600279

GEOLOGY 409

An Examination of Drill Core From The Newman ~~Property~~, B. C.
Peninsula.

Report no. IV

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INTRODUCTION

The specimens examined consisted of 9 drill core samples with a length of about 5 millimeters and a diameter of about 3 millimeters. Thin sections and polished sections were made from each specimen and examined.

DESCRIPTION OF HAND SPECIMENS

Hole # 14 - 20'

The rock appears to be a grey, very fine grained, sandstone or siltstone primarily composed of quartz and possibly with some feldspar. The rock has been highly sericitized and silicified which has resulted in some porosity. The rock is cut by pyrite bearing quartz veinlets in which no chalcopyrite or other copper mineral was seen. The veinlets pinch and swell irregularly. Pyrite also occurs as disseminated blebs in the highly altered country rock. Minor hematite (specular) was noted. The mineralization appears to be fresh with only minor limonitic stains on the pyrite. No chalcopyrite or other copper mineral was seen in the hand specimen.

Hole # 6 - 70'

The rock is a biotite feldspar porphyry. It is grey in colour with medium grained biotite and plagioclase feldspar, euhedral phenocrysts in a fine grained matrix that appears to be primarily quartz. The biotite appears very fresh while the feldspar is somewhat altered. The rock is dense and shows no apparent porosity. Pyrite occurs as dissiminated grains some of which have a red-blue coating on the surface.

Hole # 3 - 70'

A pink, highly altered (kaolinized ?) feldspar porphyry. The feldspar seems to be completely altered as does the matrix. The rock is cut by a branching quartz veinlet. Pyrite and chalcopyrite are dissiminated throughout the rock and the veinlet. Specular hematite and/or molybdenite was noted in the quartz veinlet.

Hole # 87 - 35' (true depth 25')

A very fine grained green-grey rock which appears to be primarily quartz and kaolinite or sericite. The rock appears to have some porosity. Pyrite veins cut the rock. The pyrite in some places is highly altered to limonite. The pyrite is much fresher when disseminated and shows little weathering.

Hole # 87 - 115' (true depth 82')

A light buff coloured very fine grained quartz sericite rock with quartz veinlets cutting it. The rock has a poor but visible porosity. Mineralization is mostly pyrite which is disseminated but some does occur in the quartz veinlets. Surely some of the mineralization is chalcopyrite but it impossible to identify in the handspecimen.

Hole # 87 - 235' (true depth 165')

A light pink coloured feldspar porphyry that has been highly altered by quartz and sericite and or/ kaolinite. Pyrite and chalcopyrite both disseminated and in quartz veinlets. Limonite stains in the gangue.

Hole # 87 - 315' (true depth 223')

A completely silicified and sericitized feldspar porphyry with good porosity. Chalcopyrite and pyrite disseminated in the quartz veinlets cutting the rock and in the altered feldspar grains.

Hole # 87 - 545' (true depth 385')

A white highly altered rock with quartz veinlets cutting it. It is impossible to tell what the original rock was. Pyrite and chalcopyrite disseminated throughout the rock. Some molybdenite seen in this specimen. The specimen has a high porosity which seems to be due in large part to the alteration of the feldspars.

Hole # 87 - 770' (true depth 546')

Much as hole # 87 - 545' with a few relict feldspar grains which are completely pseudomorphed by kaolknite or sericite. This specimen has the highest porsity of any of the specimens in this suite. Chalcopyrite and pyrite disseminated throughout the rock.

DESCRIPTION OF THIN SECTIONS

Hole # 14 - 20'

Mode:	Sericite	- 50%
	Biotite	- 25%
	Quartz	- 20%
	Opaques	- 5%
	Tourmaline	- trace

A highly altered, very fine grained, subporphyrytic (with respect to biotite) rock cut by quartz veinlets. The opaques occur in the veinlets and in the altered country rock. Although the rock give a kaolinite-like smell in handspecimen the alteration appears to be all sericite, however, if fine grained kaolinite is mixed with the sericite it would be hard to distinguish because the sericite is so fine grained. The rock could be called a biotite porphry.

