GEOLOGY 409 PROBLEM No 4

SILVER KING MINE
B.C.

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A Report on the Silver King Mine B.C.

Introduction:

The suite of ores examined is from the Silver King Mine, British Columbia. The mine is located 4.75 miles south of the city of Nelson B.C. and is 1.25 miles northeast of Toad Mountain.

Access to the mine is provided by a road which connects with Nelson B.C.

This property, staked in 1886 is mentioned in the B.C Department of Mines report of 1887 and subsequent reports. Dawson examined the area in 1889 and in 1911 it was also examined by Le Roy of the Geological Survey of Canada.

LEGEND

MESOZOIC OR CENOZOIC

CRETACEOUS OR TERTIARY

9a-9c — 9a, *feldspar-quartz-augite porphyry dykes;* 9b, *aplite dykes;* 9c, *lamprophyre and diabase dykes*

8 — *Pegmatite stock; age relation to other intrusions not known*

MESOZOIC

CRETACEOUS

NELSON INTRUSIONS

6 — *Granodiorite, granite, diorite;* 6a, *dioritic porphyry satellite bodies*

7 — *Monzonite chonoliths; age relation to other intrusions not known*

5 — *SILVER KING PORPHYRY: quartz diorite*

JURASSIC OR CRETACEOUS

3 — *BEAVER MOUNTAIN FORMATION: augite andesite and basalt porphyry flows, breccia, agglomerate; minor conglomerate, argillite, limestone*

JURASSIC AND (?) CRETACEOUS

2 — *HALL FORMATION: siltstone, greywacke, conglomerate, argillite; quartz-biotite schist, quartzite; minor flows and pyroclastic rocks;* 2a, *limestone*

4 — *ELISE AND BEAVER MOUNTAIN FORMATIONS: undivided, Hall formation unrecognizable or absent*

