600172

A MICROSCOPIC STUDY

of the

LUCKY STRICK GOLD ORE

Submitted in fulfilment of the
requirements for credit in
Geology 9.

by

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Contents

Introduction

Location of the Mine

The Lucky Strike group of seven claims is situated in Taylor Basin at the head of Taylor Creek, a tributary of Tyaughton Creek which in turn flows into Bridge River. The summits of the broad ridges which form the boundary of the basin are about 8000 feet in elevation, and the basin floor near the mine is about 2000 feet lower. The elevation of the surface workings is about 6600 feet, and the adit is located at 6275 feet above sea level towards the western end of Taylor Basin.

A road about 11 miles long has been completed to connect the camp with the Bridge River road at a point 37 miles from Bridge River station on the Pacific Great Eastern Railway.

Microscopic Study and Acknowledgments.

Previous microscopic studies of the Lucky Strike ore have been made by the Department of Mines, Victoria, and in 1938 by Mr. Daniel Lee, a senior student in mining engineering.

The present report is the result of a study performed during the months of January to April, inclusive, 1939.

The writer wishes to express his indebtedness to the patient assistants of the Geology Department and especially to Dr. H. V. Warren whose words of encouragement and assistance made this work possible.

Bibliography

The following sources of information were referred to in compiling this report:

Report of the B. C. Minister of Mines, 1933.

Contains the results of the assays of the first surface showings.

Report of the B. C. Minister of Mines, 1936.

Describes the location, workings and assays of the mine as well as the regional and detailed geology of the ore bodies.

General Geology

The oldest underlying rocks exposed consist of highly metamorphosed sediments of the Bridge River Series. Overlying these are the serpentines of the Shulaps Volcanics and the Eldorado series referred to the lower Cretaceous. The latter sediments are locally represented by outcrops of argillite, gray feldspathic sandstone, and conglomerate. Intruding these sediments are large bodies of diorite mapped as being related to the Bendor batholith. This diorite contains narrow quartz-arsenopyrite veins.

Descriptive Geology of the Ore Deposit

On Lucky Strike ground the geological conditions are complex. The deposits occur in lenses along the walls of dikes cutting serpentine and altered rock consisting largely of ferruginous carbonate.

The dikes strike north and are generally vertical, 4 to 10 feet wide, and underground are fine grained and porphyritic consisting of a highly altered complex of sericite, chlorite, and feldspar. This rock is classified as altered latite porphyry. South of the dike are irregular areas of hornblende diorite merging into a dense dark serpentinized rock without definite boundaries.

The mineralization consists mainly of sulphide streaks and masses in irregular lenses on one or both sides of the dikes, also penetrating them in places. The gangue is generally silicified altered rock with minor amounts of quartz, calcite and bright green chlorite.

The metallic minerals found in abundance were sphalerite and jamesonite in irregular masses, pyrite in cubes up to 2 mm. veined by the other sulphides, and chalcopyrite occurring as ex-solution blebs in sphalerite.

Mine Sampling and Assays

The surface showings of the Lucky Strike claims, which were examined, are along the east side of a basic dike from 8 to 10 feet wide which is nearly vertical. It cuts brown-weathering soft rock, probably weathered serpentine, and the contacts are marked by about 6 inches of oxidized decomposed material containing sulphide remnants. Exposed at another part of the dike is a 56 inch width of oxidized green stained material containing masses and bands of sulphides in which sphalerite and pyrite predominate. A sample across 56 inches assayed: gold, 12 oz. per ton; siver, 3 oz. per ton; and zinc, 10.1 percent. Across three feet a sample assayed: gold, 1.02 oz. per ton; silver, 6 oz. per ton; and zinc, 18.3 percent.

Another showing of the vein-outcrop splits into stringers at the southern end and at the other end it is curved and dragged by an apparent reverse fault. The vein consists of banded sulphides and decomposed streaks between smooth vertical walls.

In the northerly section the dike is 4 to 5 feet wide with the western wall showing evidence of shearing and the eastern wall poorly defined. Mineralization is present on both sides of the dike and the two pay-streaks join at one place to form a short lens across the width of the drift.

Taken from along a 40 foot length of the western wall the following samples were assayed: Across 6 to 8 inches, gold,.40 oz.per ton; silver .6 oz. per ton. Across 64 inches, gold, .74 oz. per ton; silver, 2.8 oz. per ton; zinc, 4.7 per cent; antimony, 4 percent; and arsenic, 1.15 percent. Across 4 inches, gold, .6 oz.per ton, and silver,2 oz. per ton.

Samples taken along the eastern wall gave the following assays: Across 10 inches in a 2 foot lens, gold, .40 oz. per ton, and silver,.6 oz. per ton. A lens narrow to 24 inches across assayed: gold, 1.3 oz. per ton, and silver, 1.2 oz. per ton.

Irregular mineralization in the winze 11 feet deep consists of massive sulphides which assayed on the north and south sides respectively: Across 7 feet 6 inches, gold,.44 oz. per ton; silver, 3 oz. per ton; and arsenic, 5.3 percent. Across the same width, gold, .5 oz. per ton; silver, 1 oz. per ton; sinc, 8.2 percent; and arsenic, .65 percent.

The Suite of Ores.

The suite of Lucky Strike ores is comprised of samples brought from the mine by Mr. E. A. Schmidt late in 1936. Although the samples are labelled with numbers, there is, in most cases, no indication as to where they were located. Consequently no corelation between geological structure and mineral occurrence can be made, and this study, therefore, is less valuable with respect to the mine itself than it might otherwise have been.

Megascopic Description of the Specimens.

