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A MINERALOGRAPHIC STUDY OF ORE FROM THE BEATRICE MINE, CAMBORNE, B. C.

GEOLOGY 409

WILBERT SANDERSON PENTLAND

UNIVERSITY OF BRITISH COLUMBIA

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FROM THE BEATRICE MINE,

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A report submitted to Dr. R. M. Thompson of the Department of Geology, University of British Columbia, in partial fulfillment of the Geology 409, Mineralography course.

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INTRODUCTION

During the second term of the University calendar year 1956-1957, a mineralographic study was made of ore from the Beatrice mine. The work was done as a part of the course Mineralography 409 under the guidance of Br. R. M. Thompson of the Department of Geology at the University of British Columbia.

The purpose of the mineralographic examination was as follows:

a) to determine the minerals composing the ore and to study any textures, etc. they might exhibit.

b) to study the relationships of the minerals to one another in regards to distribution, origin and sequence of formation.

c) to classify the deposit in accordance with the results of the above observations.

The work was done using a reflecting type microscope to study highly polished sections cut from the ore samples. Where necessary, microchemical tests were used in making mineral determinations. A binocular type microscope was also used in observing both polished sections and the rough ore specimens.

CONCLUSIONS

The microscopic study of ore samples from the Beatrice mine indicated the deposit to be a mesothermal type with the ore being composed of fine grained sphalerite, galena, tetrahedrite, chalcopyrite and pyrite. Approximately one half the ore was sphalerite. Quartz and calcite form the gangue.

Deposition appears to have been continuous with considerable overlapping of some minerals. There has apparently been movement in the vein during deposition; resulting in numerous microscopic fractures which have been filled during later deposition.

In order to find the source of silver which has been reported in assays from the property, microchemical tests were run on galena and tetrahedrite with negative results. It is probable that silver occurs in small amounts in both minerals or perhaps in an erratic manner.

LOCATION

The Beatrice mine lies in the Selkirk Mountains of the Kootenay district of southeastern British Columbia. The mine is situated at the 7500 foot level at the head of the east fork of Mohawk creek in the Trout Lake Mining Division. It is seven miles south of the village of Camborne and approximately thirty five miles southeast of the town of Revelstoke.

Access to the mine is gained by a four mile trail from the road between Camborne and the Spider mine.

