A MINERALOGRAPHIC REPORT OF
THE ST. EUGENE MINE & THE SOCIETY GIRL CLAIMS

Submitted to partially
fufill the requirements
of the course Geology 409

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THE ST. EUGENE MINE AND THE SOCIETY GIRL CLAIMS

Introduction

The purpose of this problem is to investigate the paragenetic relationships existing between the ore minerals of the St. Eugene Mine and Society Girl Claims. These properties are located in the Moyie district of southern B.C. The genetic classification of the deposits is contact metamorphic. The ore minerals are silver bearing galena, sphalerite, and chalcopyrite. Other metallics in association with the ore minerals are pyrite and pyrrhotite. The gangue minerals are chiefly quartz, calcite, garnet and minor amounts of amphibole.

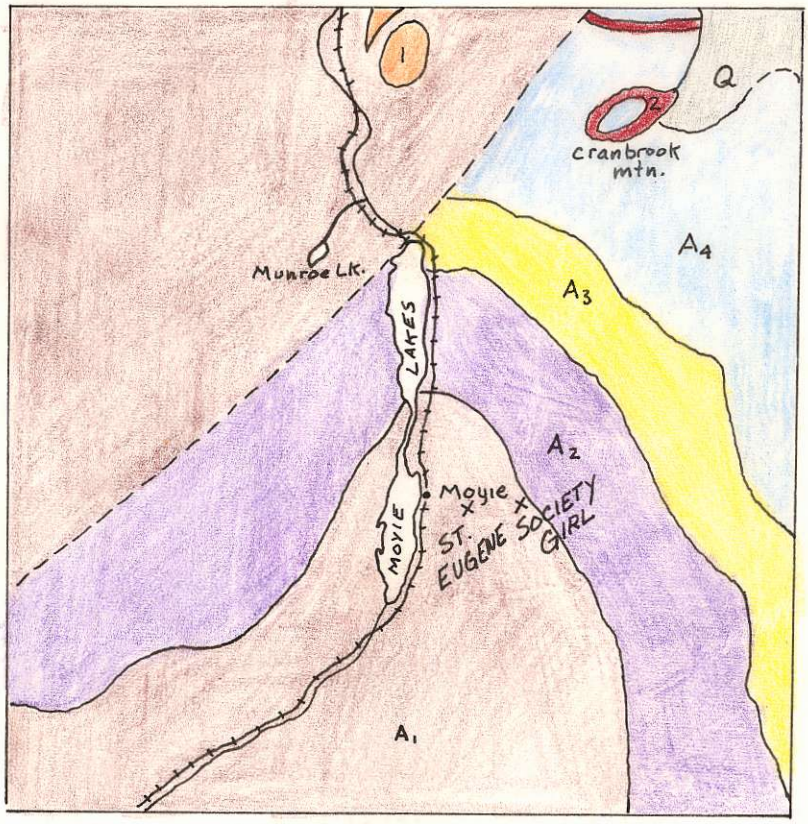
Location

The St. Eugene and Society Girl are situated about 2 miles east of the town of Moyie, which is on the eastern shore of lower Moyie Lake. The Moyie Lakes are found about 20 miles south of Cranbrook in the Kootenay area of southern B.C. Both properties are only a short distance from the southern Trans-Canada highway which passes through Moyie. During the operation of the Mine a branch spur of the Kettle Valley railway was in service.

The Moyie area is in the Ft. Steele Mining Division.

Geological Sketch Map of the Moyie Area

Kootenay District of Southern B.C.



LEGEND

Q	Stratified Clay & Sand
2	Purcell Lava (basalt & rhyolite)
1	Purcell Sills (gabbro to granite)
A_4	Siyeh Formation (argillite; siliceous Zs)
A_3	Kitchener Formation (calc. qtzite; Zs)
A_2	Creston Formation (argillaceous qtzite & qtzite) grey weathering
A_1	Aldridge Formation (argillaceous qtzite & qtzite) rusty weathering

After G.S.C. MAP SHEET 147 A

SCALE 1" = 4 miles

History

The St. Eugene deposit was found by a local native of the Kootenay Indian tribe in 1893. James Cronin, a mining engineer, did the fist development work on the property under the name of the St. Eugene Consolidated Mining Company. In 1905, the properties of this company were taken over by the Consolidated Mining and Smelting Company. The total amount of development work under ground to September 30, 1913, was 19.79 miles. The total production to this time was 1,017,106 tons of ore containing 5,365,232 ounces of silver and 229,305,721 pounds of lead, having a value of $10,626,608.

