A MICROSCOPIC STUDY OF A SUITE OF ORE FROM THE MORRIS GOLD MINE TATLAYOKO LAKE B.C.

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by

John E. Armstrong

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University of British Columbia

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ACKNOWLEDGEMENTS

I wish to acknowledge the information obtained for the preparation of this report, from the following sources.

The facts regarding the general geology were obtained from Dr. Dolmage's report on "The Chilko Lake and Vicinity"-British Columbia-Canadian Geological Survey, Summary Report, 1924, Part A, pp. 59-65. The information regarding the location, mineralization, and the assays was obtained from Dr. H.V.Warrens' report on "The Morris Gold Mine"-July 1933.

I wish to thank Dr. H.V.Warren for his most valued assistance in the study of the polished sections, and Mr. H.C.Edwards for assaying the arsenopyrite.

INTRODUCTION

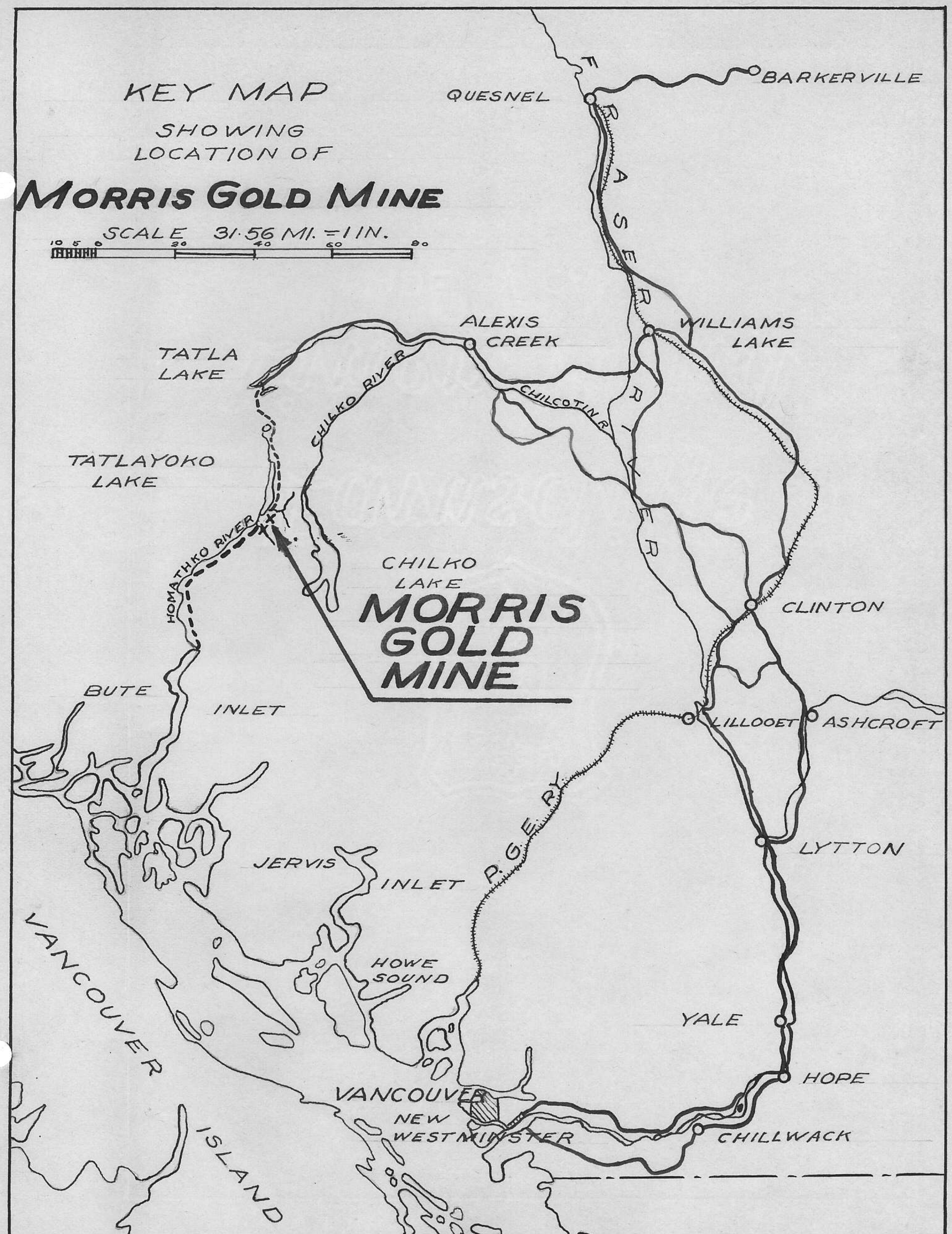
Location and description of the mine.

The claims lie at elevations in the vicinity of 6000 feet, and lie about 3 miles to the southeast of Tatlayoko lake in the Nanimo Mining Division, British Columbia.

The property is still in the prospect stage, and only two short prospect tunnels have been driven. No building or mining has yet been commenced. The property is essentially a gold, silver deposit, with considerable arsenic and antimony, which might also be mined if a suitable market could bee found for them.

Statement of the problem

In this paper an attempt will be made to determine, what minerals carry the gold and silver, and how these minerals occur. Previously it was thought that the silver was associated with the stibnite and the gold with the arsenopyrite, but a study of the assay results shows that these associations are not of a direct nature. To determine what minerals were carrying the gold and silver, polished sections of representative samples of the ore were made and studied microscopically. The samples were also studied megascopically. The probable paragenesis of the deposit was also determined.


