600233

ABERDEEN MINE, HIGHLAND VALLEY, BRITISH COLUMBIA

Geology 409, Problem 4

Submitted by: Stanley Gifford Turner

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Stanley Gifford Turner

ABERDEEN MINE, HIGHLAND VALLEY AREA, BRITISH COLUMBIA

HISTORY AND DEVELOPMENT:

The Aberdeen mine is situated near Broom Creek, a tributary entering Guichon Creek about 10 miles north of the Nicola River and 4 miles south of Mamit Lake. The showings of this camp were discovered about 1897, and early development was done by the Broomheal Syndicate. Small shipments of ore were made. The propery was idle in the period between 1906 and 1916. However, the property is reported to have shipped 1400 tons of 7 percent copper ore in 1916 and a "fair tonnage of excellent grade ore" in 1917. The property was closed down in 1917, and was idle until 1925 when it was unwatered and more ore shipped. In 1928 it was reopened by Aberdeen Mines (1928) Limited, and some development work done. Figures supplied by the B.C. Department of Mines show that the Aberdeen mine produced 1809 tons of ore yielding 9 ounces of gold, 761 ounces of silver, and 391,381 pounds of copper. A 250 foot vertical shaft had been sunk during the past years of exploration. In 1959 Torwest did some surface excavation by bulldozer, exposed old workings, and drilled several holes in the immediate vicinity of them. A total of 5,024 feet was drilled by two surfaces diamond drills. The Minister of Mines Report for 1960 is not available with regards to information of more recent exploration since 1959, however, the author thinks that more development work in the way of diamond drilling is being carried on at present by Torwest.

GENERAL GEOLOGY:

The Aberdeen mine is situated on what is called the Guichon Creek Batholith near its' eastern contact with the Nicola Group. ~~The contact with the Nicola Group.~~ The contact in this area runs alomost due north and south. The Guichon Creek Batholith, composed essentially of medium to coarse grained granddiorites or quartz diorites, with local areas of more acid or more basic types, is of Jurassic and (?) later age and has intruded the Nicola Group of which is Upper Triassic in age. The

GEOLOGICAL MAP OF MINE AREA

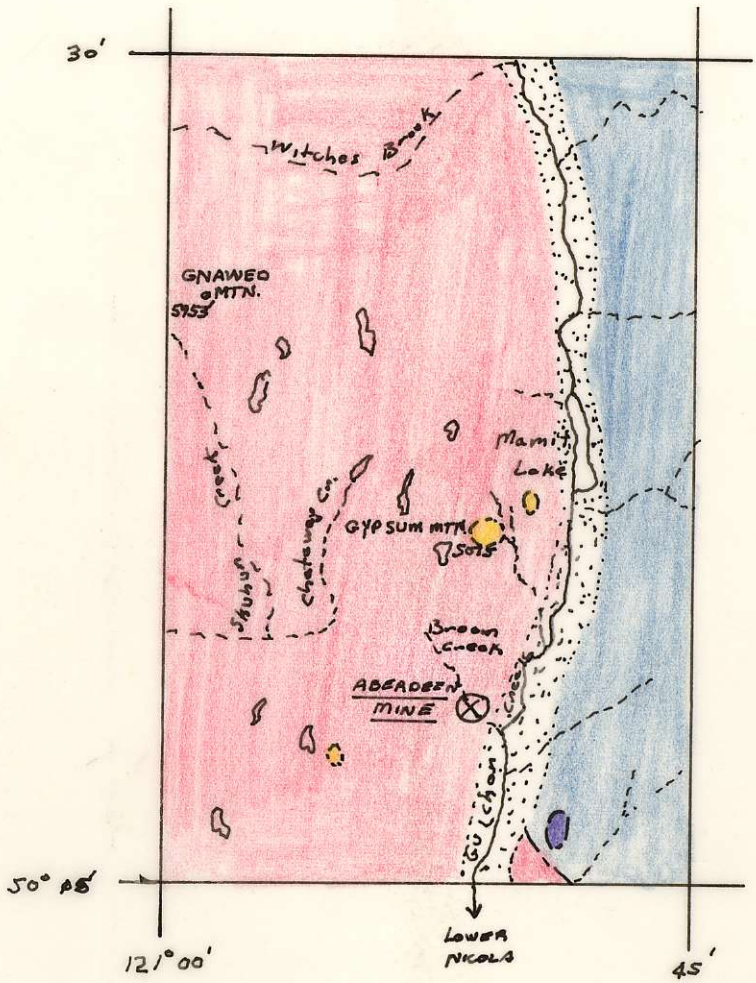


FIGURE 8.