The Society Girl claims which adjoin the eastern boundary of the St. Eugene were first developed in 1911. For this year the total output of the mine was 400 tons of ore.

The St. Eugene ceased operations in 1923, while the Society Girl has continued sporadically up to 1947.

Geology

The Moyie area is underlain by the Aldridge and Creston formations of the Purcell series. These formations are folded into a northerly dipping anticline, the axis of which roughly coincides with the depression occupied by the Moyie lakes and river. The Aldridge formation is made up of argillaceous quartzites and pure quartzites which weather a characteristic rusty brown color. The Creston formation is made up of the same rocks but which weather a characteristic grey color. These formations are bedded up to 1 foot in thickness.

Dr. S.J. Schofield of the Geological Survey of Canada mapped the Moyie area and published his report in 1915. In his report

he states that....."All the ore deposits in the Moyie area are connected with two main parallel fissures striking a little north of west and dipping on an average of 70 degrees to the south. They cross the axis of the anticline composed of the Aldridge formation." With regard to the character of the ore bodies Schofield further says....."The ore-bodies are replacement deposits in the heavy bedded purer quartzites and are restricted to the fractured area between the two main fissures. Where the fissures cross the more argillaceous quartzites, the veins are narrow and usually filled with quartz containing small quantities of sulphides."

Megacopic Description of
the Ore Specimens

Specimen 1 In overall appearance it is characterized by the presence of sprays of fibrous tremolite, interlocked with euhedral garnets. On weathered surfaces the metallic minerals are a dull grey and the gangue material is a dull transluscent brown. On fresh surfaces the rock shows a fair amount of platy galena.

The tremolite needles are in sprays having a diameter of about the size of a ten cent piece. They are a dirty greenish white in color and have a matted appearance. The tremolite makes up about 20% of the rock.

The euhedral garnet crystals are dark reddish brown in color and are approximately 1/8 inch in size. They are found in clusters up to 3/4 inch in diameter and are quite evenly distributed throughout the rock, with the one exception that they occur in greater abundance in the presence of the radiating tremolite. The garnet accounts for about 20% of the rock.

Dark greenish granular chlorite occurs as evenly througout the rock as does the garnets, but is present in only about one-half the amount (i.e. 10%).

Euhedral calcite is present in small amounts (10%) occuring mainly in the presence of metallic mineralization. The calcite rhombs are about 1/8 to 1/4 inch in size and are surrounded in most cases by galena. In a very few instances flakes of chalcopyrite (1/16 inch in size) occur in the calcite.

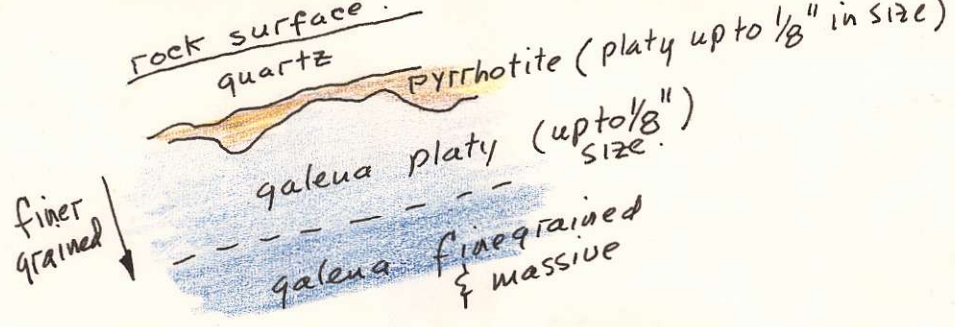
Quartz crystals in this specimen have a granular texture and account for about 15% of the rock.

