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A MICROSCOPIC EXAMINATION OF ORE FROM TATLAYOKO LAKE DISTRICT

BY

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ACKNOWLEDGEMENTS

I wish to acknowledge the following references which aided me in compiling this report.

The description of the general geology of the Tatlayoka Lake Property was from Dr. Dolmage's report on "TheChilko Lake and Vicinity" - British Columbia - Canadian Geological Survey, Summary report, 1924, Part A, pp.59-72.

The information concerning the mineralization and assays of the deposits are credited to Dr. H. V. Warren in his report, "The Morris Gold Mine" - July, 1933.

Constant reference was made to the two previous undergraduate reports on the property, namely those ofJohn E. Armstrong, Geology 1934, and L. F. Wright, Metallurgy, 1937.

I wish to thank Mr. William Armstrong and Leon Gouin for their assistance in the study of the polished sections.

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INTRODUCTION

This report is the result of the study of polished sections of ore from the Tatlayoko Gold Mines, which is better known as the Morris Mine. The sections were prepared and examined in fulfilment of the Geology 409 Course at the University of British Columbia.

GENERAL INFORMATION

The property is still in the prospect stage and only two short prospect odits have been driven. The property is essentially a gold-silver deposit with considerable arsenic and antimony present.

LOCATION

The ore deposit, 5900 feet in elevation, is situated three miles south-east of the south end of Tatlayoko Lake, B.C. The Tatlayoko Lake District was formerly in the Nanaimo Mining Division, however, the present boundaries include it in the Clinton Mining Division.

ACCESSIBILITY

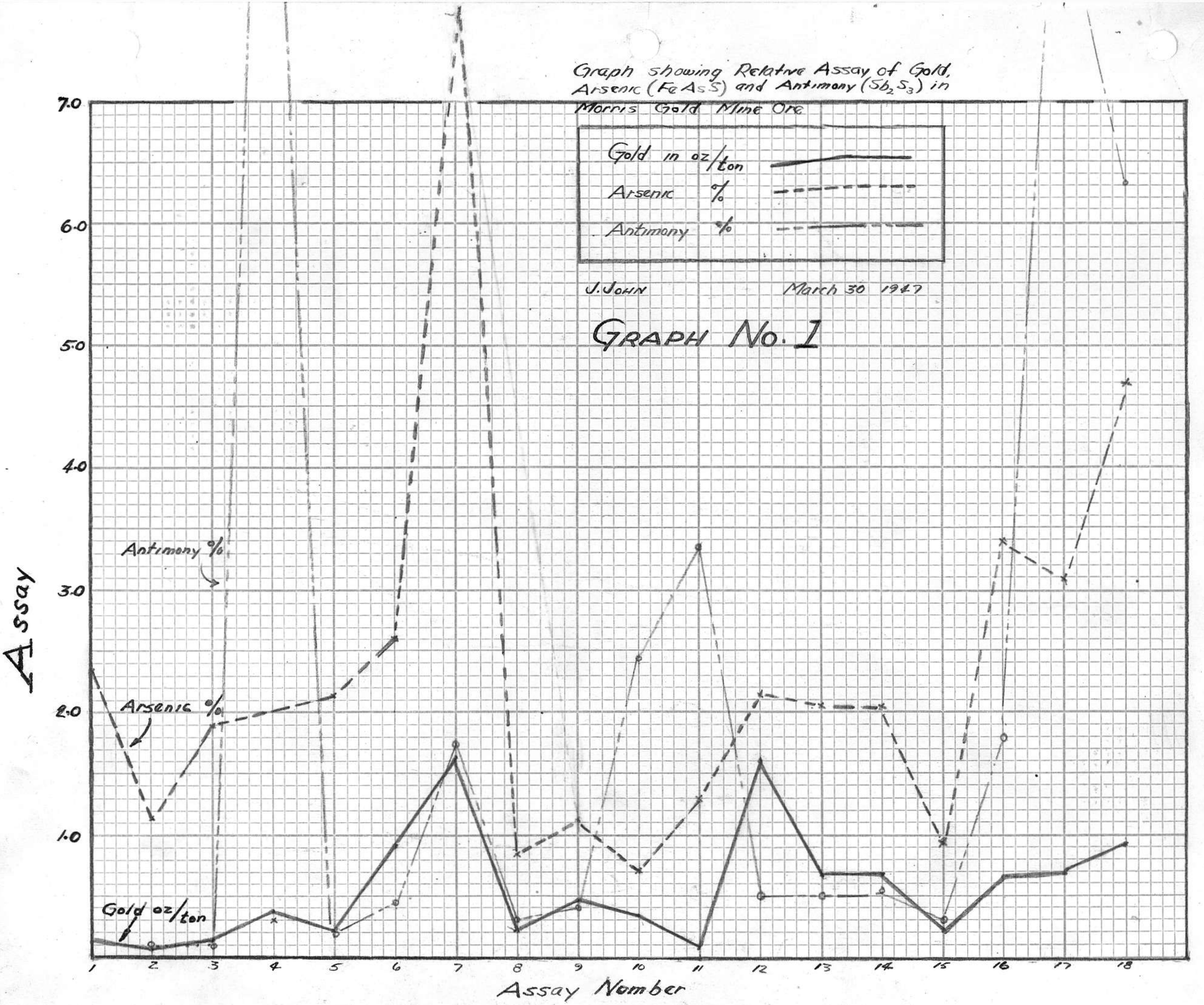
One hundred and sixty miles of road connect Williams Lake on the Pacific Great Eastern Railway to the north end of Tatlayoko Lake. From this point, the fifteen miles to the south end of the lake is best travelled by boat.