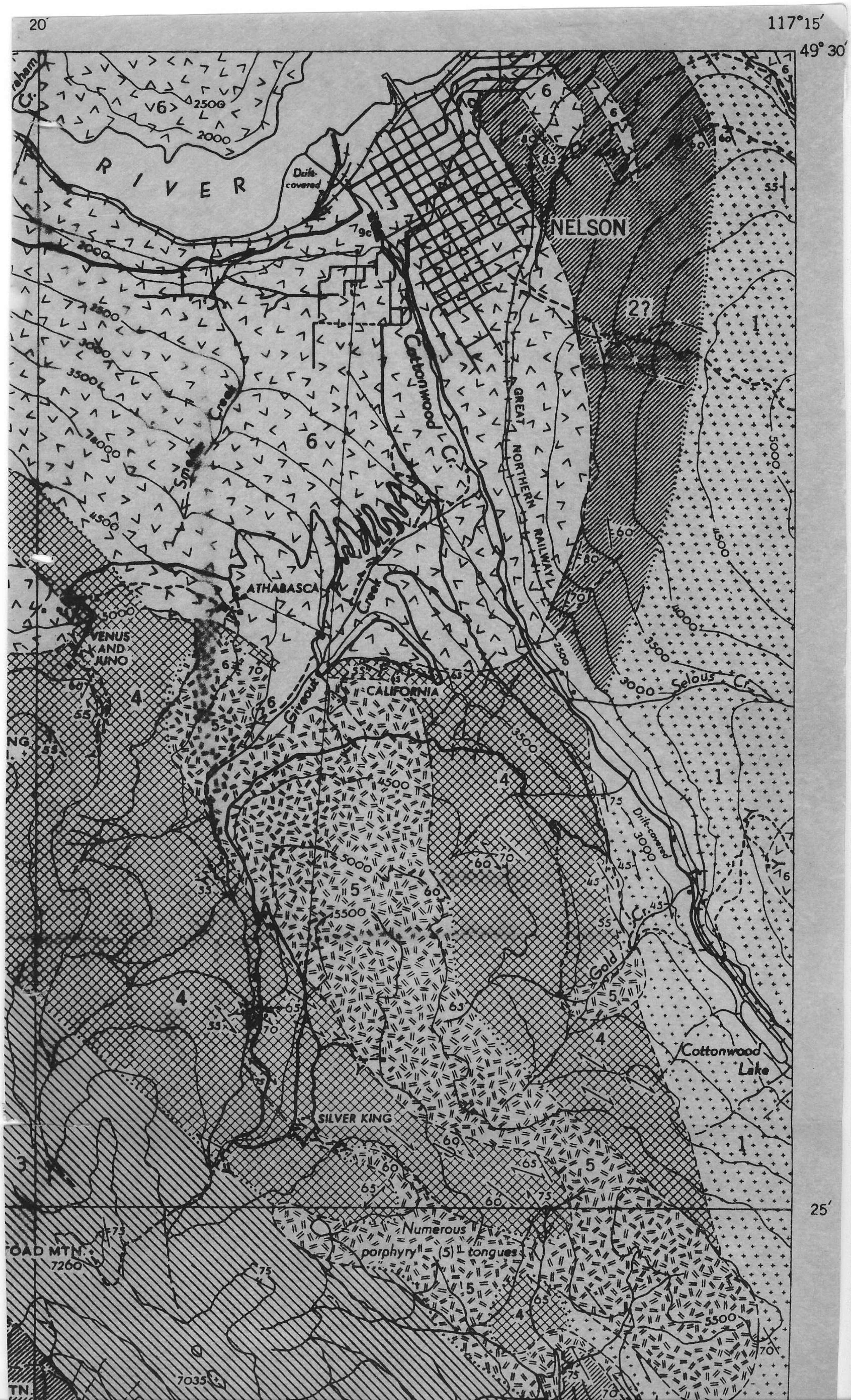
TRIASSIC AND (?) JURASSIC

1 — *ELISE FORMATION: andesite, augite andesite and basalt porphyry flows, breccia, agglomerate; minor tuffs and sedimentary rocks*

BONNINGTON COMPLEX

C — *Syenite; age relation to Nelson not known; in part gradational, in part intrusive into A*

A, B — *Pre-Nelson in age*
A. Pseudodiorite
B. Pyroxene-hornblende-biotite rock


20'
117°15'
49° 30'
25'
RIVER
Drift-covered
NELSON
GREAT NORTHERN RAILWAY
Cottonwood Cr.
Smoky Creek
Give-out Creek
ATHABASCA
VENUS AND JUNO
CALIFORNIA
Selous Cr.
Gold Cr.
Drift-covered
Cottonwood Lake
SILVER KING
Numerous porphyry (5) tongues
TOAD MTN.
7260
7035
Graham Cr.

General Geology

The Silver King mine is situated in rocks which have been mapped by R. Mulligan (1949) of the Geological Survey of Canada, as the Elise - Beaver Mountain Group.

In other parts of the map sheet this is a conformable series of volcanic and sedimentary rocks which overlie the Ymir formation. The lower volcanic formation is called the Elise, while the middle, predominantly sedimentary formation is called the Hall. The upper volcanic formation is the Beaver Mountain. These rocks form part of the "Rossland Volcanic group" which with younger intrusions underlies the greater part of the Bonnington and Rossland Mountains.

The lithology of the bottom and top members differs very little and they are classified mainly on their position with reference to Hall sedimentary rocks. North of Norman Creek the sedimentary rocks apparently pinch out and are not recognized. Consequently the rocks are mapped as the undifferentiated Elise-Beaver Mountain group.

The Elise Formation is dominantly volcanic, consisting of flows, agglomerates and breccias, with some tuffs and interbedded water lain clastic rocks. The most characteristic volcanic rocks of the formation are aphanitic to porphyritic andesite greenstones and similar pyroclastic rocks with only plagioclase feldspar occurring as phenocrysts.