The metallic mineralization in this specimen is mainly galena.

It is platy in appearance, the individual plates being 1/8 inch or less. It comprises approximately 20% of the rock. The galena is most commonly separated from the tremolite by the granular quartz, rarely does it come into direct contact with the amphibole.

Specimen 2

This specimen is most likely the best ore sample of the set. On weathered surfaces it is a dark rusty brown. On fresh surfaces it is dark blue grey color with about 15% of a tarnished brassy mineral, (identified by its magnetism as pyrrhotite). The rock is very heavy and is characterized by massive galena in association with pyrrhotite. A small vein (1" 1/2" 3") of quartz traverses the specimen. The pyrrhotite is next to the vein while the galena is next to the pyrrhotite as shown below.....



The galena is platy where it is found interlocked with pyrrhotite and grades off to a fine grained massive type away from the contact.

The rock appears to have been silicified either during or after mineralization because where gangue material is exposed it was tentatively identified as a siliceous sediment by reason of its fine grained texture and its association with the Aldridge formation.

Specimen 3

This rock is a siliceous sediment which is fractured and mineralized to a lesser extent than specimen 2. The fractures are sub-parallel and are filled with either quartz or calcite. The quartz stringers are about 1/2" wide and are mineralized with sulphides while the calcite stringers are about 1/8" wide and are barren. Metallic minerals identified within the quartz include galena, sphalerite, pyrrhotite and chalcopyrite; arranged in decreasing order of abundance. The galena and sphalerite are platy in appearance and are up to 1/8" in size.

The altered surfaces of this rock are a dark rusty brown; the fresh ones are a dull dark grey with flecks of white (1/16" in size).

Garnets occur away from the zones of metallic mineralization. They are euhedral and are about 1/8 to 1/4" big.

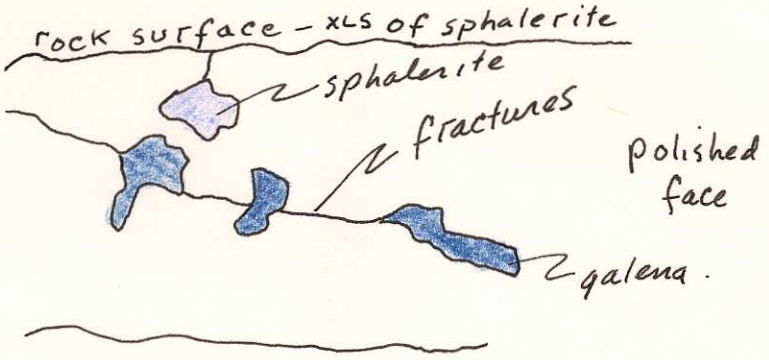
Fine grained pyrite (and possibly pyrrhotite) and magnetite are disseminated throughout the specimen with no regard or preference for the zones of mineralized material mentioned above. This would suggest that these two minerals are earlier than the valuable metallics.

Specimen 4

This specimen is characterized by its light dull grey color and the dark red brown fillings in the many vugs that occur in it. The vugs are roughly square in cross-section, about 1/4" to a side. There is about 40% galena visible in this rock. The porous texture of the specimen would suggest that it could be hydrothermally altered wall rock of a large sulphide vein. The square vugs could be the result of pyrite crystals altering out of the rock either in the mine or in the mine dump.

Specimen 5

This specimen in mainly characterized by euhedral crystals of sphalerite in granular quartz. The sphalerite is a pitchy black brown in color. It has a good brown streak. About 20% of the crystals exposed show good dodecahedral cleavage. The crystals are interlocked and are about 1/8" in size. Fractures in this rock are very narrow, 1/16" or less. They are cheifly mineralized with galena, but some sphalerite occurs in near surface fractures. The specimen is shown as below.....



THIN SECTIONS

Two thin sections were cut of the rock bearing the sprays of amphibole. Dr. Schofield identified the amphibole as actinolite, however these two sections did not exhibit the characteristic green pleochroism of actinolite and were therefore classified as being tremolite the non ferrous end member of the tremolite-actinolite series. These sections are shown below inassociation with subhedral quartz and some metallic mineral (probably magnetite), (positive identification of the metallic was not possible as the particular rock from which the sections were cut was not known).