Hole # 6 - 70'

Mode:	Plagioclase	- 38%
	Sericite	- 25%
	Quartz	- 20%
	Biotite	- 15%
	Opaques	- 2%

One of the least altered rocks in this suite. A biotite feldspar (An_{35}) porphyry of quart monzonite to granodiorite composition. The feldspar, somewhat altered to sericite, is zoned and shows carlsbad, pericline and albite twinning. The rock is cut by quartz veins carrying sulfides.

Hole # 3 - 70'

Mode:	Sericitized feldspar	- 75%
	Quartz	- 20%
	Iron oxides	- 4%
	Opaques	- 1%

A highly sericitized and siclicified feldspar porphyry. The feldspar is to altered to be identified.

Hole # 87 - 35' (true depth 25')

Mode:	Quartz	- 55%
	Sericite	- 23%
	Opaques	- 15%
	Tourmaline	- 7%

A highly altered allotriomorphic granular quartz sericite rock. The sulfides occur in veinlets of quartz and around quartz veins in the country rock. The tourmaline occurs a suns and appears to be earlier than the sulfides.

Hole # 87 - 115' (true depth 82')

Mode:	Quartz	- 50%
	Sericite	- 25%
	Opaques	- 20%
	Tourmaline	- 5%

This rock is so highly siclicified and sericitized that the original rock cannot be determined. The handspecimen and the thin section are in a large part a quartz veinlet cutting the rock and not much of the surrounding rock is represented. The mineralization occurs in quartz veinlets and around quartz veinlets and disseminated in the country rock.

Hole # 87 - 235' (true depth 165')

Mode:	Quartz	- 60%
	Sericite	- 20%
	Opaques	- 15%
	Carbonate	- 5%

A highly altered quartz sericite rock. Texture allotriomorphic-gran--ular. The carbonate cuts the sulfide mineralization which occurs on the boundaries of quartz veins and disseminated.

Hole # 87 - 315' (true depth 223')

Mode:	Quartz	- 55%
	Sericite	- 20%
	Opaques	- 15%
	Carbonate	- 5%
	Tourmaline	- 5%

A highly altered feldspar porphyry with sericite,quartz and tourmaline pseudomorphing the feldspar. The opaques occur in veinlets of quartz and as distinct veinlets themselves and as disseminated blebs in the highly altered country rock.

Hole # 87 - 545' (true depth 385')

Mode:	Quartz	- 60%
	Sericite	- 25%
	Opaques	- 10%
	Tourmaline	- 5%

A highly altered quartz sericite rock which was originally a felspar porphry.

Hole # 87 - 770' (true depth 546')

Mode:	Quartz	- 60%
	Sericite	- 30%
	Opaques	- 10%
	Tourmaline	- trace

The most highly altered rock of all the specimens. Impossible to tell what the original rock was, it is now a quartz sericite rock.

The sericite in many of the specimens is developed in two directions at right angles to each other and is probably pseudomorphous after the cleavage planes of the feldspar. The quartz is invariably anhedral in these specimens. The disseminated opaques are commonly found coating quartz grains and should be easily seperated in milling.

POLISHED SECTIONS

Primary minerals:

Pyrite - FeS_2: colour - pale yellow

hardness - F

polish - poor

reflectivity - moderate

anisotropism - isotropic

grain size - 4 to 320 mu and up.

Chalcopyrite - $CuFeS_2$:

colour - yellow

hardness - C

polish - good

reflectivity - moderate to high

anisotropism - weak

grain size - 8 to 300 mu.

Specular hematite - Fe_2O_3:

colour - grey with a blue tint

hardness - F

polish - good

reflectivity - high

anisotropism - distinct

internal reflection - red

grain size - 4 to 400 mu.

etch tests:

$HgCl_2$	neg.
KOH	"
KCN	"
HCl	"
$FeCl_3$	"
HNO_3	"
Aq. Reg.	"

$SnCl_2$ in 1 : 7 HCl posotive.