KEY MAP
SHOWING
LOCATION OF
MORRIS GOLD MINE
SCALE 31·56 MI. = 1 IN.
10 5 0 20 40 60 80
QUESNEL
BARKERVILLE
FRASER RIVER
ALEXIS CREEK
WILLIAMS LAKE
TATLA LAKE
CHILKO RIVER
CHILCOTIN R.
TATLAYOKO LAKE
HOMATHKO RIVER
CHILKO LAKE
MORRIS GOLD MINE
CLINTON
BUTE INLET
LILLOOET
ASHCROFT
P.G.E. RY.
LYTTON
JERVIS INLET
HOWE SOUND
VANCOUVER ISLAND
YALE
HOPE
VANCOUVER
NEW WESTMINSTER
CHILLWACK

GEOLOGY

General Geology

Dr. Dolmage, to whom reference has already been made, describes the general geology thus:-

"The veins cut Triassic sediments chiefly argillites and fine sandstones, but with one thin bed of fine cherty conglomerate. A short distance northeast of the veins is a stock of quartz diorite probably related to the Coast Range Batholith, the edge of which is situated a few miles to the south. Many dykes cut the sediments and range in composition from diorite to basalt, the majority being basaltic. Many if not all of them are younger than the veins since they cut the veins or cut other veins which cut the veins. One basalt dyke follows the main vein throughout its length, crossing it and recrossing it and holding included fragments of it."

Dr. H.V.Warren makes the following observations in his report.

"None of the basic dykes were observed to displace the veins more than a few feet so that post mineral faulting will probably be of little hindrance to mining.

One vein similar in strike to the main veins and apparently related to them cuts the quartz-diorite and this places the veins as Post Lower Cretaceous or Upper Jurassic in age and indicates their probable relationship with the quartz-diorite and a period of igneous activity with which many of the important mines in B.C. are associated. The rocks in which the veins occur are eminently suited to the development of fissure veins and all the geological evidence is satisfactory."

Mineralization

The deposit consists of three quartz veins outcropping on the sides of a steep rocky gulch. Two of these veins are followed under ground by tunnels. The number one vein is the most important at the present time having been traced 850 feet along the surface and followed for over 300 feet underground.

The veins follow fault fissures and consequently pinch and swell both laterally and vertically. In the upper or number one tunnel the vein averages between one and one half and two feet in width ~~two feet in width~~ throughout its length, but in places it swells to as much as five and one half feet. The vein in the lower tunnel averages about eight inches in width.

The veins consist of quartz, which is the most important gangue mineral, and arsenopyrite, stibnite, pyrites, together with minor amounts of sphalerite, tetrahedrite, and calcite.

Table No 1

Assay Results

Sample	GOLD ozs|ton	SILVER ozs|ton	ARSENIC percent	ANTIMONY percent	IRON percent	SULPHUR percent
Assays from No 1 Tunnel.						
1	0.11	0.51	2.35	Trace		
2	0.04	0.35	1.15	0.10		
3	0.13	0.61	1.90	0.10		
4	0.36	3.3	0.30	24.85	4.3	
5	0.22	0.5	2.15	0.20	3.5	
6	0.91	9.6	2.60	0.45		
7	1.64	12.8	7.75	1.75	9.4	
8	2.09	1.68	0.85	0.30		
9	0.47	5.10	1.15	0.40		
10	0.33	0.72	0.90	2.45		
11	0.08	1.5	0.30	14.70	5.0	
12	0.18	1.7	1.30	3.35	5.2	
26	0.02	0.2				
27	1.14	134				
28	0.86	22.5				
Assays from No2 Tunnel.						
15	0.28	6.5				
16	0.16	2.81	2.15	0.50		
17	0.68	2.55	2.05	0.55		
18	0.20	2.78	0.95	0.30		
19	0.66	14.8	3.4	1.7	5.5	2.8
20	0.68	6.0	3.1	9.1	6.8	5.3
21	0.90	18.9	4.7	6.3	7.7	6.5
22	0.15	0.79	0.30	Trace		
23	0.72	5.2	6.9	0.6	7.5	3.6
Vein outcrops						
13	0.01	0.4				
25	0.01	1.6				
29	0.38	19.5				
30	1.76	67.9				
A	0.84	7.0				
B	0.86	15.7				
C	0.02	0.5				

ASSAY RESULTS

Assays of the ore.

In table number one the average results of the assays carried out by G.S.Eldridge and Company, and P.W.Thomas are tabulated. In considering these results it must be taken into account that some of the high values are due to secondary enrichment.

Conclusions drawn from the assays of the ore

1. Number one vein is the most promising of the two veins that have been explored underground.

2. The outcrops where no metallic minerals or green stains can be seen are very low in gold and silver; whereas, the outcrops in which metallic minerals and green stains are found are very high in gold and silver.

3. The silver and the antimony may be associated, but a consideration of assays numbers 4,6,7,9,11,19,and 21 show clearly that the relationship is not a direct one. As tetrahedrite was found on a megascopic examination of the ore, it is quite probable that the silver is associated with this mineral rather than with the stibnite.

4. The gold and the arsenic may be associated, but a consideration of assays numbers 1,5,6,7,8,16,17,19,20,21, and 23 show that the relationship is not a direct one.

5. In spite of secondary enrichment, it is clear that gold and silver in appreciable quantities occur throughout all the mineralized veins.

Assays of the arsenopyrite

An assay was made on the arsenopyrite by H.C.Edwards. It ran .12 ozs of gold per. ton, which is lower than the majority of the assays obtained from the ore samples. As the sample contained some impurities the result cannot be taken as conclusive evidence, but only as a further proof that the gold and arsenopyrite are not directly related.

MINERALIZATION

Megascopic description of specimens

Sample No. 4

Predominately a mixture of fine-grained stibnite and quartz, together with minor amounts of fibrous arsenopyrite, which shows iridescent alteration. Very small crystals of pyrite may be seen. The surface of the specimen, which was next to the wall rock, is altered.

