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Mineralographic Report of the Mayflower and Blue Bird Mines

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GEOLOGY 409

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MINERALOGRAPHIC REPORT OF THE MAYFLOWER AND BLUE BIRD MINES

HISTORY AND LOCATION

In 1947 the Rossland Mining Company Limited, with offices at 675 West Hastings Street, Vancouver, took control of ten square miles of land, which extended two miles south of Rossland, and from Tiger Creek on the east to nearly Little Sheep Creek on the west. The property consists of seventy-five recorded claims and twenty-seven Crown-granted claims. Surface exploration has been done on this area, and underground development has been started in two locations, the Mayflower, and the Blue Bird workings. These are on the sides of Gopher Creek Valley; the Mayflower in the east slopes, and the Blue Bird in the west. The Mayflower workings are seventy-two hundred feet south of Rossland on the Olla Podrida Crown-granted claim, which was located in 1899 and developed intermittently until 1911. These workings, which are now caved, were restricted to a vein known as the south vein. In 1939 an adit was driven to intersect and explore a newly discovered vein, the main vein; and a crosscut was driven in search of the south vein. Under the management of the Rossland Mining Company, the development and mining of the property has been carried out in the main vein. The Blue Bird workings are situated nine hundred feet west of the Mayflower, and consist of a a shaft and an intersecting adit. This work was started in the late forties and is of an exploratory nature.

GEOLOGY OF THE DISTRICT

The Mount Roberts formation, the oldest in the district is composed of deformed quartzites, slates, limestones, and altered tuffs. It occurs in isolated areas and as inclusions amidst igneous intrusions of three periods:

A Triassic augite porphyrite, a Jura-Cretaceous granodiorite and monzonite, and a Miocene granite porphyry, syenite porphyry (~~Pulas Kite~~ Pulaskite), and syenite. The periods of vulcanism are directly related to the periods of ore deposition. The district is transversed by numerous dykes which trend northward and range in composition from aplites to lamprophyres. Glacial drift and recent streams gravels are scattered over the district.

GEOLOGY OF THE MINES AREA (see accompanying map)

Mayflower: The country rock at the Mayflower mine is the Triassic augite porphyrite. This rock is characterized by strong brecciation and prominent dark green crystals of altered augite. The angular fragments are imbedded in a fine grained matrix of the same composition. The augite porphyrite gives place southward to a conglomerate composed of rounded pebbles of augite porphyrite, granite, diorite, and quartz in a matrix of very fine grained dark silt material. To the southwest about one thousand feet, the contact of the augite porphyrite and the thin bedded silicious slates of the Mount Roberts formation is exposed in a railroad cut. Intruded into the augite porphyrite and the Mount Roberts formation are dykes of granite porphyrite, diorite porphyry, and lamprophyre. The lamprophyre dykes strike northward and are of two types; one with mica phenocrysts and the other without. These dykes are four to twenty-five feet wide and of considerable structural importance since they are of the controlling factors of mineralization.

Blue Bird: The country rock around the Blue Bird mine is the Mount Roberts formation which contacts the augite porphyrite three hundred feet to the east and six hundred feet to the west.

MINES GEOLOGY

As indicated by diamond drill holes, there is a main mineralized zone and several subsidiary zones. The zones trend eastward and near the Mayflower mine it appears that they end a short distance beyond the conglomerate. These zones probably extend to the Blue Bird mine, The subsidiary zones appear to be minor and discontinuous.

The workings in the Mayflower consist of a ninety foot adit to the main mineralized zone and five hundred and fifty feet of drift along this zone. The rock in the main adit is an augite porphyrite which is cut by several diorite porphyry and lamprophyre dykes. The drift follows a poorly defined mineralized shear zone. Discontinuous fault planes occur along the shear zone in subparallel and branching patterns. The augite porphyry along this zone and for several feet laterally is altered to a matted aggregate of fine grained biotie and sericite. The diorite porphyry dykes are altered to a lesser degree than the augite porphyry. The lamprophyre dykes intersect at right angles, some cross the shear zone, others follow and turn along it as irregular constricted sheets that finally cross to the opposite side. Some of the lamprophyre dykes are older than the shear zone and the mineralization.

Up to the summer of 1949, the time of the Minister of Mines' Report, from which most of the information has been taken, in a drift three hundred and seventy-five feet in length along the main shear zone 5 ore shoots had been found. The ore shoots are irregular with bulges and vein-like masses extending into the walls. The width of the ore shoots is four feet or more. They are distributed along the main shear zone immediately adjacent to the hanging wall side of the dykes. The rake is to the east parallel to the dip of the dykes. The greatest width and best ores are found near the dykes contact, and small stringers of ore are observed through the dykes. Ore values range from $22.00 to $34.50 per ton.

