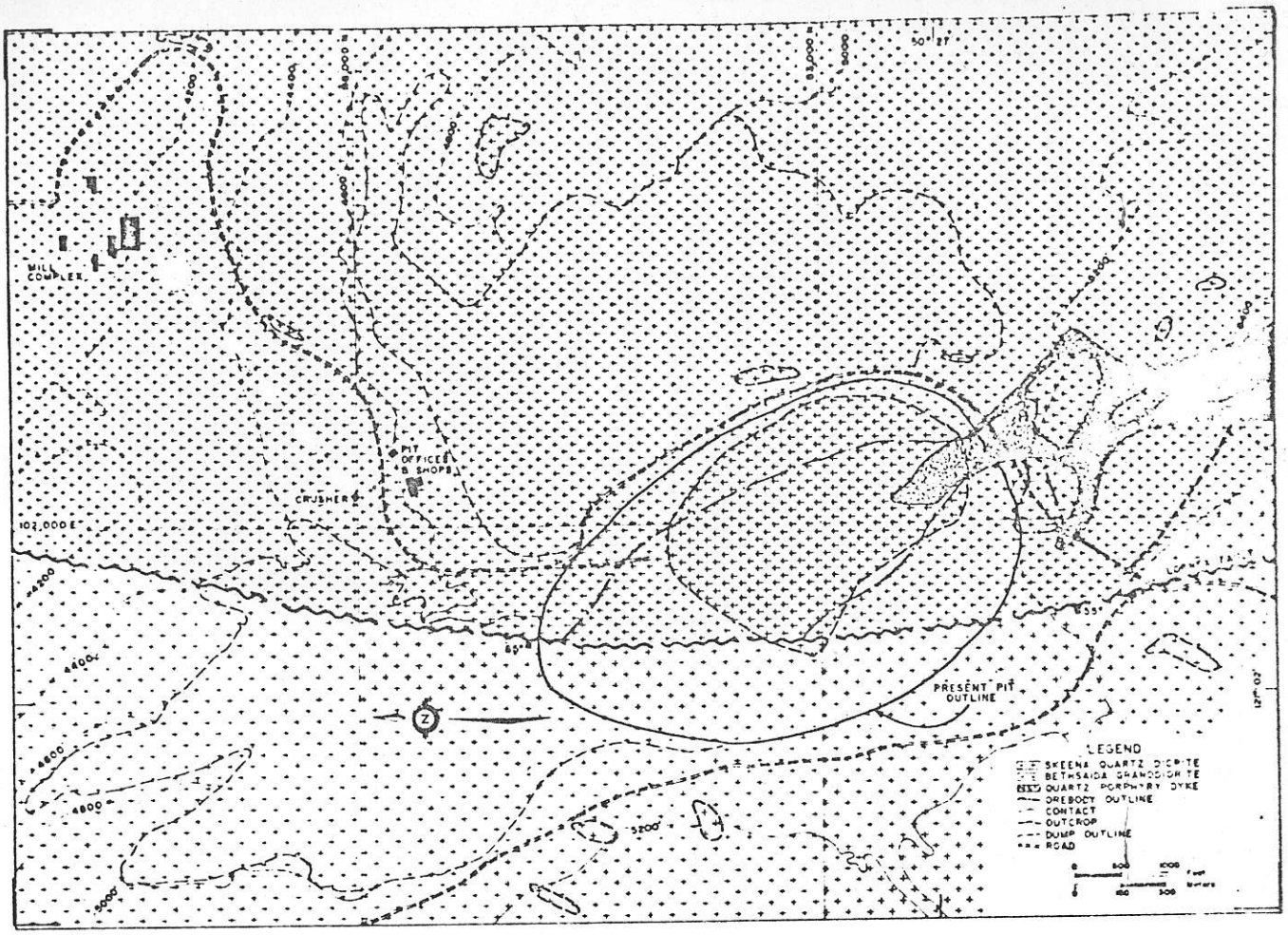

MILL COMPLEX
PIT OFFICES & SHOPS
CRUSHER
102,000 E
PRESENT PIT OUTLINE
LEGEND
SKEENA QUARTZ DIORITE
BETHSAIDA GRANODIORITE
QUARTZ PORPHYRY DYKE
OREBODY OUTLINE
CONTACT
OUTCROP
DUMP OUTLINE
ROAD