Magnetite - Fe_3O_4:

colour - grey-brown

hardness - F

polish - good

reflectivity - low

anisotropism - isotropic

grain size - 8 to 40 mu.

etch tests:

$HgCl_2$	neg.
KOH	"
KCN	"
HCl	"
$FeCl_3$	"
HNO_3	"
Aq. Reg.	"
HF	Pos.

Sphalerite - (ZnFe)S;

colour - grey

hardness - B

polish - good

reflectivity - low

anisotropism - isotropic

internal reflection - red

grain size - 4 to 8 mu.

Bornite - Cu_5FeS_4:

colour - pinkish brown

hardness - B

polish - moderate to good

reflectivity - moderate

anisotropism - very weak

grain size - 1 to 160 mu.

Molybdenite - MoS_2

colour - white to dark grey

hardness - A

polish - good

reflectivity - moderate

anisotropism - enormous with faint colours

bireflection - weak

grain size - 10 to 80 mu.

etch tests: $HgCl_2$ neg.
KOH "
KCN "
HCl "
$FeCl_3$ "
HNO_3 "
Aq. Reg. "

Secondary minerals:

Goethite - a-FeO.OH(+ xH_2O):

colour - grey with a blue tint

hardness - D

polish - good to poor

reflection - moderate

anisotropism - weak to distinct

internal reflection - orange

grain size - 4 to 400 mu.

Digenite - Cu_9S_5:

colour - blue

hardness - C

polish - good

reflectivity - moderate

anisotropism - isotropic

grains size - 2 to 10 mu.

etch tests: HNO_3 posotive, blue stain
$FeCl_3$ negative.

Chalcocite - Cu_2S

colour - white with a blue cast

hardness - C

polish - good

reflectivity - moderate

anisotropism - weak

grain size - avg. 2 mu.

etch tests: HNO_3 posotive blue stain
$FeCl_3$ posotive blue stain.

Covellite - CuS

colour-deep blue

hardness - B

polish - good

reflectivity - moderate

anisotropism - strong with red to brown colours

grain size - 1 to 2 mu.

Minerals are listed in order of decreasing abundance for each specimen. As the mineralization is so disseminated and makes up such a low percentage of the rock it is impossible to assign accurate percentages of abundance to the minerals.

Hole # 14 - 20', assay 0.08% Cu.

Pyrite, chalcopyrite, hematite, goethite, digenite, chalcocite.

Hole # 6 - 70', assay 0.19% Cu.

Pyrite, chalcopyrite, hematite, magnetite, goethite, sphalerite, bornite, and covellite.

Hole # 3-70', assay 0.05% Cu.

Pyrite, chalcopyrite, hematite, goethite, digenite, covellite, molybdenite.

Hole # 87 - 35' (25') , assay 0.25% Cu.

Chalcopyrite, pyrite, goethite, hematite, magnetite.

Hole # 87 - 115' (82'), assay 0.62% Cu.

Pyrite, chalcopyrite, geothite, magnetite, sphalerite.

Hole # 87 - 235' (165'), assay 0.97% Cu.

Pyrite, chalcopyrite, goethite, hematite, magnetite, digenite, bornite, and sphalerite.

Hole # 87 - 315' (223'), assay 1.34% Cu.

Pyrite, chalcopyrite, goethite, hematite, magnetite, bornite, sphalerite.

Hole # 87 - 545' (385'), assay 0.90% Cu.

pyrite, chalcopyrite, goethite, hematite, digenite, bornite, molybdenite.

Hole # 87 - 770' (546'), no assay.

Chalcopyrite, pyrite,goethite, hematite, molybdenite.

TEXTURES AND THEIR SIGNIFICANCE

The porous texture of the rock is the most striking feature. The mineralization simply fills open spaces in the rock and occurs in quartz veinlets cutting the rock.

Rim texture is shown by several minerals. Digenite shows rim texture on corroded grains of pyrite and chalcopyrite. Although no distinctive features were brought out by etching these rims they are definitely supergene in origin. Minor chalcocite and covellite both show rim texture around pyrite and chalcopyrite. Bornite shows a rim texture around chalcopyrite, in one example, which is difficult to interpret without reservations, however, it could be bornite exsolved out of chalcopyrite and the bornite has had time to migrate out to the border of the larger grain of chalcopyrite.