Sample No.5

Fibrous arsenopyrite and quartz at right angles to the vein wall are the two main minerals. These are veined by a massive variety of stibnite. Minor amounts of calcite are present. Small quantities of sphalerite, and iron stain may also be seen.

Sample No.11

This specimen is very similar to No. 4, although less alteration is shown.

Sample No. 12

In this sample most of the stibnite is massive, although some occurs in radiating groups of acicular crystals showing perfect cleavage. Arsenopyrite and quartz, which show a fibrous structure, also occur in large quantities. Minor amounts of massive cleavable spahlerite, and cubes of pyrites may be seen.

Sample No. 7

The predominating minerals in this specimen are arsenopyrite, which is tarnished, and quartz. These two minerals show a fibrous structure at right angles to the vein wall. Small veins of stibnite occur throughout the sample. Minor amounts of massive cleavable sphalerite also occur.

Sample No. 19

Veins of stibnite cutting the arsenopyrite and quartz is the main feature of this specimen. One surface of the sample is covered with wall gouge.

Samples No.20 & No. 21

These two samples are for all practical purposes the same, so one description will apply to both of them. Fibrous varieties of quartz and arsenopyrite, and massive varieties of stibnite are the predominating minerals. Small quantities of massive cleavable sphalerite, and crystals of pyrite also occur. The specimens are stained with iron.

Sample No. 23

This is the most interesting specimen in the suite. A highly concentrated zone of mineralization is found next to the wall rock. In this zone are large quantities of pyrite and arsenopyrite of the crystalline varieties, and minor amounts of massive stibnite. These occur in a quartz gangue, which forms a larger proportion of the remainder of the specimen. A black mineral, with high lustre, associated with the stibnite was observed. By blowpipe analyses it was determined to be tetrahedrite. Small quantities of calcite containing strontium were observed. The calcite appeared to be of a later period of mineralization than the other minerals in the specimen.

Sample No. 25

This specimen is a solid piece of rhombohedral calcite, no other minerals being evident.

Microscopic Description of Polished Sections

Polished sections were prepared from ore samples numbers 4,7,19,21, and 23. No sections were made from ore samples numbers 5,11,12,21, and 25, as this would only have been a repetition of what was already shown in the sections made from the other samples.

Each of the polished sections is described, and the interesting ones are illustrated.

Section 1, Sample 4

This section, which is illustrated in figure 3, shows irregular masses of stibnite, and crystals of arsenopyrite in a gangue of quartz. The stibnite contains hypidiomorphic crystals of quartz, showing that the stibnite is younger than the quartz. The quartz is younger than the arsenopyrite, because crystals of the latter are found in the former. Some of the fractures in the arsenopyrite are filled with stibnite.

Section 2, Sample 7

Predominately quartz and arsenopyrite, with several minor masses of sphalerite, and the whole veined by stibnite, showing that the stibnite was the latest to be deposited. Idiomorphic crystals of arsenopyrite were found in the quartz and sphalerite, and hypidiomorphic crystals of quartz were contained in the sphalerite. From the above it may be seen that the order of deposition from the earliest to the latest was arsenopyrite, quartz; sphalerite, and stibnite. This section is illustrated in figure 4 and 5. Figure 4 shows the relationship of the quartz, arsenopyrite, stibnite and sphalerite. Figure 5 is illustrating the typical crystals of arsenopyrite contained in the quartz. These crystals are large and have well developed faces.

Sections 3 Sample 7

This section is very similar to number 2, both being made from the same sample. No sphalerite was apparent in this section, but arsenopyrite, quartz, and stibnite were found. Very small inclusions of a second gangue mineral were found in fractures in the quartz.

As far as could be determined by microchemical tests, and a megascopic examination of the slide, this second gangue mineral was calcite. It is quite evident that the calcite was deposited at a later date than the quartz. This section is not illustrated, as nothing of exceptional interest was shown.

Section 4, Sample 19

Of most interest in this section was the beautiful veining of the arsenopyrite by the stibnite. This is illustrated in figure 6, and photograph I, which represents a typical occurrence of the arsenopyrite and stibnite. Figure 7 shows the stibnite veining the arsenopyrite and the quartz. The age relations here are the same as found in previous section; that is, the arsenopyrite being the earliest and the stibnite the latest.

Section 5 Sample 20

This is perhaps the most interesting section made. It is predominately sphalerite and quartz. Fractures in the sphalerite are replaced by quartz, stibnite, and arsenopyrite. Crystals of arsenopyrite are found in both the quartz and stibnite veins but no crystals were found in the sphalerite. From the above, and figures 8,9, and 10, and photograph 2 it may be seen that the age relations here are opposite to the normal; that is, the sphalerite was the first to be deposited, followed by the arsenopyrite and the quartz, and finally the stibnite. As the other sections, in which sphalerite was found, showed the normal order of deposition, the normal order will be taken as correct until further evidence to support the reverse order is found.

Section6, Sample 21

This section is predominately a mixture of massive quartz and stibnite. Hexagonal crystals of quartz are found in the stibnite. Small crystals of pyrite and arsenopyrite are also contained in the quartz. The pyrite, arsenopyrite, and quartz represent an earlier period of deposition, and the stibnite a later. The section is illustrated in figures 11 and 12.

Section 7, Sample 23

More pyrite was seen in this section than any of the others Arsenopyrite, pyrite, and minor quantities of stibnite in a quartz gangue were the minerals seen. Figure 13 shows their relation to one another, the order of deposition being the same as found in the other sections. Although tetrahedrite, associated with the stibnite, was seen in the sample none appeared in the polished section.

Section 8, Sample 23

As this section was exactly the same as section 7 it is not illustrated. The only reason it was made, was in order to find the tetrahedrite, but with no avail.