Figure 1

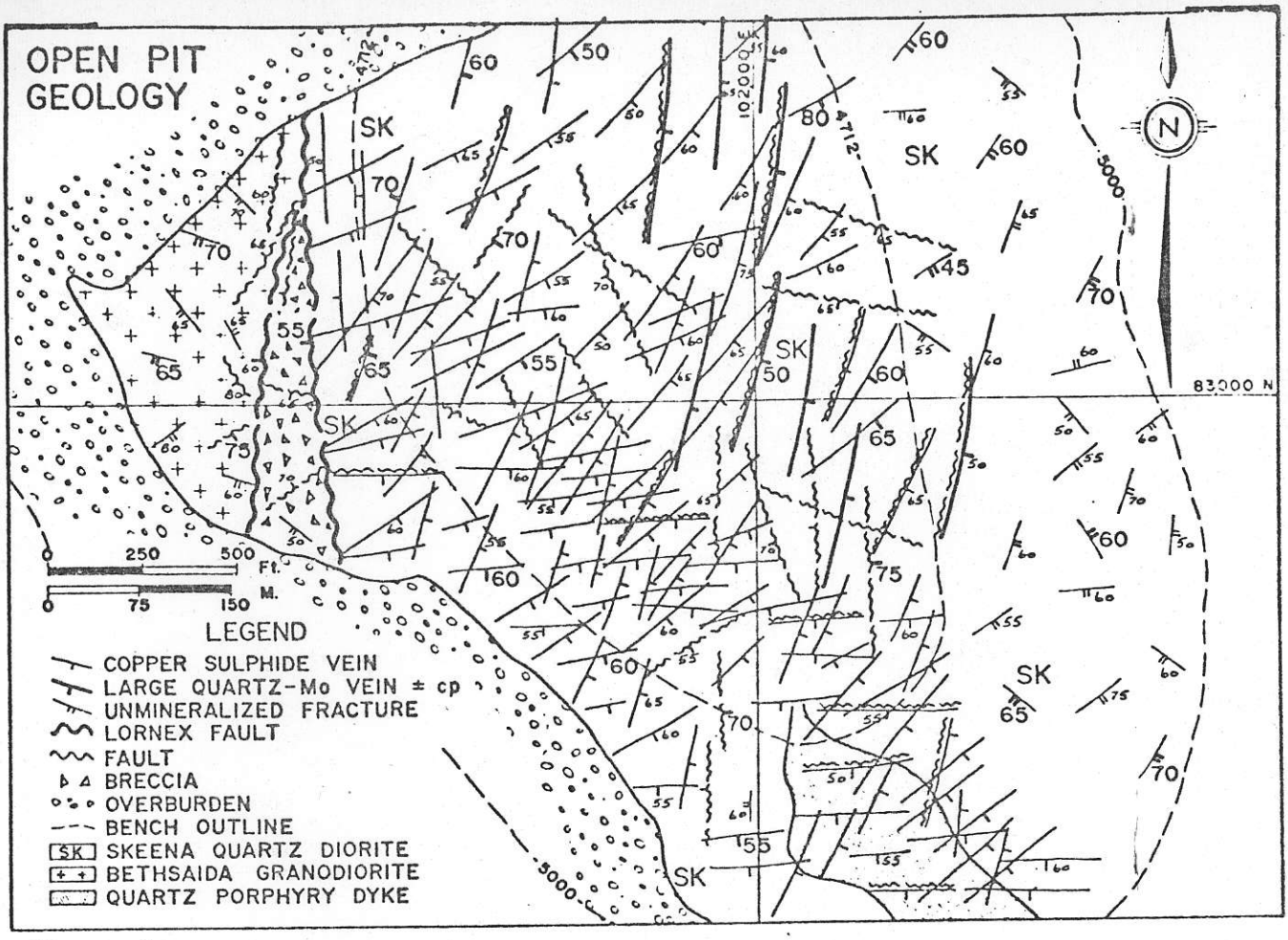


Figure 2a

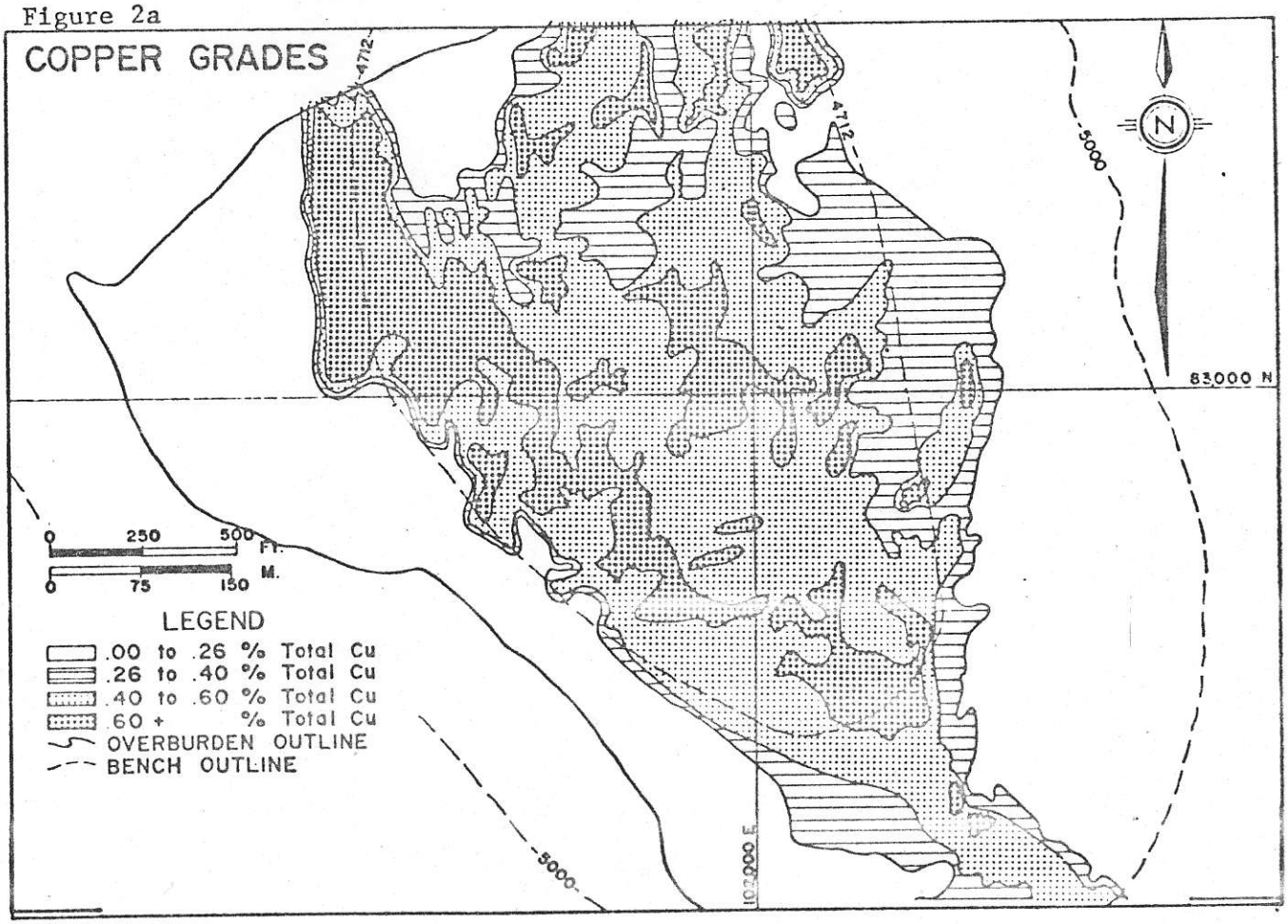


Figure 2b

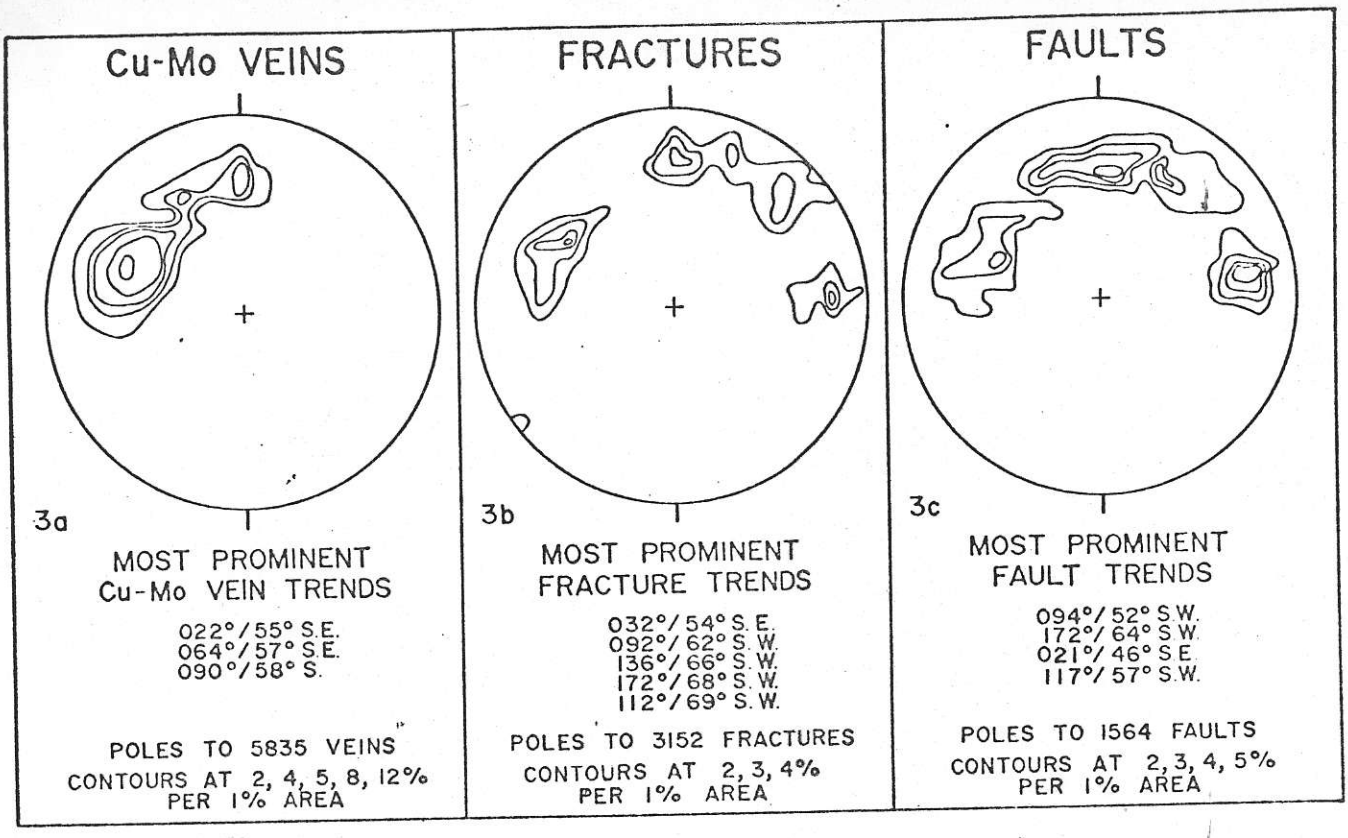

Cu-Mo VEINS
3a
MOST PROMINENT
Cu-Mo VEIN TRENDS
022°/55° S.E.
064°/57° S.E.
090°/58° S.
POLES TO 5835 VEINS
CONTOURS AT 2, 4, 5, 8, 12%
PER 1% AREA
FRACTURES
3b
MOST PROMINENT
FRACTURE TRENDS
032°/54° S.E.
092°/62° S.W.
136°/66° S.W.
172°/68° S.W.
112°/69° S.W.
POLES TO 3152 FRACTURES
CONTOURS AT 2, 3, 4%
PER 1% AREA
FAULTS
3c
MOST PROMINENT
FAULT TRENDS
094°/52° S.W.
172°/64° S.W.
021°/46° S.E.
117°/57° S.W.
POLES TO 1564 FAULTS
CONTOURS AT 2, 3, 4, 5%
PER 1% AREA

