MICROSCOPIC EXAMINATION OF ORE SPECIMENS FROM THE SWEETNER VEIN OF THE HEDLEY MONARCH PROPERTY

Submitted in partial fulfilment
of the Geology 409
course

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Gentlemen:

The following report is submitted in compliance with the regulations governing requirements for the course in Geology 409.

Yours truly,

L. P. Starck

L. P. Starck.

SUMMARY

The microscopic examination of polished sections from the Sweetner Vein of the Hedley Monarch property disclosed the presence of the following minerals, in order of decreasing abundance: quartz, chalcopyrite, tetrahedrite, galena, pyrite, native gold, magnetite, hessite, petzite, sphalerite, mineral X, and altaite (?). The average particle size of the native gold, the main economic mineral in the ore, was found to be below what is normally considered the practical limit of grinding. Furthermore, the mineralogy, association of minerals, and physical make-up of the vein suggested either straight cyanidation or flotation followed by cyanidation as the best concentrating process.

ACKNOWLEDGMENTS

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MICROSCOPIC EXAMINATION OF ORE SPECIMENS FROM THE SWEETNER VEIN OF THE HEDLEY MONARCH PROPERTY

INTRODUCTION

The microscopic examination of polished sections of ore specimens from the Hedley Monarch property was undertaken in order to identify the metallic minerals present, their manner of occurrence, and the approximate size range of the native gold particles.

LOCATION OF PROPERTY

The property is in the Olalla Camp of the Osoyoos Mining Division, Province of British Columbia. It is situated astride Keremeos Valley immediately south of the townsite of Olalla, which lies 4 miles north of Keremeos, 13 miles northwest of Hedley, and 20 miles southeast of Penticton.

HISTORY OF PROPERTY

The Sweetner Vein lies at the north end of the property, which is generally referred to as the Sunrise Section. This section has been prospected intermittently since the early 1890's, but it was not until the late 1930's when it was being worked by the Gold Valley Mines Ltd., that the Sweetner Vein was discovered. However, little work was done on it until 1945, when the Hedley Monarch Company took over the Gold Valley holdings.

GEOLOGY

Regional Geology

It is generally thought that in the region in which the property lies, the oldest group of rocks is the Shoemaker Formation which is made up of chert, argillite, cherty argillite, quartzite, and greenstone of the Triassic age. This formation, however, is intruded and underlain at various depths by the Okanagan Intrusives, part of the Great Interior Batholith. These intrusives are a group of closely allied Post-Triassic rocks which are relatively coarse-grained. The oldest of these intrusive ultra-basic rocks, which consist of pyroxenite, peridotite, biotite, and some hornblendite, form an irregularly shaped mass centered about Olalla. In the northwest, this body has been intruded by diorite and quartz diorite rocks, and immediately south of Olalla by a body of syenite and soda granite.

Geology of Sunrise Section

The Sunrise Seetion cowers the above mentioned stbck of alkali-rich granitic rocks which intrude the pyroxenite. This mass is veined by numerous quartz veins, varying from ½ to 12 inches in width, and which, for the most part, strike westerly and dip nearly vertical. Acid and basic dikes cut the stock at several points and in various directions.

DEVELOPMENT OF THE SWEETNER VEIN

The Sweetner Vein is partially explored underground by the Shepherd Tunnel, which follows the foot-wall of a 4-foot basic dike that strikes north 75 degrees west, and by the No. 1 - north and No. 2 - north cross-cuts. Side-swiping the north wall for the first 15 feet of the tunnel disclosed the vein on the hanging-wall of the dike, however, from the examination of the No. 1 - north and No. 2 - north cross-cuts it is evident that the vein does not parallel the dike but diverges about 10 degrees to the north.

On the surface the Sweetner Vein has been stripped for 130 feet along its length.

This work has shown that the vein ranges in width from ¼ to 1⅛ inches and that it has a frozen contact with the wall rock except where it is against the hanging-wall of the dike. The vein strikes north 65 degrees west and dips 75 degrees to the north.

MINERALOGY OF THE SWEETNER VEIN

The minerals present in the Sweetner Vein, as determined from the specimens examined, are as follows, in order of decreasing abundance: quartz, chalcopyrite, tetrahedrite, galena, pyrite, native gold, magnetite, hessite, petzite, sphalerite, mineral X, and altaite(?). The sulphides comprise only about 5 to 10 percent of the vein matter, the remainder being quartz.

