600118

GEOLOGY 9

ESSAY ON

S A L L Y   M I N E.

Submitted by

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OUTLINE.

INTRODUCTION:

This is a brief report based on the work done in Geology 9 at the University of British Columbia during the term of 1937-38. The object of this course is to enable the student to become acquainted with certain of the opaque ore minerals and to be able to recognize certain features regarding their intimate associations. The writer wishes to acknowledge Dr. Warren for the help received.

LOCATION:

The Salby mines are located in the Beaverdell map area, British Columbia, several miles east of the town of Beaverdell on the eastern slope of Wallace Mountain. Beaverdell is situated on the Kettle Valley Railway at approximately north latitude 49°27' and west longitude 119°03'.

General Geology:

The following information regarding the geology has been obtained from the Canadian Geological Survey report "Ore Deposits of the Beaverdell Map Area by Leopold Reinecke. For more detail concerning the area the reader is referred to this report. The formations and their members are briefly considered beginning with the oldest.

Wallace Group: This underlies one third of the area, and is a complex of 95% igneous origin. It is considered to be Mesozaic with the two oldest members maybe Carboniferous.

(a) Limestones.

(b) Hornfels.

(c) Hornblende andesite tuffs with some augite andesite tuffs and non volcanic sedements.

(d) Augite and hornblende andesite.

(e) A number of basic intrusives namely obvine, gabbro, saxonite, saxonite porphyries, pyroxenite, and hornblendite.

(f) Dykes of hornblende diorite porphyries.

The whole series has been metamorphosed.

Westkettle Bathobth: The Wallace series has been intruded by this bathobth of quartz diorite which may be Jurassic. There are a number of dykes associated which also intrude the Wallace Group.

Beaverdell Bathobth: This bathobth is believed to be Eocene. It consists of quartz diorite and is somewhat faulted. On the east part of the sheet there is also a narrow band of augite syenite porphyry of the same age.

Curry Creek Series: This series has been placed in the Oligocene age. It lies unconformably over the Wallace group and the Westkettle bathobth and consists of canglomerates and a lesser amount of dacitic tuffs. The series is faulted but not very metamorphosed.

Nipple Mountain Series: This series is of Miocene age. It unconformably overlies the Curry Creek series and consists of (a) trachyte (b) biotite andesite (c) dacite (d) hornblende andesite (e) augite andesite (f) obvine basalt.

Glacial Deposits.

River Alluvium.

Economic Geology:

In the Beaverdell area there are three types of metallic ore deposits:

(1) Mineralized shear zones.

(2) Stocks.

(3) Contact Metamorphic Deposits.

Only the first is mined at a profit, and as the ore on Wallace Mountain is associated with this type of deposit it will be the only one touched upon in this report.

The Mineralized Shear Zones: The mineralized shear zone is found in an area of three square miles on Wallace Mountain, at the town of Carmi and upon Arlington and King Solomon mountains. The country rock is nearly always quartz diorite. The shear zones lie between comparatively solid unaltered rock and are from one foot to ten feet wide. They strike east and west and dip to the south. Some of the ore has replaced the country rock, but most of it has filled the space between the fragments in the shear zone. Some dykes of andesite and aplite are found, but were intruded before the formation of the ore. The ore bodies are tabular and have been displaced by many closely spaced faults, the latter being one of the chief problems of mining. The ore is pockety. The zone of oxidation is not very deep, the deepest being along the fault planes and around the Sally mine is only a few feet thick. Glacial action is probably responsible for its absence.

The ore bodies were formed by hot ascending solutions from the Beaverdell bathobth. The Westkettle quartz diorite did not have any chemical effect on the solutions, but due to its shear zones it allowed the solutions to pass through it. The Wallace group on the other hand, acted as a blanket and stopped the ascending solutions. It did not shear with clean cut walls as did the quartz diorite, and therefore, the latter offered an easier passage for the solutions. The ores are probably Eocene closely following the intrusion of the Beaverdell bathobth. The following is a table of the chronological sequence of intrusion and ore formation:

(1) The formation of east-west shear zones in the Westkettle quartz diorite.

