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ABERDEEN (50°120°SW)

A Mineragraphic Report by

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INTRODUCTION

Aberdeen is a copper mine, lying on Broom Creek, 11 miles north of Lower Nicola, a village west of Merritt, B.C. A gravel road from the mine follows Broom Creek one mile down to its junction with Guichon Creek, and passes 11 miles down to Lower Nicola which is about 4 miles south of Craigmont, a producing copper mine.

The relief in this area ranges from 1850' altitude at Lower Nicola; 2800' altitude at the mine; to about 5000'altitude of the surrounding hills. The broad valleys of the Nicola and Guichon provide the drainage for the area. The annual precipitation, about 14 inches, occurs mostly during January to June.

HISTORY, DESCRIPTION, DEVELOPMENT

Aberdeen is non producing, but it has received much interest since its discovery about 1898 because of its mineralogy which includes high grade copper minerals.

A long history tells of the ~~history~~ development of this mine, when prospectors found the green copper stain on the granitic rocks of the Guichon Batholith. Brom Creek was one of the first showings as one progressed up Guichon Creek, because the lower stretches are drift-covered.

In the 1898 report* the following is written: "Five miles south of Mammette Lake, a dyke of granite impregnated with native copper and cuprite..."

Johnston (1904) writes: "In a few instances masses of copper of several pounds weight have been found occupying fissures in the Sovereign claim." Other minerals of copper, bornite and gray copper (tetrahedrite) were found in conjuction with specular hematite and cuprite (which probably was hematite too).

Such high grade copper in this showing attracted many people, the first of whom started the Aberdeen syndicate, represented by T.J. Corvin of Seattle, U.S.A. Work was done in 1915, and assay returns showed 4% copper, 2 oz. of silver and some gold. During 1916 shafts were sunk and three drifts were cut, thereby dumping 3500 tons of second grade ore and extracting 1400 tons of 7% copper with small silver values.

* B.C. Minister of Mines Reports

During World War I an unknown nuber of carloads of bornite were railed to the smelters; no records have been kept but about 400 tons have been estimated.

In 1925 Merritt Mines, Ltd. started working on the property. In that years report(1923) the following description of the body exists: the ore is found "... in a zone of fracturing in highly altered volcanic rocks and the deposit was characterized by the occurrence of lenses and pockets of chalcocite to a depth of over 100 feet below the surface." He (the writer of the report) mentions the greatest problem of the mine to be: "... the particular question of moment in regard to this deposit is in regard to its persistence in depth." To explain why such quantities of supergene alteration have lasted through the glaciations, he forwards this hypothesis: "... is possible that the preservation of surface-related secondary ore may have been due to the influence of a protective lava cap, since eroded away." In the workings no widespread mineralization had been intersected at the lowest levels, thus indicating a possible termination of the ore body.

The mine switched ownership again in 1928, when Aberdeen Mines Ltd. worked on exploration in the mine without success. The 1928 report (Minister of Mines) gives the following write-up: "... is identified with a body of black rock that has all the appearance of a basic dyke material, but which under the microscope is found to consist of tourmaline-quartz and hematite and is therefore regarded as vein matter."

Exploration was undertaken again in 1956 by Northwestern Explorations Ltd., a subsidiary of Kennecott Copper Corp. who did some magnetometer surveys and drilled 1024 feet in 24 holes. They found low-grade disseminated copper present in altered granitic rocks of the Guichon Creek batholith.

The last company undertaking work on the property was Torwest Resources Ltd. who in 1959 did some drilling and trenching without success at finding the continuation of the ore body.

It is difficult to give up such a high grade body of ore, and for this reason it is important to know whether the ere body is hypogene or supergene, which determines whether the ore is surface bound or whether it may be intersected in its continuation with depth.

GENERAL GEOLOGY

"The Merritt area is in a broad belt of copper mineralization extending from Lake Chelan in Washington through Copper Mountain, Princeton, the old Aspen Grove Camp, to the Merritt, Highland Valley and Kamloops areas.

"In the Merritt area, Jurassic intrusive bodies of granodiorite, quartz diorite and diorite are present, the largest being the Guichon Batholith, which extends from just north of Craigmont to the Highland Valley and from Guichon Creek to the Thompson River.