Bornite often occurs as small exsolution lamella in chalcopyrite as does chalcocite in one specimen. Sphalerite often occurs as small blebs in chalcopyrite and is probably the result of exsolution. Hematite and magnetite occur as small inclusions in pyrite and chalcopyrite and are simply the result of the later sulfides precipitating around the earlier oxides.

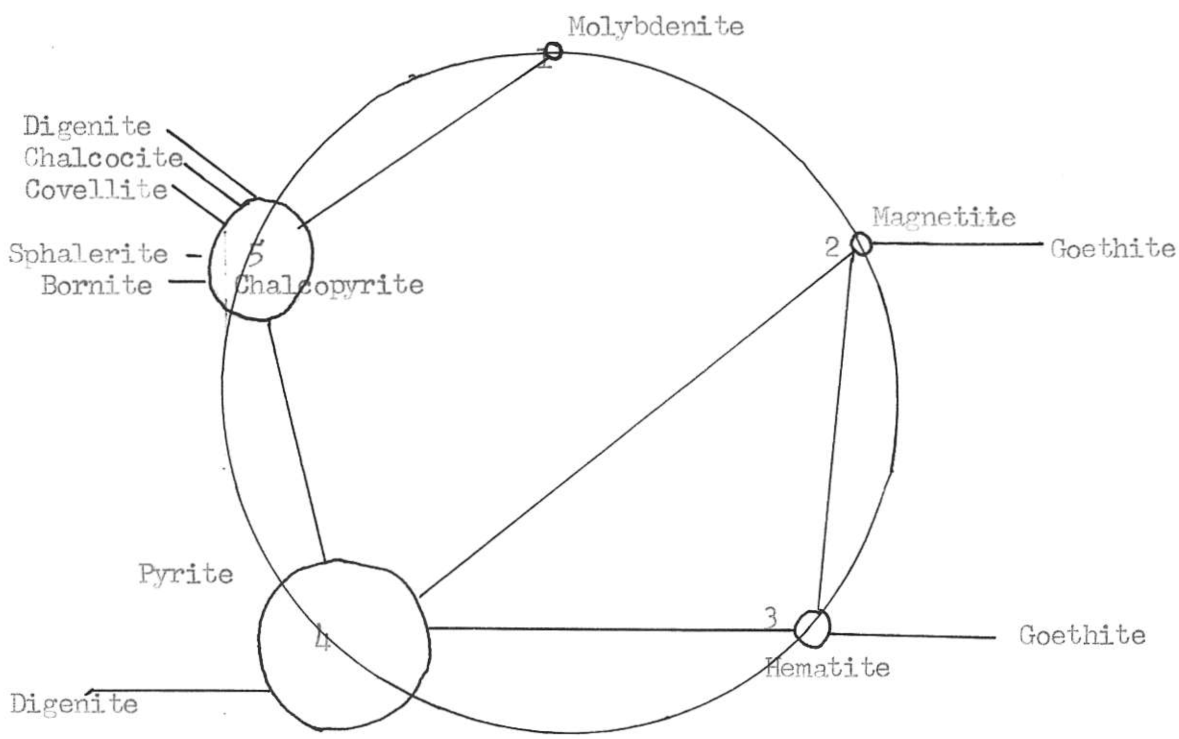
Chalcopyrite often occurs in pyrite grains and also occurs in veinlets and around euhedral pyrite grains. Presumably the chalcopyrite deposition was partly similtaneous with pyrite and partly after the pyrite deposition.

The molybdenite, which is not at all common, usually occurs as discrete grains rather than as compound grains with other minerals. However, when it occurs as compound grains it is usually with the chalco--pyrite. Hematite, magnetite and goethite usually occur as discrete grains.

PARAGENETIC SEQUENCE

It is difficult to make much of a paragenetic sequence for the deposit because of the isolated nature of most of the grains. The minerals are, therefore, listed on the Van der Veer diagram in their expected order of appearance. The rock alteration occured before the deposition of oxides and sulfides.