LEGEND :-

- Nicola Group
- Guichon Batholith
- Kamploops Group
- Kingsvale Group.
- Heavily drift-covered area

SCALE 1" = 4 miles

4 0 4 miles

Approximate magnetic declination, 24° 30' to 27° EAST

Nicola Group consists largely of volcanic rocks (greenstone). These vary from fine grained or nearly aphanitic to coarse porphyritic types. They are predomiantly green, but also occur in varions shades of purple, red, brown, or grey, and include some with a dark or nearly black groundmass. The contact between the granitic rocks of the Guichon Creek Bathalith and the volcanic rocks of the Nicola Group is definitely an intrusive contact. However, in regions to the south (Princeton Map-Sheet) some of the contacts are gradational which suggests granitization. A few small cap-like zones (the greatest being ¾ miles in diameter) of Miocene or Earlier volcanics (Kamloops Group) occur in the vicinity of the property, These zones of volcanic rocks, rhyolite, andesite and basalt, associated tuffs, breccias and agglomerates, rest unconformably on the Gucihon Creek Batholithic rocks. A heavily drift covered area occurs in the valley bottom that contains Guichon Creek and Mamit Lake. This valley parallels the contact.

For relationship between different rock groups see Figure 8 (map).

GEOLOGY OF THE MINE AREA:

Heavy deposits of drift material conceal, to a large extent, the underlying rocks of the mine area. However, where exposed the rocks consist of a series of granitic intrusives (Guichon Creek Batholith) enclosing remnants of the greenstone (Nicola Group) series and at times forming the cementing material of breccias made up of fragments of the latter. These granitic rocks are largely made up of moderately fine grained syenite consisting wholly of a mixture of a light gray feldspar and black hornblende. At different points, however, they are seen to merge gradually into a type in which white quartz becomes abundant and the hornblende is replaced by dark brown mica. Some times as a result of local disturbance, the rocks are observed to exhibit a decided shistosity and some very thin bands consist of a rather coarse grained, light reddish feldspar to the almost exclusion of other minerals. Small stringers and masses of white quartz and white calcite with specularite frequently occur. The character of the greenstones has been greatly obscured by the changes produced during the intrusion of the granitic rocks.

The ore is found in a zone of fracturing and shearing in the 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. The roots of the ore deposit are found to resolve themselves into ramification of seams and fillings along joint-planes and fractures. The mineralization of these lower horizons is largely represented by specific inclusions of native copper and is associated with a body of black rock that has all the appearanems of a basic dyke material, but which under the microscope was found to consist of tourmaline, quartz, and specularite and which is therefore probably vein matter of some sort.

DESCRIPTIONS OF HAND SPECIMENS AND THIN SECTIONS:

The following is a short description of a number of hand specimens from the mine area, and a description of two thin sections; one of which is from the Aberdeen mine, the other is from the Vimy Property which is located some 1.5 miles north of the Aberdeen mine.

Seven specimens from the mine suite are of typical gouge material from the fracture and shear zone. These specimens vary in size from 2"x3"x½" to 1"x1"x½". They are a purplish red color and exhibit polished and slickensided surfaces. The rocks are very flaky and crumbly in nature ad some appear almost schistose. A very fine grained powder gouge material on the surfaces of the samples is easily rubbed off with ones' fingers. The rocks have a layered appearance and probably should be referred to as mylonites. The layers vary in thickness from 1/32 inches to 1/8 inches and are lightly undualting in nature. Some effervescence was noted when the specimens were tested with HCl (1:5). This is due to small calcareous pods which occur throughout the rocks. Native copper occurs in all the specimens, with the greatest amount in any one specimen being about 20%. It occurs in wire-like forms parallel to the layering of the mylonites as is shown in Figure 1.