The specimens in general contain noticeably little quartz or other gangue mineral. In the hand they appear to be composed of fractured sulphides showing, in some places, a marked banded structure. A megascopic examination of the polished sections reveals the latter characteristic clearly, and after the minerals have been identified, the following general features may be noted.

Section No. 1.

This polished section is typical of the sample, being composed of large masses of closely associated pyrite and arsenopyrite through which other sulphides, quartz and calcite are irregularly scattered. Pyrite appears to be the more favored host for these minerals. There is scarcely any evidence of zoning to be seen in this section.

Section No. 2.

The minerals observed in this section by the unaided eye are the common sulphides: pyrite, arsenopyrite, pyrrhotite, and sphalerite. A definite boundary is seen beyond which pyrite and arsenopyrite are practically absent. Parallel, in general, to this boundary and throughout the pyritic area, zones of sphalerite and pyrrhotite are observed.

Section No. 3.

Definite banded structure is the prominent feature of this section. Pyrite and arsenopyrite as fractured and intergrown areas form a large mass which is bordered on one side by massive quartz, and on the other by quartz and arsenopyrite particles which form a banded structure in a ground-mass of jamesonite.

Section No. 4.

This ore specimen is composed of highly fractured pyrite, arsenopyrite, and quartz, with calcite and probably some chlorite filling the fractures.

(Note: Because of the friable nature of the specimen, the section was not successfully polished, and the examination of the specimen could be carried no further.)

Section No. 5.

This section shows a banded structure even more definitely than does Section No. 3. Within the zone of jamesonite are elongated masses of sphalerite while the borders of the zone are lined with particles of quarts. There is no arsenopyrite to be seen in this section, but fragmental and roughly banded pyrite are thickly scattered through a groundmass of quartz. Calcite particles run generally parallel to the banding throughout the quartz areas, and a zone of calcite is gound at one edge of the section.

Section No. 6.

Quartz and calcite form the ground mass in this section for irregular masses of pyrite and crystalline forms of arsenopyrite. Jamesonite is disseminated in irregular particles throughout the calcite region and to some extent in the quartz. Calcite, arsenopyrite, pyrite, and quartz are distributed generally, in this order, in irregular zones. (Note: The two portions of this polished section were originally attached at the edges most abundantly composed of pyrite.)

Microscopic Description of the Specimens.

Although the general structure of the specimens and relative distribution and proportions of the ore minerals may be seen with the unaided eye, such observations have little scientific value as to the origin and distribution of the gold unless accompanied by the results of a microscopic study. The relations and characteristic structures of the minerals, and other indications as to their contemporaneous or sequential deposition are outlined in the following microscopic description of the polished sections.

Section No. 1.

A microscopic examination of this section shows an intimate relationship between pyrite and arsenopyrite. These minerals are intergrown at several places along the contact between them with straight borders in every case. While sphalerite apparently follows some crystallographic direction in pyrite (Fig. 1a) and in arsenopyrite, its borders are noticeably irregular in contact with calcite and jamesonite (Figs. 1 a & b). Particles of chalcopyrite are disseminated through almost every showing of sphalerite and in some cases,