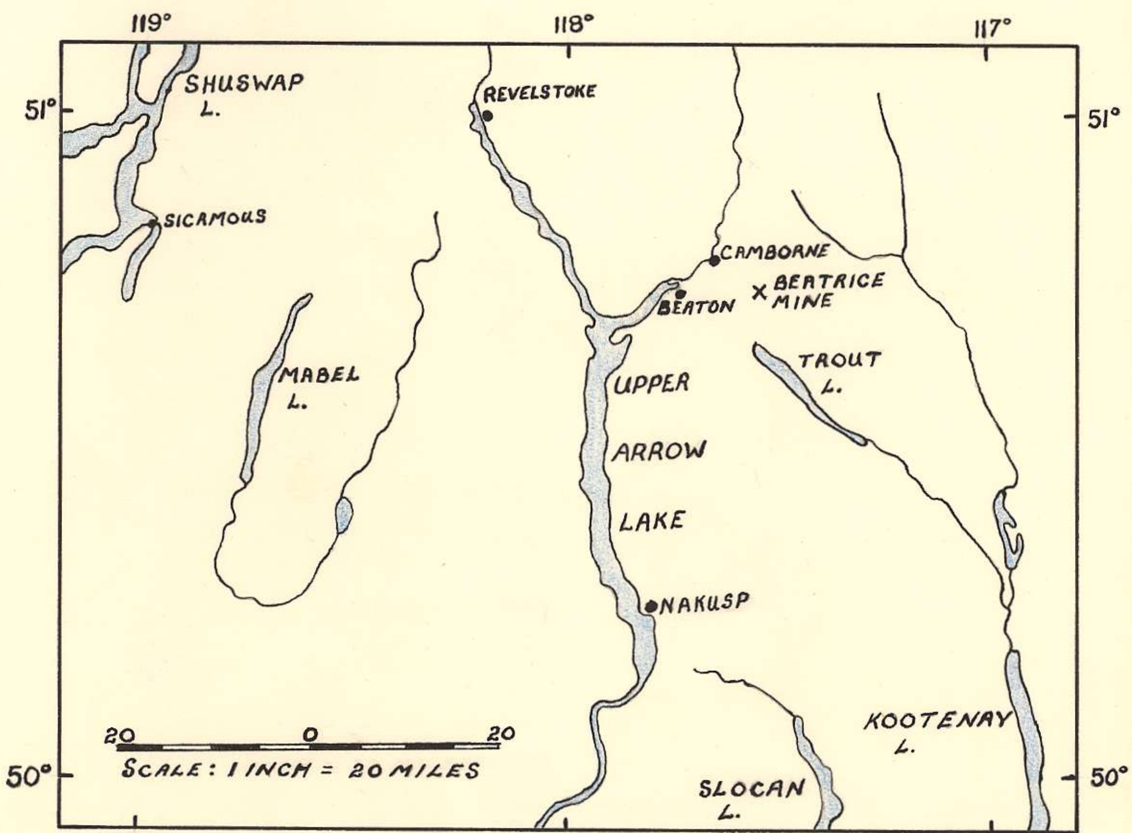


Figure 1. Upper Arrow Lake Area, Kootenay district. Showing location of the Beatrice mine.

After ?

HISTORY

The Beatrice property was discovered about 1898, the original owners being F. F. Fuller and Bonaker Bros. Later, in 1902, the Beatrice Mines Ltd. was organized. The mine again changed hands in 1918 when it came under the management of New Era Mines Ltd. of Vancouver. After remaining dormant from 1920 to 1954 a third company was formed; the Beatrice Mining Co. Ltd. of Vancouver.

Between 1898 and 1920 the property was worked sporadically. Three adit levels and several thousand feet of drifts, crosscuts and raises were put in but only an approximate total of 300 tons of hand picked ore was shipped.

Smelter penalties on the high zinc content of the ore and the lack of a road did not allow the mine to become a paying proposition at that time.

GENERAL GEOLOGY

The Beatrice mine is in the Lardeau series, which is the uppermost member of the Windermere system; a long, narrow belt of Late Proterozoic rocks extending northeastward from the International boundary to the "Big Bend" area of the Columbia river.

In the Lardeau area, in which the Beatrice mine is situated, the Lardeau series has an exposed maximum thickness of 1500 feet being comprised of slates, argillites, quartzites and crystalline limestones.