These sprays of amphibole exhibit the texture of gangue described in specimen 1.

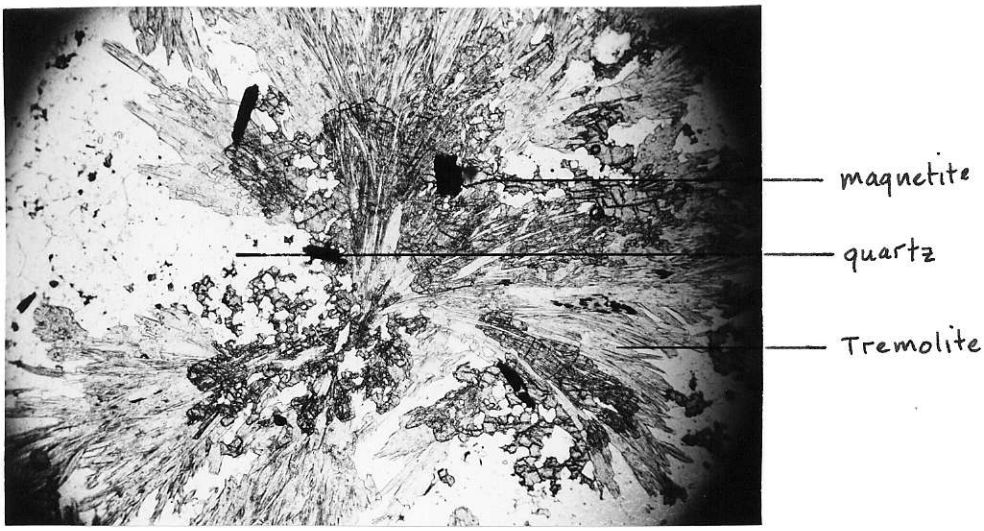


PLATE I x 20

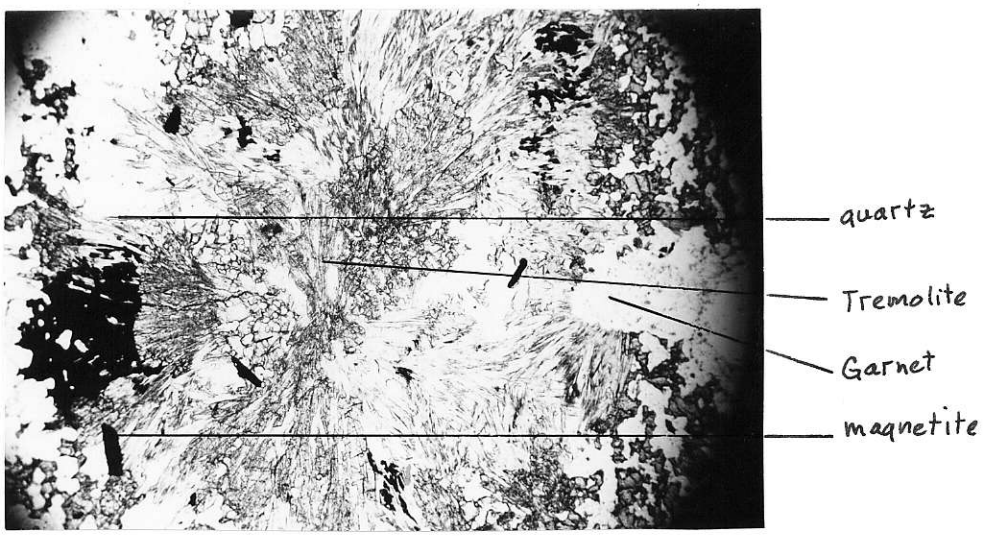


PLATE II x 20

MICROSCOPIC EXAMINATION

The material studied in this problem consisted of several hand-specimens of ore specimens taken off the dumps of the St. Eugene and the Society Girl. Of these specimens, eight were cut to suitable size and polished for microscopic study. The ore and other metallic minerals identified were.....