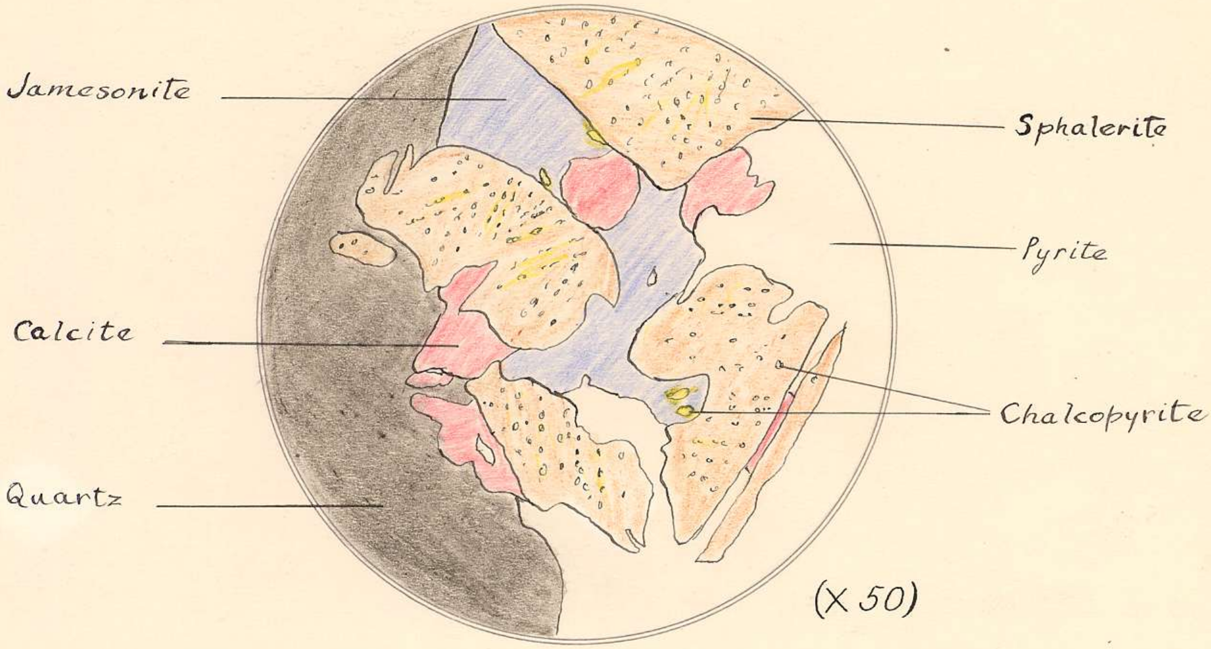
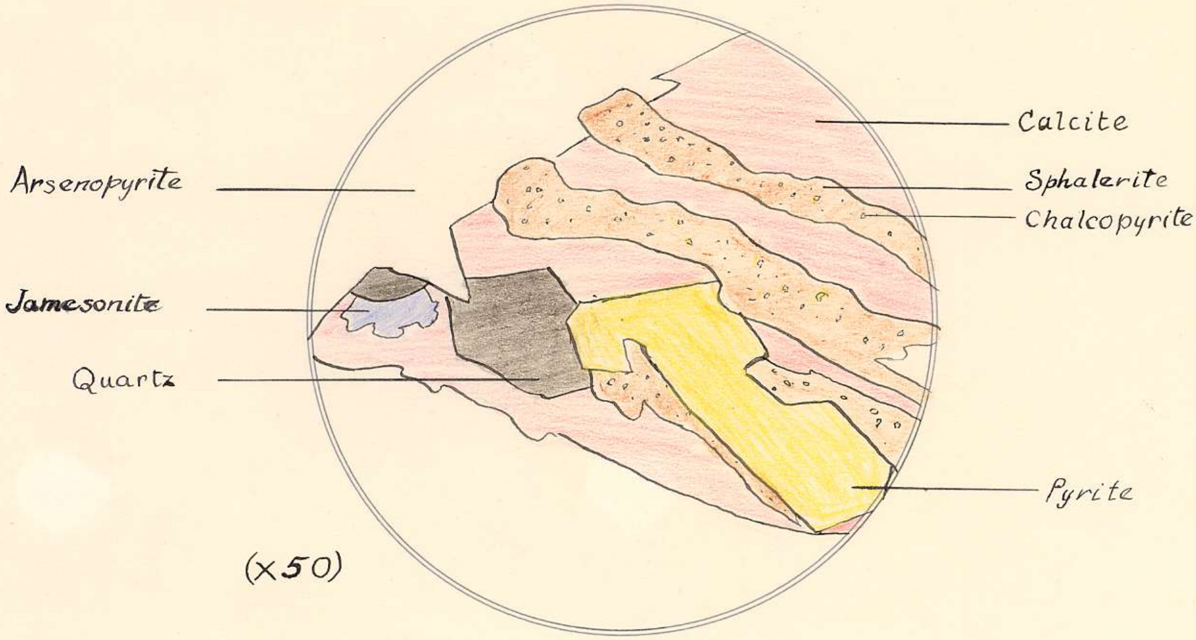
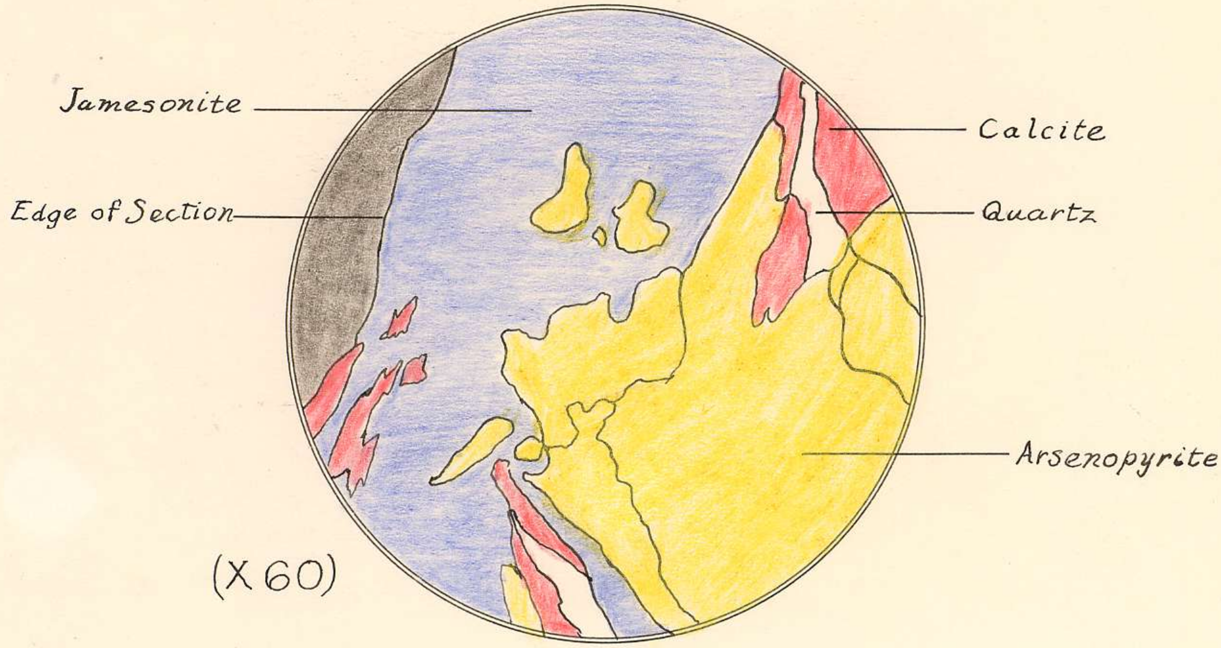

Jamesonite
Sphalerite
Pyrite
Calcite
Chalcopyrite
Quartz
(X 50)

Fig. 1a.



Calcite
Arsenopyrite
Sphalerite
Chalcopyrite
Jamesonite
Quartz
Pyrite
(x50)

Fig. 1b.



Jamesonite
Edge of Section
Calcite
Quartz
Arsenopyrite
(X 60)

Fig. 1c.

as in Fig. 1a, the particles, though themselves irregular, are arranged along some crystal structure of the sphalerite. In the same figure are illustrated larger irregular masses of chalcopyrite as they occur at many parts of the section associated with jamesonite. The latter mineral occurs in irregular masses at all times being associated at zones of apparent weakness with sphalerite (Fig. 1a) and as a corrosive injection encroaching on arsenopyrite (Fig. 1c). Quartz is found both as crystalline masses (Fig. 1b) and as irregular bodies among the sulphides, while calcite occurs as a filling, as seen in all three diagrams of this section, between the other minerals.