Figure 3

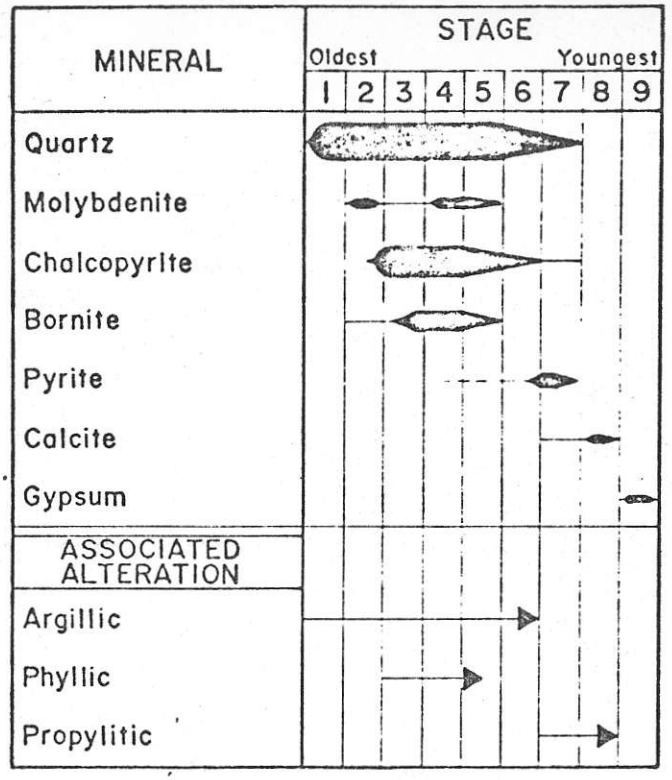


Figure 5

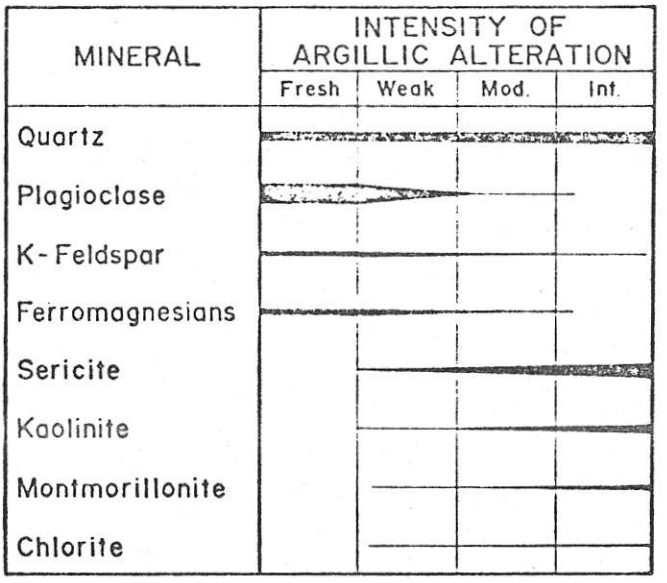


Figure 4

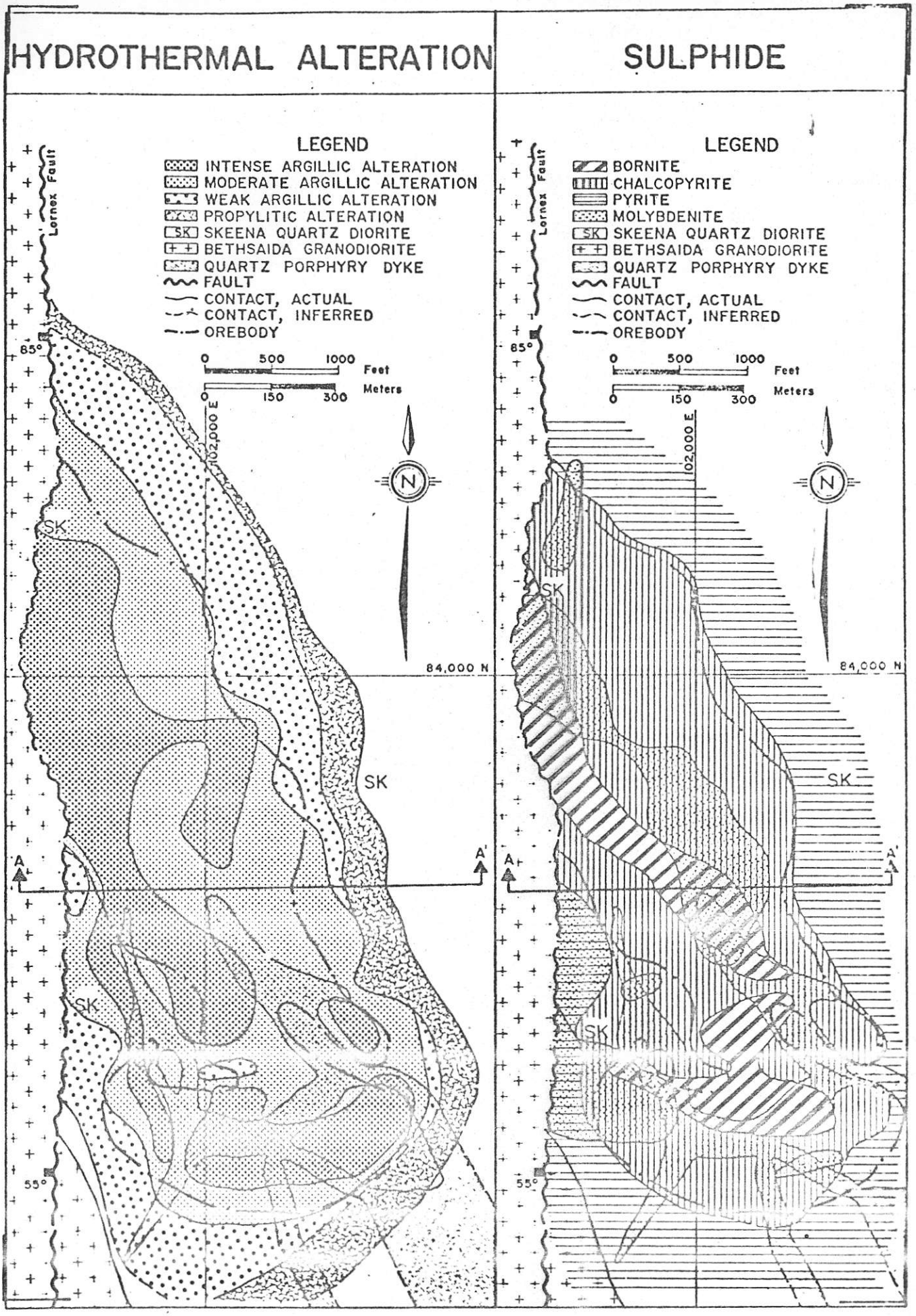

HYDROTHERMAL ALTERATION
SULPHIDE
LEGEND
INTENSE ARGILLIC ALTERATION
MODERATE ARGILLIC ALTERATION
WEAK ARGILLIC ALTERATION
PROPYLITIC ALTERATION
SKEENA QUARTZ DIORITE
BETHSAIDA GRANODIORITE
QUARTZ PORPHYRY DYKE
FAULT
CONTACT, ACTUAL
CONTACT, INFERRED
OREBODY
BORNITE
CHALCOPYRITE
PYRITE
MOLYBDENITE
0 500 1000 Feet
0 150 300 Meters
Lornex Fault
85°
55°
102,000 E
84,000 N
SK
A
A'
N

