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Report on the Ore from Bayonne Mine

by

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PREFACE

The following report deals with the mineragraphic examination of ore from the Bayonne Mine.

The writer wishes to extend his thanks to Doctor H.V. Warren for his valuable guidance during the investigation and also to Mr. W.H. White for his help in the polishing and with the assays.

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1. Geology

General. The claims cover gently sloping, well-timbered summit country. They are located toward the Southern extremity of a batholith which itself is related to another known as the Nelson. This batholith which is called Bayonne, consists of granite rocks several hundred square miles in area extending for the most part along and west of Kootenay Lake.

A main vein system consisting of a series of fissures cuts the granodiorite of the Bayonne Batholith in a direction North 60° to 85°, and dips at from 80° to 85° to the south. Pyrite, with some galena and sphalerite, make up the ore minerals, while the vein filling is quartz and altered granite. In the upper portion of the veins the pyrite, with which the gold values are chiefly associated, is largely altered to limonite. The main system of fissuring includes two parallel veins, of which only one has been developed underground. A characteristic feature of these veins is their persistency along the strike. In nearly every case open cuts expose a strong quartz vein, which consists in some of the cuts of a foot- and hanging-wall band of quartz with horsts of decomposed country rock between.

11. MINERALOGY

Megascopically the ore shows dissemination of sulphides in quartz.

Two generations of mineralization are evident, with the result that the structural features of the minerals are different. The older mineral is fractured and cemented by younger ones, which appear under the microscope as veinlets cutting the older minerals at all angles. This fracturing accounts for the friability of the ore, which was especially displayed during the preparation of the polished sections.

As a result of microscopic examination, the following metallic minerals, in order of their relative proportions, were found to be present in the ore:

1. Pyrite.
2. Sphalerite.
3. Galena--both fresh and altered to a secondary sulphate
4. Tetrahedrite.
5. Chalcopyrite .
6. Secondary Copper Mineral--possibly Covellite.
7. Gold.

1. Pyrite.

This mineral was found to be the most abundant metallic constituent. It fills the fractures in a quartz gangue, and appears well distributed among the other sulphides. It is much fractured and the fractures are filled with sphalerite, galena and altered galena.

2. Sphalerite.

This is the second predominating metallic sulphide of the ore. It occurs as irregular anhedral masses in association with chalcopyrite and galena, or fills the most fractured portions of the pyrite.

3. Galena.

The sulphide of third importance occurs also as irregular anhedral masses in association with sphalerite, the alteration product, and tetrahedrite. Characteristic triangular pitting and numerous lines of cleavage at 90° to each other are prominently displayed. Though much of the galena is fresh, an alteration product consisting of a sulphate of lead, probably anglesite, is noticeable throughout the sections.

4. Tetrahedrite.

This sulphide, although not present in any one large mass, is scattered throughout the galena.

It occurs in irregular veinlets on the galena-pyrite boundaries and alsp as islands in the galena.

5. Chalcopyrite.

There was noticed very little chalcopyrite in the ore but that present occured as islands scattered through the sphalerite.

6. Unknown Secondary Copper Mineral.

One unknown mineral was found in the ore in quantities insufficient for a complete microchemical examination. It is found in association with quartz, pyrite, and galena.

Color--Light indigo blue

Hardness--2+

Etching test--Darkened with KCN which must be accepted with reservations as the size of the mineral grains made the test not conclusive.

7. As no gold was found in the sections used to find the sulphide relationships it is discusses later.

111. PARAGENESIS.

Following is the attempt to tabulate the order in which the different constituents of the ore have been deposited:

(1) Quartz

(2) Pyrite

(3) (Sphalerite
(
(Galena

(Chalcopyrite
(
(Tetrahedrite
(4) (
(Secondary Galena
(
(Unknown sec. Copper mineral

Quartz and Pyrite are the oldest minerals--both are much fractured, and megascopically both tend to show crystal faces. The fractures are being healed by other sulphides. Because pyrite fills the fractures in the quartz, it is assigned the second place in order of deposition. The sulphides, sphalerite and galena, are presumably next in the order. They predominantly fill the fractures in the pyrite. They are intergrown where present together and these facts indicate their contemporaneous order of deposition which follows those of quartz and pyrite.