GEOLOGY

The deposit, of three quartz veins, lies in the Triassic sediments. These sediments consist chiefly of argillites and fine sandstones with a thin bed of fine cherty conglomerate. A stock of quartz-diorite, probably related to the Coast Range Batholith, lies a few miles to the northeast of the veins. The sediments are cut by several dykes, which are chiefly basaltic but range to diorite. Some of these dykes cross and recross the quartz veins and are consequently younger than the Morris deposit. This post-mineral faulting of the veins gave displacements of no more than a few feet and hence will be of little hindrance to mining.

MINERALIZATION

The deposit's three quartz veins crop out on the sides of a steep, rock gulch. The veins follow fault fissures and hence pinch laterally and vertically. Themain vein has been followed underground for approximately 400 feet and has a width which varies between 8 inches and 5 feet, and averages 2 feet. The second vein has been traced for 250 feet and has an average width of 8 inches. The third vein has only been stripped of overburden for a short distance but appears similar in character to the other two veins.


Graph showing Relative Assay of Gold, Arsenic (FeAsS) and Antimony (Sb_2S_3) in Morris Gold Mine Ore
Gold in oz/ton
Arsenic %
Antimony %
J. JOHN
March 30 1947
GRAPH No. I
Antimony %
Arsenic %
Gold oz/ton
Assay
Assay Number
7.0
6.0
5.0
4.0
3.0
2.0
1.0
1
2
3
4
5
6
7
8
9
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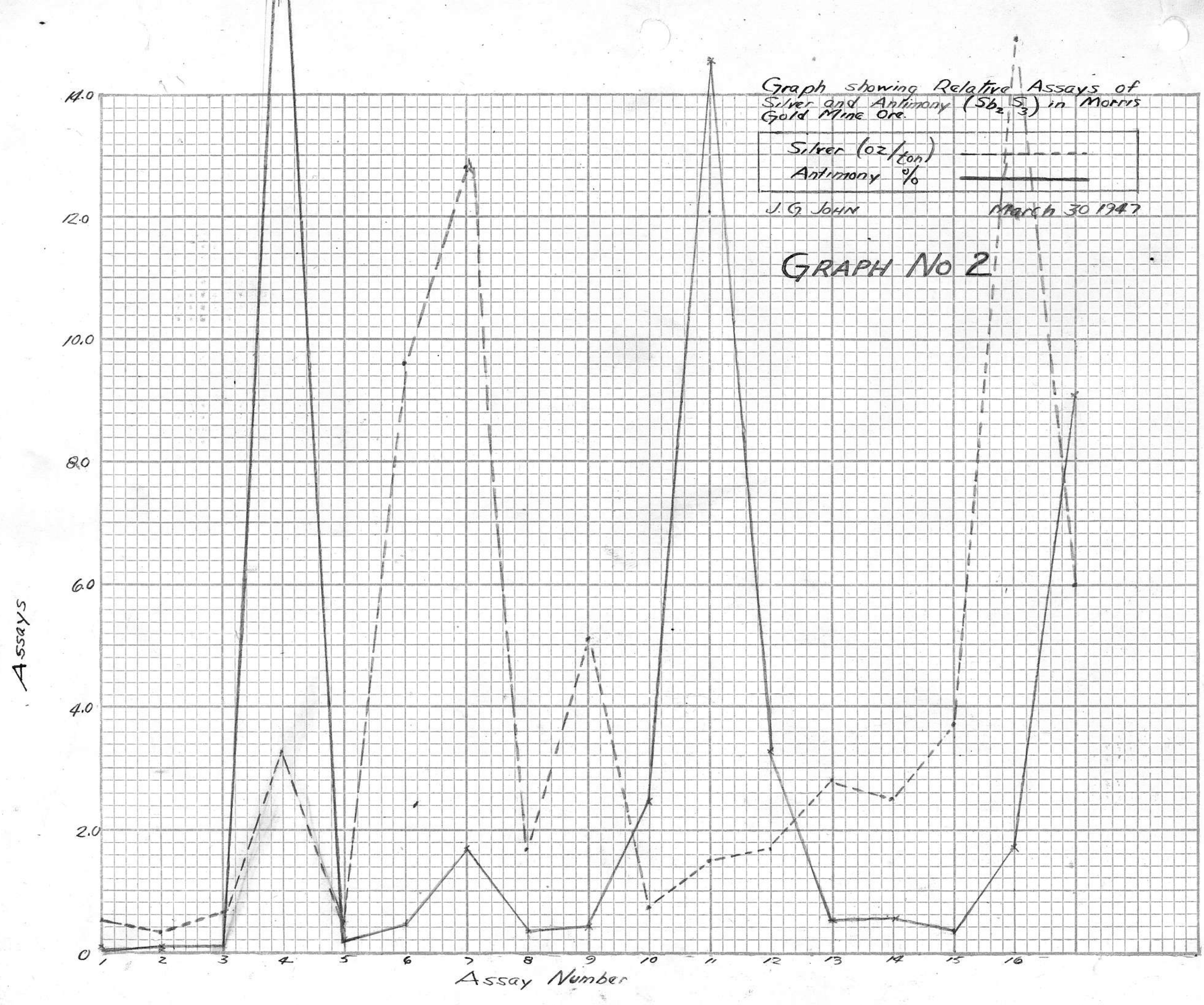
Graph showing Relative Assays of Silver and Antimony (Sb_2S_3) in Morris Gold Mine Ore.
Silver (oz/ton)
Antimony %
J. G. JOHN
March 30 1947
GRAPH No 2
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Assays
Assay Number

The veins have quartz as a gangue mineral (70%) with stibnite (10%), arsenopyrite (11%) and pyrite (1%) as the predominate sulphides. Minor amounts of tetrahedrite,calcite, sphalerite, chalcopyrite, galena, gold and silver are also present.