Section No. 2.

As indicated by Fig. 2a, pyrite and arsenopyrite are separated by a very indistinct border and form the ground mass for sharply angular bodies of sphalerite. It is observed, however, that sphalerite displays a more corrosive effect, rather than that of an intergrowth, in the pyrite at some distance from the arsenopyrite contact. The same figure illustrates the occurrence of chalcopyrite in isolated masses while at other parts of the polished section the usual regular distribution of its particles along crystallographic directions of sphalerite is observed., In isolated regions of the section pyrrhotite forms the groundmass for scattered areas of sphalerite, the borders of which are straight but sharply jagged and form a graphic patern in the pyrrhotite. Calcite is present in this section both as corrosive masses as illust-

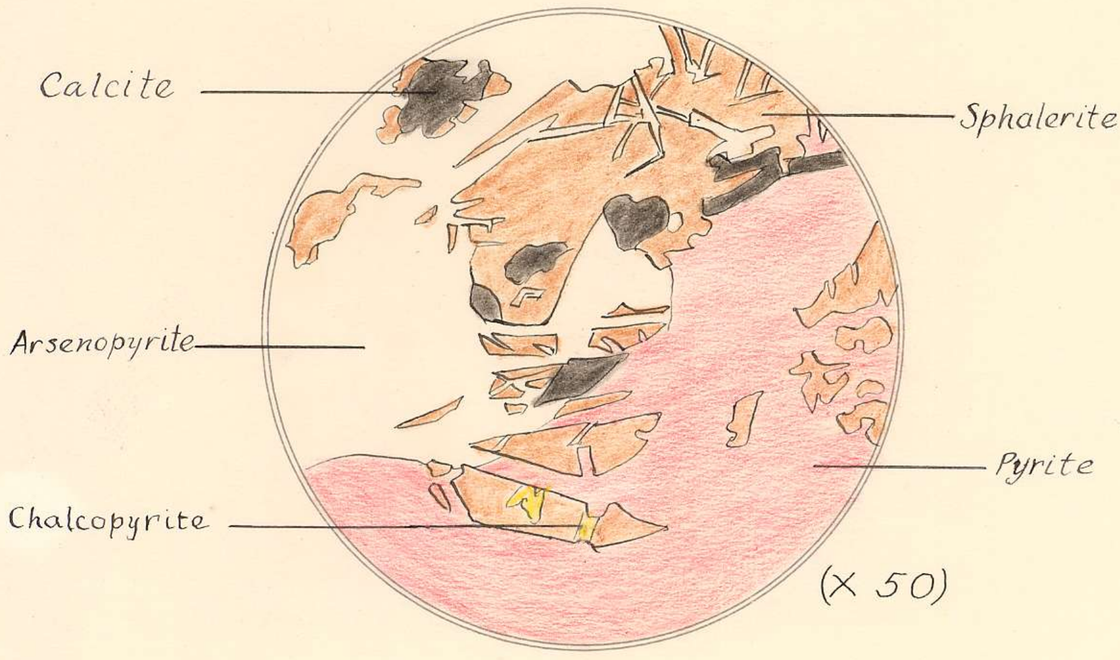

Calcite
Sphalerite
Arsenopyrite
Pyrite
Chalcopyrite
(X 50)

Fig. 2 a.

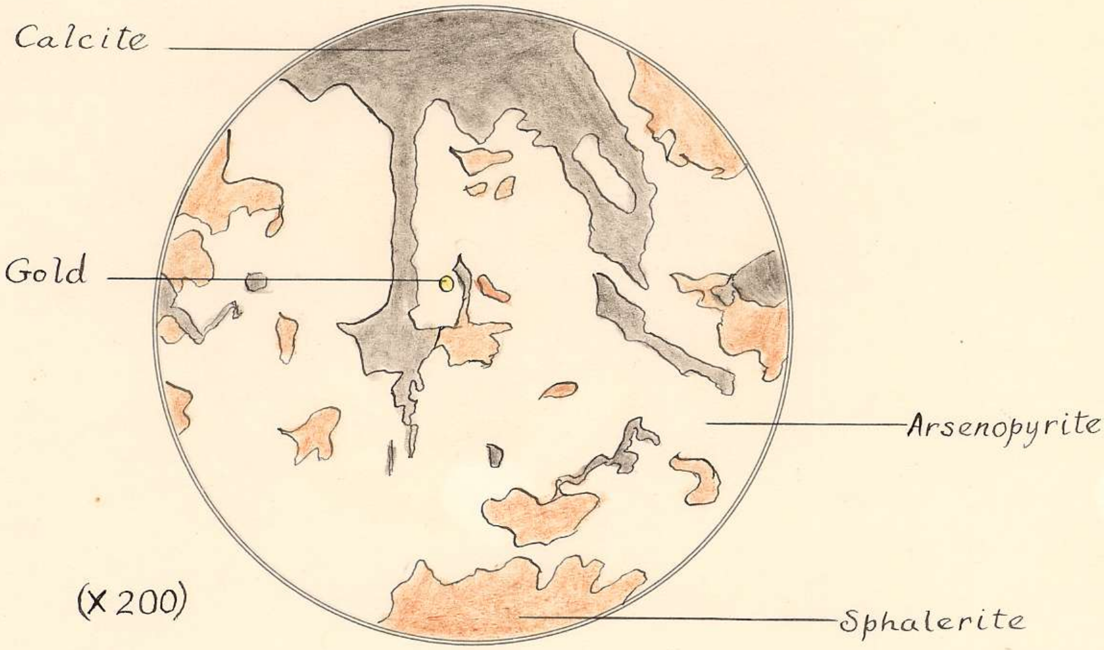


Fig. 2b.

rated in the diagrams and as veinlets in the pyrrhotite area. The sheared structure of the specimen is supplemented by the arrangement of calcite and sphalerite streaks parallel to this structure. A globular particle of gold (Fig. 2b) is found associated with arsenopyrite and measures only 8 microns in diameter.

