A MICROSCOPIC STUDY AND DETERMINATION OF ZINKENITE.

by

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Introduction.

The object of this investigation is to determine whether the mineral thought to be zinkenite has the chemical composition and properties of zinkenite. It is also desirable to determine the other minerals present in the specimens and their relationship with one another.

Specimens.

The specimens used in this investigation were samples taken from the surface workings on the Bonanza group of claims in the Bridge River district of British Columbia. These claims are situated in Bonanza Basin near the head of Bonanza Creek. Bonanza Creek is a tributary of Tyax Creek which runs into the Bridge River. The claims are about 15 miles from Minto City, 10 miles of road and 5 miles of trail. The specimens are found in the Bridge River series of sedimentary metamorphic rocks which are of the Paeolozic age.

Megascopic Study.

All specimens available were considerably weathered. The specimens are all found in a silicious green rock which seems to contain some serpentine. One specimen consisted of a section of a mineralized vein one and one-quarter inches wide. On one side of the vein there is a sharp division between the silicious gange rock and a band of coarse grained arsenopyrite crystals varying in width from one-eighth to one-quarter inches in width. Next was a band of zinkenite showing a needle-like structure broken up by quartz crystals. This band was three-quarters to seven-eighths inches wide. The remainder of the specimen consisted of a one-eighth inch band of sphalerite which was mixed with quartz crystals.

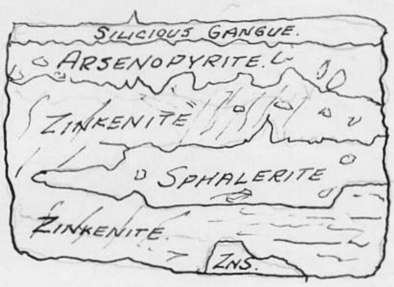


Diagram of a vein sample.

Another band specimen was one inch in diameter completely covered with arsenopyrite cyrstals. The center of this specimen consisted mainly of zinkenite with some quartz gangue. This center was very brittle and quite decomposed.

In one specimen was found a small half-inch diameter pocket of decomposed calcite. This pocket was separate from the other mineralized zones of the sample. The calcite had dissolved away leaving hair-like crystals of zinkenite. These crystals were up to 4 to 5 millimeters in length.

Minerology.

By the examination and application of microchemical tests to the polished sections the following minerals were determined:

1. Quartz.
2. Zinkenite.
3. Sphalerite.
4. Arsenopyrite.
5. Tetrahedrite.
6. Chalcopyrite.
7. Calcite.
8. Gold.

The minerals are numbered in the order of their abundance in the sections as a whole as some sections showed much more of one band of the ore than others.

Examination and Determination of Zinkenite.

On a polished section zinkenite is seen as a soft white mineral which is badly broken up by quartz which appears to have held the zinkenite in solution. There are also newer quartz grains which cut through the zinkenite and old quartz.

The first tests applied were etch tests. The mineral gave a negative test for $HgCl_2$, KCN, and $FeCl_3$. KOH leaves a slight iridescence on the mineral while HNO_3 causes the mineral to effervesce slowly and it becomes dark. HCl has only a very slight effect which is difficult to distinguish as it tarnishes the mineral slightly.

The next tests applied were microchemical tests. The mineral gave an extremely good test for lead when it was dissolved in 1:1 HNO_3. The residue was leached with water and a speck of KI added giving a lemon-yellow precipitate of lead iodide.

A positive test for antimony was obtained by dissolving the mineral in 1:1 HNO_3 and leaching with 1:5 HCl. A fragment of KI and CsCl are added to the drop and orange coloured hexagons of antimony iodide were precipitated.

The next tests applied were specific gravity tests. These tests were not very successful as under the microscope it can be seen that the mineral is too closely locked with quartz to get a clean piece for a specific gravity test. The following results were obtained:

Specific Gravity.	
4.66	The correct specific gravity of zinkenite is 5.12-5.35.
5.15	
4.90	
4.26	
4.77	
4.70	

In order to determine the composition of the mineral a clean as possible sample was picked. This sample was then superpanned and assayed for antimony, lead, and sulphur. The following is the assay of the mineral sample.

