A MICROSCOPIC EXAMINATION OF MINERALS FROM THE QUEEN MINE, B.C.

by

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INTRODUCTION

This is a report of a microscopic examination of minerals from the Queen Mine, in the Sheep Creek District, B.C. The main object of this examination was to ascertain the mode of occurrence, association and paragenesis of gold and vein minerals, and to apply this information to the solution of certain problems of mining development.

The introduction contains a brief description of the location and geology of the Queen Mine. The main part of the report describes, with the aid of sketches, the association and paragenesis of minerals found in the polished sections. Additional information concerning gold values is presented in a list of assays. The conclusion consists of a summary of results of the examination, and the application of findings in determining the possibility of persistence of gold values with depth, and the choice of methods of ore treatment.

The location of the Queen Mine is shown in Plate 1. It is in the Sheep Creek District which is twenty-five miles due south of Nelson, B.C., and only a few miles from the International Boundary. The Queen Mine is located on Waldie Creek, immediately above its junction with Sheep Creek, and is about ten miles by road from Salmo.

* The Queen mine was first staked in 1896, but the first shipment of ore was not made till 1902. The mine operated between 1902 and 1916 and produced 118,000 tons of ore

* From "The Miner", July 1935

valued at $1,204,726. For the following seventeen years, production was negligible. In 1933 and 1934 exploratory work was undertaken by the "Sheep Creek Gold Mines Ltd." Results of investigations were favorable and as a consequence, a 150 ton mill was built and commenced operating in 1935. Production has continued from that date to the present.

Geology *

Geologically, the Queen Mine is situated in the "Reno" formation which is a subdivision of the Pre-Cambrian "Windermere" group. (See Plate 4.) The Reno formation consists of an upper part, about 1500 ft. thick, and a lower part about 1600 ft. thick. The upper part is essentially grey quartzite having a brittle character favourable to the formation of fissure veins. The lower part consists of argillaceous quartzite, grading upwards into siliceous argillites, limestone and calc schists.

The formations of the Sheep Creek camp consists of steep beds of quartzite, separated by beds of argillite and schist, and beds of limestone. In the Queen Mine there are two main quartzite members, the Reno quartzite belt and the Motherlode quartzite belt. The gold deposits occur in veins filling fault fissures as they cross the beds of quartzite. These fissures strike north about 65° east, and are almost vertical. There are four veins on the property, which are known as the Queen, the Yellowstone, the Alexander and the Hideaway. A longitudenal section of the workings of the Queen Mine is shown in Plate 2.

Primary ore consists of pyrrhotite, pyrite,

* Condensed from Memoir # 172, Geological Survey of Canada and "The Miner", July 1935.

sphalerite, galena and some chalcopyrite in a quartz gangue. Onidation of the primary sulphide minerals extends to the level of Waldie Creek.

EXAMINATION OF ORE SPECIMENS

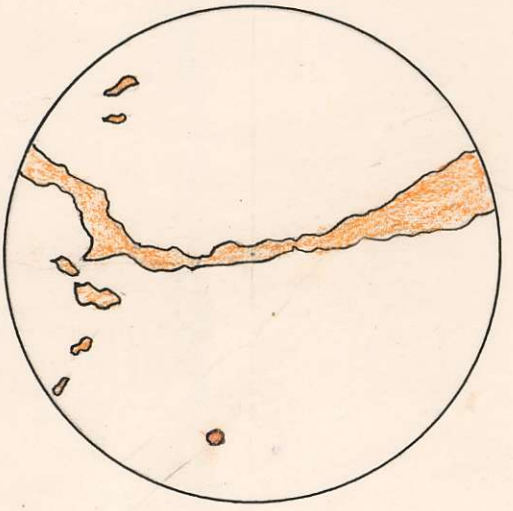
Ore samples from two shipments of Queen Mine Ore were examined. Specimens from the 1936 shipment were numbered from 1 to 5, and those from the 1939 shipment were given numbers from 6 to 12. Each specimen was cut, mounted and polished. Pieces of ore adjacent to the specimens were assayed for gold. The results of these assays are shown in Table 1.

Results of the microscopic examination of sections are shown on the next few pages, by means of sketches of microscopic views, and by descriptions . Descriptions include the results of both megascopic and microscopic examinations.

In the descriptions of sections, no references are made to tests used in identifying the various minerals. These tests are contained in Table 3 in the Appendix. The main object of each description is to show the probable order of deposition of minerals in the specimen. The sequence of deposition was determined principally by the marginal relations of the grains of different minerals. Smooth boundaries were considered to indicate contemporaneous deposition, and jagged, penetrating boundaries were taken to be a sign of diversity of age. Veinlets of one mineral in another, or one mineral filling a fracture in another were considered as good evidence of diversity. Also, in some cases minerals themselves

provided information which assisted in determining paragenesis. Other criteria for determining paragenesis were found in chapter 7 of a book titled, "The Laboratory Investigation of Ores", by Fairbanks.

SECTION 1.



810 Stope - East Ore Shute

Gold - 0.6 Oz. per ton

Magnification x 26

Legend

Quartz - - - - - - - - - - -

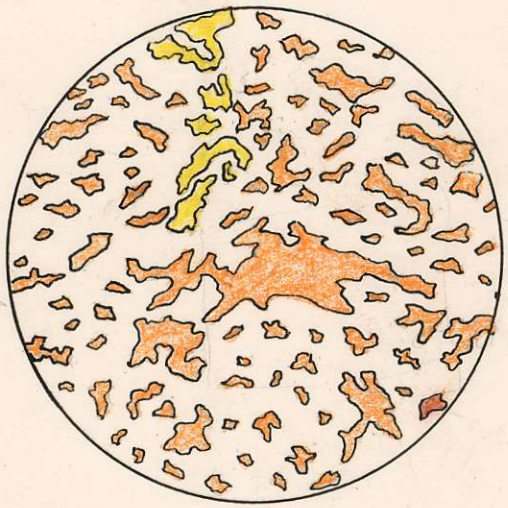
Pyrrhotite - - - - - - - -

Chalcopyrite - - - - - - -

Megascopically, section 1 consists of a network of bronze colored mineral filling fractures in quartz, i.

Under the microscope this mineral was found to be pyrrhotite. It had a pink-brown color, a hardness of three, and was tarnished when etched with KOH. The microscopic view sketched above, shows the pyrrhotite filling a fracture, indication that it was deposited later than the quartz. Chalcopyrite was found in the form of small grains in the quartz, indicating contemporaneous deposition.