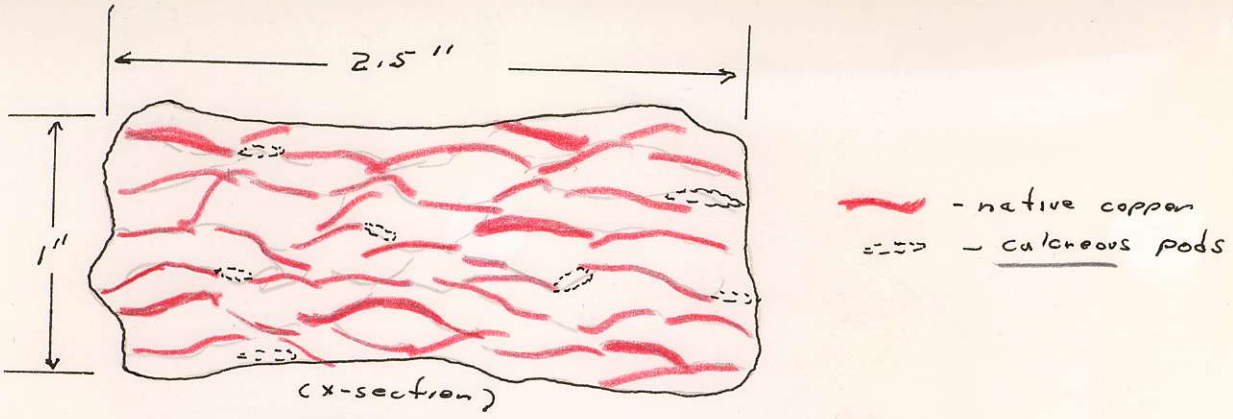


Figure 1.

Malachite is also visible in all of the specimens and is usually less than1% in abundance. Also present in the suite of rocks are small samples of orange colored feldspathic rich granitic material. These specimens are medium grained (1-2mm) and contain about 1% disseminated native copper and specularite.

Other specimens consist of moderately sheared, orange colored granitic rocks which are well altered and crumbly in nature; and sheared greenstones exhibiting chloritized shear surfaces. The alteration in the former rocks is mainly kaolinization.

However, most of the mineral suite consists of samples of massive chalcocite ore with abundant malachite alteration on the weathered surfaces. These ore samples are medium gray in colour and in some cases display a vuggy character. Specular hematite is usually in occurrence with the chalcocite as micaceous flakes and constitutes up to 60% in some samples, however, average occurrence is about 10%.

THIN SECTIONS:

Thin Section A:- This thin section is of a rock from the Vimy property. The sample is a medium grained (1-2mm), highly altered granitic rock with orange coloured kaolinization products visible on the weathered surfaces. Epidote and calcite is also visible on one fracture surface. The rock contains about 1% disseminated native copper and specularite, with a patch of bornite visible on one fracture surface. The thin section shows the rock to be composed of; altered feldspars 60%, quartz 30%, sericite 7%, chlorite 1%, apatite 1%, and ore minerals (specularite and/or native copper) 1%, and calcite less than 1%. The feldspars are highly altered to sericite and clay minerals but were probably originally K-feldspar, as no albite twinning is visible. The quartz occurs intergranularly and as fracture fillings. No mafic

minerals are visible in the thin section. The ore minerals occur interstitially with very irregular outlines.