To the northeast, the Windermere formation is cut by the

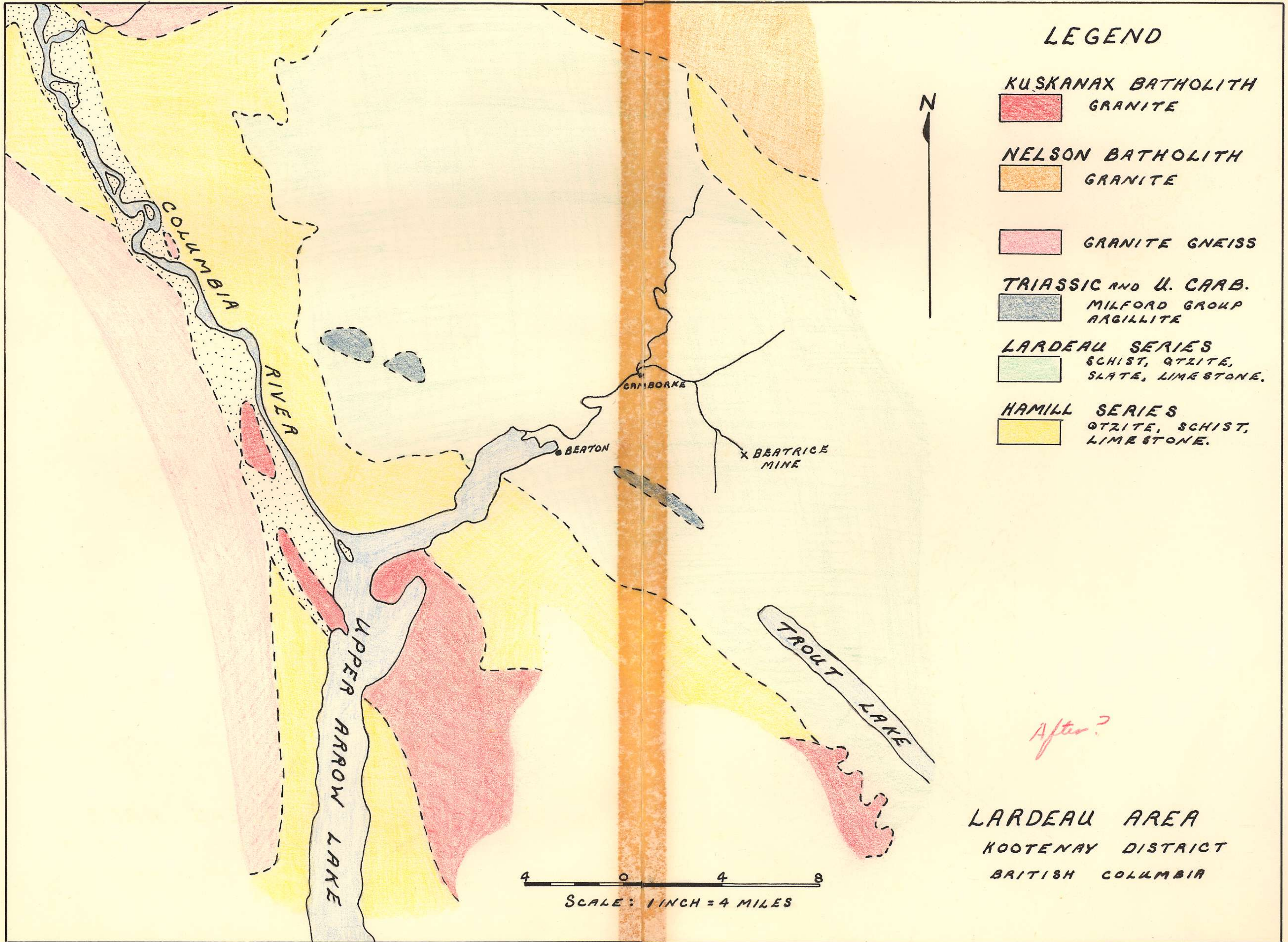


Figure 2. Geological map of the Lardeau area.

Nelson batholith of Mesozoic age. Afew miles to the southwest of the Beatrice mine the Windermere is intruded by the Kuskanax batholith of Late Mesozoic age. It is believed that the granitic magmas of this latter intrusive were the source for the innumerable veins found in the Lardeau area.

The rocks on the property are slates, argillites, quartzites, carbonaceous schists and talcose schists with an average strike of N 40° W and a dip of 60° to 70° NE. There has been a good deal of contortion of the rocks and minor faulting.

The ore occurs in the carbonaceous schists as irregular veins along slips and shear zones, parallel to or crosscutting the bedding at small angles.

MINERALOGICAL DESCRIPTION

Megascopic Inspection

Approximately 50 pounds of massive sulphide ore samples from the Beatrice mine were available for study. These ranged from small fragments to fist-sized specimens.

Ore minerals found were sphalerite, galena, tetrahedrite, pyrite and chalcopyrite, with quartz and calcite forming the gangue.

A study of several of the specimens gave the impression that mineralization had occurred in two ways; by replacement and by open space filling, with the majority of the ore being formed by replacement.

The ore which is believed to have originated through replacement of the wall rock is composed mostly of light colored sphalerite, with some galena and a little tetrahedrite, all very fine grained.

Cutting the fine grained zinc ore are many stringers, lenses, etc. of medium grained, well crystallized galena, tetrahedrite, and sphalerite, with galena being the predominant mineral. This latter mineralization appears to be open space filling.

Several polished sections of the ore showed the sphalerite concentrated in rounded or lens shaped masses up to one inch in diameter, with galena and tetrahedrite surrounding the sphalerite. Under the binocular microscope many narrow, irregular veins of pyrite were seen in the sphalerite. Numerous small, scattered grains of pyrite were noted in the galena and tetrahedrite as well.

Pyrite also occurs in fairly large masses up to one inch across. In such cases it is associated with quartz, generally near the boundaries of massive quartz.