The other sulphides, chalcopyrite and tetrahedrite, are considered third in order and contemporaneous.

The Alteration of the Galena and the formation of the Secondary Copper Mineral (possibly alteration of chalcopyrite)has taken place after mineralization.

IV. Description of Sections.

Section# 1. On this polished section all principal sulphide constituents of the ore and some quartz are present. The pyrite shows a tendency to develop crystal faces. The pyrite is fractured and the fractures are healed by the galena and sphalerite. This section also shows the galena and sphalerite with more or less mutual boundaries.

Section# 2. This section shows the sphalerite with inclusions of quartz and chalcopyrite. This was the only section where the chalcopyrite was seen.

Section# 3. This is similar to section #1. It shows fracturing of the pyrite and definite healing of the fractures by sphalerite. The pyrite shows definite crystallization.

Section# 4. This section shows the relationship between the sphalerite and galena. The mutual boundaries are denoted while an irregular veinlet of galena runs through the sphalerite. The section also shows the sulphate of lead--alteration product after galena. There is much of this alteration product throughout the sections.

A small amount of tetrahedrite will also be noted on the boundary between the galena and its alteration product.

Section# 5. This shows fractures in pyrite being filled by galena and also an irregular veinlet of tetrahedrite on the border between the pyrite and galena.

Section# 6. On this section is seen the secondary copper mineral replacing the quartz and pyrite. It is probably contemporaneous with the lead sulphate.

ILLUSTRATION No. 1
from section No. 1

Mag. 70 x

General Sulphide Relationships.

Sphalerite

Galena

Quartz

Altered Galena

Pyrite

ILLUSTRATION No. 2
from Section No. 1

Mag. 70 x

Association of Chalcopyrite with Sphalerite.