Quartz (SiO_2): The quartz, which is massive to crystalline, has undergone extensive fracturing. It is milky white in color and represents about 90 to 95 percent of the volume of the vein.

Chalcopyrite ($CuFeS_2$): The chalcopyrite occurs mainly along fractures in the quartz where it replaces the walls. It usually forms mutually rounded boundaries with tetrahedrite and galena, however, it also occurs as intergrowths in tetrahedrite. The chalcopyrite shows some evidence of replacing pyrite and in one particular specimen it was observed to be veining sphalerite. It sometimes contains microscopic blebs (5 microns and under in diameter) of galena and tetrahedrite.

Chalcopyrite may have some influence on the precipitation of the native gold as it is more commonly associated with the gold than are the other sulfides.

Tetrahedrite ($3Cu_2S.Sb_2S_3$): Tetrahedrite is normally found in the fractures along with galena and chalcopyrite and usually shows mutually rounded boundaries with them. Occasional blebs of chalcopyrite ranging from 5 to 15 microns in diameter were observed in tetrahedrite.

Galena (PbS): The associations of galena and its manner of occurrence have been dealt with in the preceding paragraphs on chalcopyrite and tetrahedrite. Sub-microscopic inclusions of an unknown mineral, which has a color lighter than galena, have been noted in the galena.

Pyrite (FeS): The pyrite has a granular texture with grain sizes varying from 5 to 250 microns in diameter and averaging less than 80 microns. It is usually found as isolated "islands" in the quartz and syenite, but in places it appears with chalcopyrite which has evidently corroded and replaced the pyrite. In several instances native gold and magnetite have been noted in contact with the pyrite grains. One of the sections showed inclusions of an unidentified galena white mineral in the pyrite.

Native gold (Au): The native gold occurs mainly as veinlets and blebs isolated in the quartz, however, it was also observed in contact with chalcopyrite and occasionally with hessite and pyrite. The blebs of gold range from 5 microns to 150 microns in diameter and the veinlets average 15 microns in width by 75 microns in length.

<u>Magnetite ($FeO \cdot Fe_2O_3$)</u>: Magnetite is usually found as isolated grains in the syenite wall rock, however, it has also been noted in both the quartz and syenite in association with pyrite.

<u>Hessite (AgTe)</u>: A mineral tentatively identified as hessite was observed along fractures in the quartz in association with gold, petzite, and a mineral assumed to be altaite (?).

The hessite was identified by etch reactions, its change of colors under polarized light, its anomalous anisotropism, its sectility, and by microchemical tests. However, as yet its determination has not been confirmed by X-ray powder photographs.

<u>Petzite</u> ($(Ag,Au)_2Te$) A mineral which has been tentatively determined as petzite, was observed in contact with an unknown galena white mineral (mineral X). The grain boundaries between these two suggest that they were deposited contemporaneously.

On the basis of the following information the mineral has been tentatively identified as petzite, however, verification will depend on X-ray analysis .

1) Examination of the polished section revealed that the

mineral was isotropic, pinkish brown in color, and gave etch reactions fitting those of petzite as reported by Short (U. S. Geol. Survey, Bull. 419, 1940).

2) A minute quantity of the mineral was placed on a glass slide and then roasted in an oxidizing flame. Examination of the slide under a microscope revealed a residue of reddish gold porous beads surrounded by halos of silvery white metal. This is indicative of gold-tellurides as similar results have been obtained by roasting known gold-tellurides in the same manner. (The reddish gold bead is gold that has been reduced and the silvery white metal is tellurium)

3) Microchemical tests run on the mineral proved the presence of gold and tellurium, however, there was not sufficient material available to check for silver.

<u>Sphalerite (ZnS)</u>: Sphalerite was found in the fractures in the quartz and in one case it showed veining by chalcopyrite.

<u>Mineral X</u> - A bleb of this mineral about 10 microns in diameter was found in contact with petzite. The mineral is galena white in color, soft, and is isotropic. It gave the following etch reactions: $HgCl_2$ - negative, HCl - irides, $FeCl_3$ - brown, KCN - negative, HNO_3 - black, and KOH - black. This does not agree with any of the minerals listed by Short. ~~However~~, No microchemical tests were run on it as it was deemed wiser to save the

mineral for determination by X-ray powder photographs.