Chalcopyrite was seen only once. It occurred as a small mass, 1/2 inch long and 1/8 inch wide, enclosed by massive quartz and the other sulphides.

Quartz was present in nearly all the ore samples to some degree. In some cases it occurred in minute amounts mixed with the sulphides and again as large massive pieces up to five inches across. Generally, it appeared to have been deposited as open space filling. One sample showed crude comb texture and there were several small vugs lined with small quartz crystals.

Calcite occurred in two or three small vugs in the sulphides and also as a vein in quartz about 3/8 of an inch wide.

Ore samples which had been exposed to weathering showed a little limonite staining.

Microscopic Inspection

In preparation for the microscopic study several samples of ore were selected and from them eight polished sections were made. The specimens were picked in an attempt to show each known mineral to its best advantage in at least one polished section.

A study of the polished sections with the microscope confirmed the presence of those minerals noted in the hand samples. No new minerals were found.

An estimate of the quantity of each mineral was made for each section. The approximate averages of the eight sections are as follows:

sphalerite	52.0%
pyrite	28.0%
galena	11.0%
tetrahedrite	8.0%
chalcopyrite	0.5%

It may be noted that with the exception of traces, all the chalcopyrite was found in one polished section.

The following is a brief discussion of the occurrence of each mineral taken in the order of quantity as calculated above.

a) Sphalerite

The sphalerite generally occurs in large masses as previously noted in the megascopic study. A small amount of it does occur as unreplaced remnants in galena and tetrahedrite or as open space filling in quartz. It also appeared occasionally as an apparent replacement of pyrite but in very small amounts. (See Fig. 7)

b) Pyrite

The pyrite is found almost everwhere in the polished sections. It occurs filling fracture in sphalerite, as small grains in galena and tetrahedrite and as large masses usually associated with quartz. It replaces a little sphalerite, usually along grain boundaries. (See Fig. 8)

c) Galena and Tetrahedrite

Since these two minerals appear to have been deposited simultaneously and have the same mode of occurrence they shall be considered together. The majority of the galena and tetrahedrite occurs cutting sphalerite as irregularly shaped veins. Normally the veins have the same rough trend indicating that original deposition was along a fracture pattern which served as access for later replacement of the sphalerite by the galena and tetrahedrite.

Some of the tetrahedrite occurs as more or less rounded grains in the galena but in many of the veins there appears to have been a rough longitudinal separation of the two minerals with each tending to be deposited to one side or the other in the vein.

Both minerals occur occasionally as isolated replacements of earlier pyrite. (See Fig. 7 and Fig. 9)

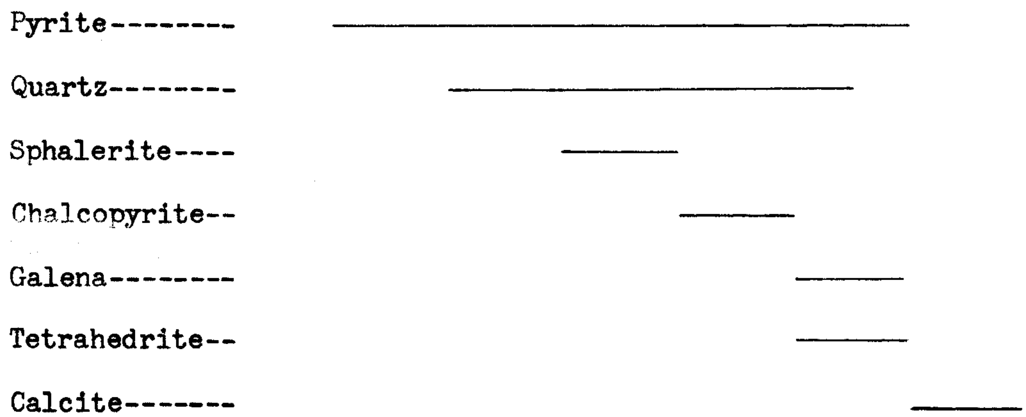
d) Chalcopyrite

The majority of the chalcopyrite occurs as masses up to 500 microns in diameter. It has generally replaced quartz and pyrite or been deposited in open spaces in quartz. (See Fig. 6)

It is also common in many areas of sphalerite where it appears as tiny irregularly scattered blebs.from 5 to 25 microns in diameter. (See Fig. 5) It is impossible to tell with certainty whether this chalcopyrite occurs as a replacement of sphalerite or as an exsolution from the sphalerite. The grains show no definite evidence of either replacement or exsolution. There is a rough lineation of some of the grains in a few areas which could indicate a replacement of sphalerite along cleavage planes. The lack of good exsolution textures and the fact that most of the chalcopyrite occurs in fairly large masses would also indicate a replacement origin.