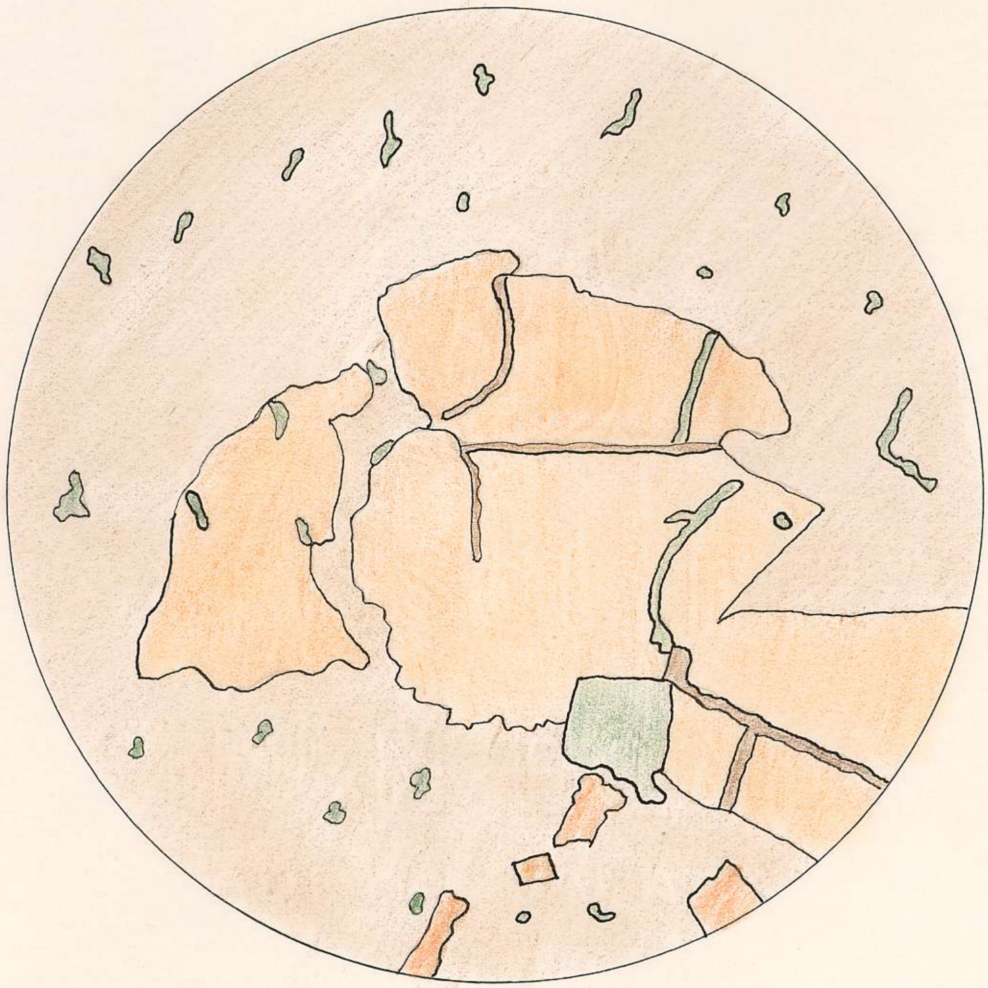
Sphalerite

Chalcopyrite

Quartz

ILLUSTRATION No. 3
from section No.2

Mag. 70 x



Shows definite tendency of pyrite to crystallize.