SECTION 2 (a)



760 Stope - West Ore Shute

Gold - 0.4 Oz. per ton

Magnification x 26

Legend

Quartz ------

Pyrrhotite ---

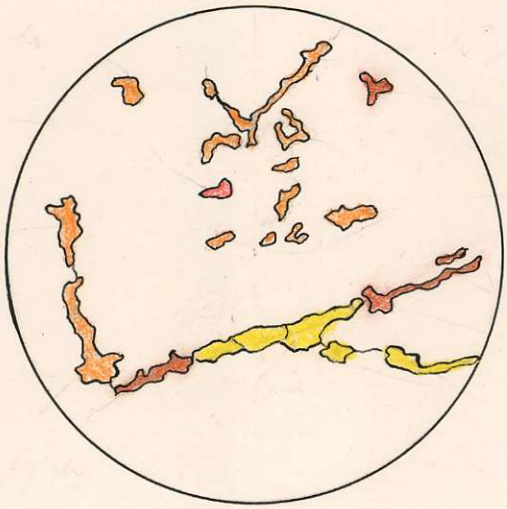
Chalcopyrite--

Pyrite ------

Megascopically, section 2 appears to be similar to Section 1, consisting of a bronze colored mineral which in one corner, fills fractures in quartz.

Section 2 (a) shows the bronze colored mineral pyrrhotite, evenly distributed in the quartz. In other parts of the section pyrrhotite was detected filling fractures, indicating that it was deposited later than the quartz. The pyrite and chalcopyrite shown in the sketch appear to have been deposited later than the quartz.

SECTION 2 (b)



760 Stope - West Ore Shute

Gold - 0.4 Oz. per ton

Legend

Quartz - - - -

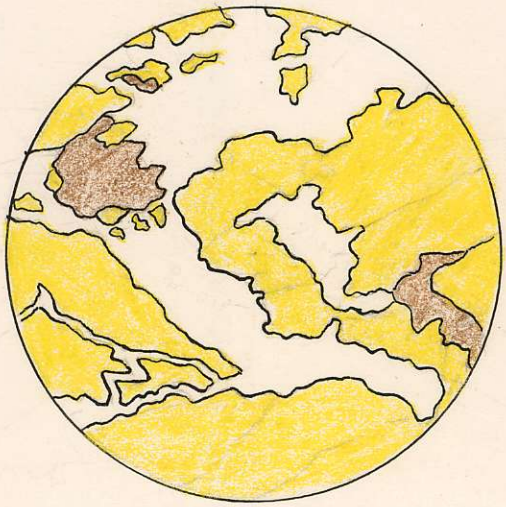
Pyrrhotite - -

Pyrite - - - -

Chalcopyrite -

In the second view of Section 2 shown above, the minerals pyrrhotite, pyrite, and chalcopyrite appear to be filling fractures, indicating that they were deposited later than the quartz. This agrees with the conclusions drawn from View 1 Section 2.

SECTION 3



West Ore Shute

Gold - 0.7 oz. per ton.

Magnification = x 26

Legend

Quartz ------

Pyrite ----

Sphalerite --

Megascopically Section 3 seems to consist of disseminations of fractured pyrite in quartz.

Under the microscope the minerals pyrite, and sphalerite were found to be distributed as shown in the above sketch. The quartz veins in pyrite show that quartz was the later of the two minerals. On the right hand side of the sketch sphalerite seems to have replaced part of the quartz in the fracture. Thus the order of deposition would be, pyrite, quartz and sphalerite.

SECTION 4

Face Vein

Gold - 0.7 Oz. per ton

Magnification x 26

Legend

Quartz ---

Pyrite---

Section 4 is similar to Section 3, consisting of pyrite and quartz.

Under the microscope, the constituents were found to be related as shown in the above sketch. Quartz fills the fractures in pyrite and is therefore the later of the two minerals. This agrees with the relationship found in Section 3.

SECTION 5 (a)

520 - High Grade

Gold - 5.9 Oz. per ton

Magnification = x 26

Legend

Quartz ---------

Pyrite ---------

Sphalerite ----

Calcite ---------

Electrum ---

Megascopically, Section 5 appears to consist of mainly quartz and sphalerite, with a small amount of pyrite in one corner. The sphalerite, seems to fill fractures in the quartz.

Under the microscope, sphalerite, pyrite, calcite and electrum were found in section 5 (a). Sphalerite appeared to fill fractures in the quartz and was therefore the later of the two minerals. Calcite was probably deposited last. The electrum was found adjacent to sphalerite and calcite.

SECTION 5 (b)

520 - High Grade

Gold - 5.9 Oz. per ton

Magnification = x 26

Legend

Quartz - - - - - -

Sphalerite - - -

Pyrite - - - - - -

The above sketch shows sphalerite filling fractures, proving it to be later than the quartz. The two small pieces of pyrite may have been brought in with the sphalerite or may be replacing it. This suggests that the pyrite was either contemporaneous with, or later than the sphalerite. In another view of this section, not shown, pyrite was found filling fractures in sphalerite, indicating that it was the later of the two minerals.

SECTION 5 (c)

520 - High Grade

Gold - 5.9 Oz. per ton

Magnification = x 26

Legend

Quartz ------ Pyrite - - - - -

Sphalerite- - - - Galena - - - - - -

Electrum- -

Section 5 (c) shows a fragment of electrum in quartz adjacent to sphalerite, and therefore probable contemporaneous with the latter. The shape of the pieces of sphalerite suggest that this mineral was later than the quartz. It is likely that galena and pyrite adjoining sphalerite were introduced at the same time as the latter

SECTION 5 (d)

520 - High Grade

Gold - 5.9 Oz. per ton

Magnification = x 26

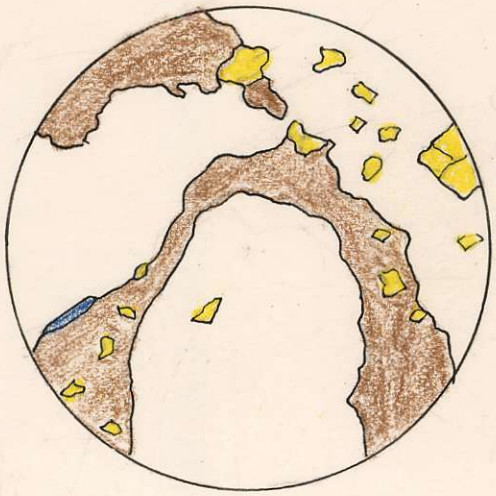
Legend

Quartz ------- Pyrite -------

Sphalerite---- Galena -------

In the above sketch, quartz is seen to be penetrating into pyrite, and is therefore later than the pyrite. Similarly, sphalerite at the top of the sketch is seen penetrating quartz, and therefore is the later of these two minerals. Galena near the middle of the sketch may have replaced pyrite, shpalerite and quartz. The fingers of galena suggest that this mineral was later than the quartz it penetrates.