The Blue Bird workings are small. A detailed report on their geology has not been published. According to the aforementioned report the development consists of a fifty foot shaft and a connecting four hundred foot adit that starts on the west side of Gopher Creek Gulch. Both the shaft and the adit are in a mineralized zone.

MEGASCOPIC EXAMINATION

Four suites of ore were collected from the Mayflower and Blue Bird workings, and from the study with a hand lens the following characteristics of the ore and its component minerals are evident.

Suite No. 1: This suite consists of thirty fresh and angular specimens about 2" x 1" x 1/2" in size. The specimens are of a grey colour except in those in which pyrite predominates. The specimens consist of massive sulphides in a grey gangue rock which is brecciated and highly silicified. Many narrow veinlets are found in between the breccia fragments.

The ore minerals in order of abundance are:

Pyrite
Sphalerite
Boulangerite
Galena
Pyrrhotite
Chalcopyrite

The gangue constituents are silicified fine grained rock and calcite.

Suite No. R2: This suite consists of five specimens cut from an angular fragment of about 4" x 3" x 3" in size. The specimens are fresh and of a grey colour. The prominent feature of these specimens is a rough banding of the minerals. These bands are of irregular shape and discontinuous, and have widths varying from three millimeters to about half an inch. An examination of one of the specimens reveals the following bands:

1. Brecciated, Pyrite predominant, mixed together with minor amounts of chalcopyrite.
2. Sphalerite predominant, together with pyrite and boulangerite.
3. Pyrrhotite predominant, together with sphalerite, boulangerite and pyrrhotite.
4. Calcite predominant, with some arsenopyrite.

The minerals in order of abundance are:

Pyrite
Boulangerite
Galena
Pyrrhotite
Sphalerite
Calcite
Chalcopyrite.

Suite A: This consists of eight hand specimens cut from an agular fragment about 6" x 4" x 4". The specimens are fresh and of a grey colour. They consist mostly of sulphide minerals with very little gangue. Banding is also the prominent feature of the ore in this suite. The bands are of the same appearance and of similar composition as those of Suite R2. Large (up to 1/2 inch in size), brecciated pyrite crystals are seen.

The observed minerals in order of abundance are:

Pyrite
Pyrrhotite
Sphalerite
Galena
Boulangerite
Calcite
Chalcopyrite

Suite R75: This consists of two fresh hand specimens, angular and about 2" x 1" x 1/2" in size. These specimens exhibit the rough banding common in the above suites.

The minerals in order of abundance are:

Galena
Sphalerite
Pyrrhotite
Pyrite

MICROSCOPIC EXAMINATION

Altogether twenty-nine polished sections, representing the four suites of ore, were studied to determine the mineral species, the significant textures, their grain size, and relative abundance in the ore.

Arsenopyrite: Diamond shaped cross section, color, hardness and anisotropism were properties used to indentify this mineral. It is abundant in the four suites of ore, and is found in association with all other minerals. Most of the crystals of arsenopyrite are shattered and corroded, however, in some instances their crystal outline is perfect. There are two generations of arsenopyrite mineralization. The first generation representing the earliest mineral in the paragenetic sequence, is evident since arsenoprite is replaced by all the other minerals. Not much of the arsenopyrite belongs to this generation, because only in three instances was pyrrhotite, the second oldest mineral, seen replacing it. However, the evidence was conclusive, it was observed that veinlets of pyrrhotite cut and replace crystals of arsenopyrite (see Plate 1.). In its second generation arsenopyrite is the fourth oldest mineral. It is observed that arsenopyrite replaces pyrrhotite and in turn is replaced by all other minerals. The grain size of arsenopyrite ranges from .02 millimeters to .4 millimeters. With ? as the average size.

Why not overlapping deposition?

Pyrrhotite: Its anisotropism, colour, hardness and etch reactions were the properties used to identify this mineral. Pyrrhotite is found in the four suites of ore. It is replaced by all other minerals except the older generation of arsenopyrite. This places pyrrhotite as the second oldest mineral in the paragenetic sequence. Its grains are badly corroded and under crossed nicols show a mosaic texture. Its size ranges from .1 to 1 millimeter, the average grain is about .5 millimeters long.

Gold: In the 1949 report from the Minister of Mines, the gold assay of the Mayflower ore shows gold content ranging from .2 to .5 ounces of gold per ton. Gold was not seen in the polished sections. However, Dr. Thompson informed me that it is present in minute particles in pyrrhotite. Therefore, it is safe to assume that it was intruded in solution with pyrrhotite and is of the same age.