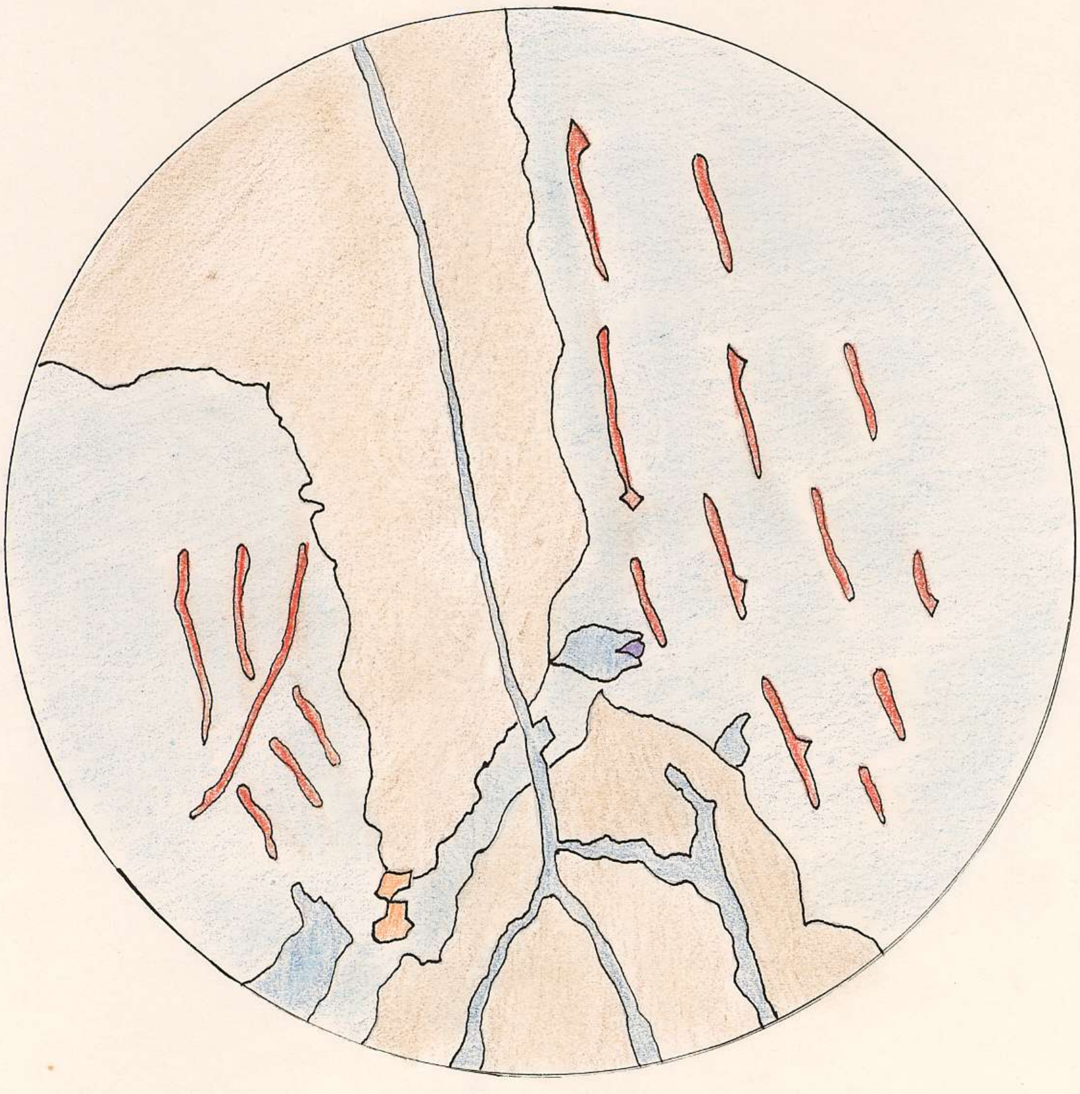
Sphalerite

Pyrite

Quartzo

ILLUSTRATION No. 4
from section No. 2

Mag. 70 x

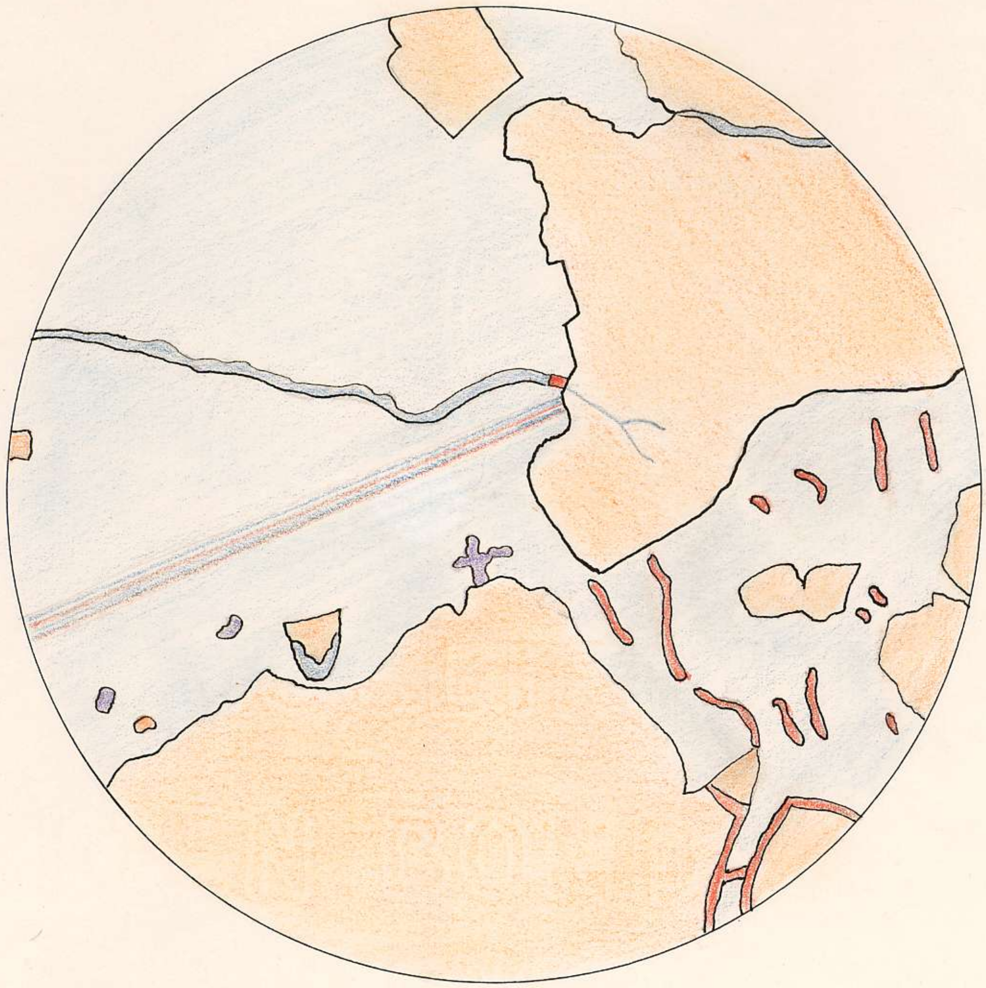


This shows the mutual boundaries between the galena and sphalerite; also the alteration of galena and a small amount of tetrahedrite.