SECTION 6 (a)



2 level - 92 Vein

Gold - 12.0 Oz. per ton

Magnification = x 26

Legend

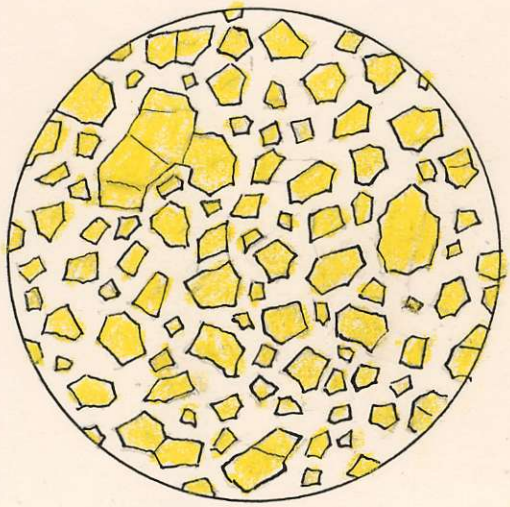
Quartz ------- Sphalerite -----

Pyrite ------ Galena -------

Megascopically, Section 6 seems to consist of pyrite, badly fractured and a small amount of quartz.

Under the microscope sphalerite and galena were found in addition to the above minerals. From the sketch sphalerite appears to be later than the quartz. Pyrite grains in the sphalerite indicate that these two minerals were contemporaneous. Pieces of pyrite in the quartz suggest that these two minerals were deposited at the same time. Galena also appears to have been introduced with the sphalerite.

SECTION 6 (b)



2 Level - 92 Vein

Gold - 12.0 Oz. per ton

Magnification = x 26

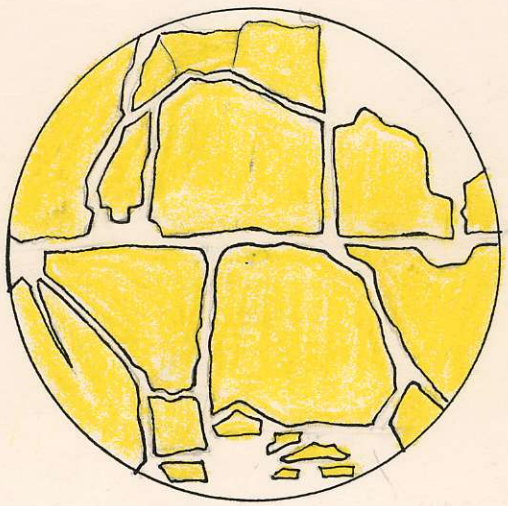
Legend

Quartz -

Pyrite -

The above sketch shows a typical microscopic view of the quartz and pyrite in Section 6. It is probable that the pyrite was deposited first and that after a period of shattering, quartz entered to fill the spaces between the pyrite grains.

SECTION 7



2 Level - 81 Vein

Gold - 2.4 Oz. per ton

Magnification = x 26

Legend

Quartz - -

Pyrite - -

Megascopically, this section appears to consist of a badly fractured mixture consisting of about 80% pyrite and 20% quartz.

Under the microscope quartz can be seen veining the pyrite as shown in the above sketch. This means that quartz was introduced later than the pyrite, following a period of shattering.

SECTION 8 (a)

2 Level - 83 Vein

Gold - 6.7 Oz. per ton

Magnification = x 26

Legend

Quartz ------ Pyrite ------

Sphalerite --- Galena ------

Megascopically, section 8 appears to consist chiefly of sphalerite with inclusions of quartz and one massive piece of pyrite.

Under the microscope, sphalerite, quartz, pyrite and galena were found to be related as shown in the above sketch. Quartz cutting sphalerite, which in turn cuts pyrite, suggests that the order of deposition was pyrite, sphalerite, quartz. Galena fragments in the sphalerite indicate the galena to be contemporaneous or later. Quartz in this section is probably of a later generation than that found in Section 1.

SECTION 8 (b)

2 Level - 83 Vein

Gold - 6.7 Oz. per ton

Magnification = x 26

Legend

Quartz - - - - - - -

Sphalerite - - - -

Pyrrhotite - - - -

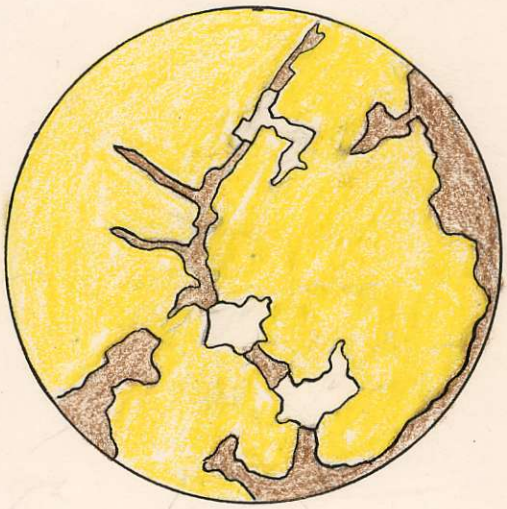
Chalcopyrite - - -

Gold - - - - - - - -

Electrum - - - -

Section 8 (b) does not provide any strong proof regarding the relationship of quartz and sphalerite. However, from evidence found in 8 (a), it can be assumed that the quartz was later than the sphalerite. The pyrrhotite fragments were introduced at the same time as the sphalerite. The gold in this section occurs in the quartz adjacent to sphalerite. A fragment of electrum was also found on the margin between sphalerite and quartz. From this evidence it looks as though the gold was introduced by a second generation of quartz, shortly after the deposition of sphalerite..

SECTION 8 (c)



2 Level - 83 Vein

Gold -.6.7 Oz per ton

Magnification = x 26

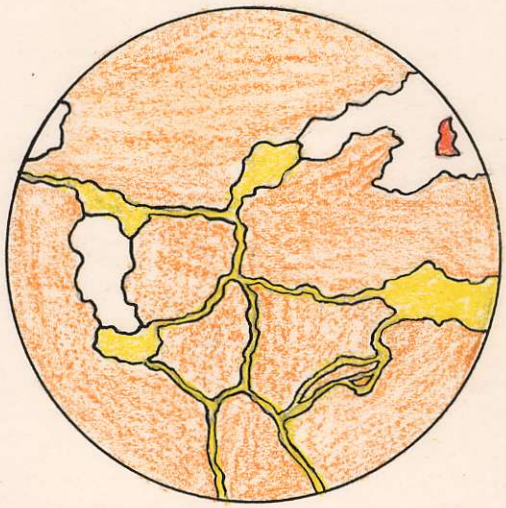
Legend

Quartz - - - - - - - Galena - - - - - -

Sphalerite - - - Pyrite - - - - -

This section gives further proof of the relationship between pyrite , sphalerite and quartz. The fracture-filling shown in the above sketch indicates that the sphalerite was later than the pyrite. The replacement of pyrite by quartz signifies that quartz was the later of the two. The order of deposition was therefore,first pyrite, second sphalerite and third quartz.