Conclusions drawn from hand specimens and polished sections

To summarize the results from the study of the hand specimens and the polished sections. The following minerals were identified:

Ore Minerals

1 Arsenopyrite ($FeAsS$)

2 Sphalerite (ZnS)

3 Pyrite (FeS_2)

4 Stibnite (Sb_2S_3)

5 Tetrahedrite ($Cu_8Sb_2S_7$)

Gangue Minerals

1 Quartz (SiO_2)

2 Calcite ($CaCO_3$)

Paragenesis of the deposit

To summarize the results obtained from the study of the hand specimens and polished sections the following order of mineralization is postulated.

1 Pyrite

2 Arsenopyrite

3 Quartz

---

4 Sphalerite

---

5 Tetrahderite?

6 Stibnite

---

7 Calcite

Although the tetrahderite was seen in hand specimens, it was not seen in polished sections, and since it was seen associated with the stibnite, it is put in the paragenesis where shown.

In section 5, sample 20, a different order of deposition is apparent. In this case the sphalerite was the first to be deposited followed by the pyrite, arsenopyrite, quartz; and stibnite. This order is probably due to the predominance of sphalerite in this sample.

Section 1, Sample 4

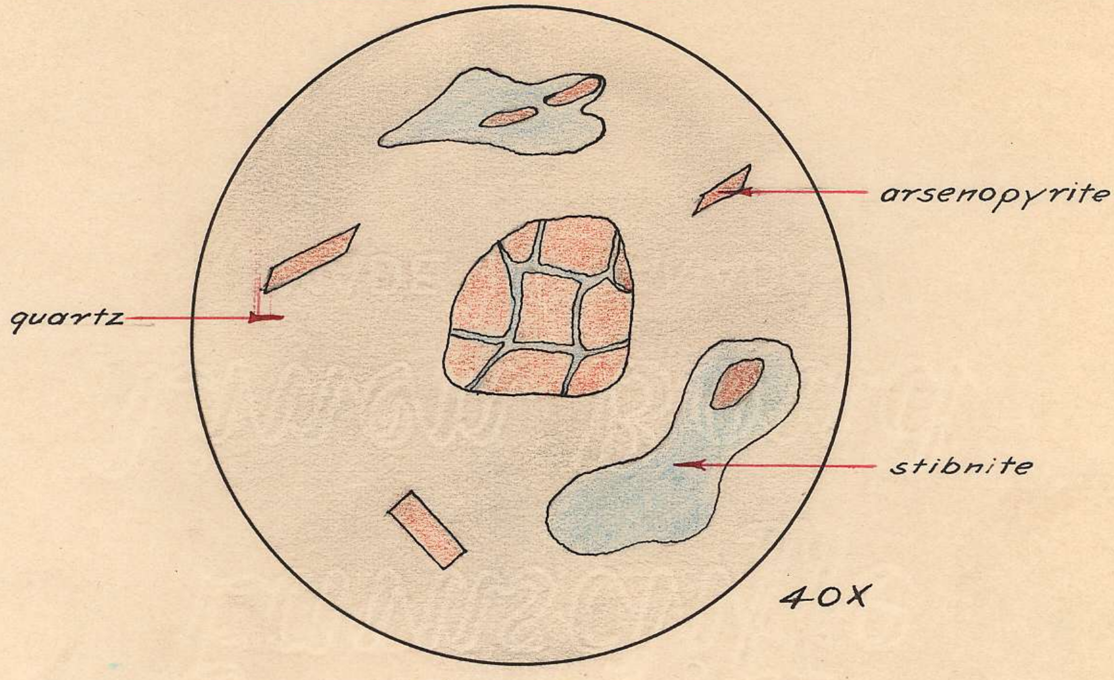


Figure 3

Section 2, Sample 7.

Figure 4

Section 2, Sample 7.

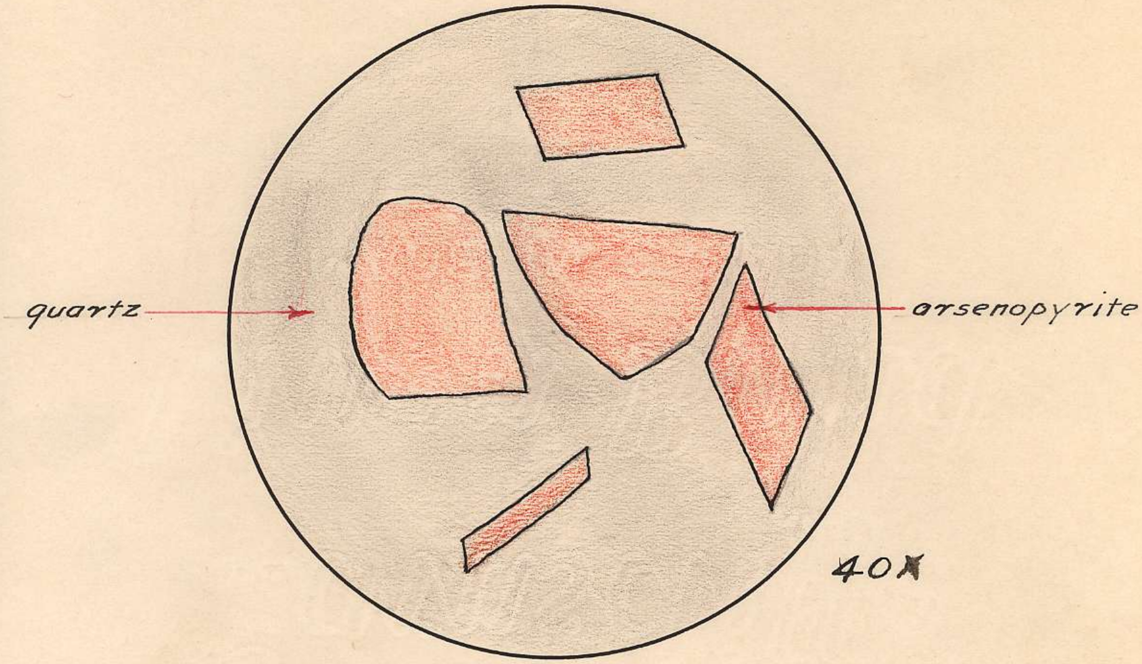


Figure 5

Section 4, Sample 19.