Spholerite | Galena
Pyrite
Tetrahedrite | Altered Galena

ILLUSTRATION No. 5
from section No. 3

Mag. 70 x



Showing irregular veinlet of tetrahedrite.

Galena

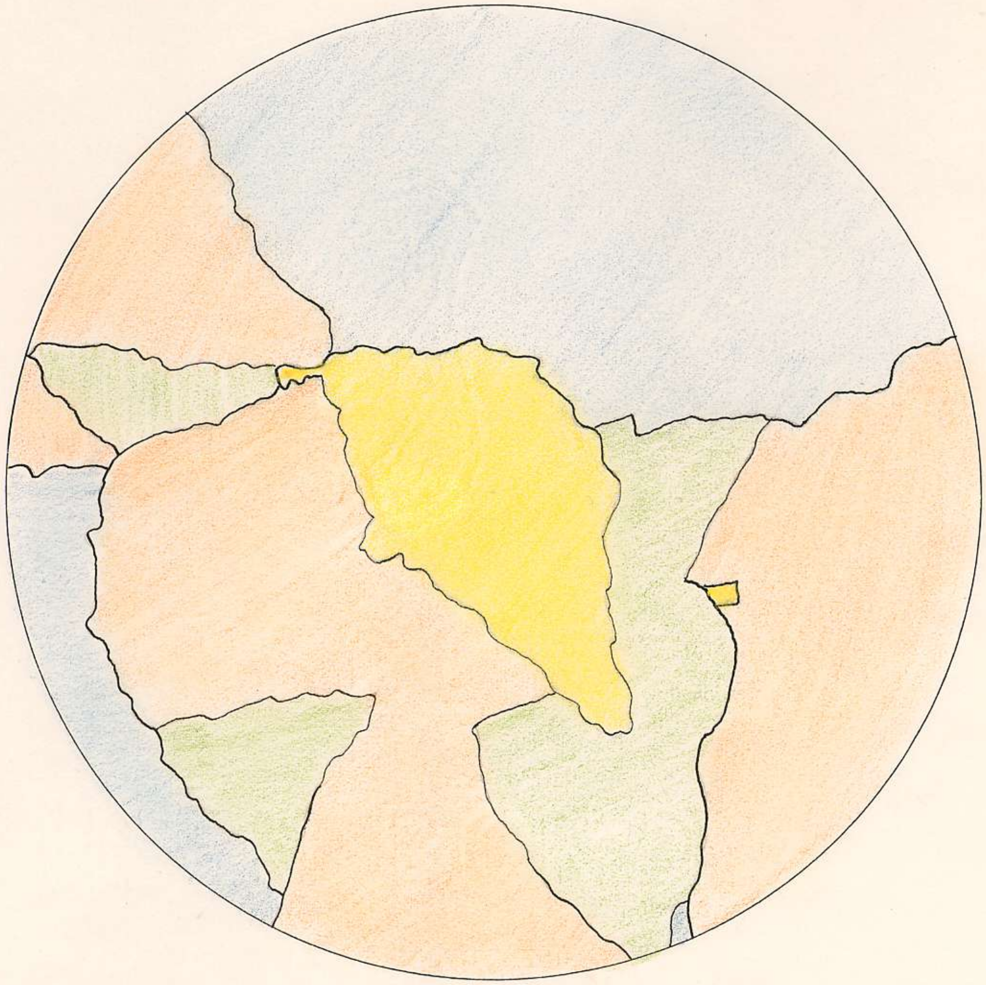
Pyrite

Altered Galena

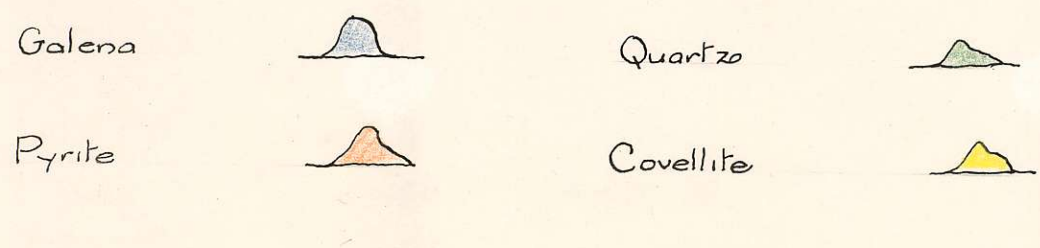
Tetrahedrite

ILLUSTRATION No. 6
from section No. 3

Mag. 250 x



Showing the Secondary Copper mineral.



V. Assay Results

The foregoing work was done under a medium power microscope. Since the gold was too fine to be observable with that magnification, some