Lithologically, the Beaver Mountain Formation is made chiefly of augite and augite-feldspar porphyry flows, breccias, agglomerates and contemporaneous intrusions. In some localities there are porous, amygdaloidal flows while in other places abundant coarse pyroclastic rocks are found. Some of the breccias and agglomerates have rounded to angular fragments up to two feet in diameter, composed mostly of volcanic porphyries, but also including banded siltstone, quartzite, limestone boulders and occasional granite pebbles. There are breccias which are entirely autoclastic, with sub-round fragments of material identical with the matrix.

The general strike of the Eline-Beaver

Mountain Group is northwest and just east of the Silver King mine they dip steeply to the southwest. However the top of the bed is not known.

In the vicinity of the mine there is a northwesterly trending belt of schistose rocks which are an important host rock for mineralization. The schistose rocks include andesite porphyries, vaguely banded dark clastic-looking rocks, and tongues of Silver King feldspar porphyry. The zone is parallel to the regional trend and appears to lie along the east limb of a major syncline.

Silver King Quartz-Diorite porphyry outcrops to the southeast and north of the mine. This rocks forms a large stock with numerous tongues.

The property is situated along the axis of the schist zone of the undifferentiated Elise - Beaver Mountain group. The schists along this axis are green, but appear to be clastic in origin, unlike those closer to Toad Mountain whose origin as augite porphyry can still be recognized. Seracite schist is also present and is undoubtably sheared Silver King porphyry, the remnants of which can be seen in the unmined parts on the surface. This rock was probably more brittle than the volcanic clastic rocks and proved more favourable for the cross fracturing which is the locus for the mineralization. The volcanic schist south of the mine contains limestone blocks or lenses several feet in length.

There is no evidence of faulting, however good horizon markers are lacking. The area is broadly folded.

Economic Geology

Megascopic:

The ore minerals identified megascopically are bornite, tetrahedrite, chalcopyrite, malachite, azurite, hematite, chalcocite and manganite. Gangue minerals are quartz and carbonate.

The bornite and tetrahedrite are closely associated and occur in a massive, medium grained form with very little gangue minerals included. The bornite has a characteristic purple alteration coating. Bornite also occures in narrow veinlets in what appears to be a brecciated quartz-carbonate gangue. Tetrahedrite, chalcocite, hematite and some malachite and azurite occur together with quartz-carbonate gangue minerals in one specimen examined. The chalcocite and hematite form an almost earthy mass locally. Chalcocite appears predominant and is very sooty.

Chalcopyrite is also massive and disseminated. These specimens contain considerable hematite on fractures which tends to mask some of the other minerals present. It also appears to permeate some of the carbonate gangue giving patches of light brown carbonate material. Bornite is also found with the chalcopyrite. Azurite and malachite are also fairly abundant on the fractures.

A mineral which, has a metallic luster, a dark brown streak, is fairly hard and occurs as lamellar aggregates in a fissure filling is

Check this

thought to be manganite. It is coated on a carbonate gangue.

Microscopic:

Primary Minerals present are:

Bornite (Cu_5FeS_4)

The bornite is isotropic, a pinkish brown colour and has a hardness of B. The main criteria for identification was the purple tarnish.

Tetrahedrite ($5(Cu_2S.\ 2(CuFe)S.\ 2Sb_2S_3)$)

This mineral was identified by the fact it ~~is~~ isotropic, has a hardness of B, and a grey colour. When scratched ~~the~~ the mineral yields a reddish-brown powder.

Chalcopyrite ($CuFeS_2$)

Chalcopyrite was identified in the polished section by its brass yellow colour, hardness of C, and by the fact it was isotropic. HNO_3 fumes tarnish while all other reagents were negative.

Stromeyerite $(Cu\ Ag)_2S$

This mineral is strongly anisotropic, a grey colour, hardness A and yields a powder when scratched. HNO_3 stained black. HCl fumes tarnished and the halo did not wash off. KCN stained black. $FeCl_3$ stained brown and KOH was negative. Stromeyerite closely resembles argenite in colour and also has cleavage traces that extend accross the mineral giving a finely striated surface.

Galena (PbS)

Galena was present in relatively small amounts and was identified by triangular pits, galena white colour and its association with tetrahedrite.