"These rocks intrude the Upper Triassic Nicola series, which is a thick, predominantly volcanic sequence of tuff, agglomerate, breccia and flows, with minor sedimentary horizons of limestone, argillite and greywacke. The resolution of the sequence and structure in the Nicola series is hindered by lack of outcrop and absence of continuous and distinctive marker horizons. In general , the Nicola rocks are steeply dipping with marked variations in strike from one area to another.

"Small areas of Lower Cretaceous Kingsvale and Spences Bridge volcanic and Tertiary Coldwater coal measures also occur in the Merritt area as relatively shallow cappings of the Nicola series."(Rennie, 1961)

PETROLOGY AND STRUCTURES

Various descriptions of the rock enclosing the mineral deposits are given in the reports(Min. of Mines), some of these are here quoted:

1. Johnston (1904)

"... moderate fine grained syenite, light grey feldspar and black hornblende, grading into dominant white quartz and showing dark brown mica replacing hornblende. In this latter type small crystals of pale red garnet are frequent."

"Sometimes as a result of local disturbance, the rocks are observed to exhibit a decided schistosity and some very t thin bands consist of a rather coarse grained light reddish feldspar to the almost entire exclusion of other minerals."

Describing the Aberdeen claim in particular he states: ".. where a large mass of the greenstone is enclosed between two coarse joint planes in the granite, striking about N85°W (mag.). A tunnel has been driven for over 100 feet. The greenstone coated with green carbonate of copper and carrying small quantities of chalcocite and specular iron is met at various intervals along the entire length of the tunnel."

Describing the I.X.L. claim he has this to say; "... old greenstone cemented in a paste of eruptive granites... A coarse joint structure with a dip S55°E $< 45^{\circ}$ is distinctly visible."

2. In the report of 1916;

"The vein varies from 6 to 12 feet wide and timbering is by stulls and square sets."

MINERAGRAPHY

Specimens Studied: The material studied representing the mineralogy of the mine can be divided into three groups, namely:

1. Hypogene ore.
2. Cataclastic rock.
3. Supergene mineralization.

Hypogene Ore: This group of handspecimens is divided into two types,

1. Chalcocite-hematite combination
2. Bornite-supergene chalcocite combination

In the first type chalcocite is coarsely crystalline and the hematite forms laths in the quartz gangue surrounding the chalcocite. (Figures XI, XII)

In the second type bornite is coarsely crystalline and well fractured. The fractures are filled with limonite, and a shell of chalcocite occurs between the fractures and the bornite. Malachite crusts occur on the outside of the specimen. Black sooty chalcocite covers some surfaces. Spherical black limonite structures occur in vugs, together with indigenous limonite.

Cataclastic Rock: Brecciation of hypogene minerals can be noted in various intensity stages, ranging from clean well crystallized specularite and chalcocite, to a pasty and gougy reddish rock that contains only small specks of the original crystals. Thin scales, wires, and flakes, often coated with red paste provide a skeleton for the gouge. (Figures II and XVI) Augen of specularite chalcocite and granular silica occur in the general schistosity of the rock specimens. (Figs. IA and XIII).

What? Thin very spongy layers of native copper transect the schistose specimens, indicating a solution of material out of the layer.

Supergene mineralization: The specimens of pink feldspar granite from drill cores contain flakes of native copper disseminated throughout the rock. Chloritized rock near the clean granite contains these flakes too. Small cracks and fissures in the rock are filled with the copper and have acted as conduits for the supergene Cu-rich waters. (Fig. V)

MICROSCOPIC DETERMINATION

Hypogene Ore: The following hypogene minerals have been found in the specimens:

Hematite-- Hardness G, anisotropic, oblique lamellæ in laths, negative to all reagents, red powder and internal reflection(not always), also mostly occurs as specularite.

Chalcocite--Hardness B, color bluish gray, anisotropic but also isotropic in some areas. HNO_3 effervesces vigorously, mineral stains blue; KCN quickly stains black, bringing out etch cleavage; $FeCl_3$ stains blue.

Bornite---Hardness B, colour pinkish brown, some anisotropism, HNO_3 effervesces, surface stains yellowish brown, brick-like etch cleavage pattern; KCN stains brown; $FeCl_3$ stains orange.

Magnetite--small hard (F) black blebs, isotropic.