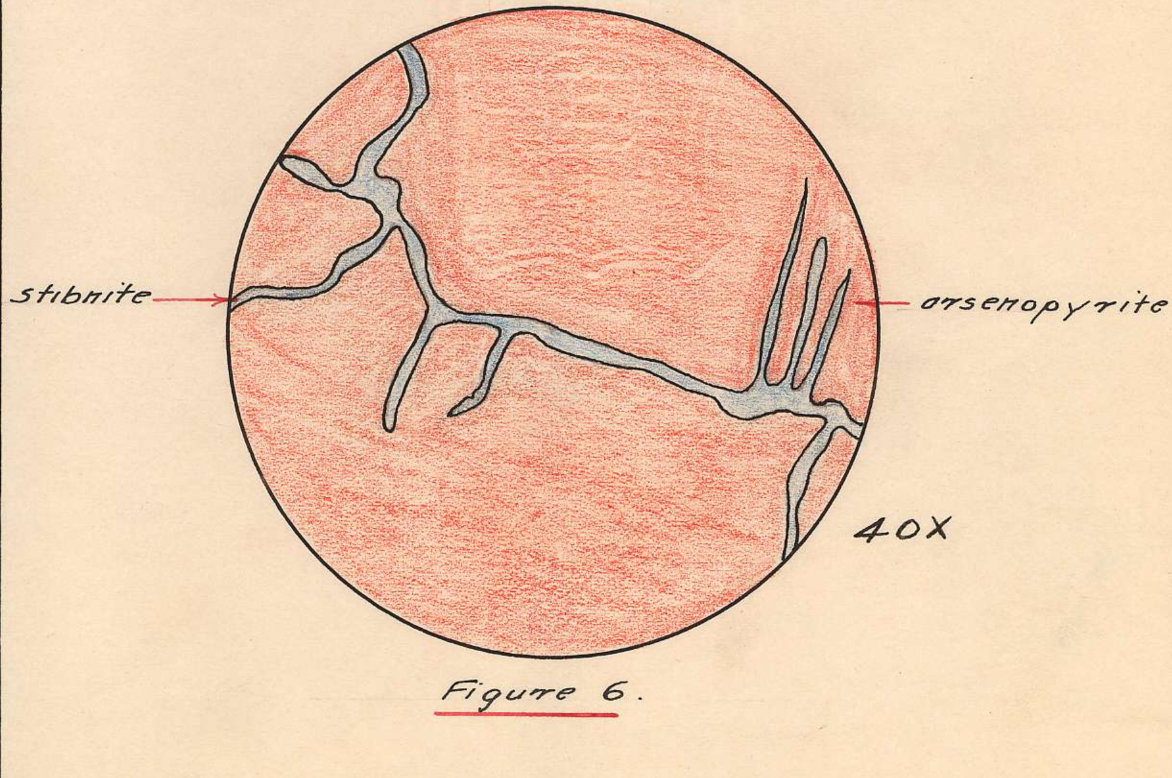


Figure 6.

Section 4, Sample 19.

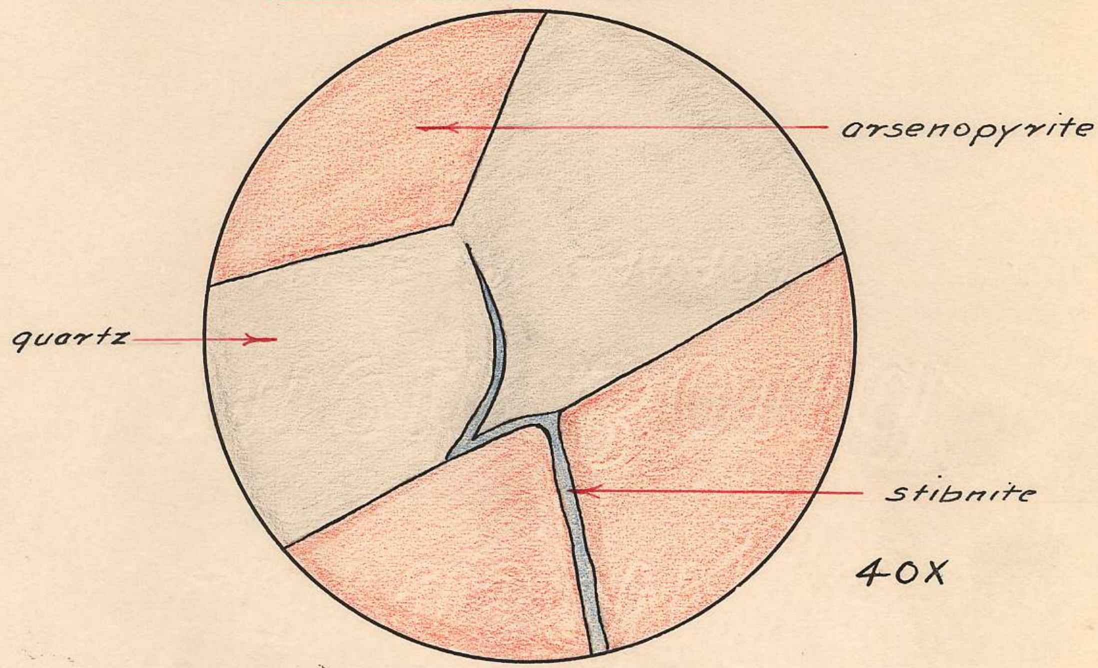


Figure 7.