STATEMENT OF THE PROBLEM

This investigation of the Tatlayoko Mineral Suite is a continuation of the study as begun by Armstrong (Geology 1934) and resumed by Wright (Metallurgy 1937).

The problem is to determine more specifically the minerals carrying the gold and silver. It was thought before 1934 that the silver was associated with the stibnite and the gold with the arsenopyrite. Subsequent assays show that although there may be local associations of silver with stibnite, the tetrahedrite is probably the main carrier of silver. The association of gold with arsenopyrite is evident but the quantitative relationship of the two is not direct, as illustrated by the change in ordinate difference between arsenic and gold in Graph 1.

The erratic assay differences between the gold and the arsenic, present as arsenopyrite, suggest two possibilities:

1. Disseminated gold may be present.

2. Another strong gold carrier may occur.

The main purpose of this investigation was to find out whether the 1st or 2nd possibility, or both, were present. The mineralization and paragensis of the deposit were further examined.

ANALYSIS

Chemical analysis, obtained by accurate sampling of the Tatlayoko ore, is given below -

Gold	1.42 oz. per ton	Sulphur	6.4%
Silver	22.30 " " "	Copper	.12%
Arsenic	3.40 %	Iron	6.0%
Antimony	7.40 %		

Mineral analysis, as roughly calculated, is as follows -

Quartz	70 %	Pyrite	1%
Stibnite	10 %	Tetrahedrite	(.5%)
Arsenapyrite	11 %	Others	7.0%

PREPARATION AND MEGASCOPIC EXAMINATION OF SPECIMENS

Representative specimens were taken from Dr. H. V. Warren's Tatlayoko Suite. The specimens were labelled and examined under the hand lens. Six specimens were cut, and mounted in demar in the regular manner. Two specimens were cut and mounted in a special plastic mold in the Metallurgy Department.