Thin Section B:- This thin section is from a specimen from the 700 foot level of the Aberdeen mine. The specimen is a medium grained (1-2mm) chloritized, feldspathic rich granitic rock (quartz diorite) with sparsely disseminated blebs of native copper and specular hematite. The thin section shows the rock to have the following composition; plagioclase 50%, K-feldspar 10%, quartz 30%, chlorite 8%, and specularite 2%. The feldspars are too highly altered to sericite and clay minerals for a determination of the exact Ab/An ratio. The quartz shows undulatory extinction which suggests stress (shearing) action and is unaltered but does exhibit a few small poikilitic inclusions of material which is undeterminable. The mafics appear to have been completely altered to chlorite and/or sericite. The pseudomorphs of chlorite after the mafics exhibit jagged end sections which again suggests shearing action. The specularite grains occur interstitially and some of them display a sieve texture with small poikilitic inclusions of altered felsic fragments. This definitely proves that the ore is later than the gangue minerals. Iron oxide (limonite) is visible in the cracks between the grains and is most intense in the immediate vicinity of the specularite grains.

MINERALOGRAPHY DESCRIPTIONS:

The following is a description of the study of 12 polish sections o f the mineral suite. Eleven are from the Aberdeen mine and the other one is from the Vimy property.

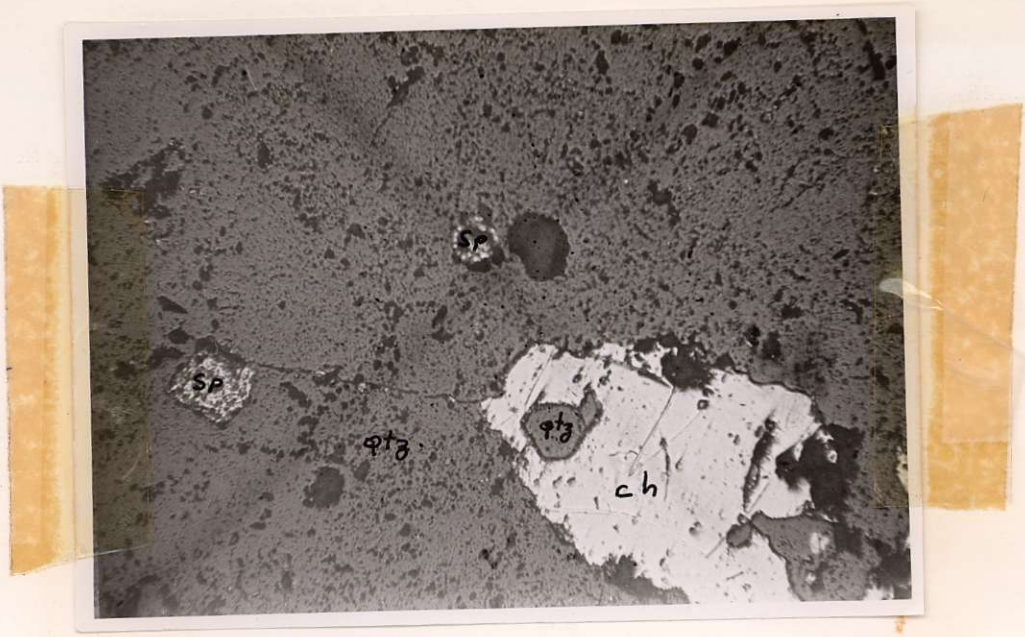
Polish Section A:- This polish section shows the following composition; chalcocite 70% and quartz 30%. Megascopically the polish section exhibits a brecciated nature with fragments (up to 1.5 cm in diameter) of chalcocite located in a quartz matrix. Under the microscope the chalcocite fragments have extremely irregular and serrated edges. The larger fragments of the chalcocite exhibit a sieve texture with poikilitic inclusions of small veinlets and blebs of quartz (see Figure 2). Thes e quartz veinlets show no set pattern in their course.

(X 27)

Figure 2.

Polish Section B:- This polish section has the following composition ; felsic minerals (quartz and feldspar) 98%, specular hematite 1%, native copper less than 1%, and chalcopyrite less than 1%. The ore minerals occur as small, subrounded to sub-angular disseminations throughout the altered igneous rock. The chalcopyrite mainly occurs as very fine grained disseminations in the specularite , although some also occurs in the gangue. The chalcopyrite is best seen, and sometimes only visible, under high power.