Section No. 3.

The close association of pyrite and arsenopyrite is illustrated in Fig. 3a where crystalline forms of both minerals are marked by straight borders and parallel fractures. Arsenopyrite also occurs in this polished section as a band of subhedral crystal remnants in the jamesonite zone. The corrosive effect of jamesonite upon pyrite is similar to its effect upon arsenopyrite as shown in Fig. 3b. Illustrated in the same diagram is the occurrence of both euhedral crystals and veinlets of quartz. The crystal forms are in general associated with jamesonite masses as they are abundantly observed in the band of jamesonite and elsewhere in the section. The more irregular quartz is found mainly as the massive area of the specimen and as stringers in pyrite and arsenopyrite. Calcite is well represented in the diagrams both as cross-cutting veinlets regardless of association and as a filling material in the fractures of the massive minerals.

Section No. 4.

No microscopic examination of this section was possible owing to the unsuccessful attempt to polish it by

Fig. 3a.

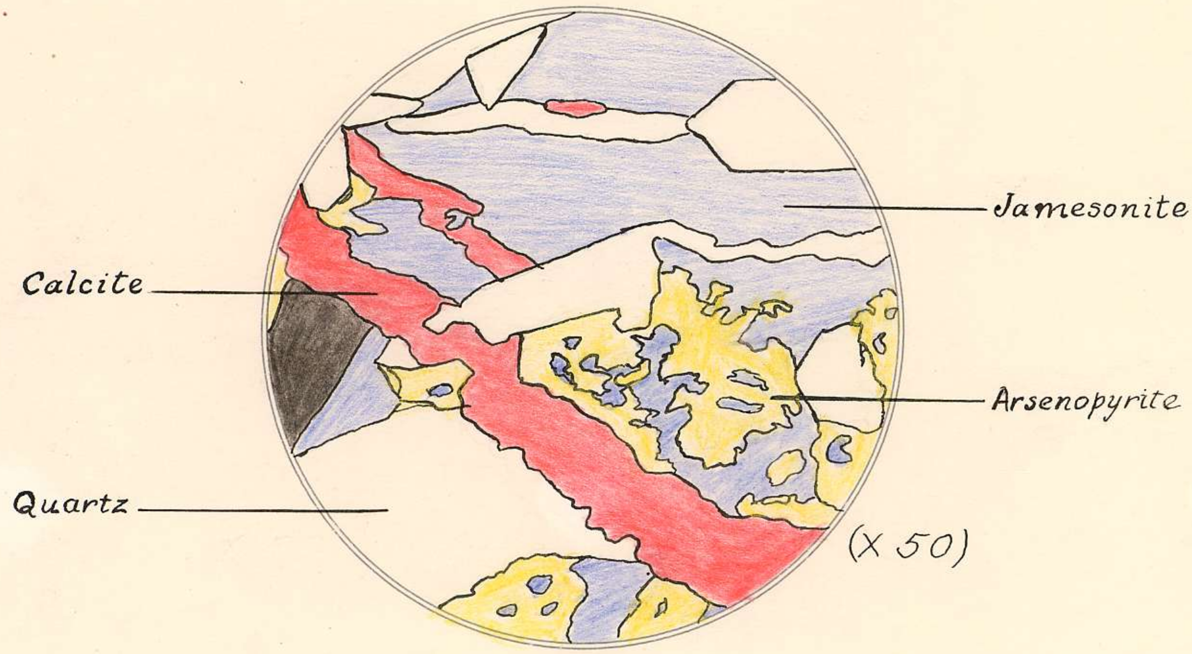


Fig. 3b.

the ordinary method. It is interesting to note, however, that in the fractures of the massive quartz body are crystalline forms of arsenopyrite.

Section No. 5.

This polished section shows an abundance of pyrite but no arsenopyrite. Quartz is found to have encroached to an advanced degree upon the fractured pyrite (Fig. 5a), leaving only remnants of the latter. Sphalerite also occurs as irregular masses with blebs of chalcopyrite, in most cases, (Fig. 5b) scattered through it. Jamesonite is the chief corrosive agent upon sphalerite, chalcopyrite, and crystalline quartz in the same diagram, while the former figure represents it as being an erosion remnant in later quartz. Besides being disseminated in sphalerite, chalcopyrite is observed in both figures, and elsewhere, as isolated remnants in jamesonite and in quartz. Many small calcite fillings are observed along the quartz-sulphide contacts (Fig. 5b), as well as along the zone of weakness at the edge of the section, and has been generally leeched out during the process of polishing.

Section No. 6.