The mounting machine, distributed by Buehler Metallurgical Apparatus Ltd., is used for mounting small metal specimens but is readily adaptable to mineral samples. The mold is transparent and circular with a one-inch diameter. The lucite mold is relatively hard and takes a ready polish. Owing to the transparency of the mold, name-labels placed inside the lucite powder before solidification provide easy identification.

The specimen, after being placed in the metal mold, is covered with lucite powder. A piston is fitted in behind the powder and the parts are placed in the pneumatic press. An electric heating filament raises the temperature to 140° C. and the pressure is raised to 400 psi. The temperature is lowered to 80°C and then the mounted specimen is ready for polishing. The mounting operation requires only three minutes.

The circular mold is not easily fitted into the traversing clamps for microscopic examination. If the specimen is to be traversed, four segments may be easily bevelled off on the emery wheel.

SPECIMEN 1

This specimen was chosen as a representative sample of stibnite in quartz. The stibnite crystals were characteristically elongated and needle-like and had the regular situations. The stibnite was intimately associated with quartz, and to a smaller extent, with some arsenopyrite. Small amounts of pyrite and sphalerite were present but their association was difficult to determine. Both stibnite and arsenopyrite appear to be locally replaced by quartz.

SPECIMEN 2

This weathered specimen is mainly arsenopyrite in quartz. The arsenopyrite has a highly fractured appearance as has quartz, although some small diamond-shaped crystals of the arsenopyrite are present. The green stain, characteristic of high arsenopyrite, was observed.

Very little stibnite was present.

Spalerite, associated with the quartz, was observed in fair quantity.

Evidence of a thin layer of basalt on the side of the specimen shows that the sample was from the contact zone of either the hanging or foot wall.

SPECIMEN 3

The specimen was a small flat sample which had been sawn. Fine grained stibnite either replacing the earlier quartz or filling a quartz fracture was observed. A narrow band of tetrahedrite contacted the quartz.

MICROSCOPIC EXAMINATION

QUARTZ

Quartz, the predominant gangue mineral in the deposit, has a highly fractured surface throughout. The displacement of the quartz by the sulphide minerals is evident in all of the specimens. However, there are several evidences of secondary quartz in the deposit because both arsenopyrite and stibnite, the major sulphides, are in places, partially replaced by the quartz. Numerous quartz veinlets were present in the masses of stibnite. These veinlets, in some parts of the stibnite, resembled a fine network of pin points. This is probably due to the replacement by the later quartz along the cleavage planes of the earlier stibnite.

Minute traces of carbonate material, possibly calcite, along the quartz fractures was noted.

Previous investigation by L. F. Wright disclosed one particle of free gold in the quartz. Further examination under magnifications as high as 1300 did not reveal any more free gold particles in the quarts. To further investigate the quartz as a carrier of gold, a number of superpannings were run on ~~the~~ same crushed ore samples. The tips of the -200 and &200 - 150 mesh fractions were mounted and examined. No free gold particles were detected under the microscopic examination. Only arsenopyrite, galena and traces of stibnite were observed. Spectrographic analyses on the tip gave positive gold tests. This was to be expected since the arsenopyrite, which was admixed, is a gold carrier.

The failure of the intensive search for visible native gold in the quartz, the most likely carrier, implies that although free gold may occur it does not exist in the amounts which would be necessary to account for the high assay fluctuations.

It should be borne in mind that proper superpanning technique is highly specialized. The writer, as an undergraduate, does not pretend to have made an optimum separation on this delicate apparatus.

STIBNITE

Stibnite is the most predominant sulphide mineral in the ore, particularly in the central portion of the veins. The stibnite occurs both massively in close association with the quartz and in well-crystallized, fan-like radiating forms. Ample evidence indicates that the stibnite is younger than both the earlier quartz and the arsenopyrite.

Stibnite is predominate in the fractures and veins in the quartz, replacing arsenopyrite (Photo 1). Stibnite is also present along with quartz in the arsenopyrite fractures, the quartz generally appearing to be the latest mineral to be deposited.

Several microchemical tests on the stibnite were made and no indication of silver was found.

The only observation of sphalerite under the microscopic showed it to be closely associated with the stibnite. Both the sphalerite and stibnite were replaced by quartz.

Generally speaking, the arsenopyrite is replaced throughout by stibnite but in two instances exceptions were observed. In both cases, vein arsenopyrite filling a quartz fracture was observed to replace some of the original stibnite.