SECTION 9 (a)



3 Level - Queen Vein

Gold - 0.5 Oz. per ton

Magnification = x 26

Legend

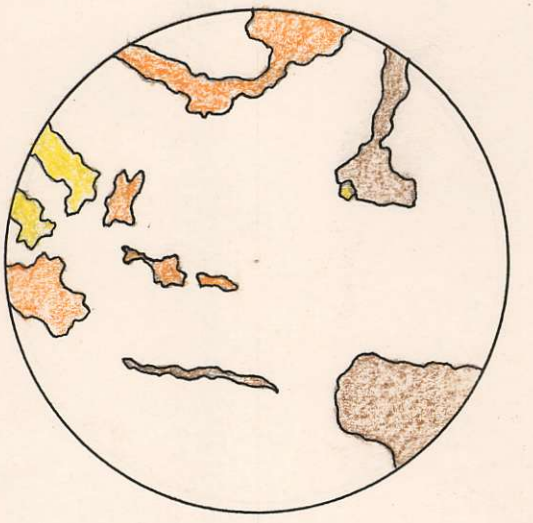
Quartz - - - - - - ▭ Pyrite - - - - - - - ▭

Pyrrhotite - - - - ▭ Chalcopyrite - - - ▭

Megascopically, Section 9 appears to consist of equal amounts of quartz and pyrrhotite. Parallel bonds of pyrrhotite are connected by veins of pyrrhotite in the quartz. This indicates that the pyrrhotite was later than the quartz.

The above sketch shows pyrite filling fractures in pyrrhotite showing that it was later than the pyrrhotite.

SECTION 9 (b)



3 Level - Queen Vein

Gold - 0.5 Oz. per ton

Magnification = x 26

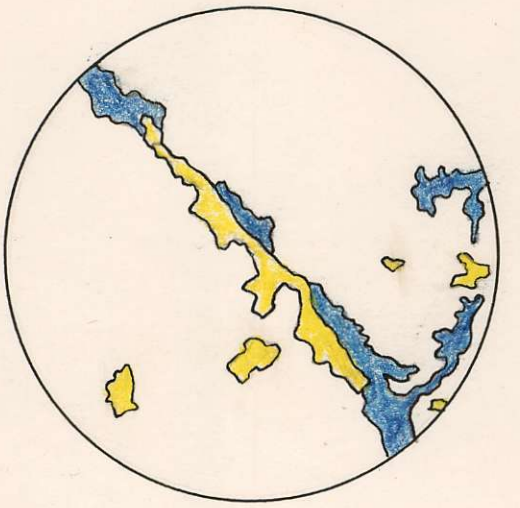
Legend

Quartz ------- ▭ Sphalerite---- ▭

Pyrrhotite---- ▭ Pyrite ------ ▭

The above sketch shows pyrrhotite, sphalerite and pyrite penetrating the quartz. This indicates that all these minerals were deposited later than quartz.

SECTION 10 (a)



5 Level - 75 Vein

Gold - 67.2 Oz. per ton

Magnification = x 26

Legend

Quartz - -

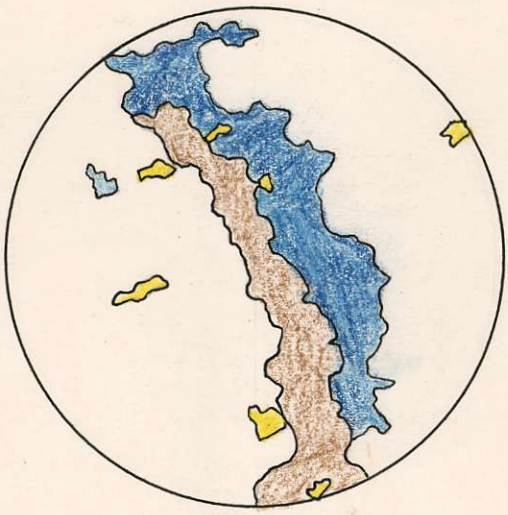
Pyrite - -

Galena - -

Megascopically, Section 10 appears to consist of quartz having a considerable number of fractures filled with pyrite and galena. An especially prominent, straight, continuous vein runs through the center of the specimen.

Section 10 (a) shows galena and pyrite filling the central fracture. It is obvious that these minerals were deposited later than the quartz.

SECTION 10 (b)



5 Level - 75 Vein

Gold - 67.2 Oz. per ton

Magnification = x 26

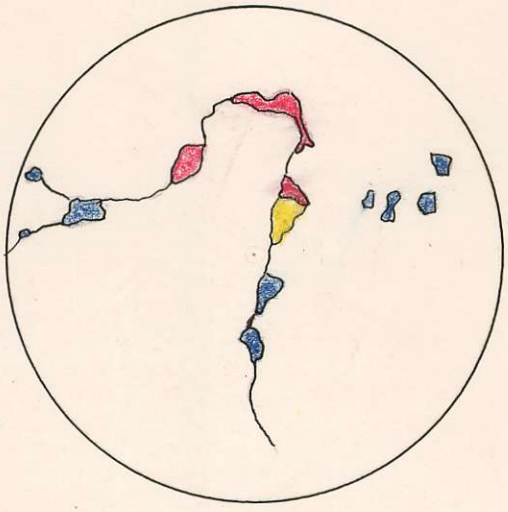
Legend

Quartz - - - - - - ☐ Sphalerite - - - - ▭

Galena - - - - - - ▭ Pyrite - - - - - - ▭

The above sketch shows sphalerite and galena filling a portion of the central fracture. It is apparent that these minerals were deposited later than the quartz. Fragments of pyrite in the sphalerite and galena suggest that the three minerals were deposited contemporaneously.