Pb. 33.3%, S. 20.9%, Sb. 40.8%, Insoluble Gangue 2.2%, and As. a trace. (97.27)

The correct assay for zinkenite is: Pb. 35.9%, Sb. 41.8%, S. 22.3%. These assays do not seem to confirm the fact that the mineral is zinkenite, although they are very close to the correct values.

Sphalerite can be determined in the specimens by its resin-coloured internal reflection under the arc lamp. A small piece also gives an excellent microchemical test for zinc. The piece is dissolved in 1:1 HNO_3 and leached with 1:7 HNO_3. A drop of potassium mercuric thiocyanate is added to the drop and white feathery zinc crystals will form.

Tetrahedrite and chalcopyrite can both be tested for copper by dissolving a particle of mineral in 1:1 HNO_3 and leaching it with 1:7 HNO_3. A drop of potassium mercuric thiocyanate is added and greenish-yellow fern-like crystals of copper are formed.

Gold may be determined by an etch test as it can only be confused with chalcopyrite. A drop of KCN is placed on the specimen, the gold will turn dark distinguishing it from chalcopyrite.

Paragenesis.

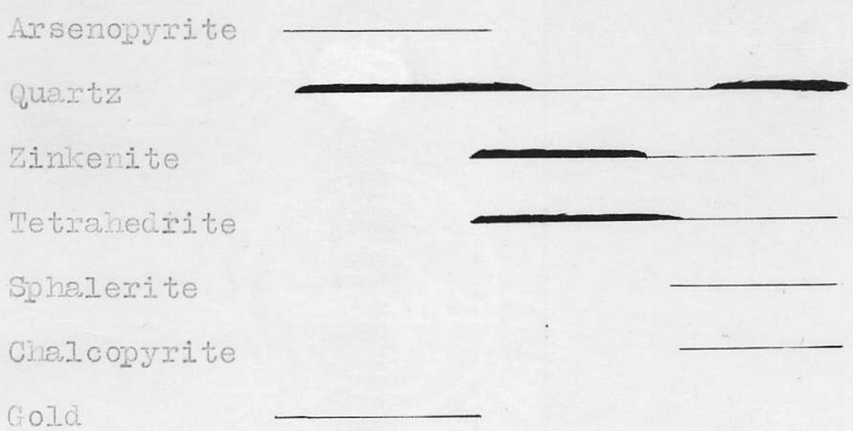
The evidence of paragenesis is not very clear in the specimens examined. It appeared that the first to come was the arsenopyrite as this has been dissolved by the quartz and has been badly broken up by the quartz which seems to have come in at the same time as the zinkenite and tetrahedrite. The next to come was the sphalerite and chalcopyrite with a certain amount of quartz which cut through the old quartz and zinkenite.

Chalcopyrite is found only with the sphalerite. It is found in crystals along the boundaries and in crystals in amongst the sphalerite.

The gold is found only in the quartz gangue and seems to be most often found with the late quartz although this is not certain as only 3 specimens of gold were found.

The zinkenite dissolved by the sphalerite has had time to crystallize and is found both cutting and in the sphalerite.

Diagram of Paragenesis.



Description of Sections.

Section A.

This section shows good examples of the exsolution of the old quartz from the zinkenite. It also shows the dissolution of the quartz crystals. Samples of gold can be found in the quartz in this specimen. This specimen does not show the banding as there is none of the sphalerite band in it.

Section B.

This section gives a good picture of the banding between the sphalerite and the zinkenite. This specimen is the best specimen to find chalcopyrite in as it is quite plentiful. The needle-like structure of the zinkenite crystals can be seen and the clean cut contact between the sphalerite and the zinkenite can be traced all across the specimen on one side of the sphalerite.

Section C.

This section is similar to Section A but it shows larger quantities of tetrahedrite and also shows that the zinkenite crystals can be found in the tetrahedrite.

Section D.