There is little or no evidence supporting the former belief that the silver assay of the ore is related to the stibnite content.

ARSENOPYRITE

The arsenopyrite, present in both massive and crystalline form, is highly shattered. The fractures are filled by quartz, stibnite, and in one instance by tetrahedrite.

The wider fractures in the arsenopyrite are usually filled with quartz. The finer fractures were usually healed with both quartz and stibnite.

There were evidently two generations of arsenopyrite. The chief deposition being after that of the first quartz, the other being after the stibnite deposition.

Examination of the arsenopyrite under high magnification (1300x) revealed small bead-like metallic inclusions along the cleavage planes. The determination of the composition of this minute inclusion proved impossible under such high magnification. (Photo 4).

PYRITE

Minor amounts of pyrite were observed and they appeared with the quartz. The relative proportion of pyrite appeared less than was described in the previous reports of Armstrong and Wright.

TETRAHEDRITE

Only small amountsof tetrahedrite were present. The small inclusions of the tetrahedrite made it extremely difficult to get dependable etch and microchemical results. One inclusion which did give a dependable copper and iron positive test also carried silver. One tetrahedrite inclusion was associated with the stibnite, however, the relative deposition periods were difficult to determine.

Some tetrahedrite was noted in a small quartz fracture. L. F. Wright's estimation of tetrahedrite assay of about .5% of the ore appears to the writer as a very high estimate.

SPHALERITE

Although not very predominant in the mounted sections, sphalerite was present in fair quantity in the hand specimens. On examining some of the hand specimens which were to be ground for superpanning, sphalerite crystals were found in the calcite gangue providing good evidence of replacement.

Other sphalerite under the microscope appeared with the stibnite and was replaced in part by quartz. Some of sphalerite did not give external reflection. Iron was present in most of these inclusions.

GALENA

There is a relatively small amount of galena present. The spectrographic analysis of the superpan tip verified the presence of the lead. One crystal of galena was observed to be associated with stibnite and together displaced the surrounding quartz.

MINERAL X

Microchemical tests show that this mineral contains tellurium. Further tests implied that the mineral contained neither arsenic or copper.

The mineral was only observed in two instances, the inclusions being very small. The mineral left after the microchemistry samples were removed proved too small for conclusive X-ray tests.

The mineral was extremely sectile having almost a scaly or platy hardness. Under direct lighting it appeared a light brown. The telluride test using CeC_2 was repeated and again yellow rectangular plates were observed.

The microscopic examination suggested the presence of a telluride, however the spectrographic analysis and further microscopic examination of the superpan tip did not detect any tellurium.

Since several witnesses substantiated the telluride crystals under the microscope, the writer feels that superpanning under close, experienced control would yield highly interesting results.

If such a telluride did exist the gold assay descrepancies would be more fully explained.

CHALCOPYRITE

The writer found no conclusive evidence of chalcopyrite. Chalcapyrite was reported in 1937 by L. F. Wright.

PARAGENSIS

Several periods of mineralization are evident and at least three generations can be correctly described. Quartz, arsenopyrite and pyrite are in the first generation. Stibnite, galena, sphalerite, tetrahedrite, Mineral X (chalcopyrite) and a second quartz generation all are younger than the first generation. Sufficient evidence was found to substantiate a second arsenopyrite generation..

METALLURGICAL TREATMENT

The most probable gold recovery method for this arsenic-antimony gold ore appears to be flotation, followed by roasting and cyanidation of the float concentrate.

CONCLUSIONS

The arsenopyrite evidently carries considerable values in gold, however, discrepancies in the relative arsenopyrite and gold assays suggest that some of the gold is with another mineral (see Graph 1).

Examinations imply that the silver is not carried by stibnite but is carried in part at least by the tetrahedrite (See Graph 2).

The presence of a telluride is indicated. A gold telluride may exist. If this actually occurs, carefully experienced superpanning will disclose it.

A third period of mineralization, consisting of arsonapyrite deposition was observed.