of the ore was broken up, hand picked, and assayed in an endeavour to find the relationship between the gold and the sulphides.

The assays ran as follows:

Sample 1. Picked products of "B" Material.

	Composition		Oz. Au / Ton
Sample 1.	PbS	Galena	------
" 2.	FeS_2	Pyrite	0.96
" 3.	ZnS	Sphalerite	------
" 4.	FeS_2+ZnS	Pyrite & Sphalerite	Trace
" 5.	Mixed Metallics		0.16

From this it was found that the gold followed the pyrite.

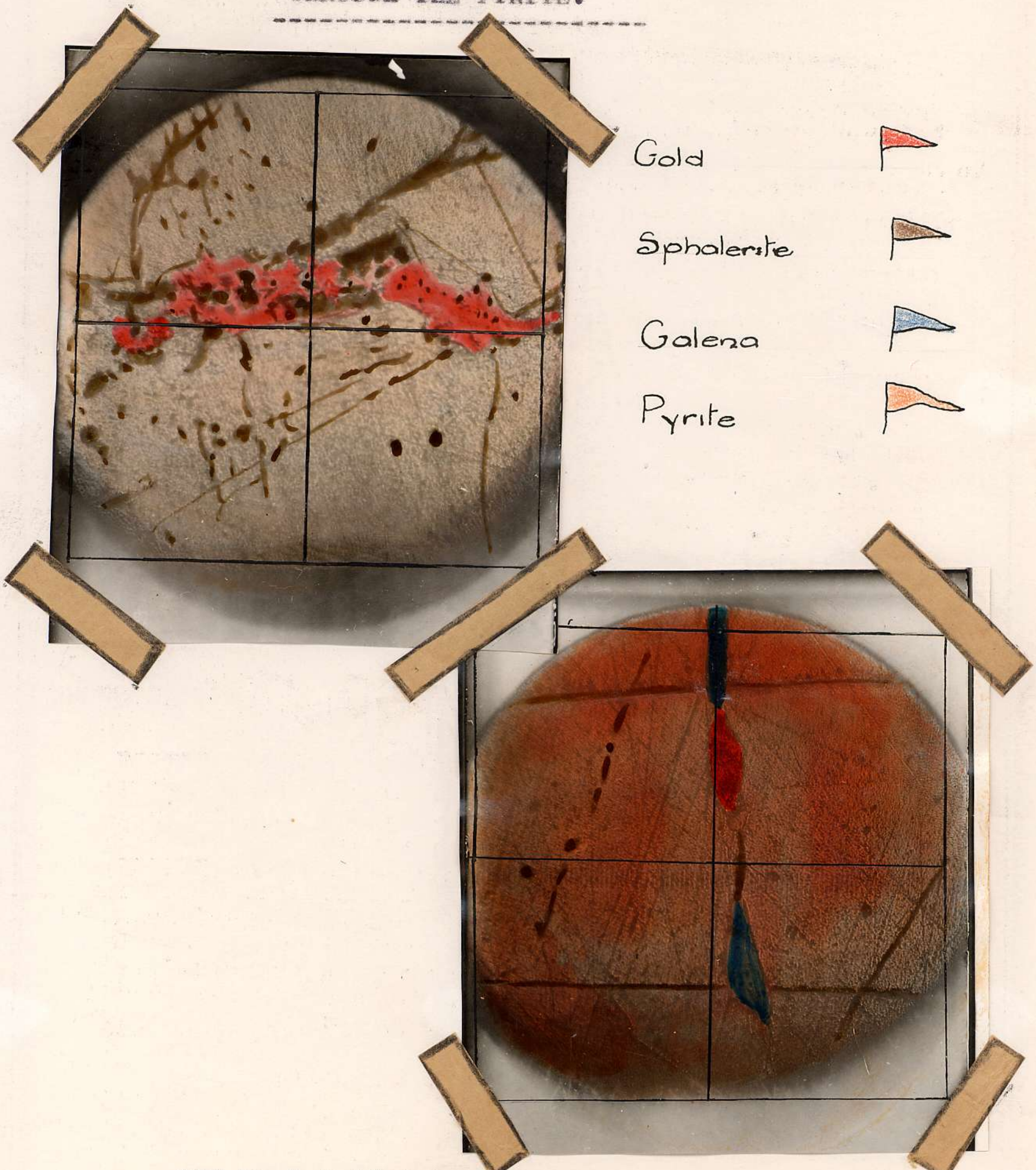
VI. Special Section Cut Through Pyrite.