Pyrite occurs in its usual fractured manner corroded by both quartz and calcite, while arsenopyrite has retained much of its crystal outline (Fig. 6a) in the presence of these minerals. The larger masses of calcite (Fig. 6b) are the interesting groundmass for irregular particles of evenly disseminated jamesonite. In other parts of the section larger

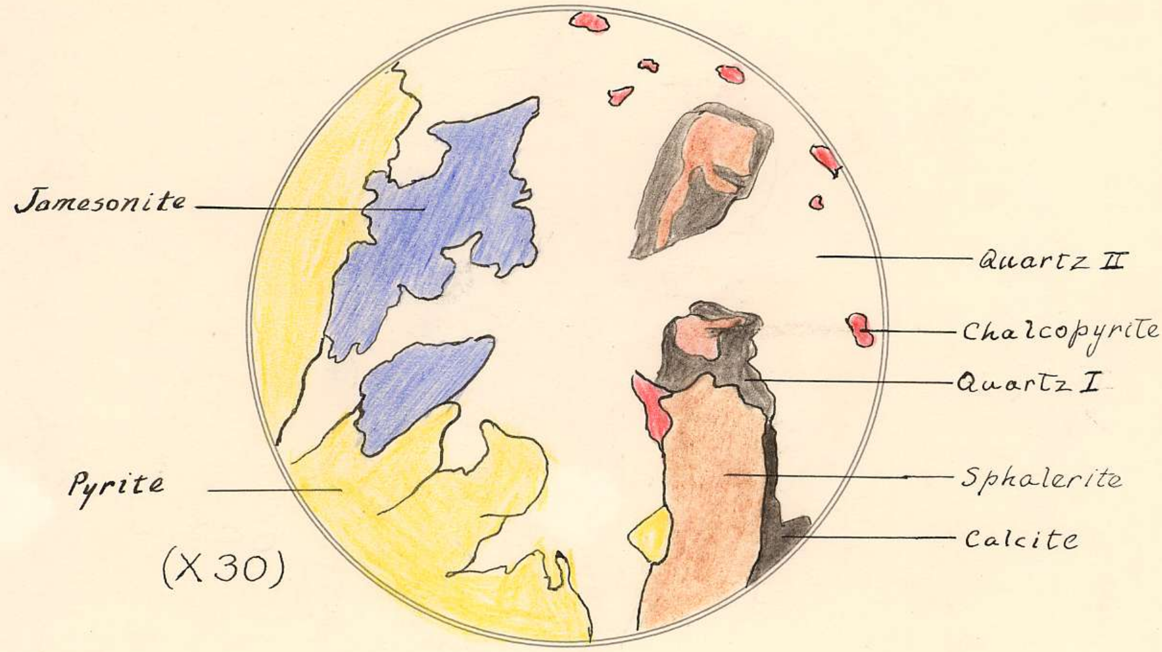

Jamesonite
Pyrite
(X 30)
Quartz II
Chalcopyrite
Quartz I
Sphalerite
Calcite

Fig. 5 a.

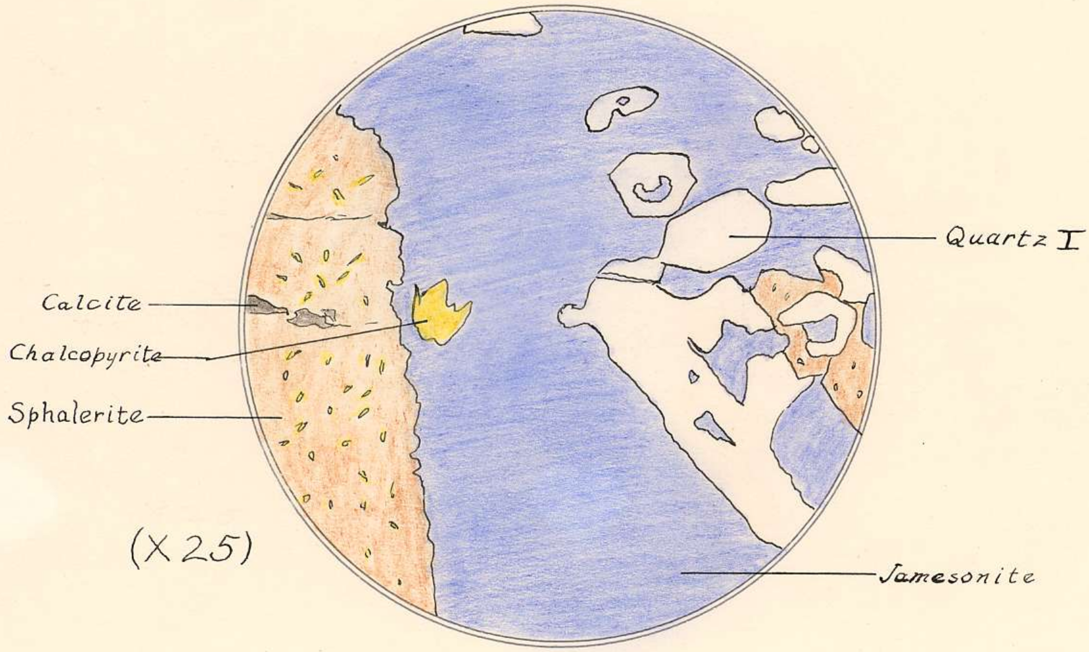


Fig. 5 b.

but similarly corroded jamesonite masses are observed. Quartz forms the groundmass for the larger part of the section where remnants of all of the sulphides of the specimen occur. Crystalline forms of quartz (Fig. 6b) are also present but show similar relationships to the other minerals as does the massive quartz.

Summary of Microscopic Observations.

Gold

Very little gold is found to occur in a visible state in this ore. The assays of the samples show gold values from .12 to 1.3 ounces per ton, with an average of .53 ounces. This indicates that a large number of sections or a high powered microscope would be required to locate it. In Section No. 2 the globular particle of gold in a groundmass of arsenopyrite was located under a magnification about 4 times as great as that under which the polished sections were studied.

Pyrite

This mineral occurs in all sections examined. In every case it takes the form of irregular and fractured masses. Except in Section No. 5 arsenopyrite is closely associated with it in a similarly corroded form.