Section 5, Sample 20

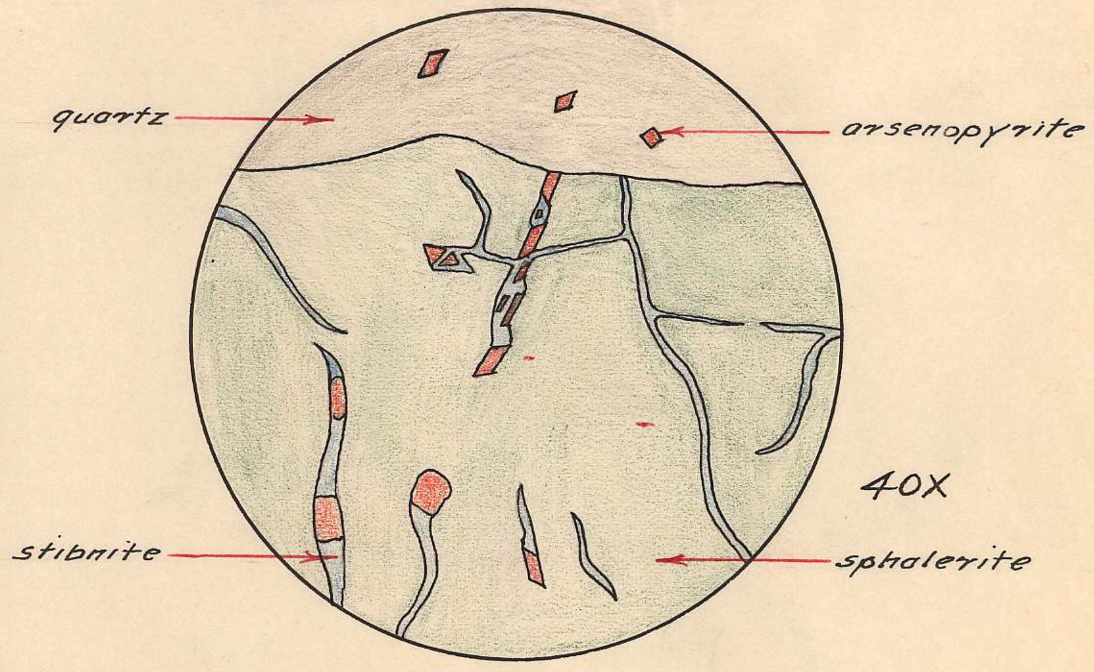


Figure 8

Section 5, Sample 20

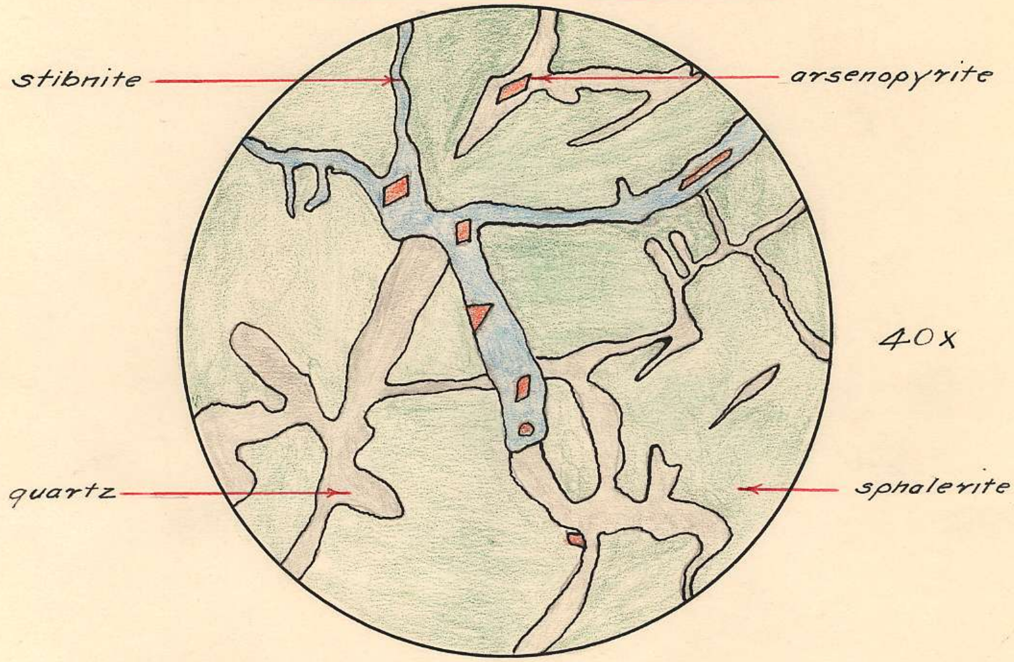


Figure 9

Section 5, Sample 20