A section was then cut through the pyrite and polished. After polishing, the specimen was placed under a high-powered microscope (260 diameters) and the relationships ascertained.

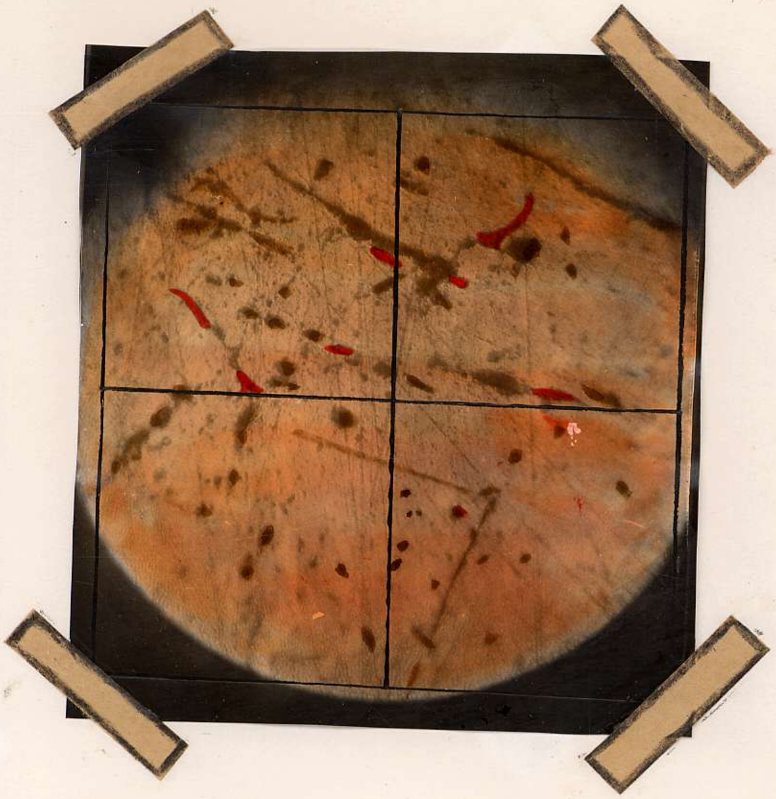
This also showed the alteration of pyrite and galena.

PHOTOGRAPHS OF POLISHED SECTION

THROUGH THE PYRITE.