SECTION 10 (c)



5 Level - 75 Vein

Gold - 67.2 Oz. per ton

Magnification = x 26

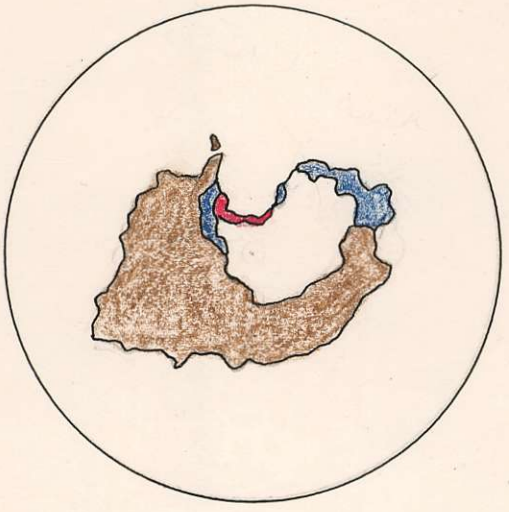
Legend

Quartz - - - - - - Galena - - - - - - -

Pyrite - - - - - - Gold - - - - - - -

Section 10 (c) shows gold occurring in a fracture adjacent to galena and pyrite. Therefore it is evident that the gold was deposited at about the same time as the galena and pyrite. The galena, pyrite and gold were obviously deposited later than the quartz.

SECTION 10 (d)



5 Level - 75 Vein

Gold - 67.2 Oz. per ton.

Magnification = x 26

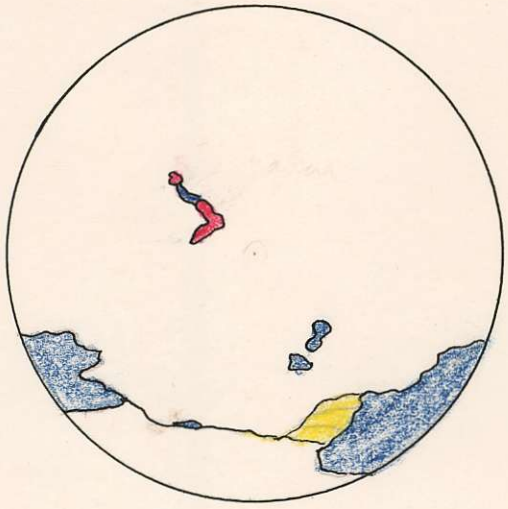
Legend

Quartz - - - - - - - Galena - - - - - - -

Sphalerite - - - - Gold - - - - - - -

Section 10 (d) shows glod occurring in a fracture adjacent to galena. It is probable that the order of deposition of minerals in this section was first quartz, followed by sphalerite, galena and gold. The galena seems to have replaced sphalerite.

SECTION 10 (e)



5 Level - 75 Vein

Gold - 67.2 Oz. per ton

Magnification = x 26

Legend

Quartz - - - - - ▭ Pyrite - - - - - ▭

Galena - - - - - ▭ Gold - - - - - - ▭

The above section shows gold in quartz which is not occupying a fracture. It appears that the gold was deposited at the same time as the quartz. The order of deposition of minerals in this section was probably quartz, pyrite, galena and gold.

About half the gold found in Section 10 was located in quartz, and not in contact with any metallic mineral. It is possible that quartz may have been re-dissolved when galena entered with gold, and the gold trapped in the quartz when it re-solidified. On the other hand, contemporaneous deposition of minerals in this section would explain the disseminationsof gold in quartz.

SECTION 11

7 Level - 92 Vein

Gold - 2.1 Oz. per ton

Magnification = x 26

Legend

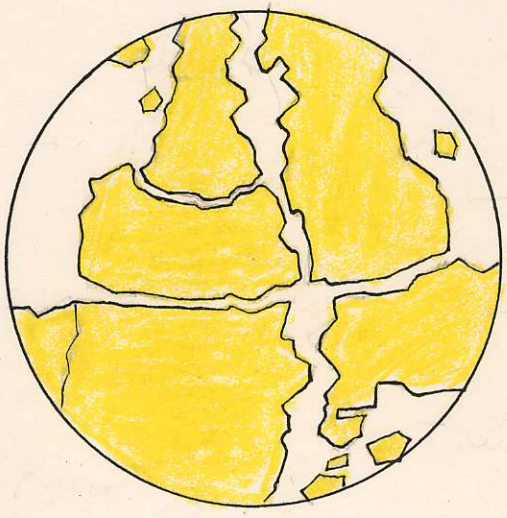
Quartz - -

Pyrite - -

Megascopically, Section 11 seems to consist chiefly of a light colored pyrite, with a few small veins of quartz.

A Sketch of a portion of Section 11, shown above, discloses a fracture in the pyrite to be filled with quartz. This means that the quartz was deposited later than the pyrite.

SECTION 12

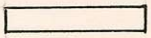


7 Level - 81 Vein

Gold - Trace

Magnification = x 26

Legend

Quartz - - 

Pyrite - - 

Megascopically, section 12 seems to be an intimate mixture of quartz and pyrite. The pyrite appears in some places to be filling fractures in the quartz.

Under the microscope, pyrite was seen filling fractures in quartz as shown in the above diagram. This means that pyrite was deposited later than the quartz.

QUEEN MINE ORE

Summary of Paragenesis

A summary of the order of deposition of minerals in Sections examined is as follows:

Section 1 - 810 Stope - East Ore Shute	Quartz, chalcopyrite. pyrrhotite
Section 2 - 760 Stope - West Ore Shute	Quartz, pyrrhotite, pyrite, chalcopyrite
Section 3 - West Ore Shute	Pyrite, quartz, sphalerite
Section 4 - Face Vein	Pyrite, quartz
Section 5 - 520 - High Grade	Pyrite, quartz, sphalerite, calcite, electrum galena, pyrite
Section 6 - 2 Level - 92 Vein - Elev. 3365	Quartz, pyrite, sphalerite, galena,
Section 7 - 2 Level - 81 Vein - " " 3395	Pyrite quartz.
Section 8 - 2 Level - 83 Vein - " 3410	Pyrite, (pyrrhotite and sphalerite) galena, quartz, gold, electrum
Section 9 - 3 Level - Queen Vein - Elev. 3220	Quartz, pyrrhotite, sphalerite, pyrite, quartz
Section 10 - 5 Level - 75 Vein - " 3070	Quartz, sphalerite, glaena, pyrite, gold
Section 11 - 7 Level - 92 Vein - " 2590	Pyrite, quartz
Section 12 - 7 Level - 81 Vein - " 2835	Pyrite, quartz.

Minerals Found in Queen Mine Ore

Sections of ore from the Queen Mine contained the following minerals in the order of their prominence, quartz, pyrite, pyrrhotite, sphalerite, galena, chalcopyrite, calcite, gold and electrum.

Quartz appears to have occurred in two generations. The first generation was found in most of the sections, in many cases cutting pyrite. Second generation quartz was found in Section 8 cutting and replacing sphalerite, and in Section 9 with second generation pyrite.