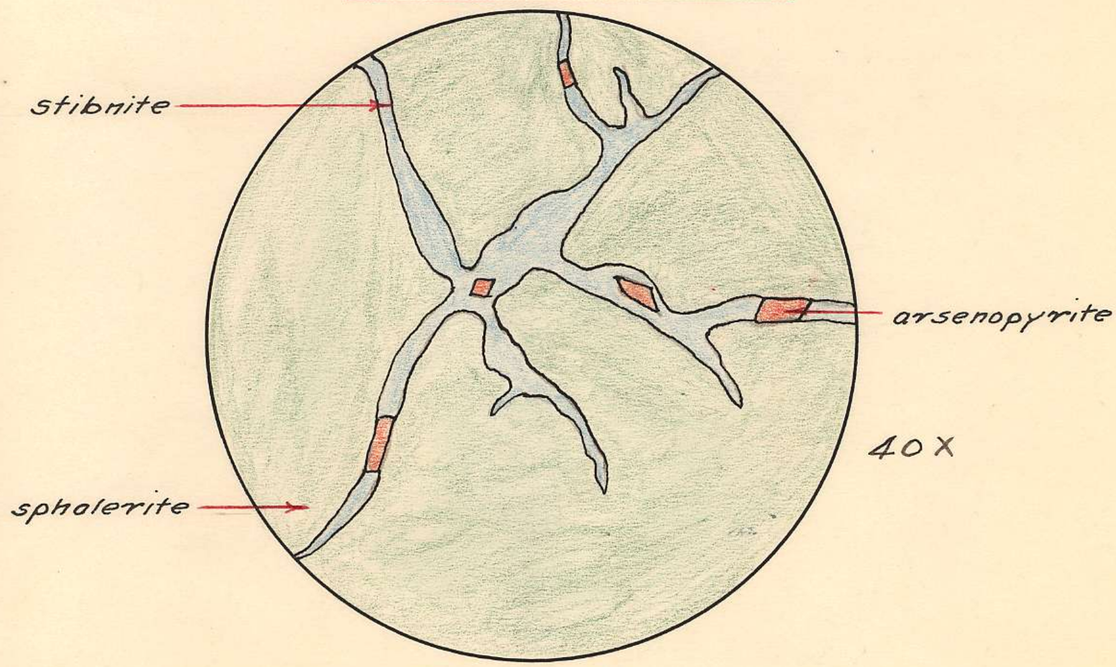


Figure 10

Section 6, Sample 21.

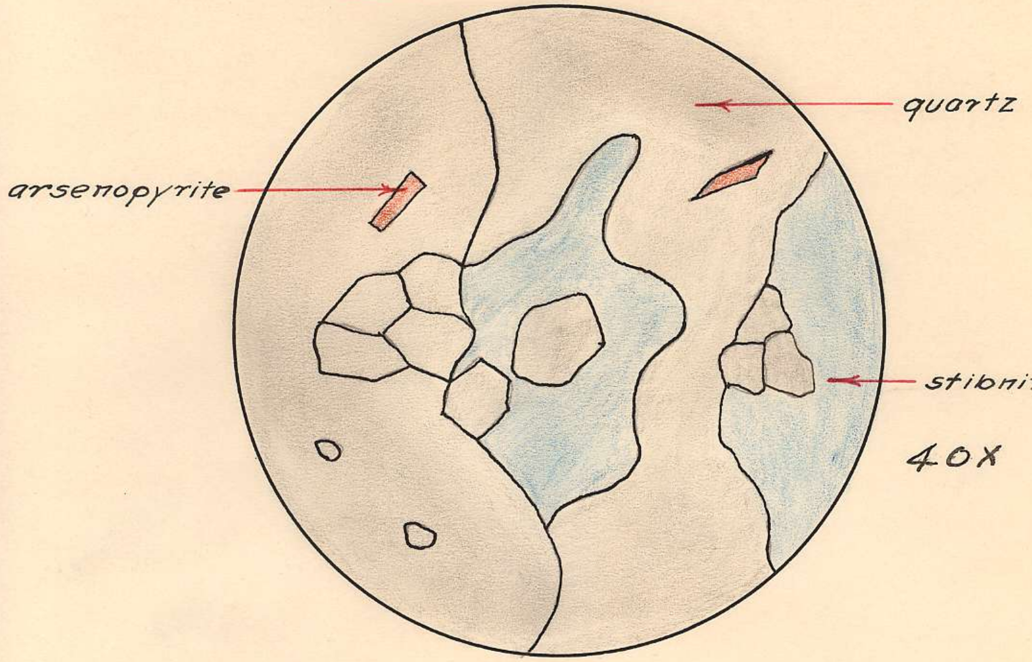


Figure 11

Section 6, Sample 21.

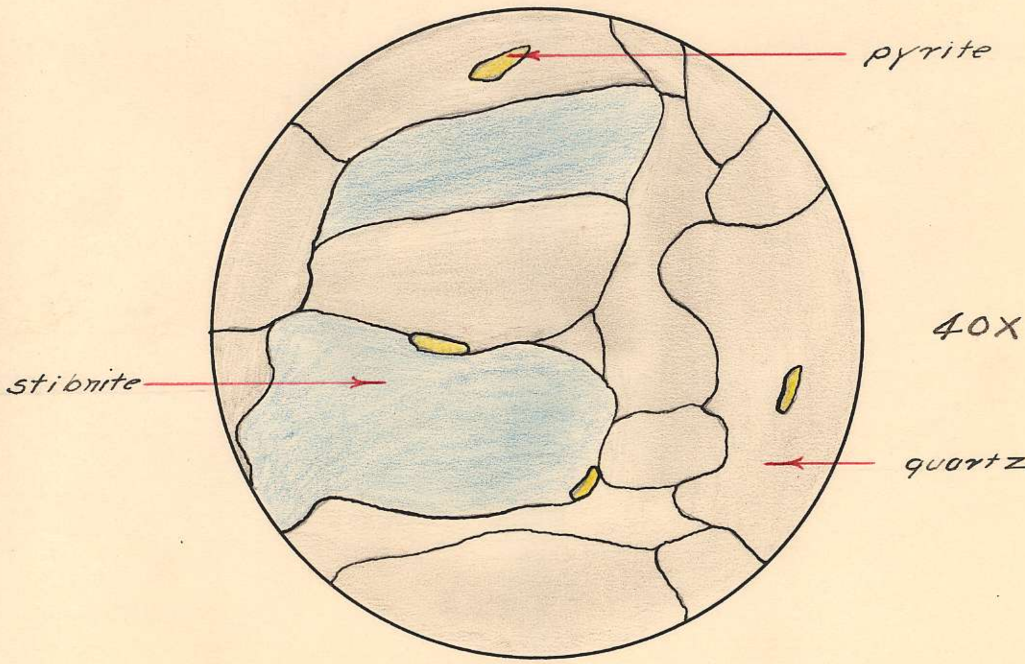


Figure 12.