(2) The intrusion of the Beaverdell quartz monzonite proceeded by the intrusion of dykes of andesite and accompanied by intrusions of aplite dykes.

(3) The formation of serecite in the shear zones during the intrusion of the quartz monzonite.

(4) The formation of quartz and pyrite and the other metallic sulphides.

(5) Faulting and offsetting of the ores.

(6) The formation of native silver, iron oxide, chlorite, calcite and kaolin.

MINERALOGY:

Eight polished sections were studied by the writer under the microscope and the following minerals were identified:

1. pyrite	2. galena	3. sphalerite
4. ruby silver	5. unknown	6. polybasite (?)
7. arsenopyrite	8. chalcopyrite	9. argentite
10. quartz	11. calcite.	

Pyrite:

Pyrite is by far the most abundant metallic mineral and occurs as irregular masses. It has suffered considerable fracturing, the fractures being healed by quartz, calcite, sphalerite and the silver sulphides.

Galena:

Galena is quite abundant and occurs as irregular masses easily recognized by the small triangular cleavage pits. It contains numerous inclusions of the silver sulphides and occurs mostly in pyrite, in quartz, associated with the silver sulphides and to a lesser extent in sphalerite. Reinecke says that probably all galena occurrences on Wallace mountain are argentiferous.

Sphalerite:

Sphalerite is abundant and occurs as irregular masses being veined by quartz and small veinlets of galena and the silver sulphides. It contains numerous inclusions of the latter two and chalcopyrite.

<u>Ruby Silver</u>:

Ruby silver is not quite as abundant as galena, but has a similar occurrence.

<u>Unknown:</u>

The writer noticed a blue mineral in section similar to ruby silver and had a red internal reflection, but differed from it by giving a positive reaction with nitric acid. However, due to its similarity in appearance to ruby silver its relative abundance could not be determined.

<u>Polybasite</u> (?):

This mineral has a greenish tinge and is most abundant in section 5. It is not as common as ruby silver, but has a similar occurrence with the exception that it is practically always associated with ruby silver, often occurring with it as an intergrowth.

<u>Arsenopyrite</u>:

Arsenopyrite is a minor constituent although it is locally abundant. It occurs in quartz and pyrite, often displaying its characteristic diamond shaped crystal form. Arsenopyrite is fissured and healed mostly by quartz.

<u>Chalcopyrite</u>:

Chalcopyrite is also a minor constituent. It occurs wholly as small inclusions in sphalerite.

<u>Argentite</u>:

Argentite was only observed in section 5. It was intimately associated with galena, occurring in contact with it and as inclusions, and was also seen as inclusions in sphalerite. Argentite is probably not very abundant and was not seen by Reinecke in any of the samples collected by him.

Quartz:

Quartz is abundant and is the principal gangue mineral. It is quite brecciated in places. It frequently exhibits good crystal form.

Calcite:

Calcite is less abundant than quartz, but is an important gangue mineral.

Native Silver:

Native silver was not observed in any of the sections studied. However, it was seen on a smooth fault plane in one of the hand specimens occurring as thin leaves.

Tetrahedrite:

Tetrahedrite has been reported from a number of mines on Wallace mountain, but the writer did not identify any of the sections.

PARAGENESIS:

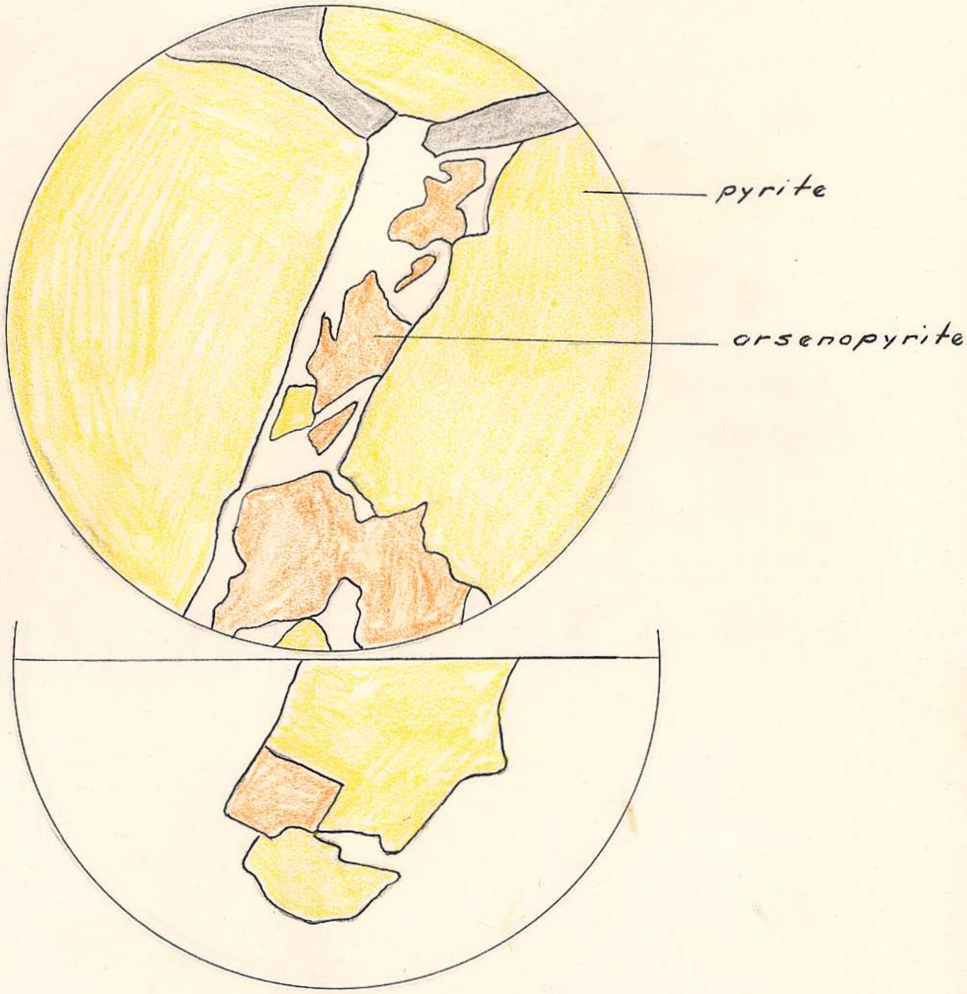
Pyrite was the first mineral introduced, and is veined by quartz, sphalerite, silver sulphides and calcite. It contains numerous inclusions of arsenopyrite, some of which have good crystal form (figure 16), suggesting that arsenopyrite was deposited before or along with pyrite. This was followed by considerable fracturing. More arsenopyrite was then deposited and is found mostly in quartz occurring in fractures in pyrite (figure 1a). Fracturing again reoccurred to be followed by sphalerite and chalcopyrite, the latter found only as inclusions in sphalerite and the former often found healing fissures in arsenopyrite and pyrite (figures 2 and 3). Sphalerite then suffered a slight fracturing followed by the introduction of quartz (figure 4). More brecciation occurred. The silver sulphides and galena were next deposited contemporaneously. They are intimately associated, and when in contact with each other have smooth boundaries (figures 5 and 6), and frequently vein pyrite, sphalerite and quartz (figures 7, 8 and 9). Tetrahedrite was not seen, but was observed by Reinecke to be intergrown with galena suggesting contemporaneous deposition. Calcite was the last mineral deposited and was found definitely veining galena (figure 10). The writer did not determine how many series of quartz there were, but it is quite possible that there were more than one for fractures in quartz sometimes appear to be healed by quartz. Regarding native silver Reinecke says "native silver is found in a number of mines on Wallace mountain, chiefly in or near the later fault planes.......It is generally in thin leaves or hackley scales, and they often lie on a smooth surface of the rock, probably in most cases the edge of a break. Native silver was not seen except in the later cross faults or very close to them. It was in places evidently deposited in these fault planes and its formation, therefore, took place after the primary ore had been formed and faulted. It is a secondary product and was probably formed by the cold surface waters which now percolate through the fault planes."

Figure 1 (a & b).