Polish Section C:- This polish section shows the following composition; quartz 98%, specular hematite 1%, chalcocite less than 1%, and nativecopper less than 1%. The ore minerals occur as disseminated fragments throughout the polish section. Some of the chalcocite fragments contain poikilitic inclusions of quartz (see Figure 3), while others contain inclusions of native copper. The specularite grainsware of much smaller size than the chalcocite grains as is visible in Figure 3.



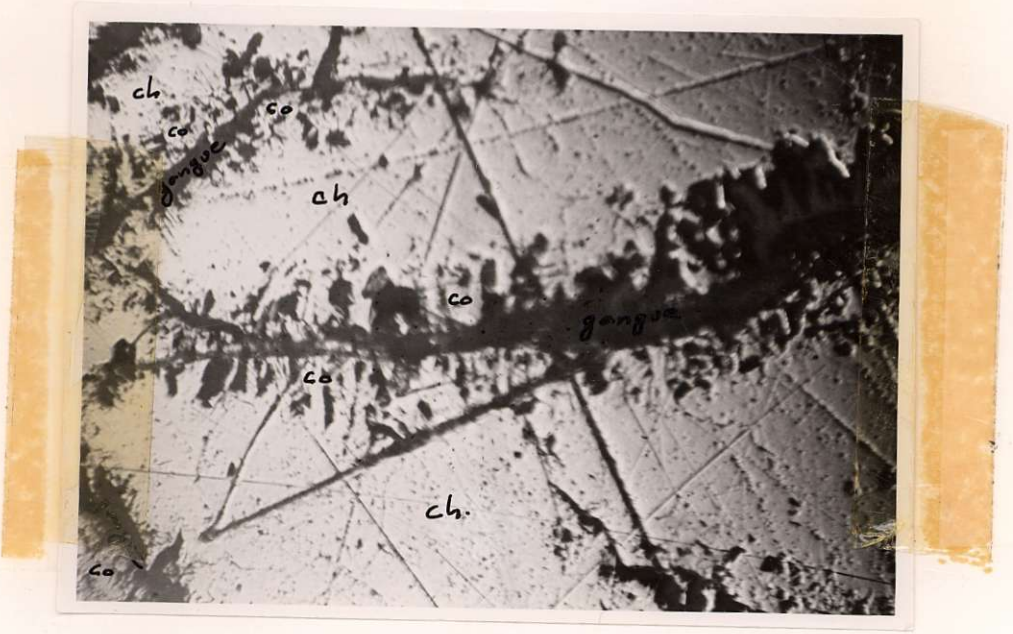
(X 27)

Figure 3.

Polish Section D:- This is a polish section of a medium grained (1-3mm) granitic rock composed of plagioclase 50%, quartz 30%, biotite 20%, and native copper and specular hematite less than 1%. The ore minerals occur as small, subangular to subrounded disseminated grains throughout the gangue in an interstitial nature. Some of the specular hematite contains poikilitic inclusions of gangue minerals (quartz and feldspar).

Polish Section E:- This polish section has the following composition; chalcocite 40%, covellite 20%, limonite 10%, specularite 5%, malachite 1%, native copper less than 1%, and gangue minerals 23%. The chalcocite appears to be fractured and filled with quartz and calcite. On either side of these fractures the chalcocite has been altered to covellite (see Figure 4). The native copper is disseminated throughout the polish section in very fine grains as is the specularite. Some of the native copper occurs as small inclusions within chalcocite fragments. A section of the polish section shows a zone of iron oxidation products (limonite ?) and covellite. This probably represents the development of gossan as the zone is slightly vuggy in nature.

The limonite and/or goethite displays a colloform banding texture in the vugs. The malachite occurs as a rim of alteration on one side (weathered surface) of the polish section and contains small blebs of native copper.



(x27)

Figure 4.

Polish Section G:- This is a polish section of medium grained (1-2mm), pinkish feldspathic granitic rock which contains less than 1% of sparsely disseminated specualar hematite. One of the other samples in this tray shows a few (less than 1%) disseminated grains of native copper. Also visible on some of the specimens are slickensides which means samples are most likely from the shear zone.