Van der Veen diagram:



TEMPERATURE AND TYPE OF DEPOSIT

The minerals of the suite indicate a temperature of deposition near 500° C. Edwards (1960 p. 160) lists molybdenite, magnetite, hematite and tourmaline as minerals deposited above 500°C. Bateman (1958 p. 42) lists sphalerite in chalcopyrite from exsolution as occuring around 500°C and Bornite exsolution from chalcopyrite at 475°C. However, no lower limit can be put on the temperature of mineralization because pyrite and chalco--pyrite can be deposited at temperatures much below 500°C.

The deposit is a typical "Porphry Copper" deposit. The deposit is a simple epigenetic hydrothermal deposit related to quartz veinlets and open spaces. The high temperature of the deposit makes it hypothermal.

COMMENTS

One of the major ore controls is rock alteration and the porosity caused by rock alteration, however, there must be other controls not evident from the data available to the writer. Notably some holes(#3 - 70') with a high degree of alteration and good porosity have as good a copper assay as those which have little prostity and are not as highly altered(#6 - 70').

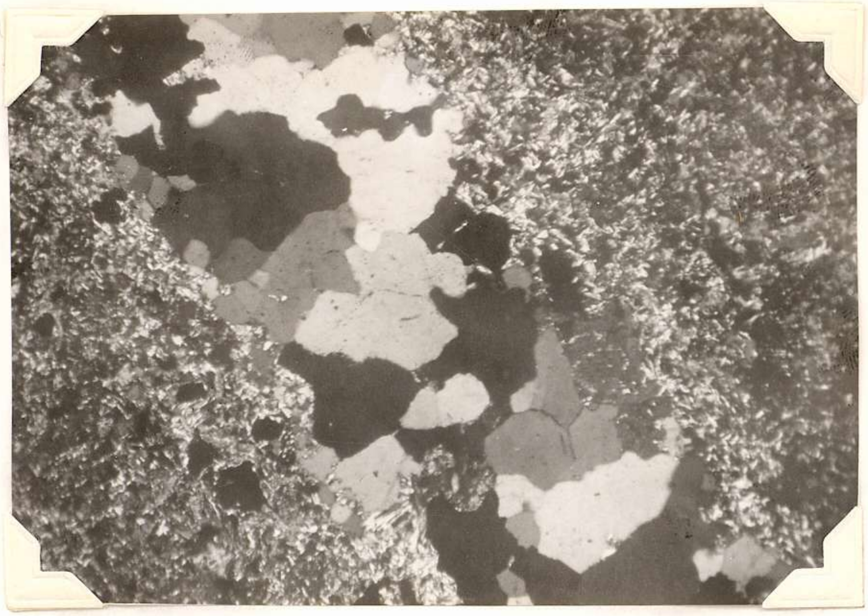
If hole # 87 - 770' (nō assay) is projected on the magnetic anomaly maps it would fall close to hole # 4 - 580' (Cu assay 0.42%) and yet # 87 770' is the most porous and highly altered rock in group I "zoning specimens".

The high copper assays in hole # 87 (235' to 545') are not due to secondary sulphide enrichment. These high assays are simply the reflection of an abundance of primary chalcopyrite.