The hematite-chalcocite ore relations can be seen in fig. XI The fractured chalcocite has been healed by clear quartz containing hematite laths. Figure XII shows laths of both minerals. Figures eight, nine and ten depict some relations between hematite, chalcocite and clear quartz with the quartz gangue. They all seem to be contemporaneous.

Bornite-hematite relations are seen in figure XIV which shows some specularite in the bornite. The same figure together with IV and XVIII show some interesting supergene features. Figure four exhibits a bluish rim around bornite. This may either be digenite or blue chalcocite containing some bornite dissolved in it, as Edwards(page 98) suggests. Outside of this rim is the ordinary bluish white chalcocite.

Edwards (page 127) indicates that "Lattice replacement textures appear to be less common... The chalcocite has penetrated the bornite as a micro-vein along a fracture or cleavage, and then begun to spread laterally into the bornite along the (111) planes of the bornite. A feature of this particular intergrowth is the development of minute spindles of chalcopyrite in the bornite, as a temporary phase, at the actual loci of replacement." It is believed that this was seen under high power and oils.

Areas of covellite around carbonate veins in chalcocite can be seen in figures VI and VII; this may represent solid solution unmixing.

<u>Supergene Mineralization</u>: Native copper occurs in the Guichon Creek Batholith granite together with crystals of chalcocite. Figure V has been mentioned in this regard. A thin-section of the granite when viewed under reflected light shewed ribbons of native copper winding between the quartz-grain boundaries and through fissures. Supply conduits passed through greenstone and thence possibly to the protore just described.

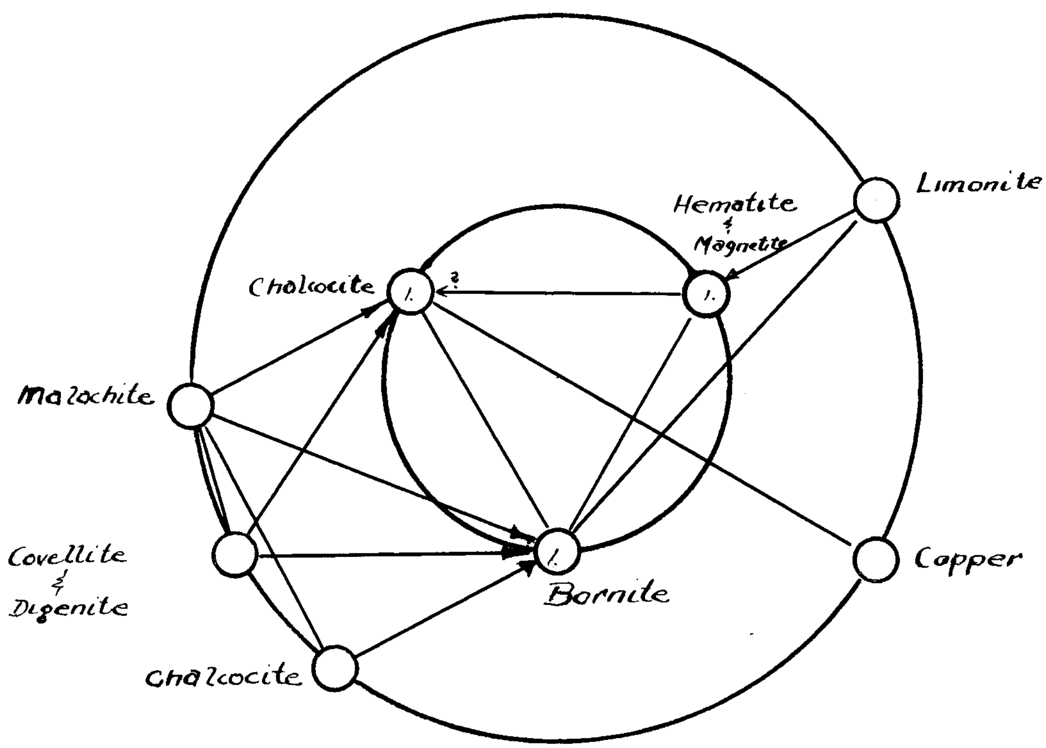
MODE OF THE MINERALS

In this type of collection it is difficult to ascribe a certain frequency value to a mineral; the following are approximations of the relative occurrence:

<u>Protore</u>:	Hematite (+magnetite)	1/3
	Chalcocite	1/3
	Bornite	1/3
<u>Supergene</u>:	Malachite	
	Limonite *indigenous*	
	Chalcocite + Covellite + Digenite	
	Copper	

According to reports the amount of copper can be high grade. *ie pounds.*

PARAGENETIC SEQUENCE



TYPE OF DEPOSIT

The Aberdeen is a ~~meso-~~ to epi-thermal vein deposit of chalcocite, bornite and specularite. Some of the chalcocite is supergene but most of it is either hypogene or an exsolution product from a hypogene bornite-chalcocite mixture.

The native copper has been liberated from the copper sulfides through the extreme shearing these minerals have undergone in the rock. Ascending groundwaters dissolved the copper and deposited it in cracks and intergrain boundaries in the batholithic rocks.

There is no pyrite in the specimens that would suggest supergene enrichment, but the shearing is believed to help the liberation of the copper to produce some supergene chalcocite and large amounts of unrecombined native copper. No deeper pods are expexted.

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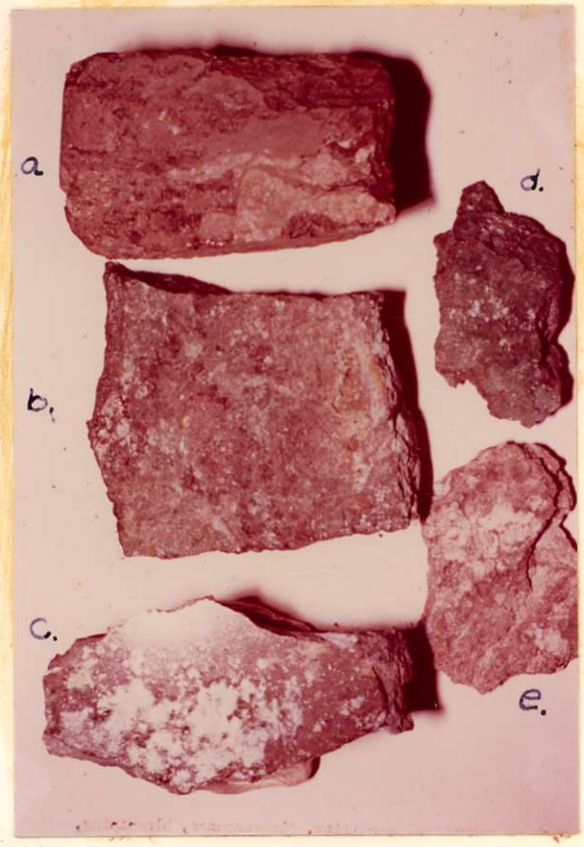
Johnston, Robert A.A.(1904), The Copper Claims of Aspen Grove and Aberdeen Camp, B.C.: Geol. Surv. Of Canada, Ann. Rept., page 74A.

Rennie, C.C.(1961), Geology, Craigmont Mine: The Can. Min. And Met. Bull., vol. 54, number 588, page 297.

Reports, Minister of Mines, Annual Reports, Province of B.C.



<u>Figure I</u> Some specimens

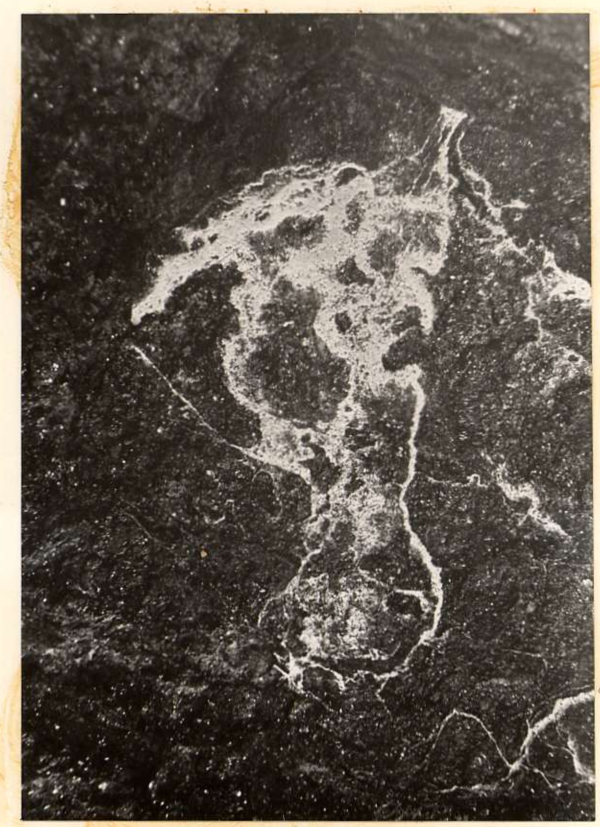
a. gouge with hematite, chalcocite and siliceous augen.