PARAGENESIS

The following diagram shos what is believed to be the relative order and length of deposition of the ore and gangue minerals.



The deposition of pyrite appears to have been continuous during the formation of the ore. Numerous fractures in the pyrite are filled with quartz indicating it to be earlier in age. (See Fig. 3.) The pyrite in turn fills numerous narrew veins in sphalerite and is found as small grains scattered in galena and replaced remnants tetrahedrite.

Quartz also was deposited over a considerable period of time although the majority came out of solution shortly after the early period of pyrite deposition. A few tiny grains are mixed in with the galena and tetrahedrite.

Sphalerite and chalcopyrite are believed to have followed in order although the possibility remains that some of the chalcopyrite may have been contemporaneous with the sphalerite. (See Fig. 5.)

Sphalerite replaces quartz and is in turn replaced by galena and tetrahedrite. (See Fig. 4.)

Galena and tetrahedrite were simultaneous in deposition. They replaced some sphalerite and a little pyrite. (See Fig. 8, Fig. 9, and Fig. 10.)

Deposition was completed by calcite which filled numerous fractures cutting all other minerals. This period of deposition may have been at a later date, not necessarily immediately after galena and tetrahedrite.

CLASSIFICATION OF DEPOSIT

The minerals found composing the ore all fall within the intermediate temperature range of 500°C to 250°C. The deposit should therefore be classed as mesothermal.

Lack of characteristic high temp. minerals
Not banding, crustification or heavy alteration.

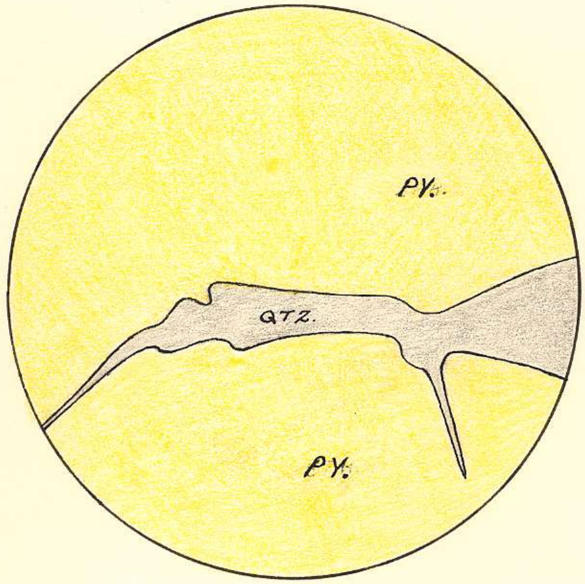


Figure 3. Quartz filling a fracture in pyrite. X75.

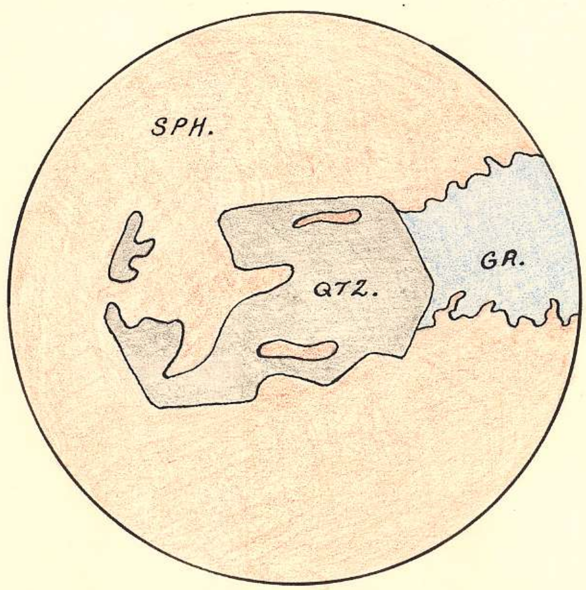


Figure 4. Quartz crystal partially replaced by sphalerite. Galena replacing sphalerite. X75.