MICRO PHOTOGRAPHS[1]

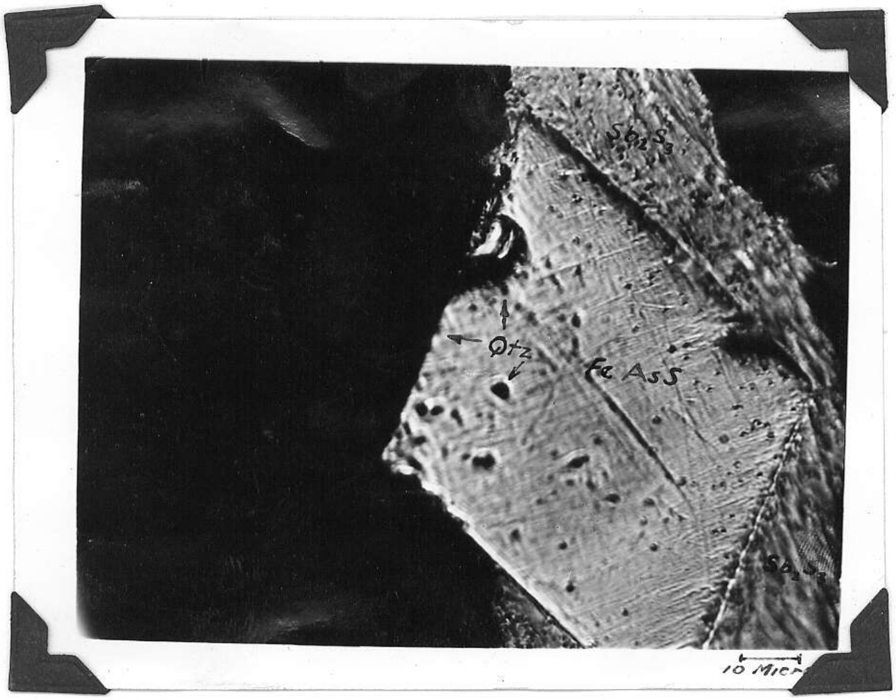

Fig. 1 (x780)
Showing stibnite replacing quartz and arsenopyrite and quartz replacing arsenopyrite.

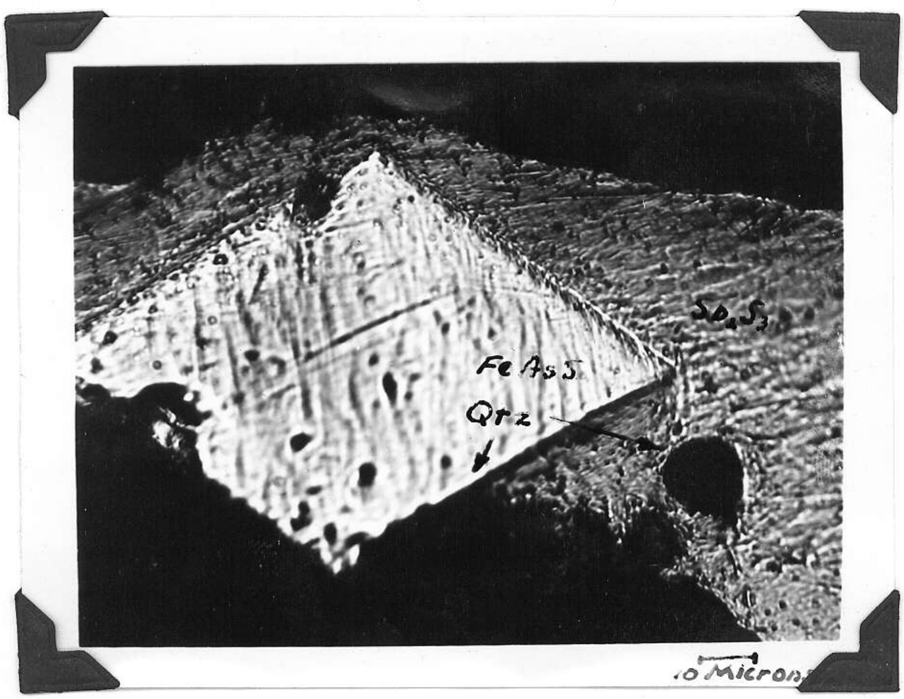

Fig. 2 (x780)
Showing stibnite replacing quartz and arsenopyrite and quartz replacing arsenopyrite.