1. Galena PbS

Isotropic
Color galena white
Hardness B
Texture: triangular pits developed upon polishing.
Polish: good

Etch tests: KOH & $HgCl_2$ negative; HNO_3 dark black stain; HCl & $FeCl_3$ tarnished irridescent; KCN negative.

2. Sphalerite (ZnFe)S

Isotropic
Color dark grey (as compared with the galena)
Hardness C
Strong red-yellow internal reflection
Polish: fair

Etch tests: KCN, KOH, $FeCl_3$, $HgCl_2$ negative; HNO_3 & HCl fumes tarnish dark brown; Aqua regia, slight effervesence accompanied by a dark brown stain.

3. Chalcopyrite $CuFeS_2$

Isotropic
Color deep brass yellow
Hardness C
Polish: good

Etch tests: HCl, KCN, KOH, $FeCl_3$, $HgCl_2$ are all negative; HNO_3 fumes tarnish; Aqua regia fumes tarnish.

4. Pyrite FeS_2

Isotropic
Color pale brass yellow
Hardness F
Polish: in this specimen is poor

Etch tests: All reagents used above are negative with the exception

of HNO_3 and Aqua regia which fumes tarnish.

5. Pyrrhotite FeS_{1+}

Anisotropic--greys
Color off-pink cream
Hardness D — Distinctly Magnetic
Polish: fair

Etch tests: KOH, KCN, $FeCl_3$, $HgCl_2$ are all negative; HCl-drop turns yellow with no stain; HNO_3 fumes tarnish

6. Magnetite Fe_3O_4

Isotropic
Color battleship grey — Distinctly Magnetic
Hardness F
Polish: fair

Etch tests: All the above reagents were negative with the exception of aqua regia which turned yellow but left no stain.

PARAGENETIC RELATIONS

Fig. 1. In this illustration pyrrhotite cuts a pyrite crystal thereby establishing pyrite earlier than pyrrhotite. Galena has mutual boundaries with pyrite and pyrrhotite thus it is later than both. It may also fill fractures in the gangue in the lower right hand quadrant of thepicture. These fractures were probably caused by the forceful growth of the pyrite crystal.

Fig. 2. Magnetite occurs in the gangue. Magnetite has no relationships with other metallics in any of the polished sections made. Galena engulfs pyrite crystals in this polished section.

Fig. 3. Galena replaces sphalerite; the advance is to the lower left quadrant as illustrated by the island texture of the sphalerite near the contact. Relatively few islands of galena occur in the sphalerite and those which do are restricted to the near vicinity of the contact. Chalcopyrite oocurs in the sphalerite.

Fig. 4. In this section the fracturing of the quartz gangue is illustrated. Sphalerite penetrates the fractures. This is probably how the sphalerite advances through the rock., during mineralization.

From the above relationships the paragenetic sequence was established as.....

Magnetite (no basis for this other than the evidence presented by Dr. Schofield in Memoir 76)
Pyrite
Pyrrhotite
Sphalerite
Galena
Chalcopyrite

These minerals are arranged in order of decreasing age.

Fig. 5. The vein relationship of sulphides is illustrated in this section. The galena and chalcopyrite occur along the margins of the quartz veins, which in hand specimen may be up to 1" accross. Chalcopyrite seems to follow fractures in the quartz along the margin of the vein, while galena occurs with mutual boundaries with the quartz.

Fig. 6. This section illustrates the odd texture of pyrrhotite in contact with gangue material. It strongly resembles the spray texture of the tremolite in the hand specimens. This could be evidence for open space filling in the quartz.

(NOTE: Photographs were taken of figs. 3, 5, & 6, but were too poor to print.)