Figure 6

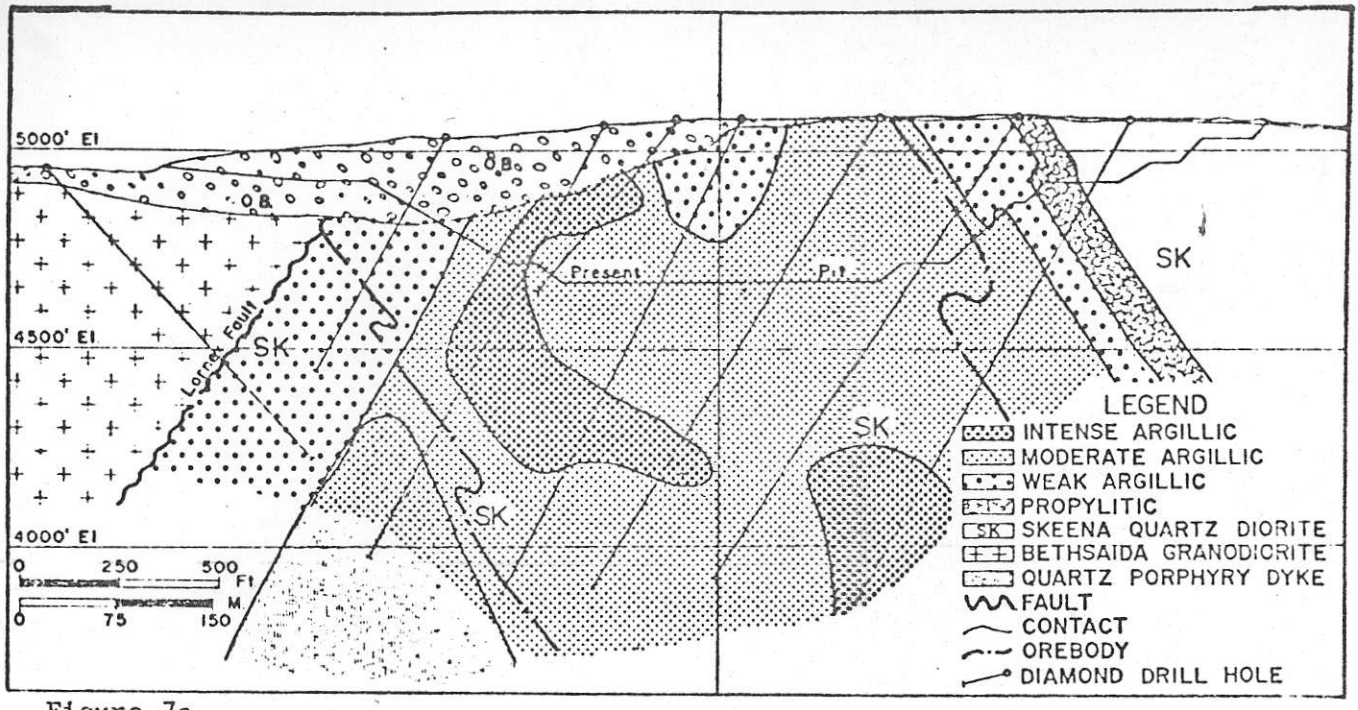


Figure 7a

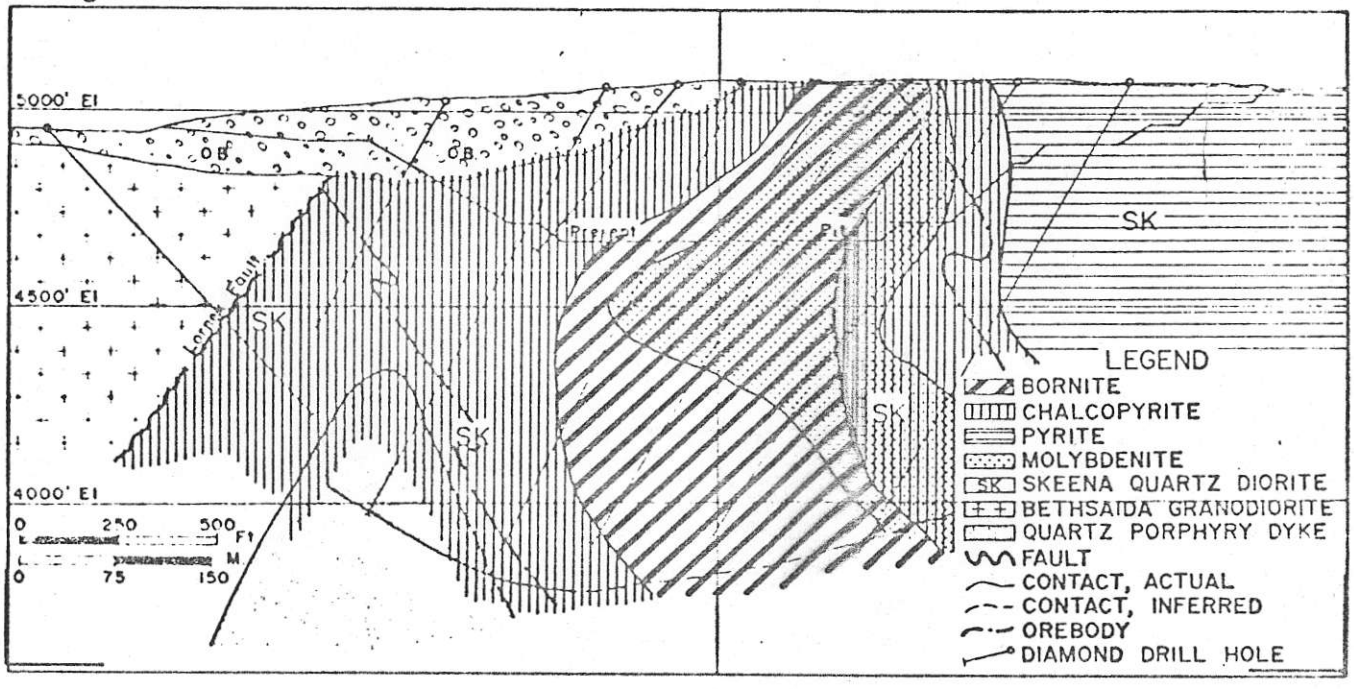


Figure 7b