100 X

(a)

(b)

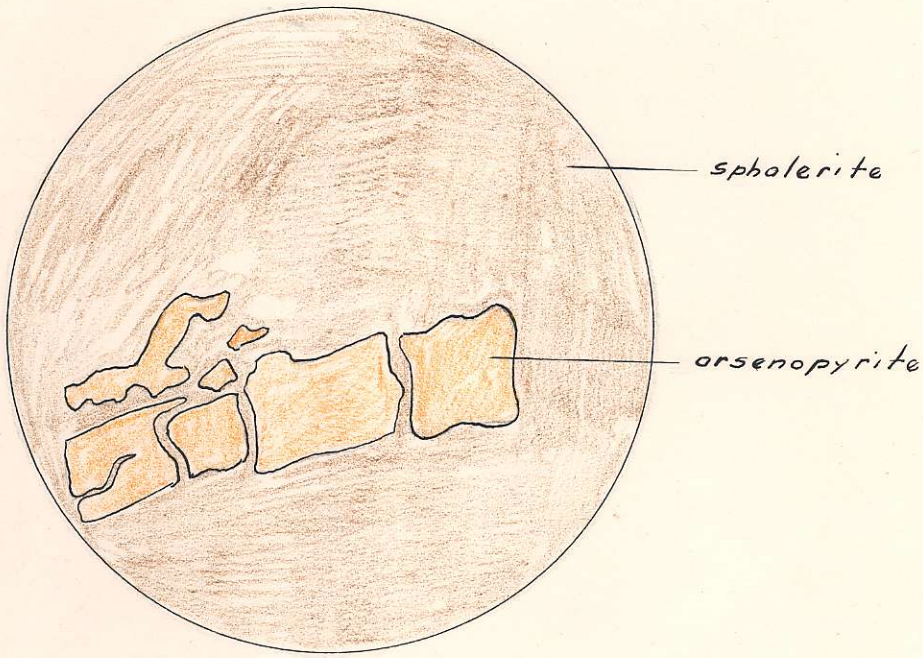


(a) Arsenopyrite and quartz filling a fissure in pyrite. Note how the arsenopyrite is scattered through the quartz. This is a common occurrence, arsenopyrite is seldom found completely filling a fissure by itself.

(b) A good diamond shaped crystal of arsenopyrite is shown embedded in pyrite. Arsenopyrite commonly occurs as inclusions in pyrite and frequently exhibits crystal form as illustrated.

Figure 2.

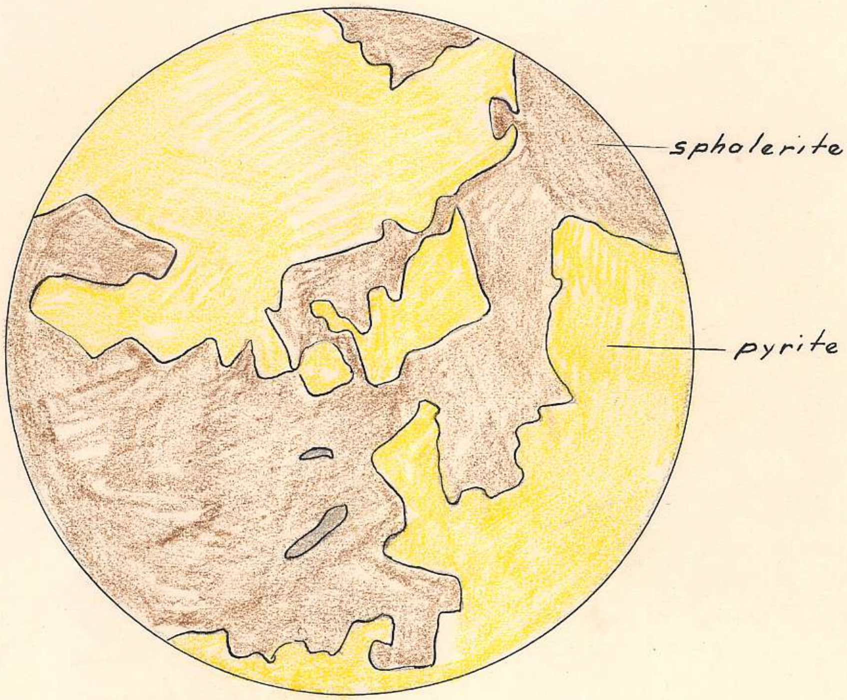
100 X



Sphalerite filling fractures in arsenopyrite.