Altaite (PbTe)A mineral assumed to be altaite (?) was found in contact with hessite.

Because the particles of this mineralware small in size and few in number it was not possible to run any microchemical tests on it nor was it possible to complete the standard seven etch tests on this mineral. However, for the following reasons the mineral was assumed to be altaite: it is isotropic, it has e color lighter than hessite, it is very soft, it is associated with hessite, and the few etch reactions that were run on it agree with those given by Short for altaite.

PARAGENESIS

In general it would appear that the vein had undergone a period of fracturing prior to the deposition of the sulfides. However, in a few instances shattered pyrite was observed and this suggested that at least some of the pyrite had been precipitated before fracturing or that there may have been more thac one period of fracturing.

The pyrite in many cases shows complete crystal form and this would indicate early pracipitation. The galena, chalcopyrite, and tetrahedrite have come in along fractures in the quartz and in many instances, replaced the walls. These three minerals show contemporaneity, however, in one or two places the chalcopyrite shows intergrowths in tetrahedrite which would indicate that the chalcopyrite was younger than the tetrahedrite. In one section chalcopyrite was observed veining sphalerite. This suggests that the sphalerite is older than the chalcopyrite, but younger than the pyrite as it appears to have replaced pyrite in some instances. The tellurides all appear to have been deposited in the fractures at the same time and contemporaneity is suggested with the chalcopyrite, galena, and tetrahedrite. The gold has most likely been deposited later than the other sulfides,

INFLUENCE OF THE MINERALOGY ON MINERAL DRESSING

A cursory examinatien ef the metallic minerals in the Sweetner Vein indicates that there is a possibility of recovering values in gold, silver, lead, zinc, and copper, however, assays have shown that gold is the only one of economic significance.

From a study of the particle sizes of the native gold it would appear that the ore will present a difficult grinding problem as the average particle size is below what is usually considered to be the economic limit of grinding. This, however, may not cause as much trouble as might be expected because the majority of the native gold occurs in relationship with fractures and in contact with sulfides and, therefore, may be unlocked at a coarser grind than would be normally anticipated.

Cyanidation, amalgamation, gravity, and flotation could all be applied separately or together as a means of effecting the recovery of the gold values. The mineralographic study of the ore specimens suggests cyanidation because cyanidation is usually more practical than the other methods when dealing with very fine gold. However, the presence of gold tellurides and cyanicides coupled with the fact that the native gold may not be completely freed by grinding favors a combination of flotation and cyanidation. The practise of making a jig or unit cell concentrate at as early a stage as possible in the mill may also be recommended in order to remove any large particles of free gold as soon as they are freed.

APPENDIX

The minerals in the polished sections were identified on the basis of physical properties, etch reactions, and microchemical tests as given by Short (U. S. Geol. Survey, Bull. 419, 1940).

The minerals identified in the eight specimens examined are as follows:

Section 1

Native gold	Chalcopyrite
Petzite	Magnetite
Pyrite	Galena
Tetrahedrite	

Section 2

Native gold	Altaite (?)
Hessite	Galena
Petzite	Tetrahedrite

Section 3

Magnetite	Tetrahedrite
Pyrite	Galena
Petzite	Chalcopyrite
Mineral X	Native gold

Section 4

Pyrite	Galena
Chalcopyrite	Magnetite
Native gold	

Section 5

Native gold	Pyrite
Galena	
Chalcopyrite	

Section 6

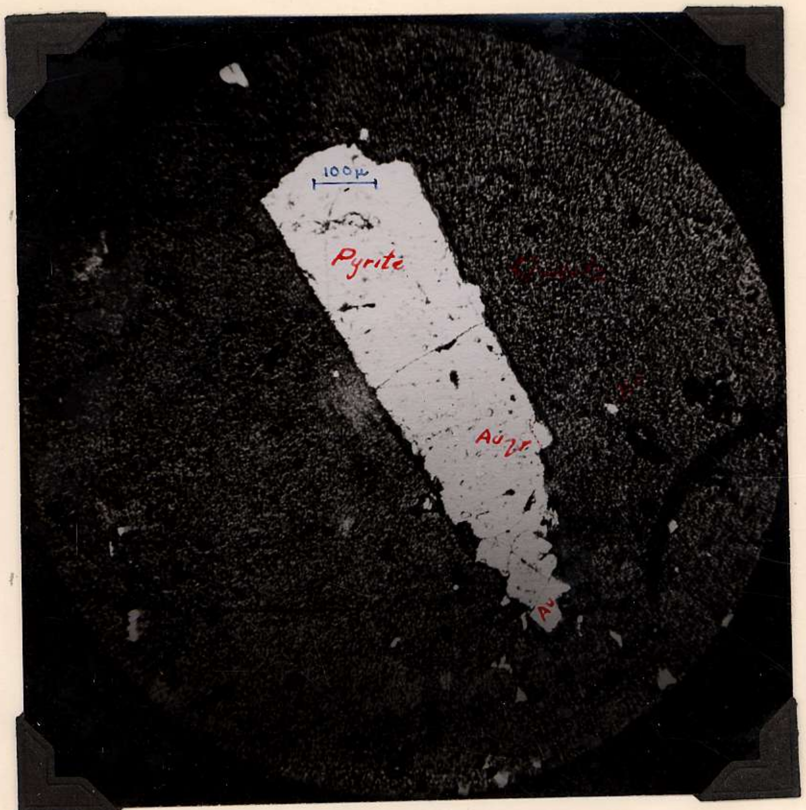
Chalcopyrite	Native gold
Galena	Pyrite
Magnetite	Tetrahedrite