Pyrite seems to have occurred in two generations. One generation was the first mineral to be deposited. Sections 3, 4, 6, 7, 11 and 12 show this first generation mineral cut by quartz, showing that pyrite was deposited first. Second generation pyrite was found in Sections 2, 5, and 10 filling fractures in quartz, and in Section 9 filling fractures in pyrrhotite. Pyrite was not so prominent in intermediate levels as in shallow and deep levels. Ninth level samples not included in this group of Sections contained much pyrite along with quartz.

Pyrrhotite was found in massive form as shown in Section 9 (a) and as disseminations in Sections 1 and 2. Disseminations consisted of irregular jagged fragments, or as fracture-fillings in quartz, proving that the mineral was deposited later than quartz. In Section 9, pyrrhotite appears in a banded structure in quartz, suggesting possible contemporaneous deposition, probably from the sides of the vein toward the center. This mineral was found to be most

abundant in intermediate levels.

Sphalerite was found in massive form in Sections 5 and 8. In sections 5 and 10, it was found occupying fractures in quartz, proving it to be later than the quartz, In Section 8 it was found to be deposited later than first generation pyrite and earlier than second generation quartz. Little evidence was found to show the relationship between sphalerite and pyrrhotite. Section 8 (b) indicated that these two minerals were deposited contemporaneously. However, due to the fact that sphalerite is a much lower temperature mineral it was concluded that this mineral was deposited later than pyrrhotite.

Galena occurs in small disseminations usually in contact with sphalerite. In section 5 (c) and 10 (d) galena appears to have replaced sphalerite. In Section 5 (d), 8 (a) and 10 (b) galena and shpalerite appears to be contemporaneous. In Sections 5, 8 and 10, galena was usually found to be adjacent to the gold or electrum . Galena was not found below the 5th level.

Chalcopyrite was found in very small disseminations in quartz in Sections 1 and 2. It appeared to be contemporaneous with the quartz in Section 1, and later than the quartz in Section 2.

Calcite was found only in Section 5 (a). Here it appeared to be a marginal replacement of sphalerite. A large particle of electrum was found in a fracture near the calcite.

Gold was found in Sections 8 and 10. In Section 8 (b)

it was seen filling a fracture in quartz adjacent to sphalerite. In Section 10 (c) it was located in a fracture along with galena and pyrite, and in Section 10 (d) it filled a fracture between two deposits of galena; In Section 10 (e) it was found as a dissemination in quartz along with galena and was not located in a fracture. In Section 10 many fragments of gold were found in quartz, where there was no indication of a fracture. In general, gold found in sections appeared always to be in close proximity to galena and sphalerite. However, its occurrence as disseminations in quartz is difficult to understand. It is possible that the quartz was redissolved during the introduction of galena, sphalerite and gold, and was thus enabled to absorb the precious metal. Also, it is possible that quartz, galena, sphalerite and gold were introduced at the same time, thus enabling the gold to appear with any of these minerals.

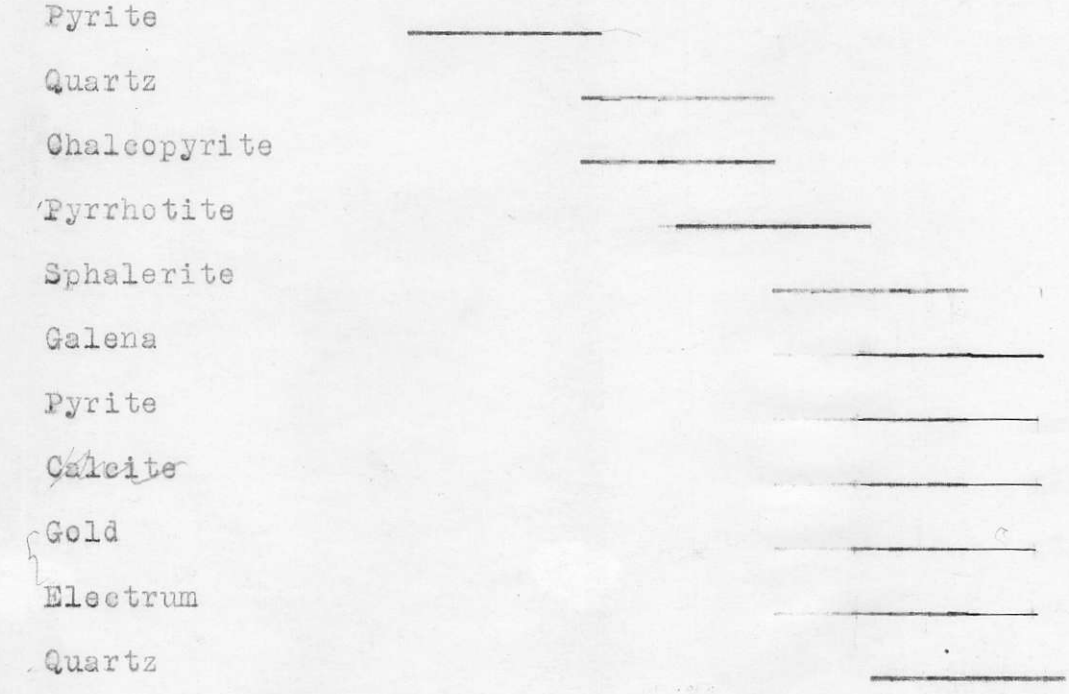
Electrum was found in two sections. In Section 5 (a) it was found in a fracture adjoining sphalerite, and very close to calcite. In Sections 5 (c) and 8 (b) small particles of electrum were found adjacent to sphalerite.

Probable Paragenesis

As a result of the microscopic examination of the minerals from the Queen Mine, it seems probable that the deposition of minerals occurred in the following order:

1. Introduction of pyrite
2. A period of fracturing
3. Introduction of quartz and chalcopyrite
4. A period of fracturing
5. Introduction of pyrrhotite
6. Introduction of sphalerite
7. Introduction of galena, pyrite, calcite, gold and electrum
8. Introduction of quartz

The paragenesis represented graphically is as follows:



CONCLUSION

As a result of this microscopic examination of mineral samples, the following conclusions have been reached concerning the mode of occurrence and associations of gold in the Queen Mine ore:

1. A considerable amount of gold and electrum was found to exist in fairly coarse grains.

2. In several samples shown by assays to contain good values, no gold was found under the microscope. This indicated that the precious metal must have been present in extremely fine grains.

3. Gold and electrum were found to occur chiefly with galena, sphalerite and calcite. Galena existed in all sections containing large amounts of the precious metal. As galena does not occur at great depths, the gold which is associated with it is not likely to persist at depth.