b. hematite (specular)-chalcocite ore with malachite coating.

c. polished hematite-chalcocite.

d. bornite-chalcocite with malachite coating.

e. greyish brown gouge rock with malachite stain.



<u>Figure II</u> Native copper threads in sheared hematite (specular)-chalcocite ore. Reflected light. About 10x magnified.

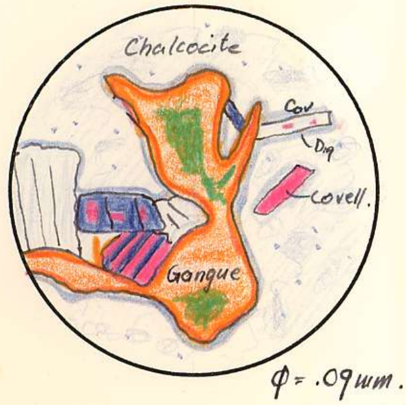


Figure III Polished section showing Fe and Cu rich gangue bordered by digenite in chalcocite which altered to covellite.

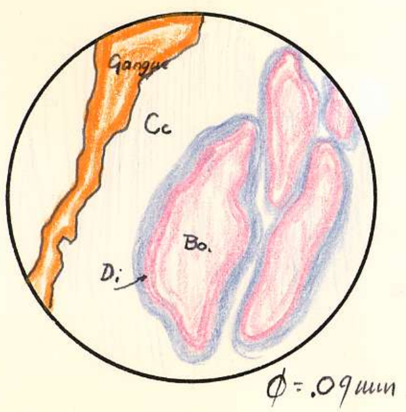


Figure IV Polished section of hematite-rich gangue in chalcocite containing bornite with digenite rims.

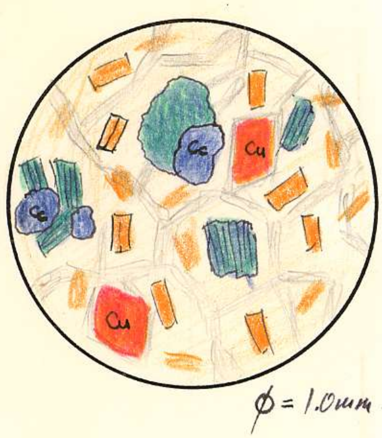


Figure V Thin flakes of native copper and chalcocite occur in the granite in this polished section.

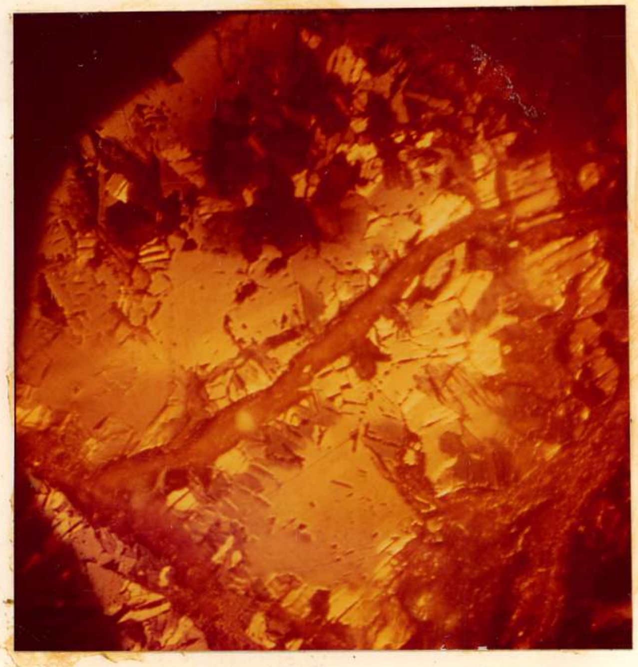


Figure VI Polished section of chalcocite with a carbonate vein bordered by covellite and digenite. Magnification 80x.