1 CAMERA - Leitz Wetzlar No 277417, Carbon Arc Green filter
PLATE Panchromatic

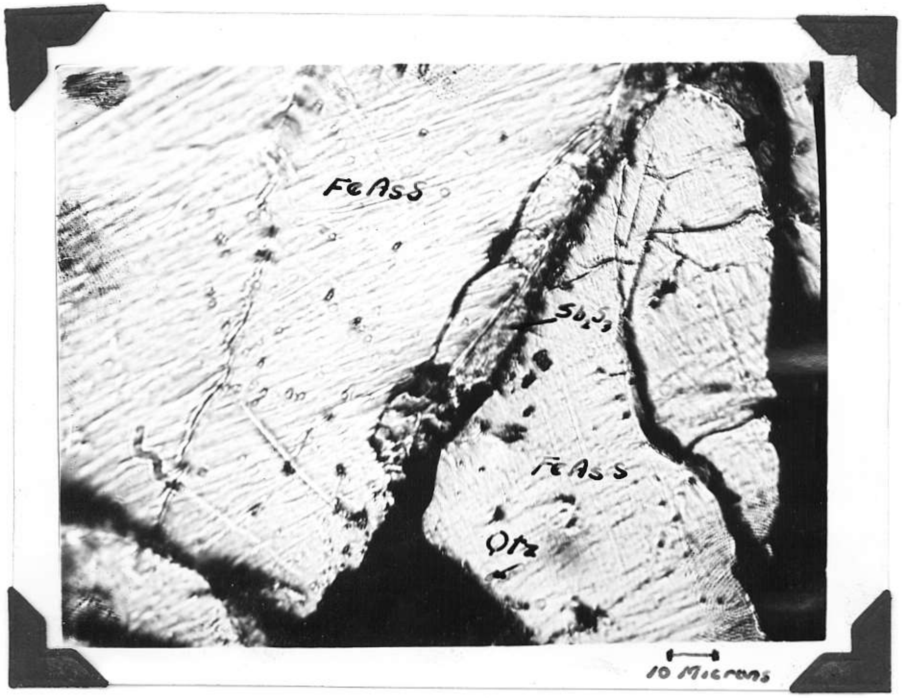

Fig. 3 (x480)

Photograph shows fractured arsenopyrite replaced by quartz and earlier replaced by stibnite.. ~~Earlier quartz.~~ Evidence of an early quartz is seen by presence of quartz inclusions in arsenopyrite. Unidentified inclusions in the arsenopyrite are observed.

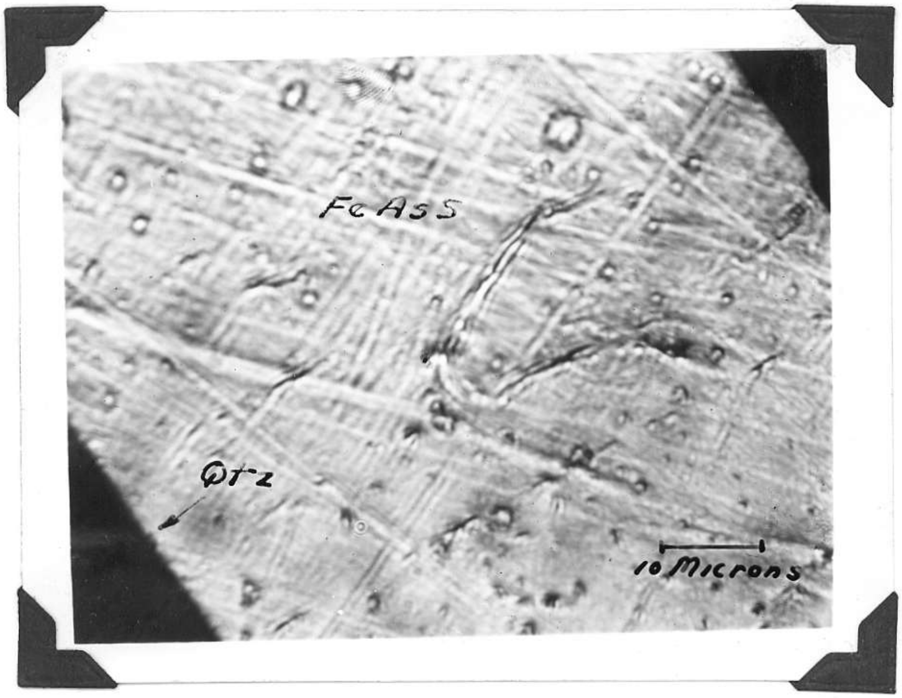

Fig. 4 (x1300)

This picture shows the typical appearance of arsenopyrite under high magnification. Unidentified inclusions in arsenopyrite indicated a supersaturated solution. Quartz in this section replaced the arsenopyrite.