4. The deposition of gold in the vicinity of galena and sphalerite may have been promoted by electrostatic forces set up by the minerals having different electrical properties.

The deposition of gold near calcite may be explained by the ability of calcite to cause gold to "gel" from the colloidal solution in which it is thought to (have been) suspended.

5. About half the gold found was located in veins adjacent to galena, sphalerite and calcite. The other half was found disseminated in quartz, and not occupying fractures. It is possible that quartz may have been redissolved during the introduction of gold, making possible the absorption of

the precious metal. On the other hand, the quartz, galena, sphalerite, calcite and gold may have been deposited simultaneously, making possible the distribution of gold amongst all these minerals.

6. Gold was amongst the latest minerals to be deposited, and therefore may have been associated with the second generation of minerals.

Recommendations

As a result of the above information obtained from the microscopic examinations, the following recommendations are offered.

1. Gold in this ore seems to be associated with galena and therefore will not be likely to persist with depth. Consequently no further extensions of workings to greater depths should be made before exhaustive investigations and studies have been made regarding this probability.

2. A great deal of the gold occurs in very finely divided state. Therefore it is advisable to grind the ore very fine in order to separate the precious metal from the other minerals. The most suitable method of extracting the gold is straight cyanidation as there are no minerals in the ore which interfere with this process. The amount of chalcopyrite found was too small to have any appreciable effect on recoveries.

APPENDIX

Table 1 - Assays of gold in polished sections

Table 2 - Etch tests for minerals found in Sections

Plate 1 - Map showing location of the Queen Mine

Plate 2 - Longitudinal Section - Queen Mine

Plate 3 - Photographs of gold in Section 10

Plate 4 - Geological Map - Salmo Sheet

Table 1

List of Assays

Queen Mine Ore

Section	Location	Assays Oz. per ton
1	810 Stope - East Ore Shute	0.6
2	710 Stope	0.4
3	West Ore Shute	0.7
4	Face Vein	0.7
5	520 - High Grade	5.9
6	2 Level - 92 Vein	12.1
7	2 Level - 81 Vein	2.4
8	2 Level - 83 Vein	6.7
9	3 Level - Queen Mine	0.5
10	5 Level - 75 Vein	67.2
11	7 Level - 92 Vein	2.1
12	7 Level - 81 Vein	Trace

Table 2. Etch Tests for Minerals

Mineral	H.	Colour	HNO_3	HCl	KOH	$FeCl_3$	$HgCl_2$	KCN	Remarks
Calcite	2	gal. white	Eff.	Eff.	N.	N.	N.	N.	Eff. HCl dist.
Chalcopyrite	3	yellow	sl.eff. tarnish	sl.eff. tarnish	N.	stains orange	N.	stain orange	yellow color dist.
Electrum	2	light yellow	sl.eff.	N.	N.	N.	stain black	stain black	$HgCl_2$ stain dist.
Galena	2	gal. white	stain bluish	N. or sl. tarnish	sl. tarn.	stain red yellow	N.	N.	Cub. cleavage triangular pits.
Gold	2	gold yellow	N.	N.	N.	N.	N.	stain black	KCN stain dist.
Pyrite	5	pale yellow	N.	N.	N.	N.	N.	N.	H. & color dist.
Pyrrhotite	3	pink brown	N. or sl. tarnish	N.	sl.eff. tarnish	N.	N.	N.	Color dist.
Sphalerite	3	dull grey	bluish irid.	N.	N.	N.	N.	N.	Resinous color under arc.

PLATE 1.

Map Showing Location of the Queen Mine

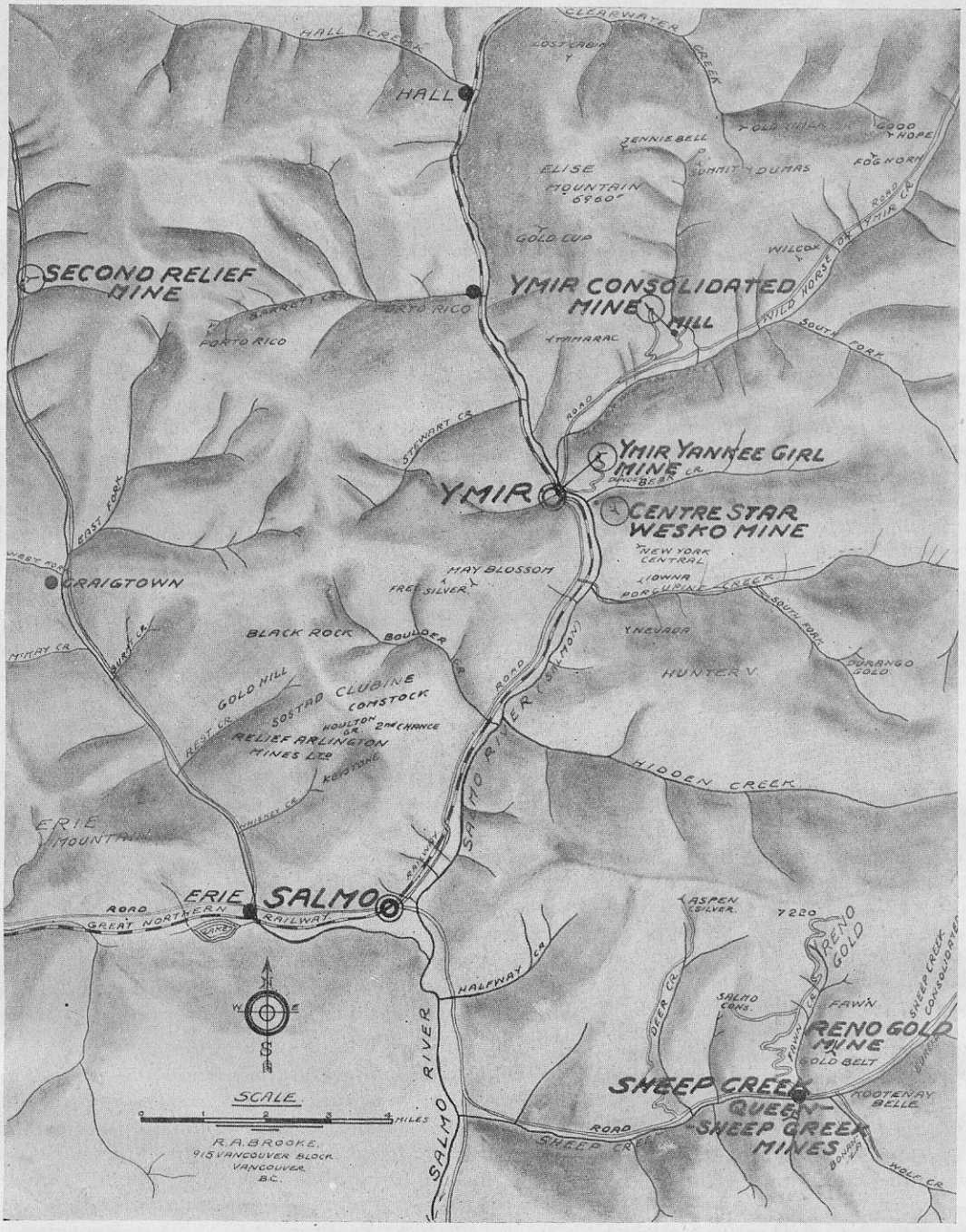


PLATE 2.