Secondary Minerals present are:

Hematite (Fe_2O_3)

Hematite occurs in narrow fractures and was identified by its grey colour and red internal reflection.

Covellite (CuS)

This mineral was not positively identified but a bluish mineral may be present in the fractures with the hematite. This blue mineral did not have the red internal reflection of the hematite and was thought to be covellite.

Malachite, Azurite & Chalcocite

These minerals were identified ~~as~~ megascopically.

Percentage of Minerals Present

Bornite	20%
Tetrahedrite	20%
Chalcopyrite	20%
Hematite	3%
Chalcocite	2%
Stromeyerite	1%
Galena	.5%
Malachite	.2%
Azurite	minor
Covellite	minor
Gangue	33%

Textures and Paragenesis:

The bornite, tetrahedrite and galena exhibit a caries texture in several of the polished sections examined. In other sections bornite is found in narrow veinlets in the quartz-carbonate gangue. Stromeyerite is found associated with the bornite in the veinlets. This is illustrated in plate II The stromeyerite exhibits a cusp and caries texture with the bornite and according to Edwards and Bastin the stromeyerite would be later than the bornite. However it is admitted that this criteria is unreliable.

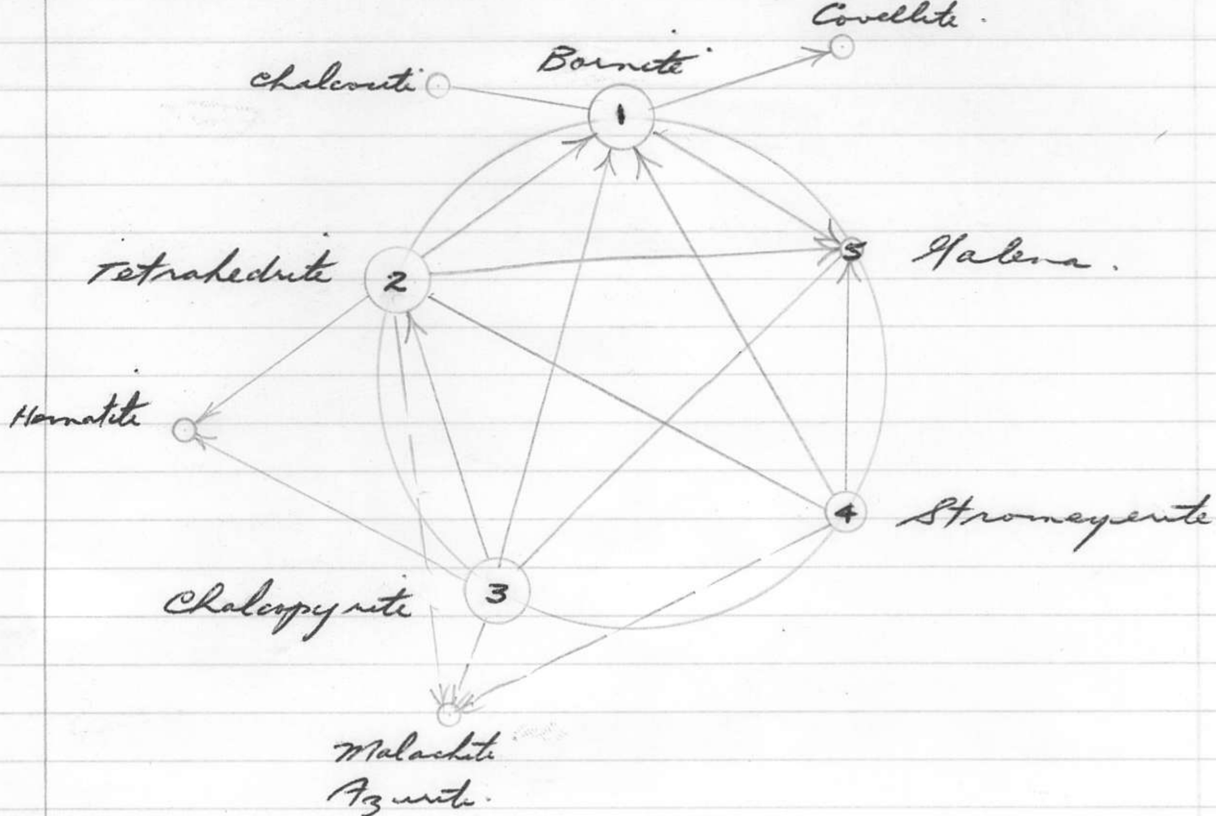
Chalcopyrite is found scattered throughout the bornite in narrow blebs and discontinuous narrow stringers. These stringers and blebs are cut off when the bornite is in contact with the tetrahedrite. The chalcopyrite is therefore thought to be later than the bornite but prior to the tetrahedrite. However in other sections chalcopyrite exhibits a cusp and caries texture with the tetrahedrite and is also scattered in rounded patches and blebs in the tetrahedrite. In this case the chalcopyrite may be later than the tetrahedrite, which would give two different ages for the chalcopyrite. This latter case is illustrated in plate IV. Bornite partially replaced by tetrahedrite is also shown in this plate.