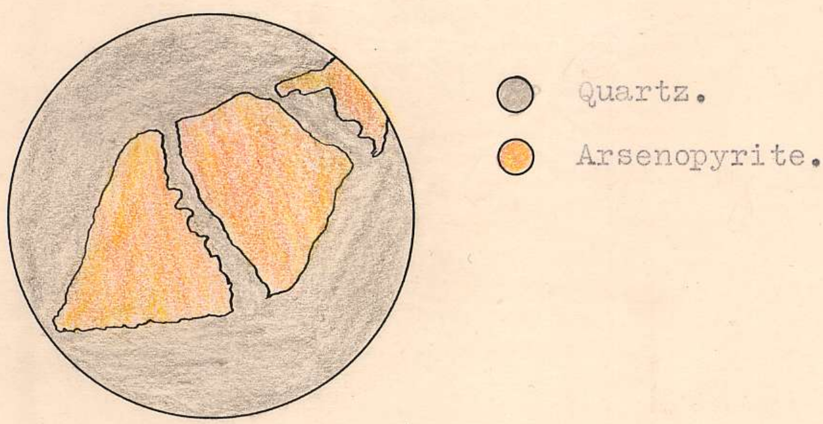
This section shows a much narrower band of zinkenite but it shows that many of the cavities found in the ore are found in the zinkenite and along the contact between the sphalerite and zinkenite.

Section A.

x 100.

This section shows gold free in the old quartz.

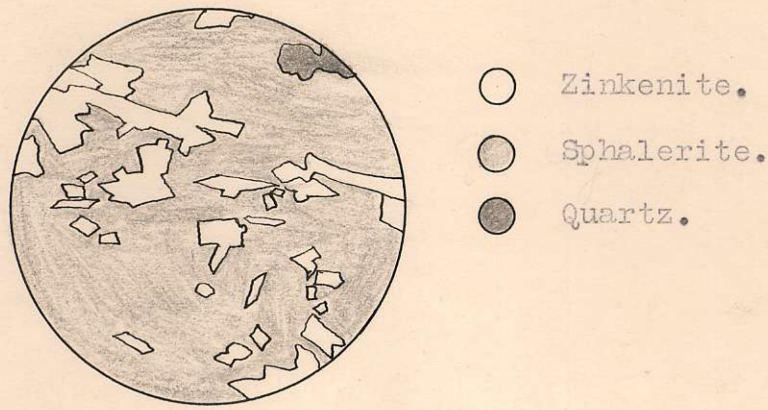
Section D.



x 100.

This section shows arsenopyrite crystal broken and partly dissolved by the quartz.

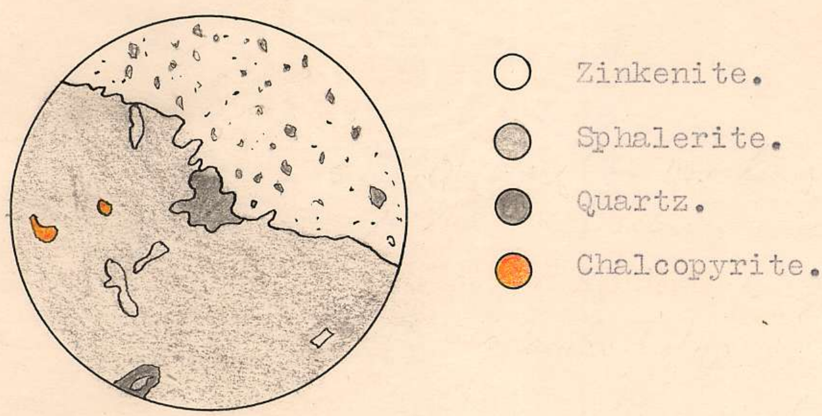
Section B.



x 100.

This section shows sections of zinkenite crystals which have formed in the sphalerite.

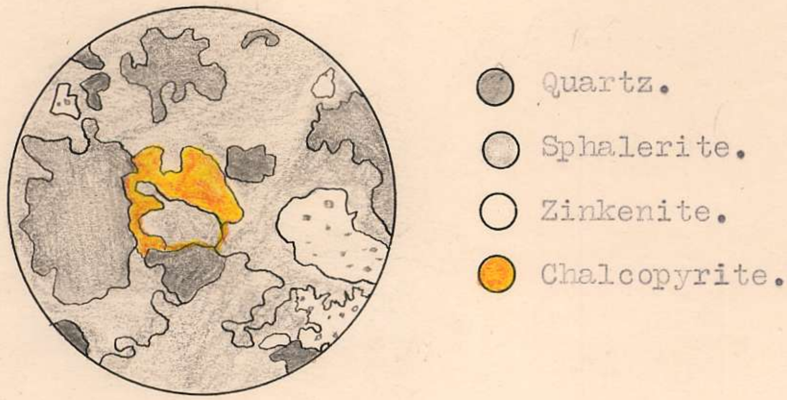
Section B.



x 100.