Figure 3.

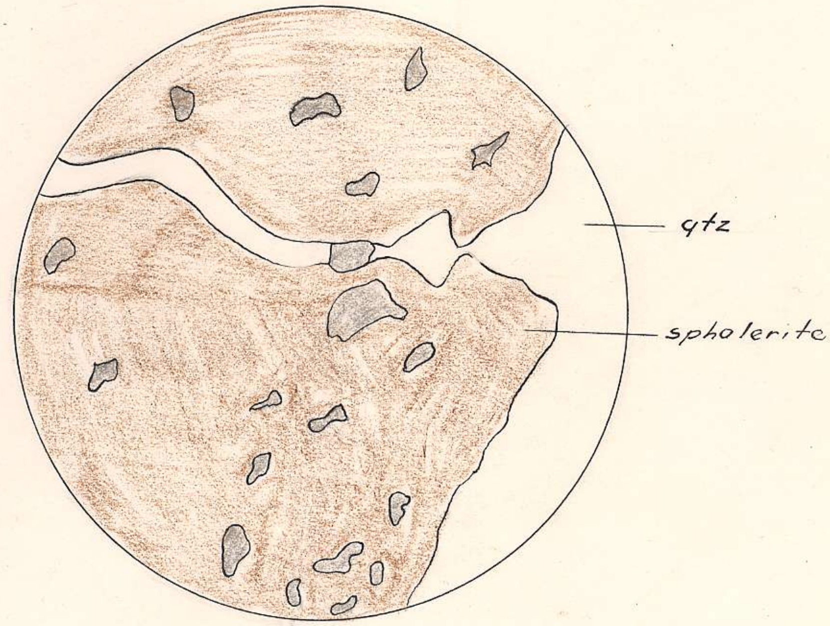
100 X



Sphalerite filling fractures in pyrite.

Figure 4.

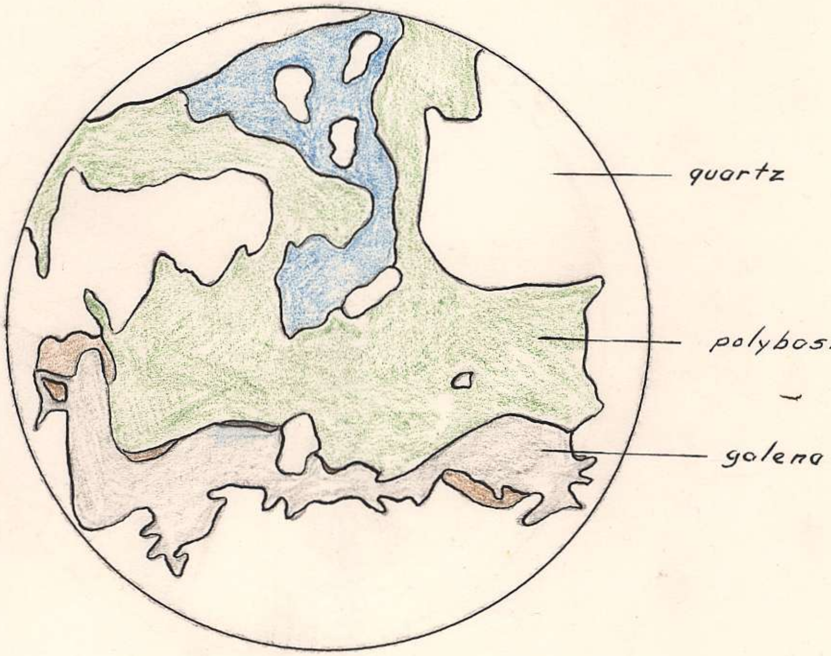
100 X



Quartz veining sphalerite.

Figure 5.