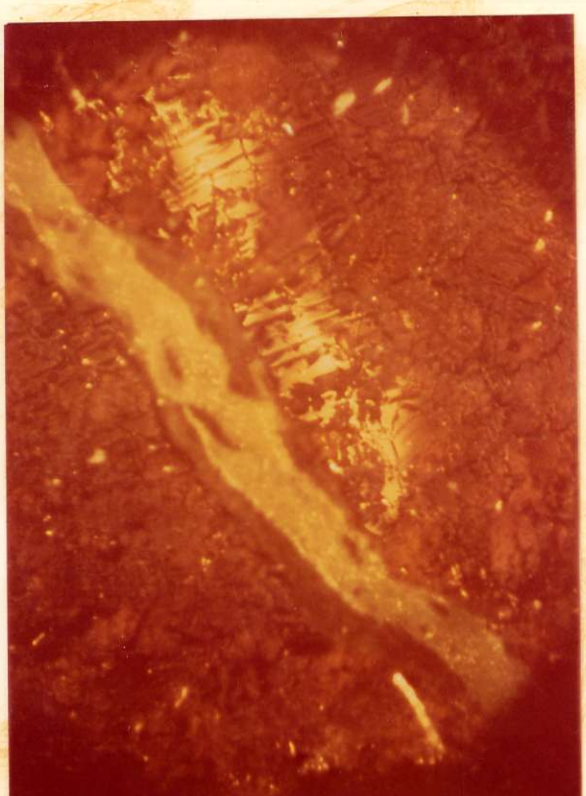


Figure VII Polished section with reflected and oblique light showing a Cu-rich carbonate vein in hematite-rich siliceous gangue with chalcocite altered to covellite. Magnification about 80x.

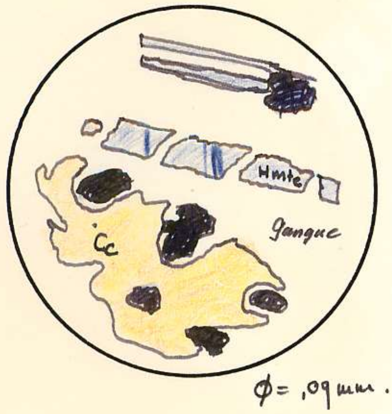


Figure VIII Hematite laths showing oblique twinning, chalcocite with irregular boundaries filled with clear quartz in a dark gangue.

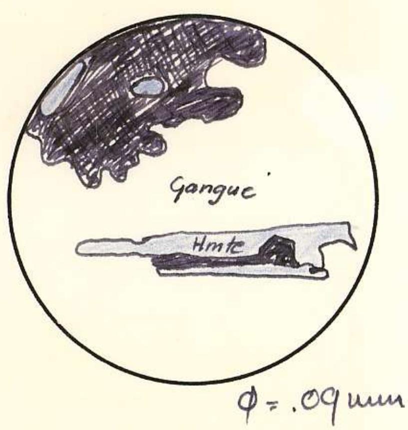


Figure IX Hematite in relation to the clear quartz gangue.

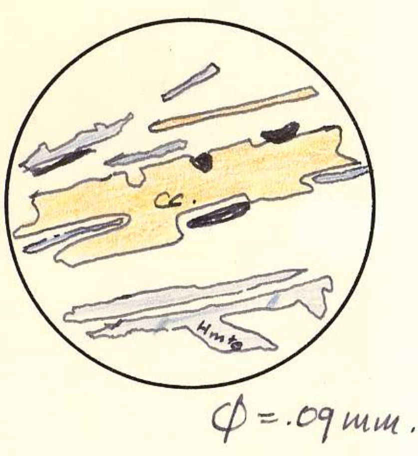


Figure X Chalcocite, hematite and clear quartz laths showing contemporaneous relations.

Figure XI Massive fractured chalcocite healed with a quartz gangue containing specularite laths. Magnification ca. 6x.