This section shows a distinct line between the sphalerite and the zinkenite. The exsolution of the quartz from the zinkenite can also be seen.

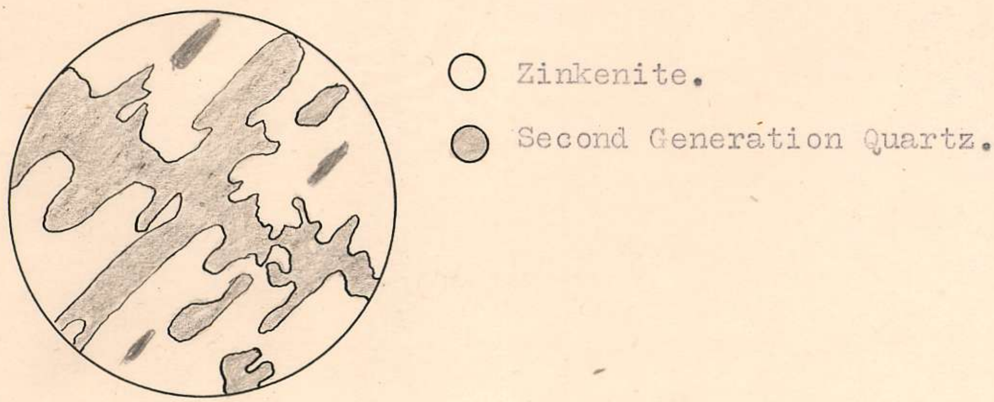
Section B.



x 100.

This section shows the chalcopyrite completely surrounding a section of sphalerite although the chalcopyrite is itself in a groundmass of sphalerite.

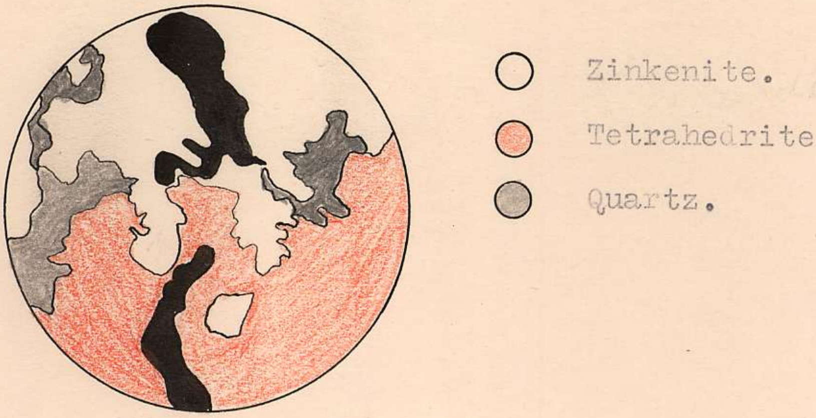
Section B.



x.100.

This section shows the secondary quartz cutting through the zinkenite which contains many crystals of the primary quartz in it.

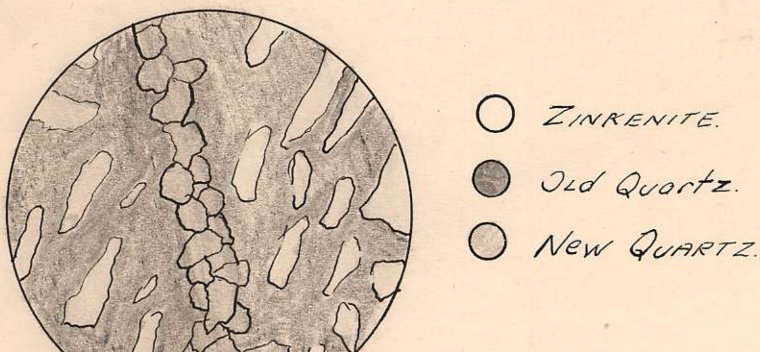
Section C.



x 100.

This section shows a contact between zinkenite and tetrahedrite.

Section. D.



New quartz veining old quartz.