Longitudinal Section - Queen Mine

1 date

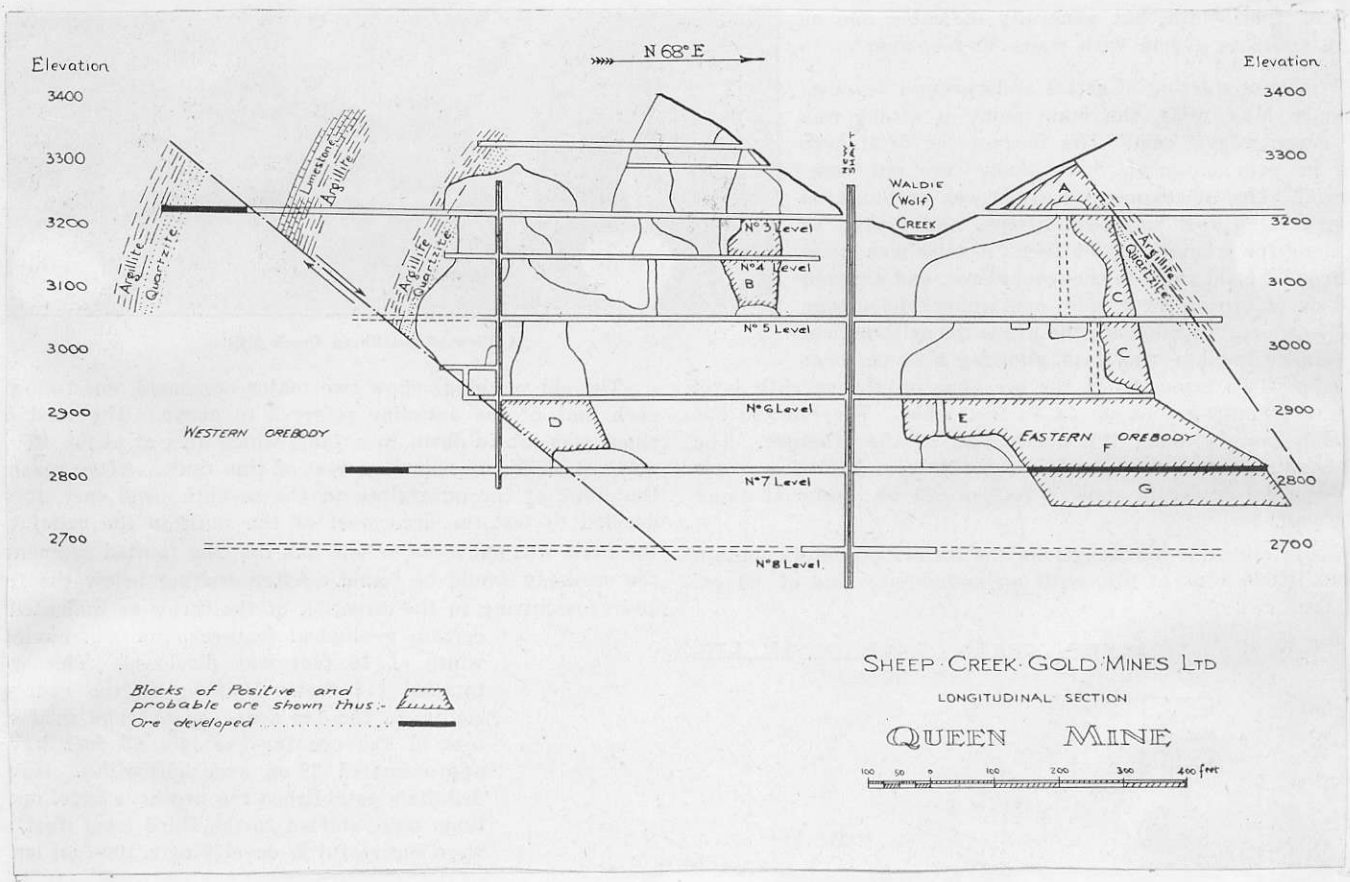
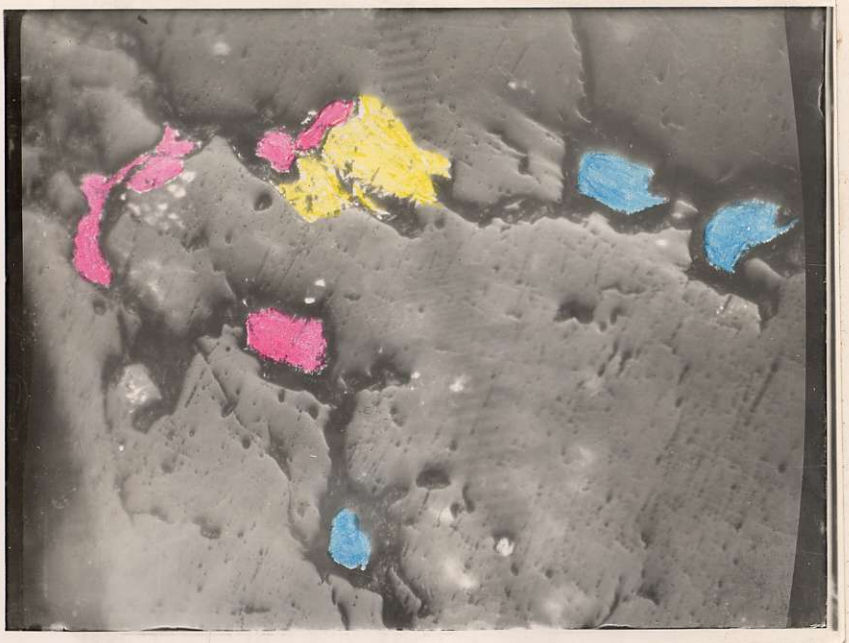


PLATE 3

Photographs of Gold in Section 10

Magnification = x 50



Gold ---- Galena ----

Pyrite ---- Sphalerite ----