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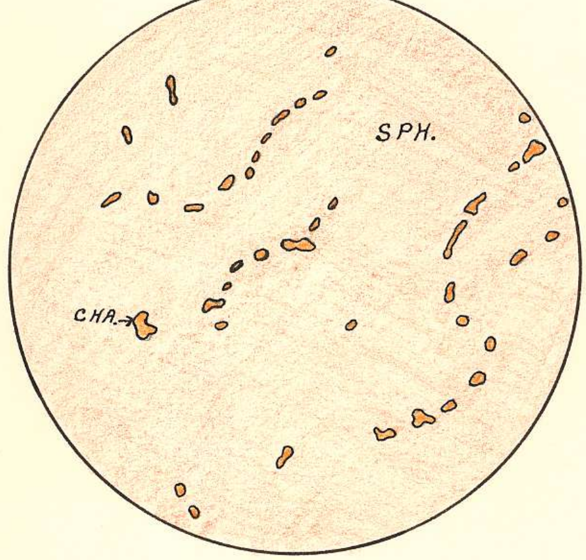

Figure 5. Chalcopyrite in sphalerite. Probably a replacement.

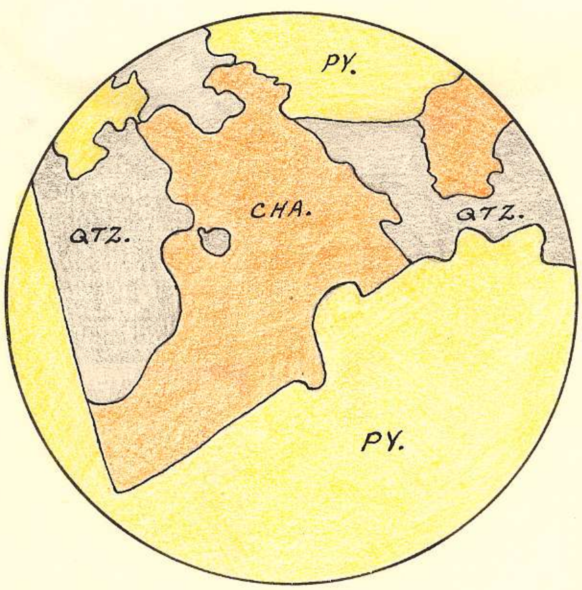

Figure 6. Chalcopyrite replacing quartz.

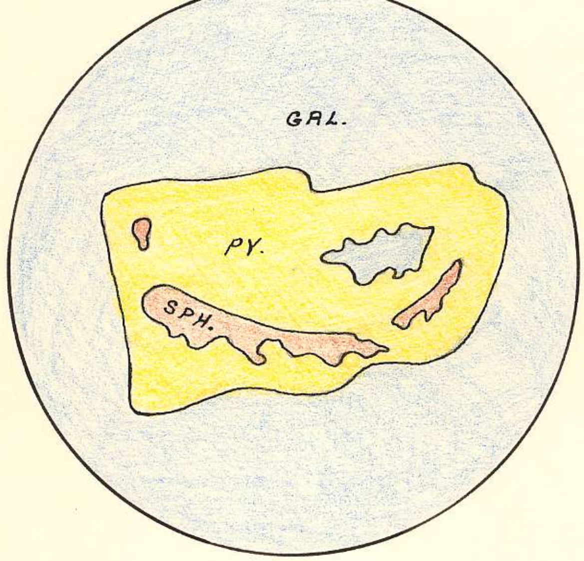

Figure 7. Sphalerite and galena forming atoll replacement texture in pyrite.