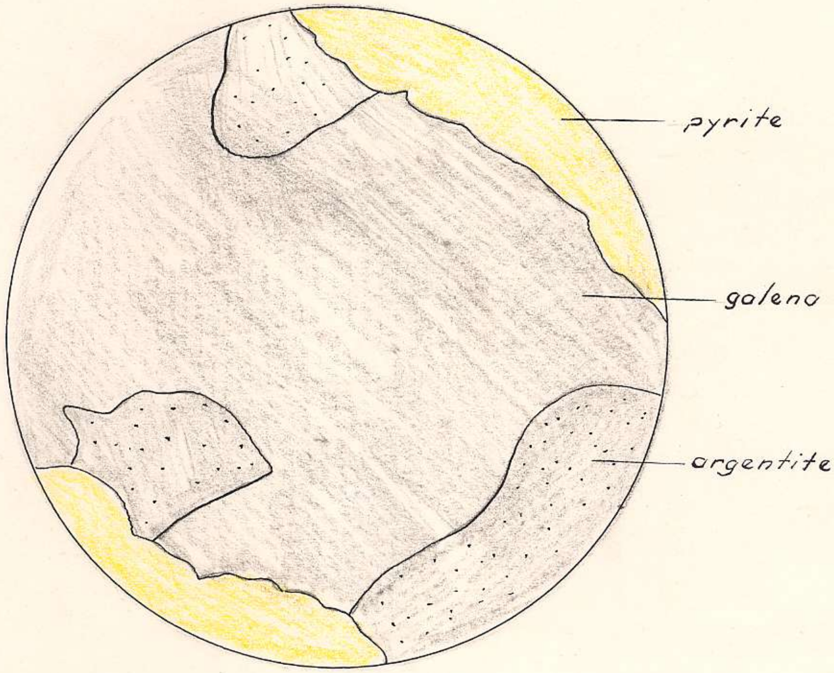
40 X



This illustrates the association of ruby silver, polybasite and galena. Note the smooth contacts between them showing contemperaneous deposition. Polybasite is usually far more closely associated with ruby silver than with galena. In this section the occurrence of a narrow band of sphalerite along the contact between polybasite and galena, as illustrated in the diagram, was often noticed.

Figure 6.

100 X

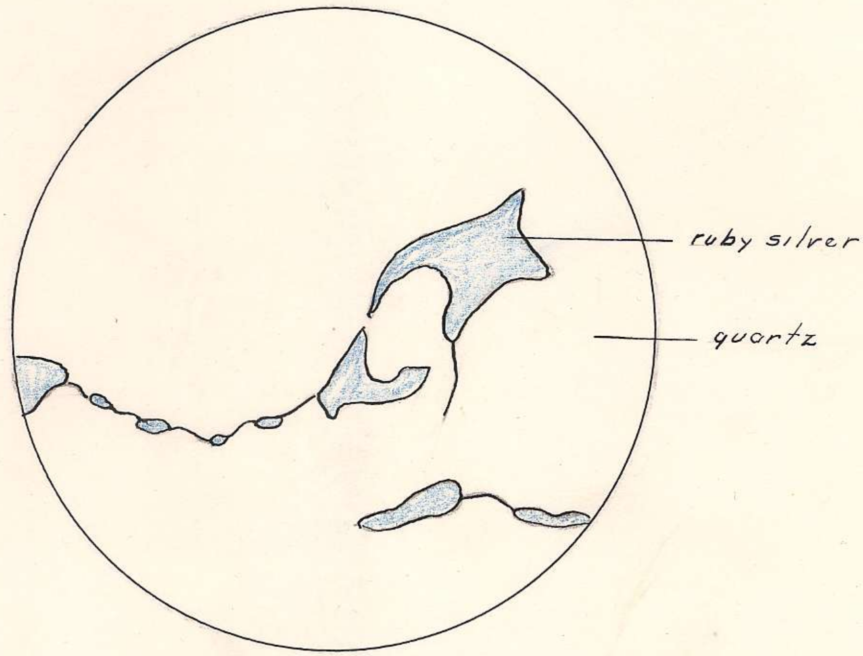


Argentite is shown associated with galena.

Note the smooth contacts.

Figure 7.