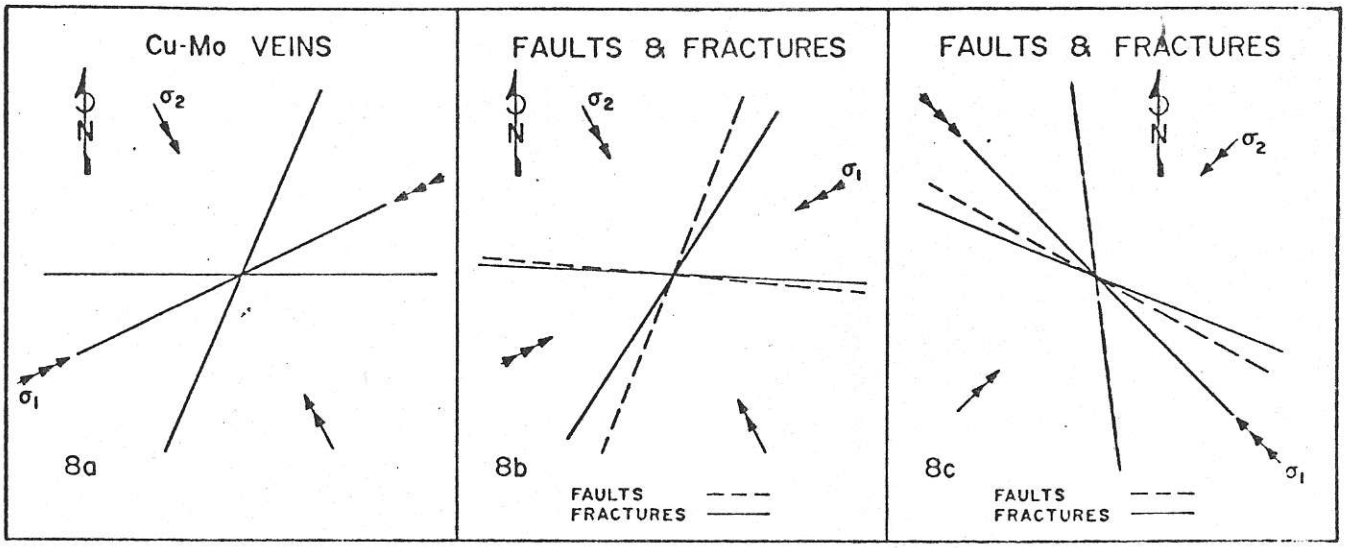
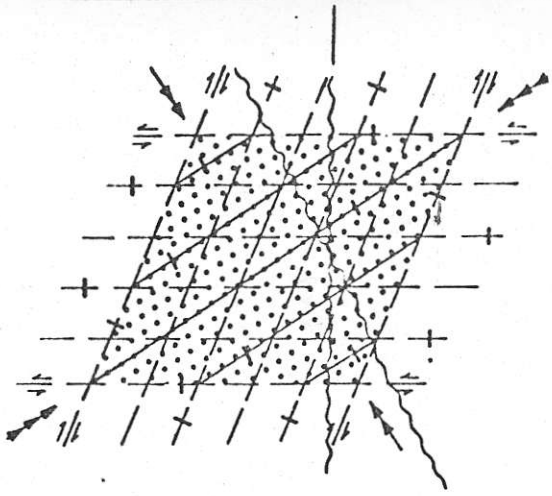
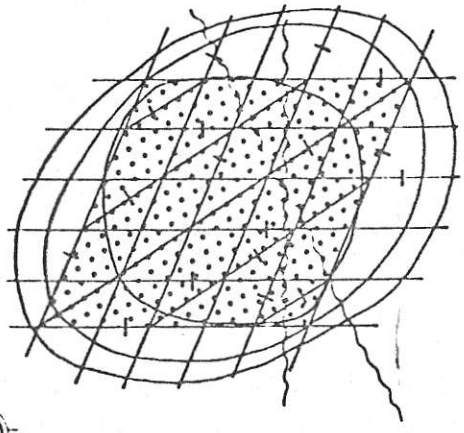