Figure XII Enlargement of Fig.11. Yellowish hematite laths (large and small) and fractured bluish grey lath of chalcocite. Magnification ca. 80x.

x 1

Figure XIII Sheared hematitic ore transected with stringers and flakes of native copper. Augen of specularite, chalcocite, and granular siliceous rock are surrounded by bent lamellæ of copper coated brown with the hematite paste.

x 10.

Figure XIV Fractured ~~hypogene~~ bornite with rims of chalcocite and limonite.

1mm ϕ.

Figure XV Thin section with polarized light and reflected light, showing blebs of chalcocite, quartz with boundaries indicating magmatic origin, and partly altered feldspar. Filaments of native copper coat grain boundaries and fissures.

16
15

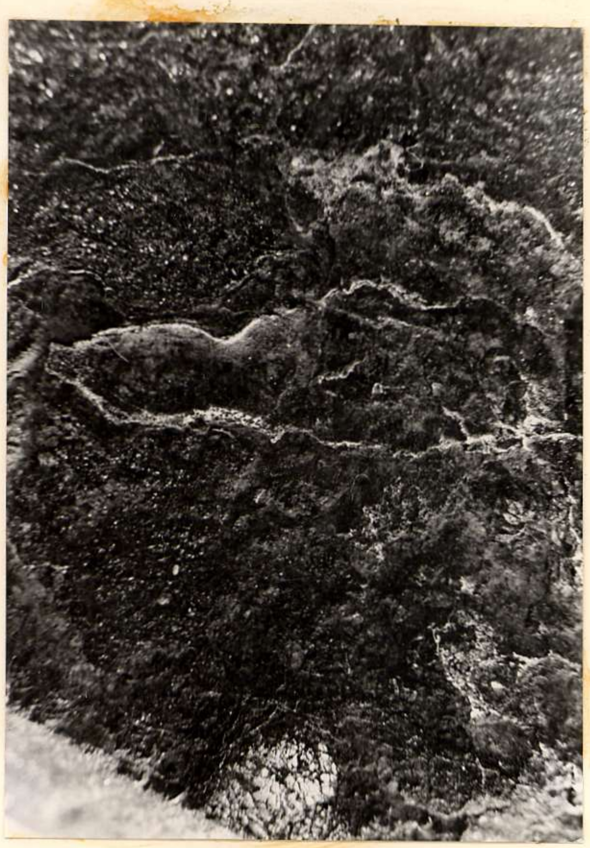


Figure XVI Filaments of native copper in sheared hematite. An area of specularite can be seen on the lower edge of the macrophotograph. Magnification about 6x.

17
16

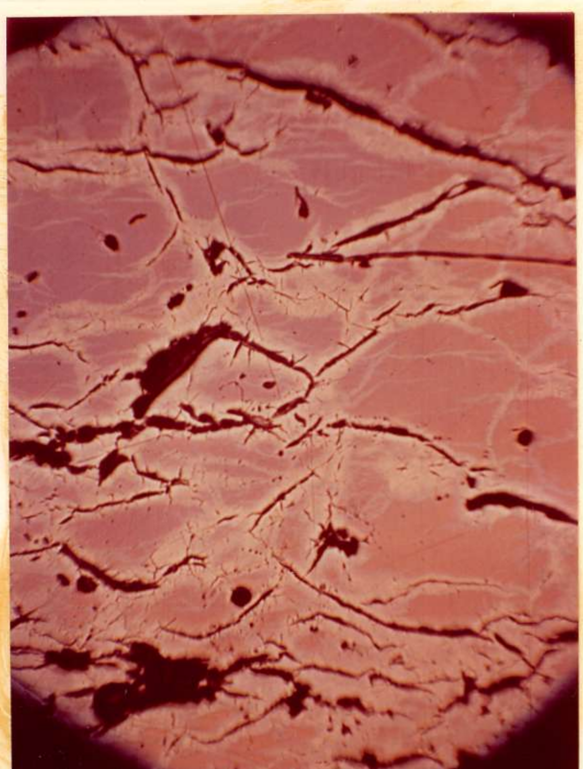


Figure XVII Bornite with a thin coat of digenite (tarnish) is highly fractured. The fractures are filled with limonite. Small veinlets of chalcocite transect the bornite, replacing it. Magnification about 70x.