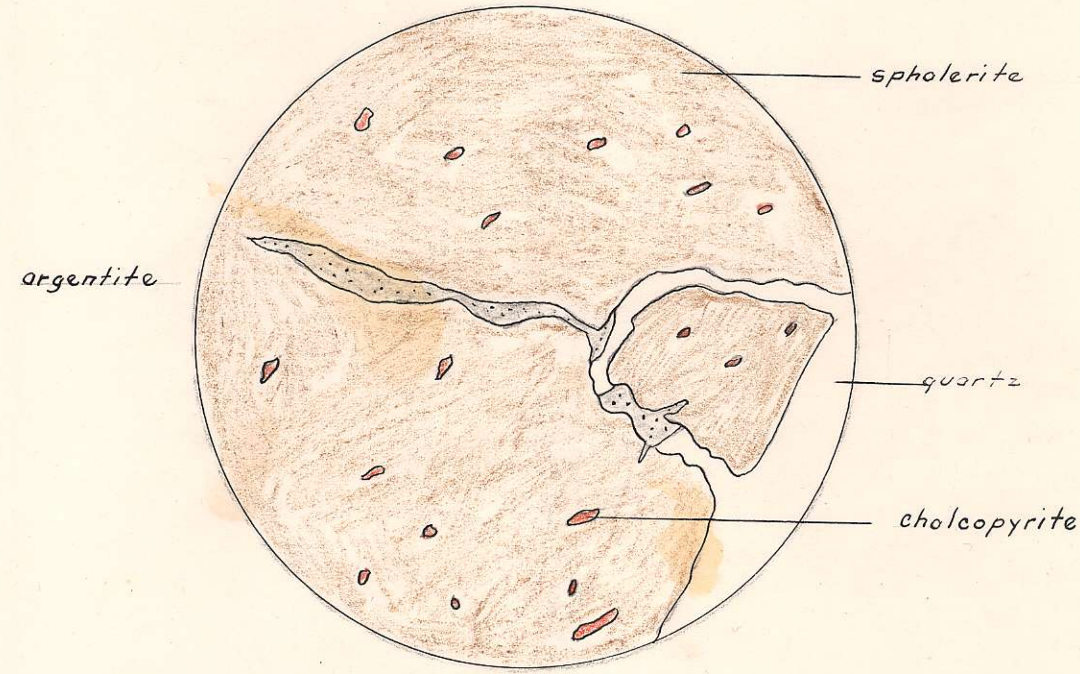
40 X



Ruby silver filling a fracture in quartz. This association with quartz was also noted with galena and polybasite.

Figure 8.

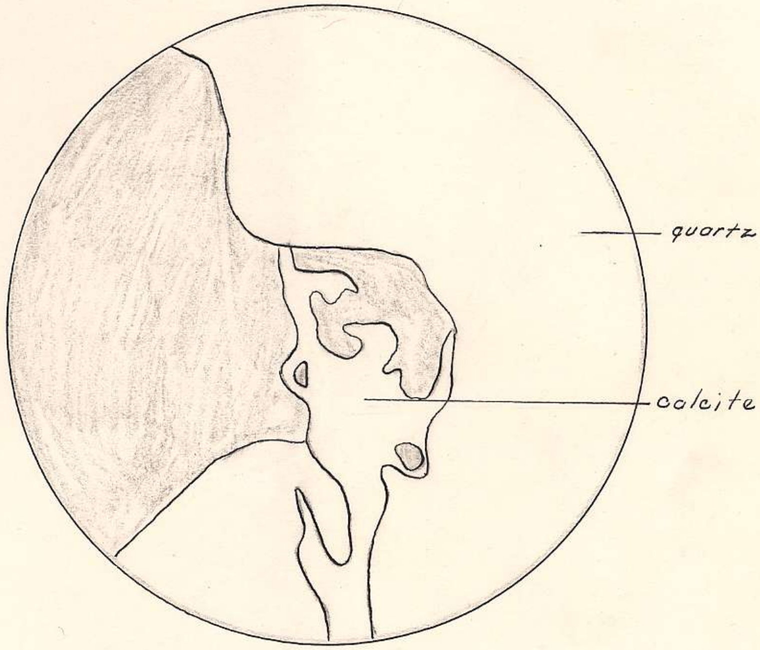
100 X



Argentite veining sphalerite. Note also the inclusions of chalcopyrite in sphalerite.

Figure 10.

40 X



Calcite veining quartz and galena.