BIBLIOGRAPHY

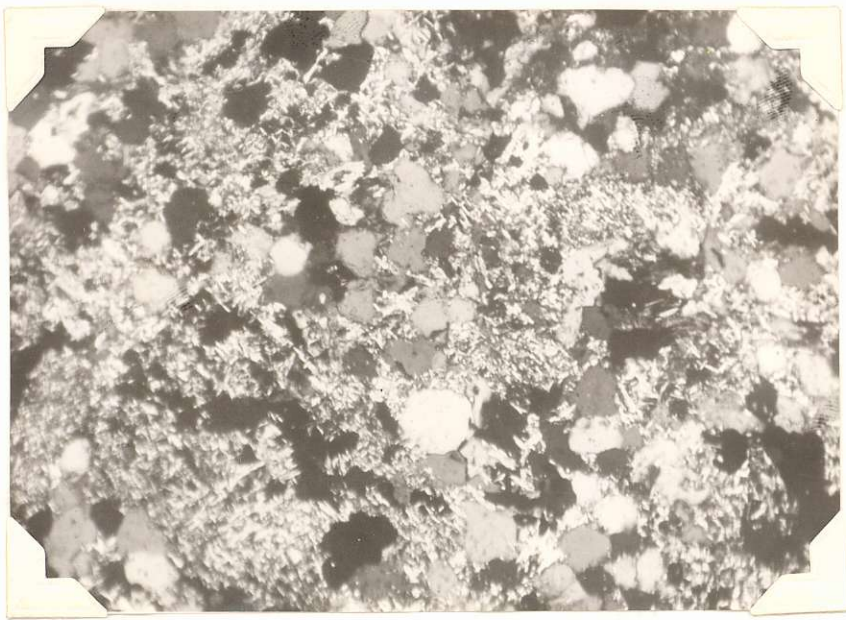
Bateman A. M. :1958. Economic Mineral Deposits. John Wiley & Sons N. Y.

Edwards A. B. :1960. Textures of the Ore Minerals. Australasian Institute of Mining and Metallurgy.



20 II

Fig. 1. Quartz vein cutting mass of sericite. Crossed nicols. X 70
Hole # 14 - 20'

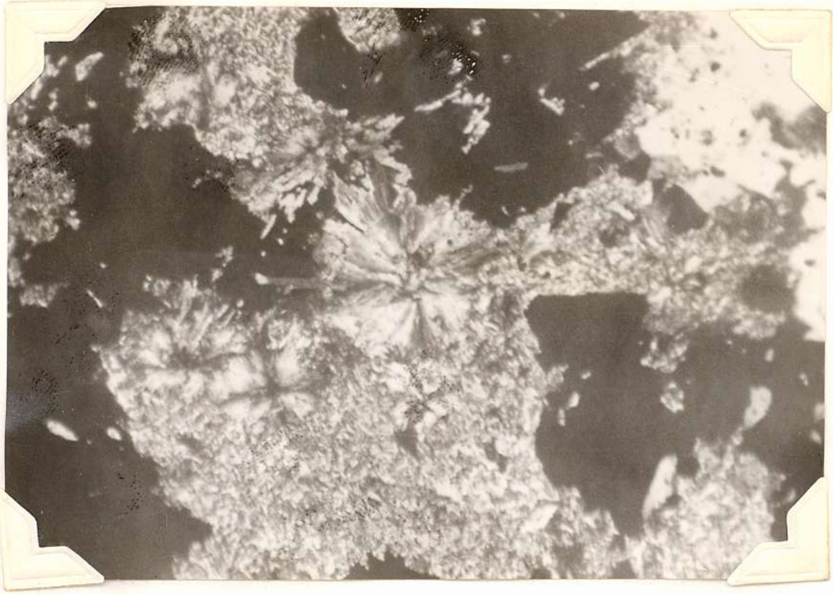


22 II

Fig. 2. Typical section of the degree of alteration. The only minerals present are quartz, sericite and the occaisional grain of sulphide Crossed nicols. X 35. Hole # 14 - 20'

Fig. 3. Partially sericitized feldspar phenocryst. Crossed nicols.
Hole # 6 - 70'. X 40.

Fig. 4. Completely aericitized feldspar phenocryst, note that the sericite is developed parallel to the feldspar cleavage. Crossed nicols.
Hole # 3 - 70'. X 30.



14 II

Fig. 5. Tourmaline suns with sericite and sulphides (black). Crossed nicols.
Hole # 87 - 315'. X 40.

38 II

Fig. 6. Tourmaline suns and sulphides (black) Crossed nicols.
Hole # 87 - 115'. X 75.

Fig. 7. Biotite, Feldspar (both as phenocrysts) and a matrix of sericite. Plain light. Hole # 6 - 70'. X 30.

30 II

Fig. 8. Pyrite and quartz veinlet. plain light. Hole # 87 315'. X 10.