Section 7, Sample 23.

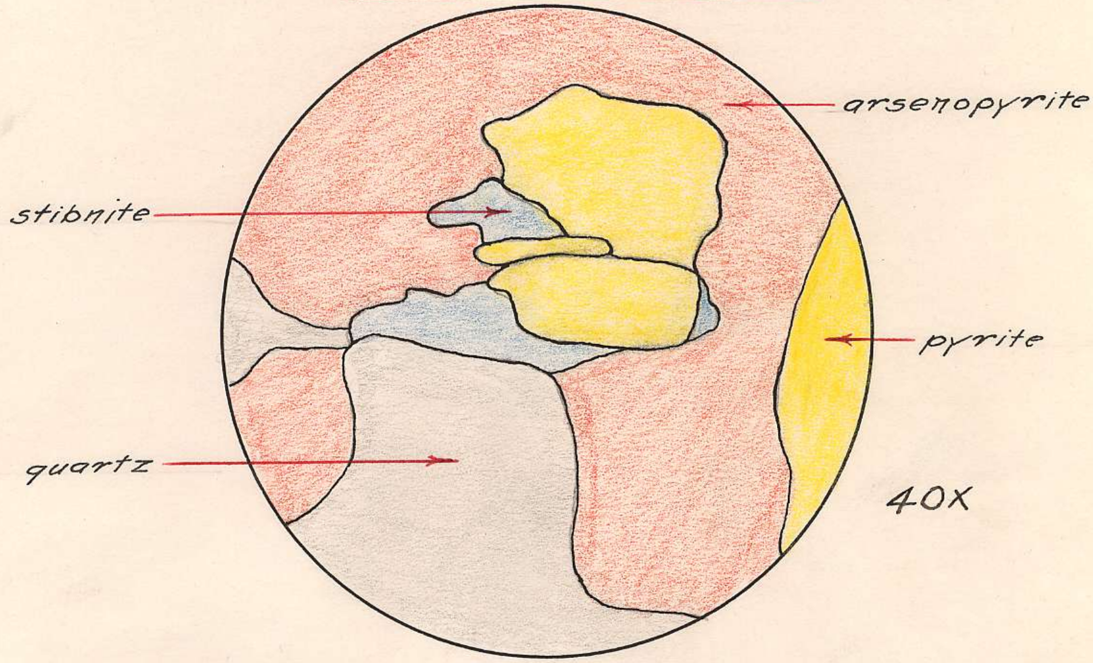


Figure 13.

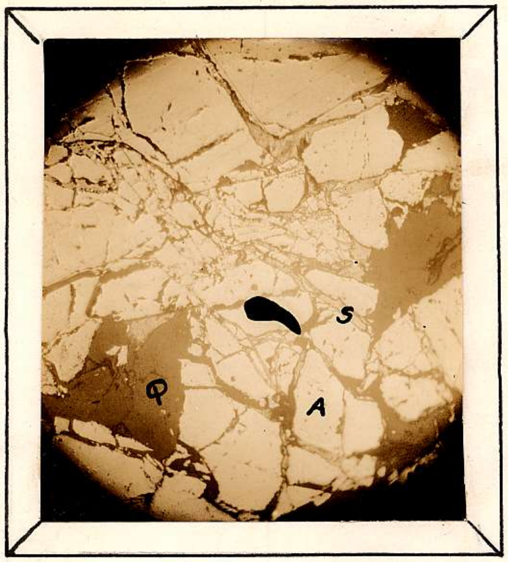
CONCLUSIONS

Although it has not been definitely determined, the silver is most likely associated with the tetrahedrite, as this is a common silver-bearing mineral. From a study of the assays it is quite evident the silver is not associated with the stibnite. No free gold was seen under the microscope, therefore the gold is most likely chemically associated with one of the ore minerals, possibly the arsenopyrite. From a study of the polished sections and assay results, it is quite evident that this is not a direct relationship. This conclusion was furthur born out by an assay of the arsenopyrite.

All the minerals except the calcite are primary, therefore it can be said that they will more than likely continue to depth, instead of playing out near the surface, as is the case with secondary minerals.

In milling the ore it should be crushed to at least 200 mesh in order to separate out the stibnite, and even this fineness will not separate all the stibnite.

Photograph 1.



Section 4, Sample 19, Mag. 40X

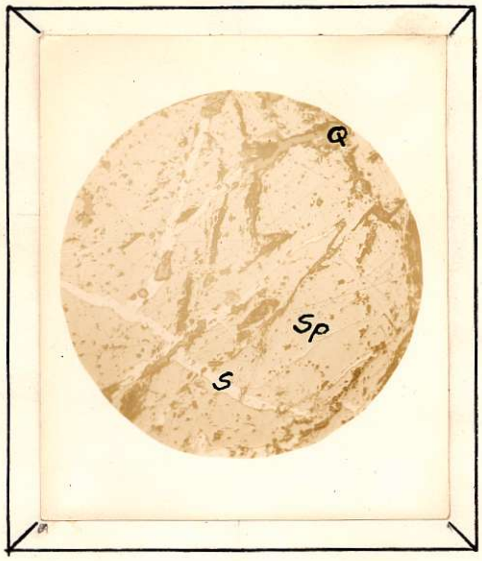
A, = arsenopyrite

S, = stibnite

Q = quartz

- ——————— -

Photograph 2.



Section 5, Sample 20 , Mag. = 40X

Sp = sphalerite

S = stibnite

Q = quartz

– ———— –

Furthur Conclusions

By means of a new method of amalgamation, Mr. W. H. Patmore found the gold to be free, and not chemically associated with any mineral. Until a check has been made this statement is just given for what it is worth.

J. E. Armstrong.

April 10/34.