Cu-Mo VEINS
N
σ_2
σ_1
8a
FAULTS & FRACTURES
N
σ_2
σ_1
8b
FAULTS
FRACTURES
FAULTS & FRACTURES
N
σ_2
σ_1
8c
FAULTS
FRACTURES

Figure 8

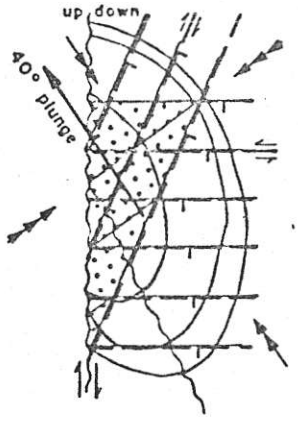
1. Tectonic stresses (maximum principal stress from NE and SW) develop vertical conjugate shears and related extension fractures at the intersection of the north striking Lornex fault and the northwest trending quartz porphyry dyke. (Stippled area is region of most intense fracturing).



2. Hydrothermal fluids migrate along the shears and fractures. The result is a vein type ore deposit with a concentric, zonal distribution of sulphide mineralization and hydrothermal alteration.



3. Tectonic stresses (maximum principal stress from NE and SW) produce conjugate shears along the veins which strike 022° and 090°. The stresses cause apparent right lateral, reverse displacement of portions of the ore deposit along the west dipping Lornex fault, and cause tilting of the Lornex orebody. The result is a 30° to 40° NW plunging orebody in which the veins dip southerly.



4. Local stresses (maximum principal stress from NW and SE) develop minor conjugate shears and related extension fractures in the vicinity of the Lornex orebody.

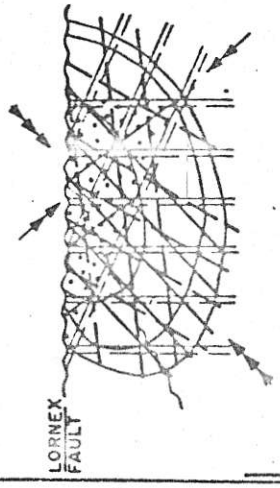


Figure 9

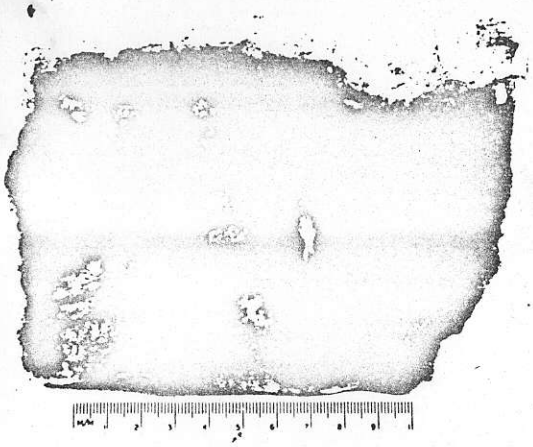


Plate I.

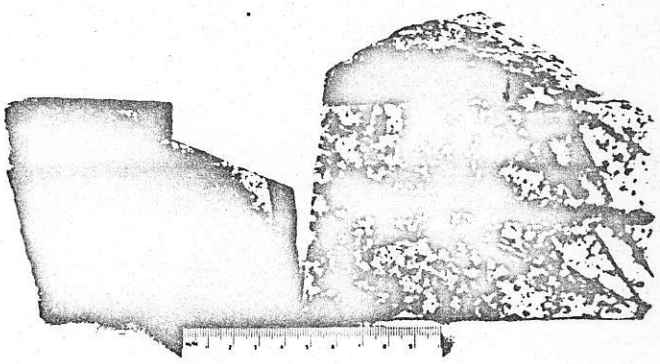


Plate II