100 Mesh Grid Superimposed.

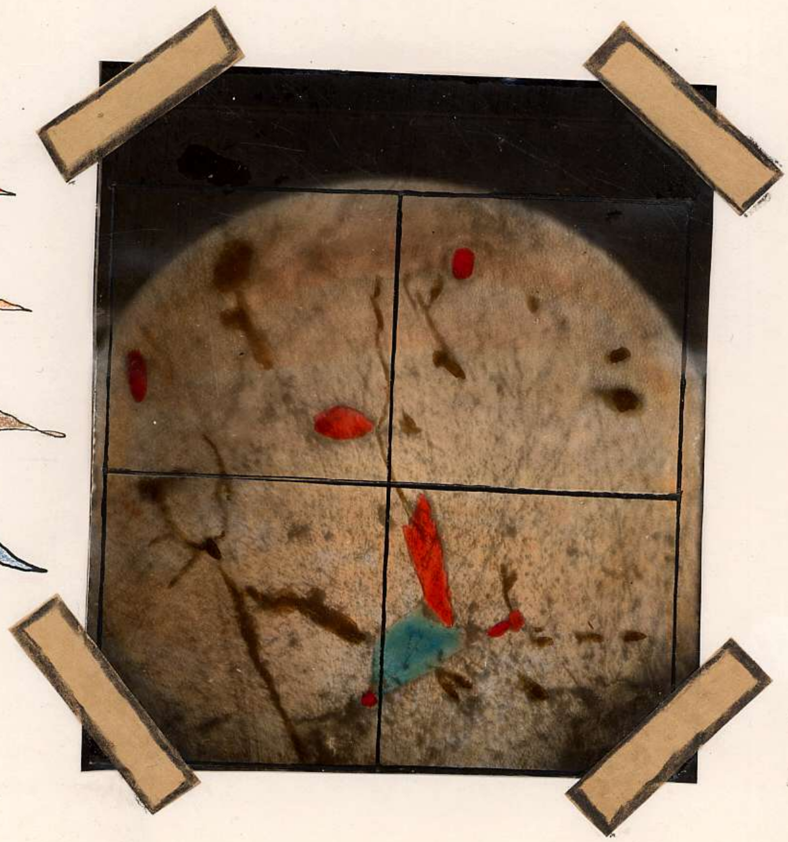


Gold

Pyrite

Sphalerite

Galena



VII Screen Analysis.

A representative portion of the portion of the section was traversed and the gold grains measured in microns.

	Area in Sq. μ.	Mesh
1.	750.0	-325
2.	2142.0	-325
3.	4740.0	-325
4.	12450.0	-325
5.	28750.0	-270 + 325
6.	2850.0	-325
7.	2130.0	-325
8.	213.5	-325
9.	266.5	-325
10.	847.5	-325
11.	623.0	-325

It can be seen from the above table that, assuming the area to be proportional to the volume, fifty per cent of the gold is in large grains; 97.5 per cent will be exposed by the 325 mesh and about one half of the remainder may possibly be exposed on 325 mesh.

The gold is of sufficient coarseness to suggest the desirability of making a concentration before cyanidation, possibly by blankets.

The larger grains of gold follow fractures; therefore they will be easily exposed, while the smaller particles are as islands in the pyrite and will be much harder to free for cyanidation.

VIII CONCLUSIONS

1. The gold values of the ore are associated with the pyrite, while the mixed sulphides are secondary carriers, probably due to the pyrite therein.
2. The distribution of the gold values in the pyrite is dependent on the amount of fracturing and degree of crystallization of this mineral. This was inferred from the assays of the carefully selected grains of the fractured and well-crystallized pyrite.
3. The gold is of the fissure-vein type of the mesothermal zone of deposition. It occurs in unaltered pyrite and is primary.

The galena has been altered in places to anglesite and this factor suggests that some changes in milling practise will be found necessary as mining progresses deeper.

The first two conclusions are very suggestive of the deposition of gold from solution upon the crystal faces of the pyrite or along the planes of its fractures. They also point to a deposition of gold approximately contemporaneous with that of sphalerite and galena, in which case gold, displayed a marked tendency to be precipitated on the crystal faces of a mineral already crystallized.