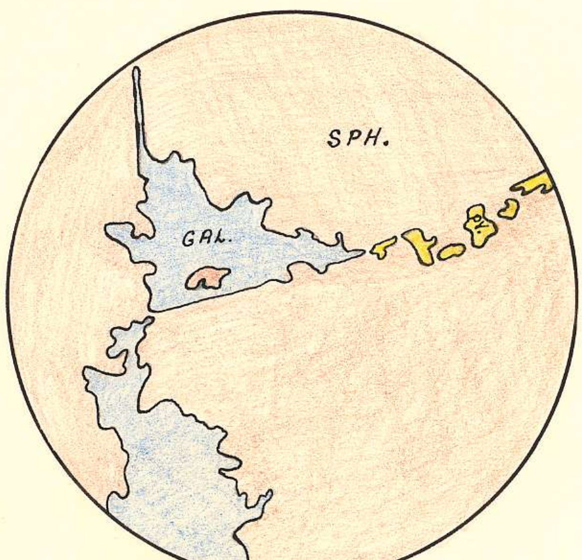

Figure 8. Galena and pyrite replacing sphalerite. Replacement appears to be controlled by cleavage planes.

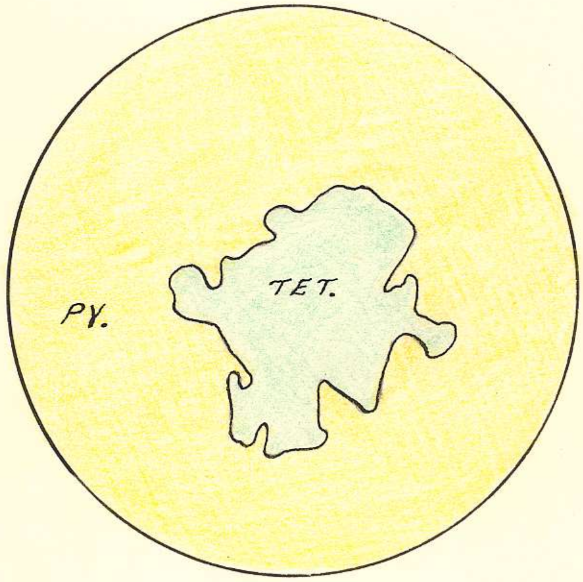

Figure 9. Tetrahedrite replacing pyrite.

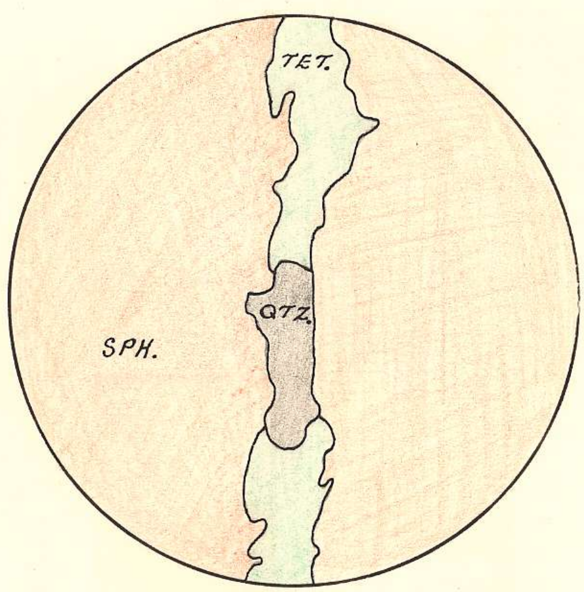

Figure 10. Tetrahedrite and quartz filling a fracture in sphalerite. The fracture extended entirely across the polished section and contained calcite as well as quartz and tetrahedrite.

APPENDIX

Microscopic Characteristics of Minerals

Sphalerite -- ZnS.

Color gray. Polish fair. Hardness D. Isotropic. Good internal reflection. Aqua regia fumes tarnish slightly. All other reagents negative.

Chalcopyrite -- Cu Fe S_2.

Color brass yellow. Polish good. Hardness C. Very weakly anisotropic. Tarnished with aqua regia. Other acids negative.

Galena -- Pb S.

Color white. Polish good. Many triangular cleavage pits. Hardness B. Isotropic. H Cl tarnishes iridescent.

Tetrahedrite -- $3Cu_2$ S. Sb_2 S_3.

Color gray with greenish cast. Polish good. Hardness D. Isotropic. Negative to all reagents.

Pyrite -- Fe S_2.

Color pale yellow. Hardness F. Polish very poor. Isotropic. Slight tarnish with aqua regia.

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