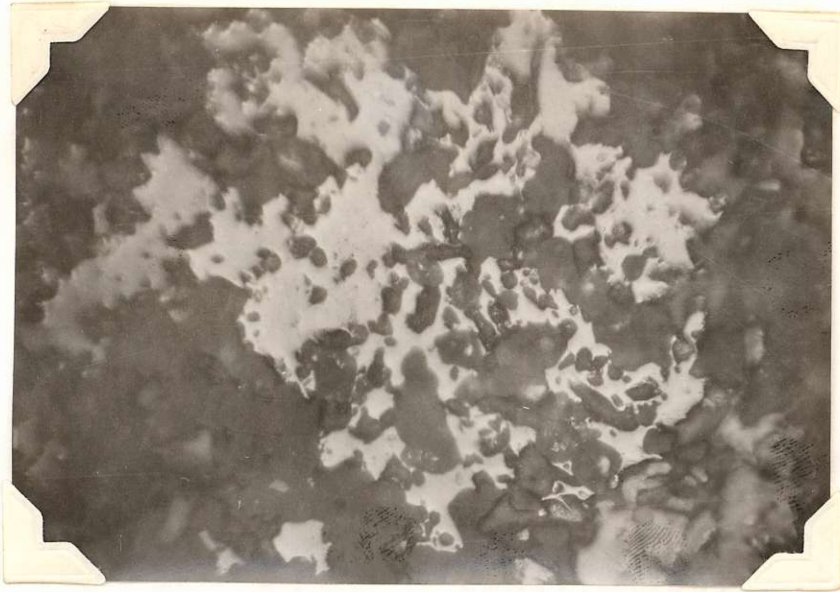


Fig. 9. Pyrite (diamond polish) interstitial to the quartz. Plain light. Hole #14 - 20'. X 160.

Fig. 10. Pyrite and chalcopyrite in gangue. plain light. Hole # 87 - 545'. X 60.

Fig.11. Chalcopyrite grain with rim of covellite. Plain light. Hole # 3 - 70'. X 400.

Fig. 12. Chalcopyrite with rim of digenite. Plain light. Hole # 3 - 70'. X 250.

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Fig. 13. Chalcopyrite and bornite replaced by digenite. Plain light
Hole # 87 - 235'. X 500(approx)

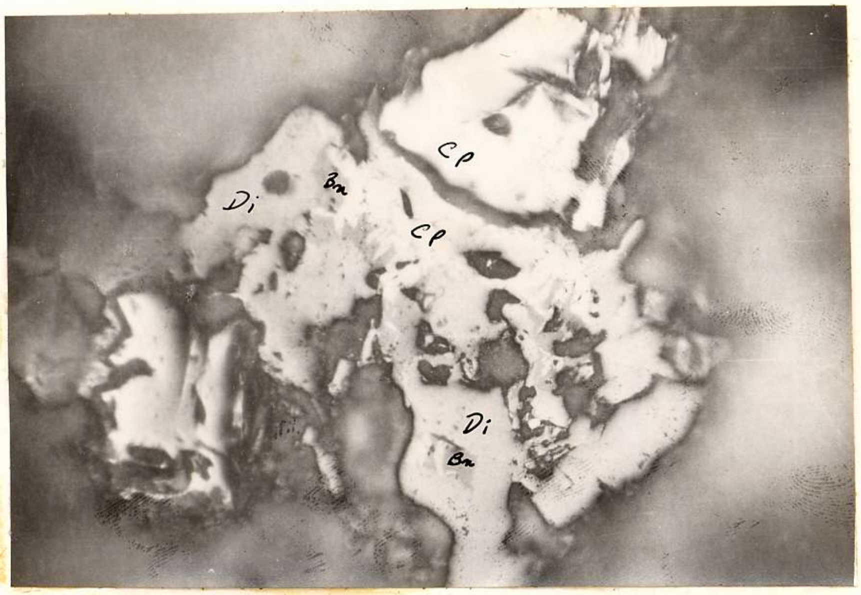

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Fig. 14. Chalcopyrite and bornite partially replaced by digenite.
plain light. Hole # 87 545'. X 75.