Section 7

Chalcopyrite	Hessite
Native gold	
Petzite	

Section 8

Chalcopyrite	Hessite(?)
Altaite (?)	Sphalerite
Galena	Petzite(?)
Native gold	



Section 2

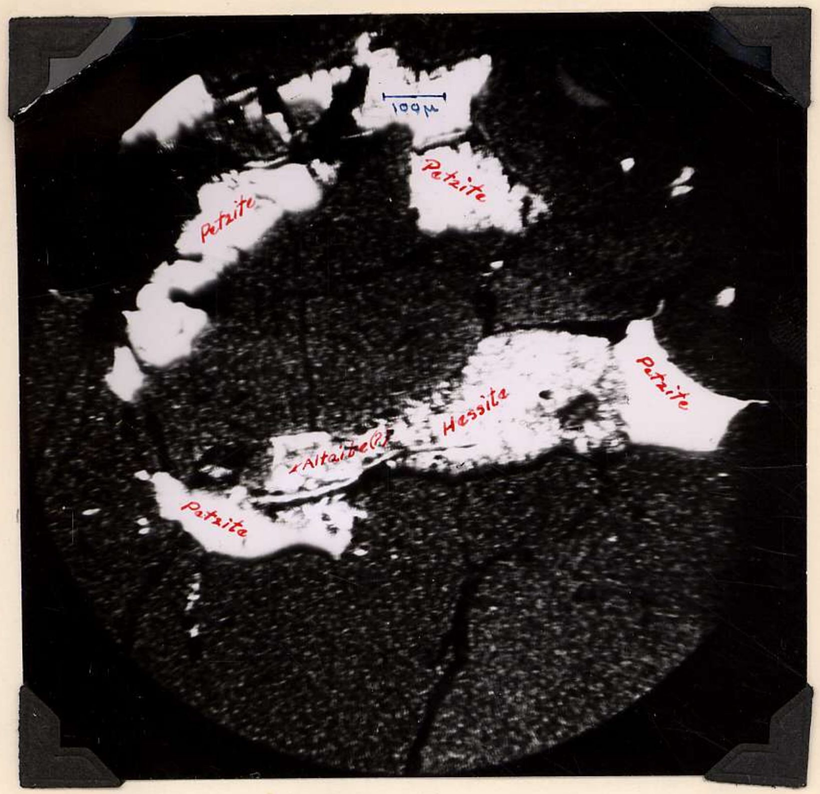
Pyrite and gold in quartz

x 78.4

Section 3

Mineral X in association with chalcopyrite and petzite

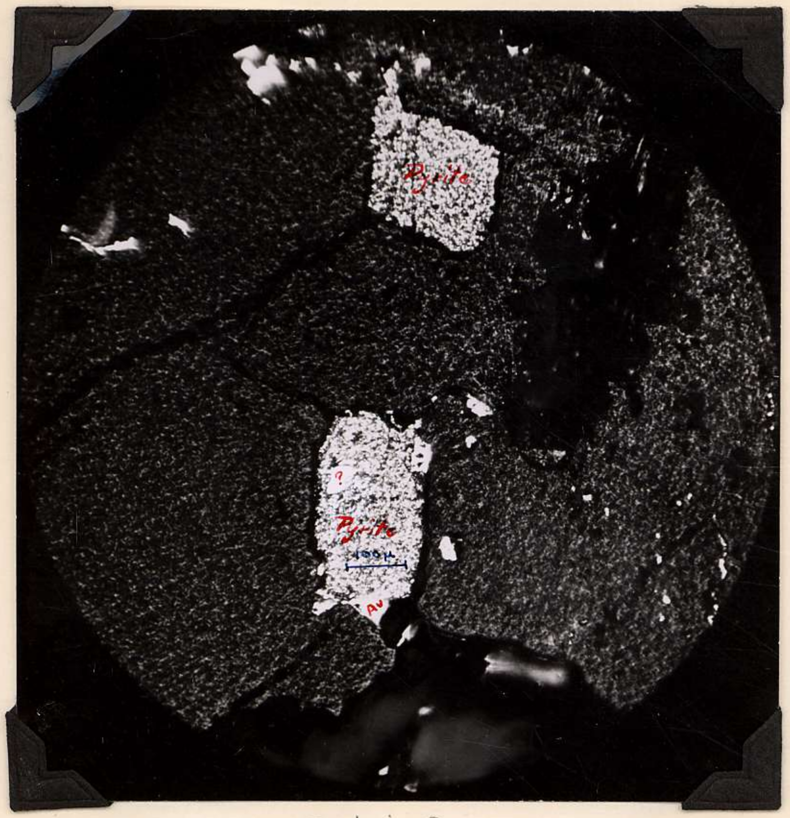
x 78.4



Section 2

Hessite in contact with petzite
and altaite(?)

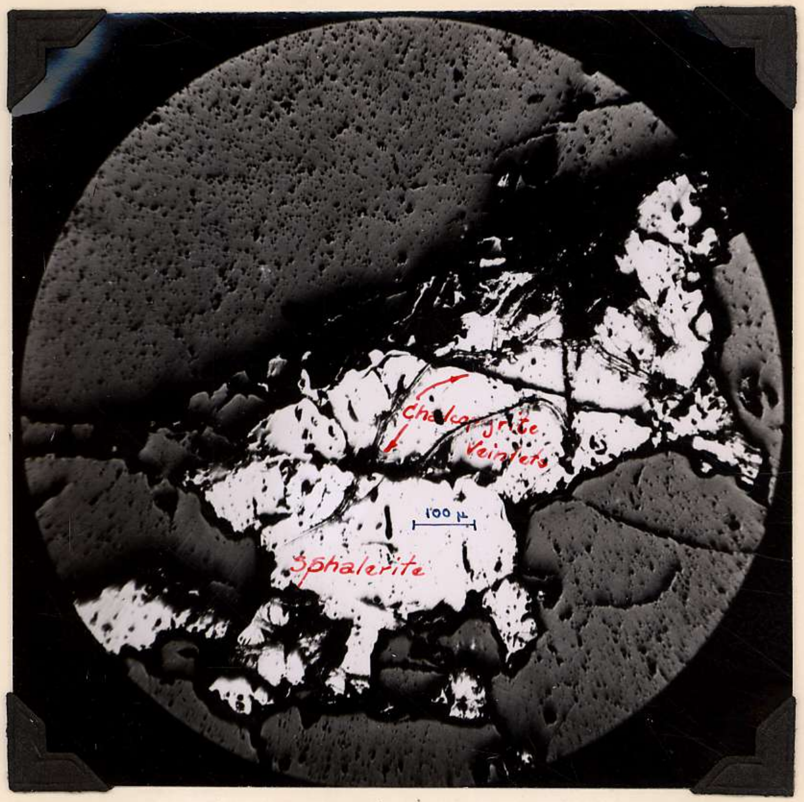
78.4



Section 2

Pyrite and gold in quartz. The pyrite in one instance shows inclusions of an unknown mineral.