Estimation of Percentages of Minerals

Magnetite	5%
Pyrite	5
Pyrrhotite	15
Sphalerite	30
Galena	40
Chalcopyrite	5

(percentages listed here are percent total of the metallic minerals present)

Estimation of Grade of Mineralization

Sphalerite	20%
Galena	25

(assays of ore material indicate that the galena carries about 1 oz. of silver to 4% of lead)(Ref. Minister Mines Report 1922)

SIGNIFICANT TEXTURES

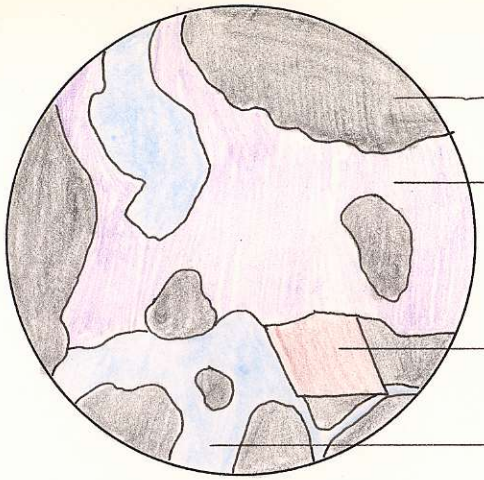


fig. (1)
Low power

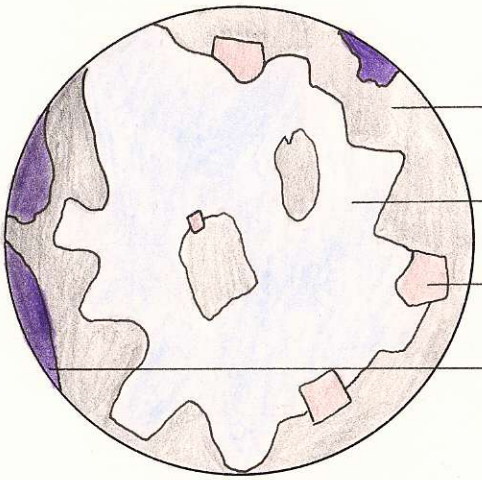


fig. (2)
Low power

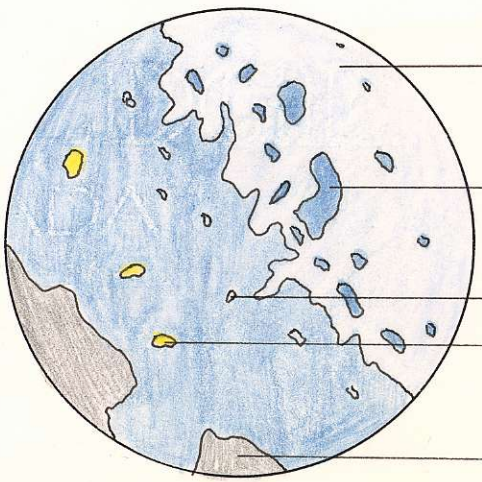


fig. (3)