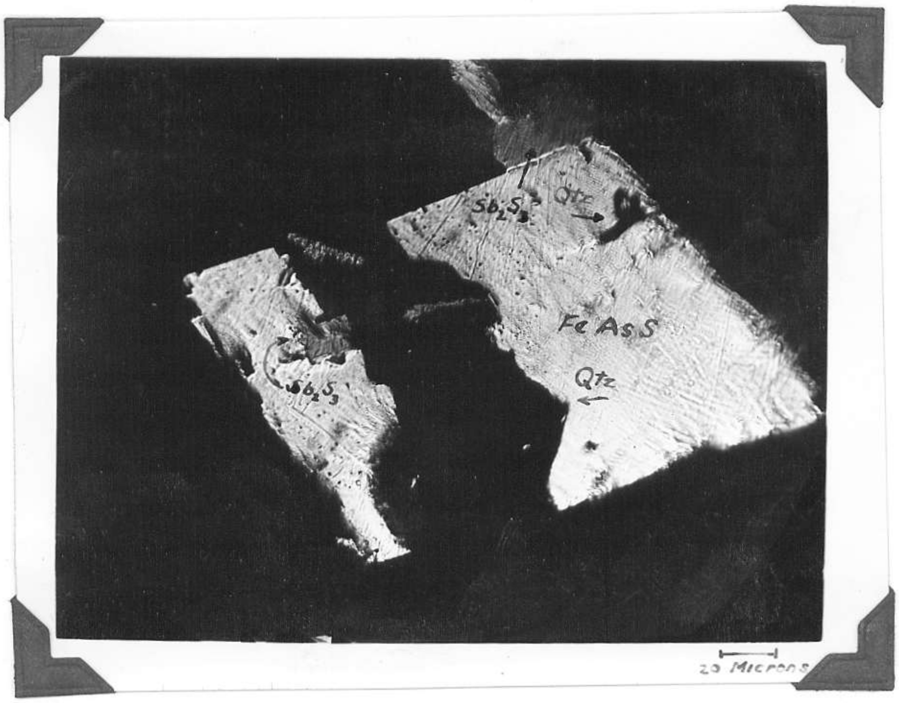

Fig. 5 (x 380)

A crystal of arsenopyrite is shown replaced by quartz. Stibnite is seen to be replaced by both the quartz and the arsenopyrite.

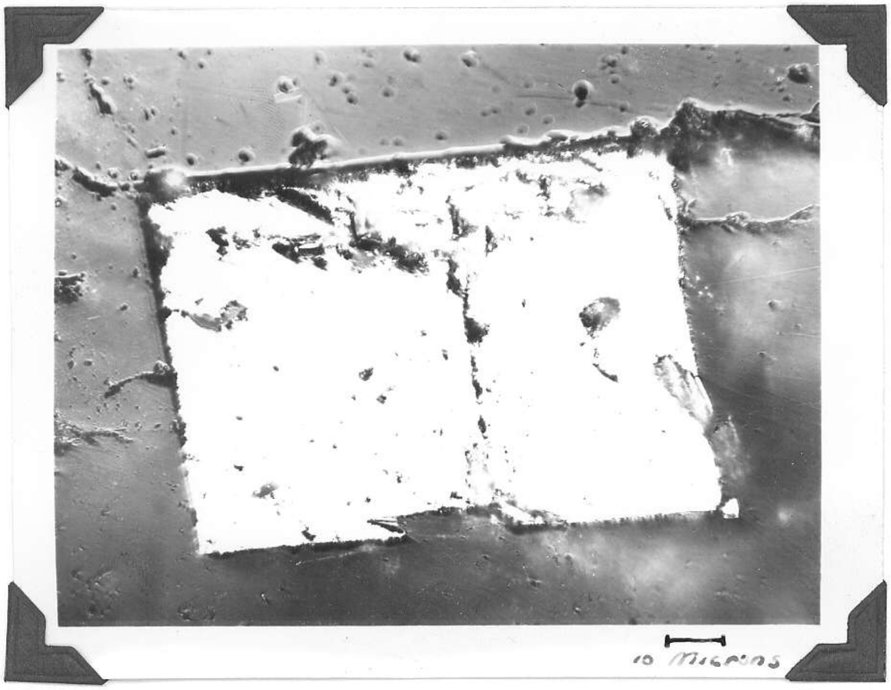

Fig. 6 (x 650)

Unidentified mineral, having all the properties of arsenopyrite, was observed only once. Orthrombic crystal system suggest it may be arsenopyrite.