The bornite, tetrahedrite and chalcopyrite all contain triangular cleavage pits which may indicate that the galena was early and was replaced by bornite, followed by tetrahedrite and then chalcopyrite with an earlier chalcopyrite replacement of bornite.

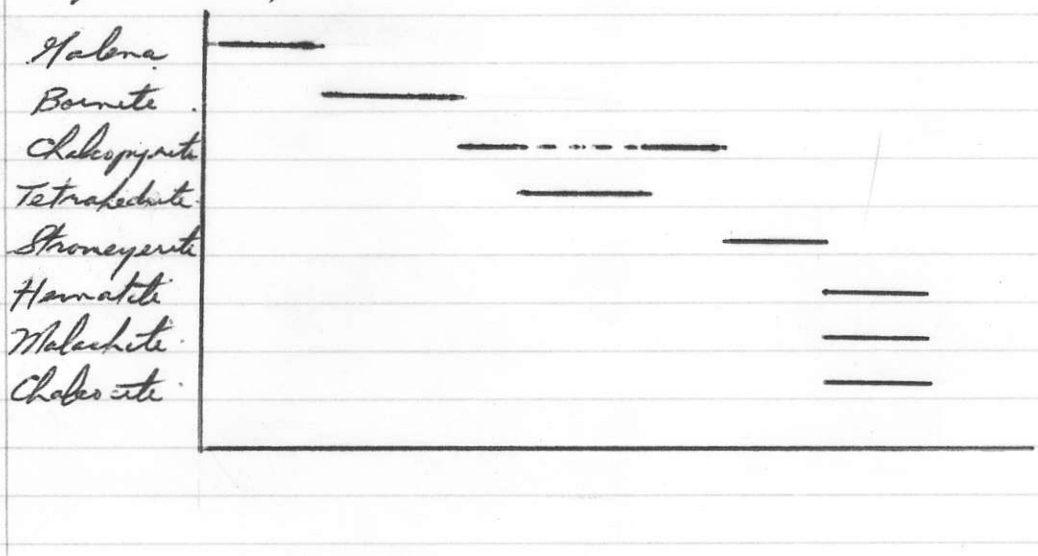
The stromeyerite has replaced galena, bornite and tetrahedrite. This is illustrated in plate I.

The hematite, covellite and chalcocite are all supergene and late.

Diagram Showing Relationship of Minerals:



Sequence of Deposition:



Type of Deposit:

Galena and tetrahedrite are deposited at temperatures below 500°C. Using these minerals as an index the deposit would have to be classified as a mesothermal deposit.

x10

PLATE I

x10

PLATE II

x10

PLATE III

x10

PLATE IV

List of References:

1. Geological Survey of Canada Ann. Rept 1889
p 57B; 1876.
p 27A; Sum Rept 1911 P. 154.

2. B.C. Dept of Mines Ann Repts 1887-1914.

3. Textures of Ore Minerals - Edwards 1954

4. Geological Survey of Canada
R. Mulligan Paper 52-13.