Polish Section H:- This polish section is of a piece of granitic diamond drill core. The composition of the polish section is as follows; gangue minerals (quartz and feldspar) 94%, specualr hematite 50%, and chalcopyrite 1%. The chalcocite occurs as irregular blebs exhibiting a carries texture as is visible in Figure 5. Some of the chalcocite fragments contain small inclusions of quartz. The specular hematite

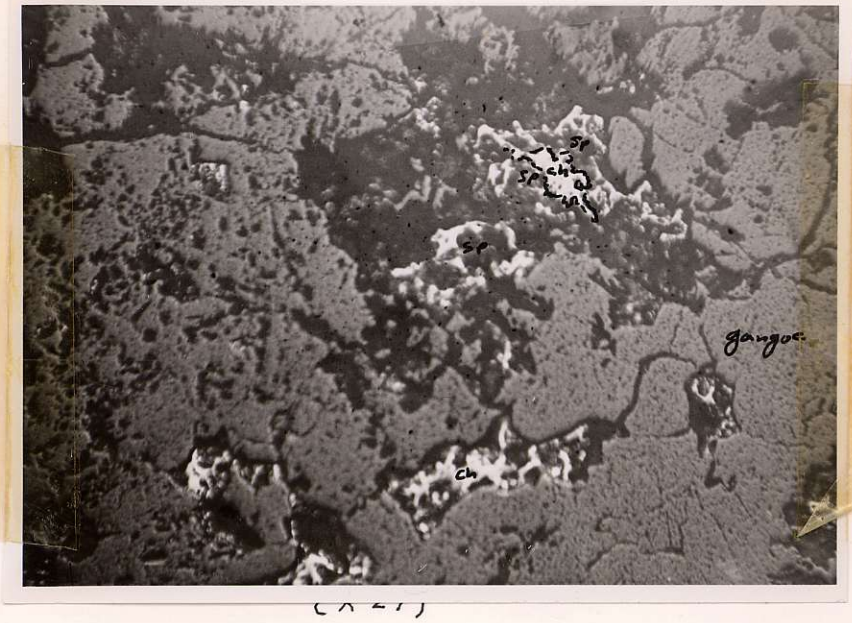
occurs as lath shaped crystals disseminated through out the polish section and in places veins chalcocite fragments (see Figure 5.). Much of the specularite displays a radiating texture. In places it could probably be called a "pseudo-widmanstetten" texture.

(X 27)

Figure 5.

Polish Sections I:- Polish Section A; This is a polish section of a reddish volcanic rock with feldspar phenocrysts. The polish section shows the following composition; gangue minerals 70%, specular hematite 20%, and chalcocite 10%. Some of the chalcocite contains poikilitic inclusions of gangue minerals and is usually multiply fractured. The specularite occurs intergranularly with the chalcocite disseminated throughout the polish section and is much finer grained than the chalcocite as seen in Figure 6. Some malachite alteration is visible on the unpolished surface. Polish Section B; This polish section is also of a red porphyritic volcanic rock with feldspar phenocrysts. It has the following composition; gangue 60%, chalcocite 25%, and specular hematite 15%. The chalcocite occurs as massive zones with a few poikilitic inclusions of gangue minerals. The specularite

occurs as lath shaped crystals disseminated throughout thegangue and in places veining the chalcocite or as inclusions in the chalcocite. Some calcite is present in the fractures.