x 78.4



Section 8

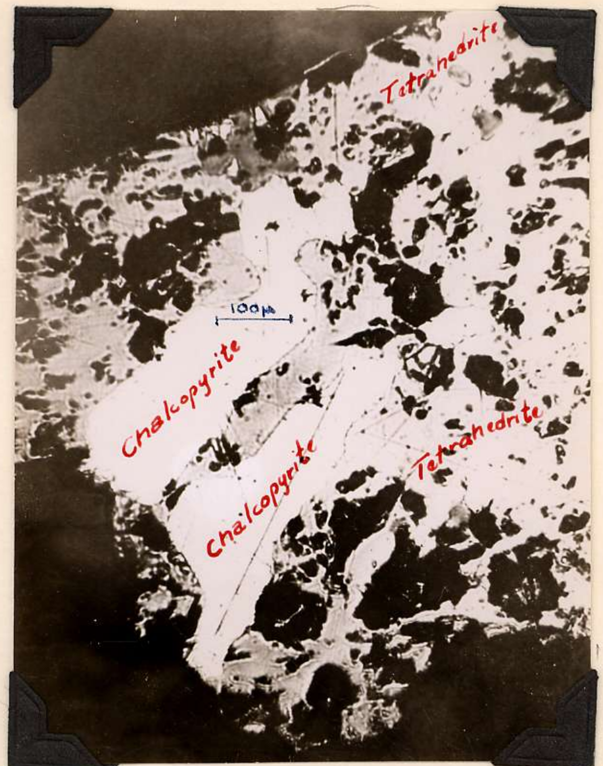
Veinlets of chalcopyrite cutting sphalerite.

x 78.4

Section 3

Tetrahedrite, galena, chalcopyrite, and gold.

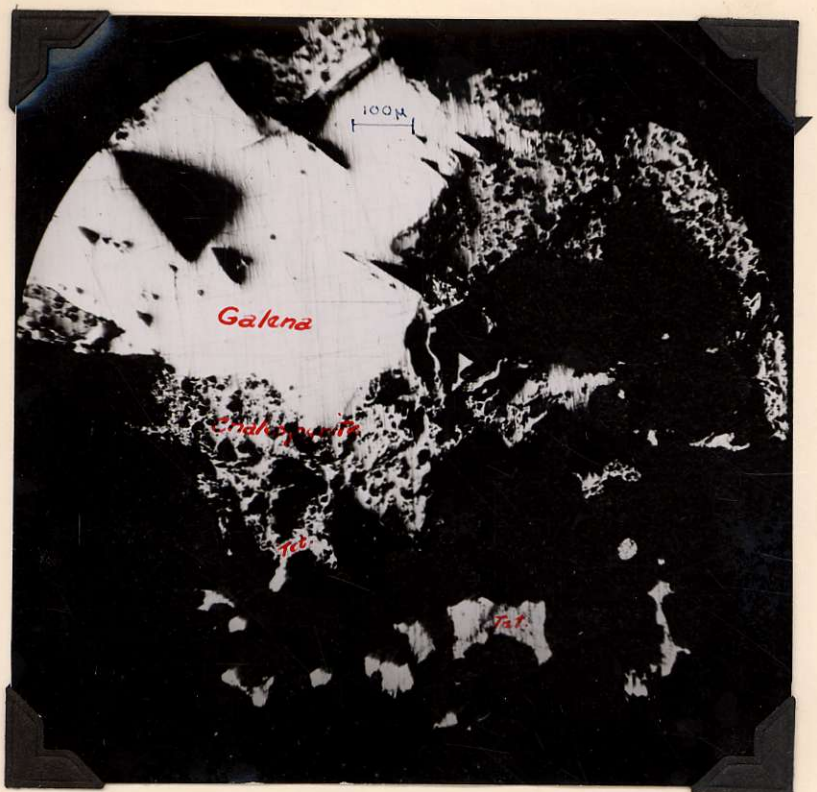
X 100



Section 3

Chalcopyrite and tetrahedrite.

x 100



Section 3

Chalcopyrite in contact with
galena and tetrahedrite

x 78.4

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