Arsenopyrite

Besides the massive and formless occurrence of this mineral as it appears with pyrite, it is also present, in two of the sections, as remnants of definite crystalline forms and associated with jamesonite.

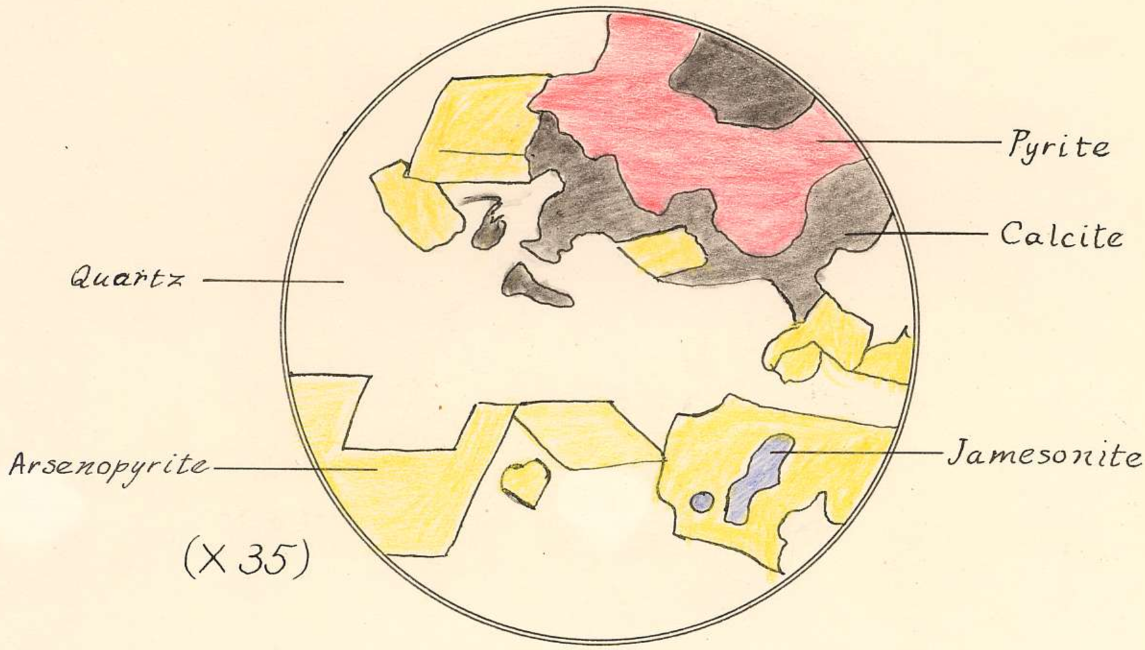


Fig. 6 a.

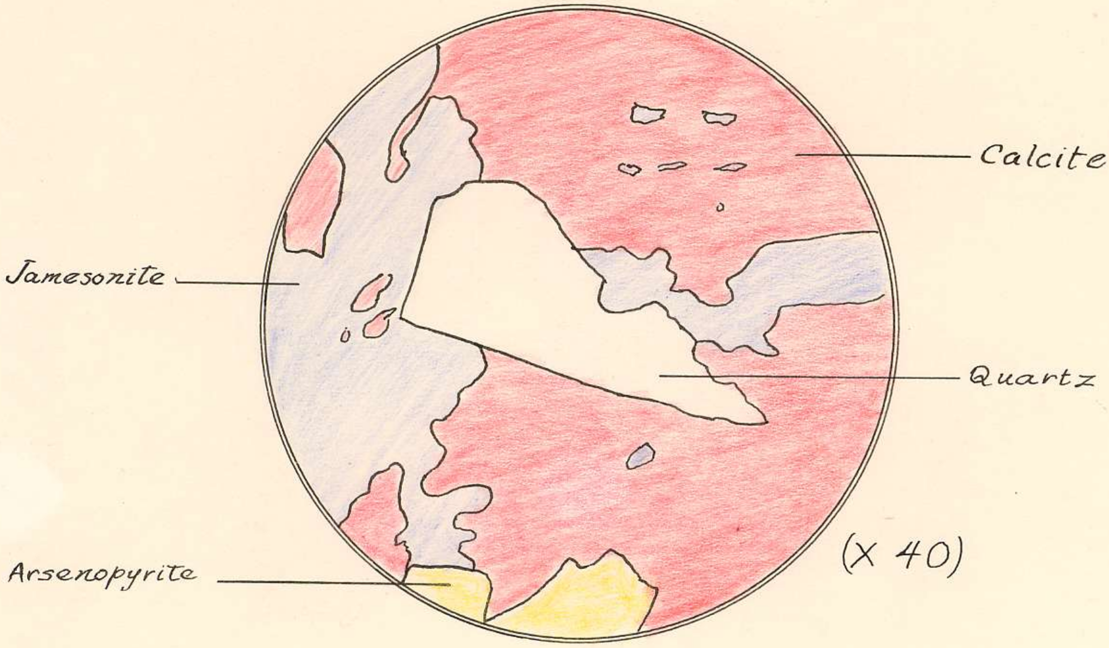


Fig. 6b.

Pyrrhotite.

Pyrrhotite is observed only in Section No. 2 where it occurs in massive form and graphically associated with its sphalerite inclusions.

Sphalerite

Where sphalerite occurs in this ore, it is very irregular and erratic. Where found bordering on pyrite, it apparently conforms to the crystallographic directions of the latter, but not with a noticeably straight boundary. Sphalerite is also found corrodded by both jamesonite and calcite, while in one case it forms sharply angular or graphic inclusions in arsenopyrite and pyrrhotite.

The almost universal occurrence of blebs of chalcopyrite in sphalerite almost a criterion for their identification. In some instances the parallel arrangement of the inclusion suggests the crystal structure of the sphalerite.