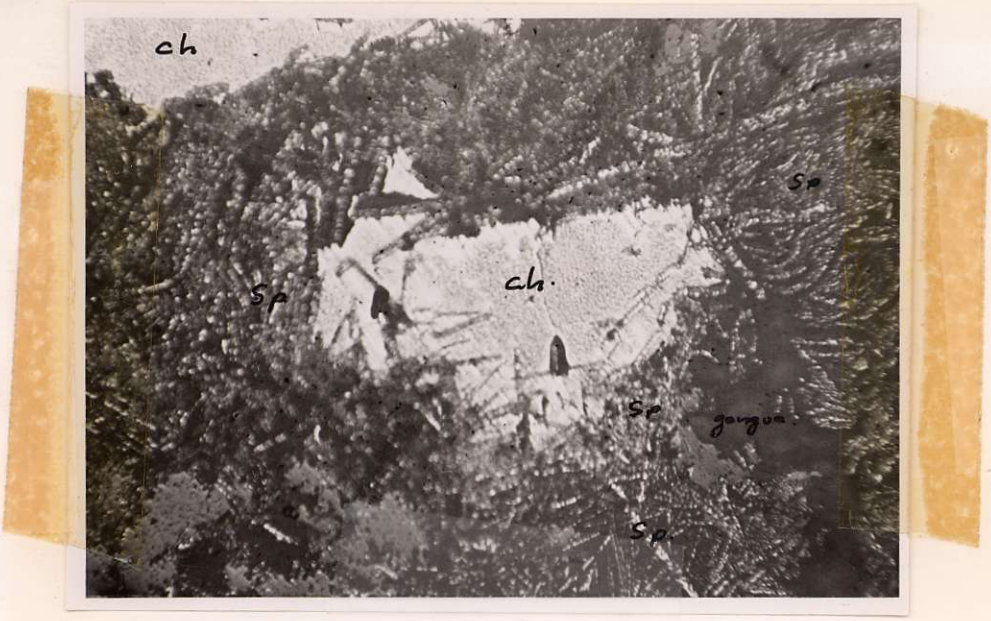


(X 27)

Figure 6.

Polish Section M:- This polish section has the following compositon; specularite 60%, chalcocite 20%, and quartz 20%. The specularite occurs as lath shaped crystals which display a radial texture and in places a "pseudo-widmanstetten" texture (see Figure 7). Some of the specularite crystals intrude into the chalcocite grains and in numerous cases occur as inclusions within the chalcocite as is visible in Figure 7.

Polish Section K:- This polish section shows 90% chalcocite, 5% specularite , and 5% quartz. The chalcocite is massive in nature and well fractured with the fractures filled with quartz. The specular hematite occurs in four isolated pods, without preferred orientation, throughout the massive chalcocite. These specularite pods are composed of many lath shaped ~~specularite~~ crystals.



(x 27)

Figure 7.

Polish Section F:- This polish section is of a rock specimen from the Vimy Property. (The previous 11 specimens have been from the Aberdeen mine area). The rock is a medium grained (1-3mm),grey, fractured granitic rock. The composition of the polish section is as follows; gangue (quartz and feldspar) 98%, native copper 1%, and s pecular hematitie and chalcocite 1%. The ore minerals occur as small blebs disseminated throughout the polish section. No bornite is visible in the polish section although a patch of it is present on a fracture surface of the rock specimen.

PARAGENESIS AND ORIGIN OF THE MINERAL DEPOSIT:

It has been noted that copper deposits have been discovered at many places in the plutonic rocks west of Guichon Creek. The copper minerals of these deposits occur as veins and in shattered zones associated in many places with molybdenite and in some with tourmaline. With this in mind one can assume that the Aberdeen mine is not a peculiar deposit but is rather a characteristic one of this region west of Gucihon Creek in the plutonic rocks. The Aberdeen mine is definitely an ore deposit which has been controlled by fracturing and shearing. The fracturing and

shearing probably resulted from the intrusion of the Guichon Creek Batholith. The origin of the mineralizing solutions is a moot point as far as the author is concerned. They may have originated directly from the intruding magma and were then deposited in the fracture zone, or alternately, may have originated from solutions once part of the intruding magma only they passed through the bordering Nicola Group, picked up copper and iron and then deposited them in the fracture zones as the ore minerals. The latter hypothesis is based on the fact that the Nicola Group contains, on the average, 7p.p.m. of copper. In either case, the deposit is hydrothermal in origin and the chalcocite is predominantly hypogene. The occurrence of specular hematite and tourmaline in the deposit strongly suggests a high temperature (hypothermal) origin. In all probability the hypogene minerals, native copper, chalcocite, chalcopyrite, and spedular hematite, as well as the gangue minerals of quartz, calcite and tourmaline were deposited simultaneously. However, there probably was more than one stage of silicification in the shear zone as is suggested by the quartz filled fractures traversing some of the chalcocite and altering it to covellite. In other cases, chalcocite with quartz filled fractures showed no covellite alteration. This means the quartz was probably deposited simultaneously with the ore minerals.