Low Power

SIGNIFICANT TEXTURES

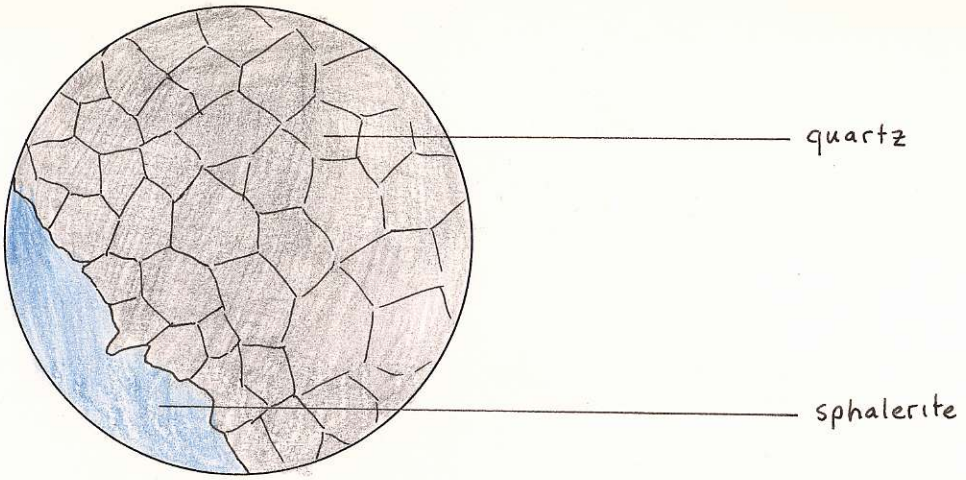


fig. (4)
Low Power

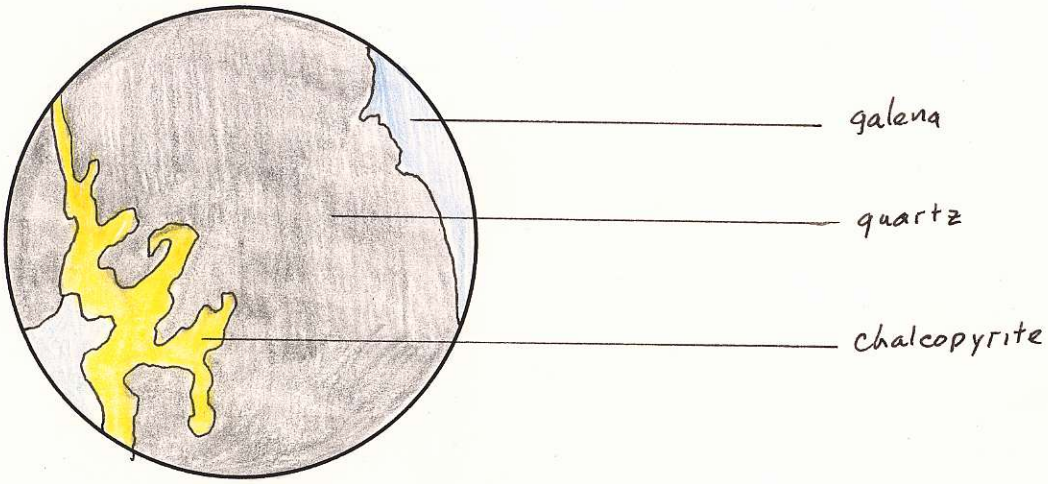


fig. (5)
Low Power

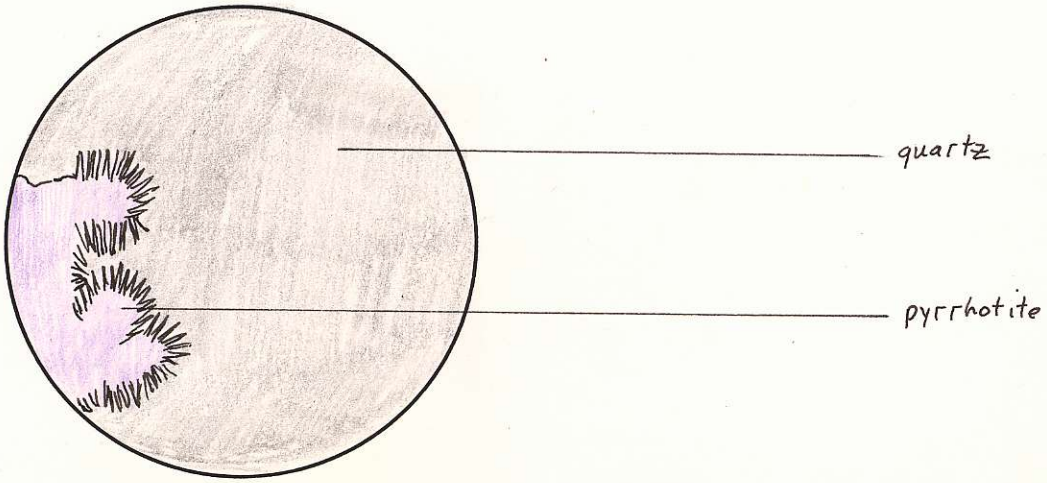


fig. (6)
Low Power.

REFERENCES

Annual Report (1909), B.C. Minister of Mines, P. 92

Annual Report (1922), B.C. Minister of Mines, P.188

Schofield, S.J., (1915), Geology of Cranbrook Map-Atrea British Columbia; GSC Mem. 76

Geological Surv. Can. (1957), Geology and Economic Minerals of Canada.

No reference to supergene alteration Type Be locality for pyromorphite ± wulfenite.