Chalcopyrite

This mineral occurs in all of the sections studied except the one in which sphalerite is also absent. This close association is partly as inclusions as described above, and partly by other irregular distribution of chalcopyrite remnants. It is invariably without crystal form, but its borders are smooth and definite.

Jamesonite

The corrosive effect of this mineral is observed upon each of the minerals, except calcite, with which it occurs. It forms the groundmass, in many cases, for sphalerite chalcopyrite, and crystal forms of arsenopyrite and of quartz. The banded structures in two sections feature this mineral as the main constituent. Except when bordered by crystal outlines of quartz or arsenopyrite its boundaries are always irregular.

Quartz

Quartz occurs as the principal gangue mineral in this ore. Large masses of it intrude the mineralized zone, while well developed crystals occur among the sulphides. Quartz veinlets fill many of the fractures in the large pyrite and arsenopyrite masses. These and other less general observations lead to the conclusion that there is more than one period of quartz injection represented.

Calcite

Closely associated in most cases with quartz, calcite forms another abundant gangue mineral in this ore. Its most common occurrence is along the borders between quartz and the fractured sulphides, while it also fills fractures as veinlets and occurs in massive form.

Paragenesis.

The above summary of mineral relationships leads to the conclusion that the minerals were deposited in the following order:

Pyrite

Quartz I, Arsenopyrite, and Gold

Sphalerite and Pyrrhotite

Chalcopyrite

Jamesonite

Quartz II

Calcite

This conclusion is supported by an abundance of evidence in the polished sections. The earliest period of mineralization in evidence involved the formation of pyrite, arsenopyrite, and quartz. In most cases (Fig. 2a) these two sulphides occur similarly, but since in some cases (Fig.6a) the pyrite is corroded by quartz while the arsenopyrite is not, the conclusions are that the pyrite injection began earlier and finished later than that of the other two, and that arsenopyrite and quartz were injected together.

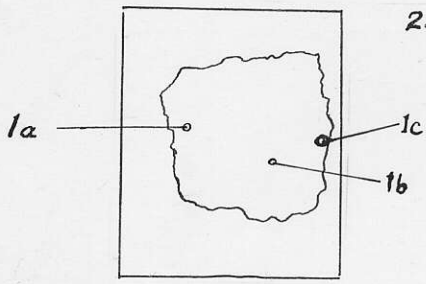
At some time during this first period of mineralization the gold, as its association(Fig.2b) with arsenopyrite indicates, was introduced. The fact that pyrrhotite bears a similar graphic relationship to sphalerite as does arsenopyrite suggests that the pyrrhotite formed along with these minerals. The occurrence of corroded arsenopyrite particles in the pyrrhotite masses and evidence that shearing movements took place during the formation of sphalerite and arsenopyrite in Section No. 2, lead to the conclusion that pyrrhotite and sphalerite were injected during a time of shearing.

Sphalerite, being closely related to arsenopyrite (Fig. 2a), as well as intruding it (Fig. 1b), and having definite relationships to the other minerals, is concluded to have both preceded and accompanied the pyrrhotite. Chalcopyrite can also be placed in this period of mineralization because of its regular presence as particles in sphalerite. Where sphalerite is intimate with the earlier sulphides, chalcopyrite is rare. The occasional regular dissemination of this mineral along the crystallographic directions of sphalerite indicates the contemporaneous deposition of these minerals.

The presence of jamesonite in continuous bands across two of the polished sections supports the conclusion that its injection followed a further fracturing of the mineralized zone. The crosscutting relationship and the occasional well-developed crystal form of quartz (Fig. 3b) in jamesonite indicates that this later injection of quartz was partly contemporaneous with and partly later than the jamesonite.

The final action of mineralizing solutions was, as shown in each of the polished sections, the injection of calcite into the fractures and along zones of weakness in the ore body.

KEY TO THE DIAGRAMS



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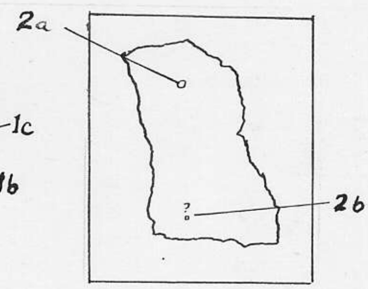

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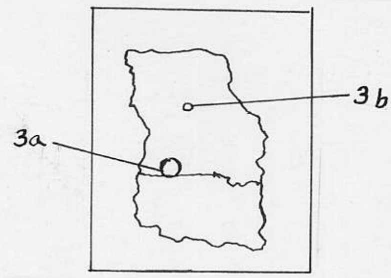

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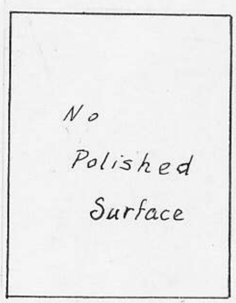

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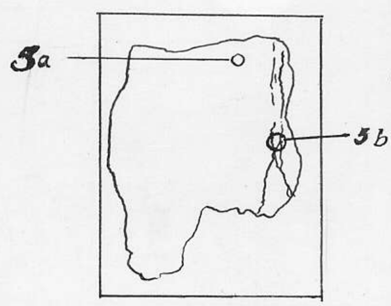

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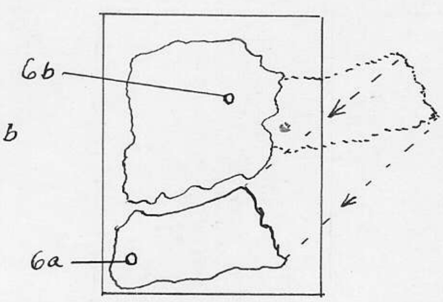

6.