No doubt some of the mineralization was contemporaneous with shearing as is shown by the native copper in the mylonite samples. Some of the mineralizing solutions "seeped" into the country rock which was not strongly affected by the shearing. This would account for the sparsely disseminated amounts of ore mineral in the partially altered medium grained granitic rocks.

By far the greater majority of ore mineral deposited was chalcocite which occurs in massive lenses and pockets as vfracture filling material.

The supergene formation of malachite, limonite and/or goethite, and some chalcocite, occured after the deposition of the hypogene minerals. The majority of the covellite was probably formed during the second stages of silicification.

The temperature of formation of this fracture filling type of hypothermal deposit was probably in the range from 300°C to 600°C. (according to Edwards).

The shallow depth (100 feet) of the deposit may be due to glaciation which eroded much of it away, as glaciation was rather vigorous in this region.

Should say why nature Cu is hypogene!

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MINERALOGRAPHIC LABORATORY

Date March 24 1960

Name or number of section . . . Polish Section A . . . . . .

Polish good

Colour light bluish grey

Hardness B

Streak dark

Texture [redacted]

Pleochroism nonpleochroic

Anisotropism slightly anisotropic (grey to pinkish)

Texture under xd. nicols

Twinning

Internal reflection

Cleavage

Association

Etch tests

$HgCl_2$ (positive) slight tarnish

KOH (negative)

KCN (positive) very quick; etch pattern

HCl (positive) brown tarnish

$FeCl_3$ (positive) very quick reaction

HNO_3

Aqua regia

Microchemical tests

Grain size

Confirmatory features such as magnetism, sectility, fluorescence, blowpiping, radioactivity, etc. . . . sectile . . . . . .

Mineral or Group CHALCOCITE

Interpretation of textures.

MINERALOGRAPHIC LABORATORY

Date March 24, 1960

Name or number of section . . . . . Polish Section A . . . . . .

Polish good

Colour coppery red to pink

Hardness B

Streak

Texture

Pleochroism non-pleochroic

Anisotropism isotropic

Texture under xd. nicols

Twinning

Internal reflection

Cleavage

Association

Etch tests

$HgCl_2$

KOH

KCN

HCl

$FeCl_3$

HNO_3

Aqua regia

Microchemical tests

Grain size

Confirmatory features such as magnetism, sectility, fluorescence, blowpiping, radioactivity, etc. . . . . sectile . . . . . .

Mineral or Group NATIVE COPPER

Interpretation of textures.

MINERALOGRAPHIC LABORATORY

Date March 24, 1960

Name or number of section . . . . . Polish Section B . . . . . .

Polish good

Colour white - grey

Hardness G

Streak

Texture surface pitted

Pleochroism non-pleochroic

Anisotropism strongly anisotropic
(dark bluish grey to light grey)

Texture under xd. nicols

Twinning

Internal reflection

Cleavage

Association

Etch tests

$HgCl_2$ (-)

KOH (-)

KCN (-)

HCL (-)

$FeCl_3$ (-)

HNO_3 (-)

Aqua regia (-)

Microchemical tests

Grain size

Confirmatory features such as magnetism, sectility, fluorescence, blowpiping, radioactivity, etc. . . . . .

Mineral or Group Hematite (specularite)

Interpretation of textures.

MINERALOGRAPHIC LABORATORY

Date March 24, 1960

Name or number of section . . . Polish Section E . . . . . .

Polish good

Colour bluish grey to blue

Hardness B

Streak

Texture

Pleochroism

Anisotropism strong (blusih to red)

Texture under xd. nicols

Twinning

Internal reflection

Cleavage

Association with chalcocite

Etch tests

$HgCl_2$

KOH

KCN

HCL

$FeCl_3$

HNO_3

Aqua regia

Microchemical tests

Grain size

Confirmatory features such as magnetism, sectility, fluorescence, blowpiping, radioactivity, etc. . . . . .

Mineral or Group COVELLITE

Interpretation of textures.