Pyrite: Crystal outline, colour, hardness and isotropism were the properties by which pyrite was identified. Pyrite is the most abundant mineral in the ore. Its grains are euhedral and subhedral, but frequently are found badly shattered. Its grain size ranges from .1 to 12 millimeters. There appear to be two generations of pyrite, the shattered pyrite being the oldest. Pyrrhotite looks as though it may be replacing it in Suite R2, but the evidence is not conclusive. Pyrite is replaced by all the other minerals except pyrrhotite. In Figure 1 it is shown replaced by sphalerite. It is the third mineral in the paragenetic sequence.

Sphalerite: Its colour, hardness, internal reflection, and triangular pits on the surface were the properties by which this mineral was identified. Sphalerite is abundant in the ore and commonly found closely associated with galena and boulangerite, where its grains are sometimes isolated blebs with ragged edges. The grain size of spalerite ranges from .1 to 5 millimeters. Figures 1 and 3 show spalerite replacing pyrite and arsenopyrite. Figure 4 shows spalerite replaced by galena. Sphalerite is the fifth mineral in the paragenetic sequence.

Galena: Its hardness, colour, pitted surface and isotropism are the properties by which galena was indentified. This mineral is abundant in the ores of Suite 1 and Suite R75. Tetrahadrite and meneghenite are always found replacing galena. Figure 4 shows galena replacing sphalerite, Figure 5 tetrahedrite and meneghenite are always found replacing galena, and Figure 6 chalcopyrite replacing galena. Galena is the sixth oldest mineral in the paragenetic sequence.

Chalcopyrite: Colour, streak, and etch tests were the properties used to identify this mineral. Chalcopyrite is a minor mineral in the ore, and is found in blebs associated with sphalerite and pyrrhotite. Chalcopyrite is most abundant in Suite A. Figure 6 shows chalcopyrite replacing galena. Chalcopyrite is the seventh mineral in the paragenetic sequence.

Boulangerite: Anisotropism, hardness, colour and microchemical reactions were the properties used to identify this mineral. Boulangerite is common in Suite 1, but also is found in other suites. It replaces all minerals except tetrahedrite and owyheeite. Boulangerite when seen under crossed nicols shows a mosaic texture. Its grains range in size from .05 millimeters to 1 millimeter. It is the seventh oldest mineral in the paragenetic seouence.

Tetrahedrite: Hardness, colour, and etch tests were the properties used to identify this mineral. Tetrahedrite occurs in veinlets and blebs and is found replacing galena and boulangerite. Figure 5 shows a typical bleb of tetrahedrite replacing galena. The grain size of the tetrahedrite blebs ranges from minute particles to .2 millimeters. Tetrahedrite is younger than galena, but its genetic relationship to the other minerals is difficult to determine.

Owyheeite: Yellowish colour, acicular habit, pleochroism and etch reactions were the properties used to identify this mineral. Owyheeite is the most important silver bearing mineral in the ore, and is always found in association with boulangerite. Plate 2 and 3 show euhedral and subhedral crystals of owyheeite growing into boulangerite. The crystals range in size from .85 to .1 millimeters in length. Owyheeite is the eighth mineral in the paragenetic sequence.

Meneghinite: This mineral was found in minute amounts in Suite R2. The properties by which it was indentified were:

Colour: whiter than boulangerite and galena

Polish: very good

Hardness: softer than galena

Pleochroism: distinct

Etch Reaction:

$HgCl_2$ (-)

KOH (-)

KCN (-)

$FeCl_3$ (-)

HCl (-)

HNO_3 (+), reaction starts after ten seconds at the edges of the grain and spreads quickly over the area.

This mineral is found in association with galena and boulangerite and is probably earlier in the paragenetic sequence.

Unknown: In polished sections one and two of Suite 1 and unknown was found in minute amounts. The grains do not exceed .5 millimeters in size. The following properties were found:

Colour: grayish with a purplish tinge

Polish: very good

Hardness: B

Anisotropism: strong

Etch Reations:

$HgCl_2$	(-)	
KOH	(+)	bluish and very weak.
$FeCl_3$	(+)	brown
HCl	(-)	
HNO_3	(+)	black and slow to start.

Indicating what group of mineral.

Calcite: Its color and optic properties were used to indentify this mineral. Calcite is the last mineral in the paragenetic sequence. It is seen cutting through all other minerals.

Paragenetic List:

1 Arsenopyrite (first generation)

2 Pyrrhotite and Gold

3 Pyrite

4 Arsenopyrite

5 Sphalerite

6 Galena

7 Chalcopyrite

8 Meneghinite

9 Boulangerite

10 Tetrahedrite?

11 Owyheeite

12 Calcite

TEMPERATURE OF MINERAL DEPOSITION

The mineral assemblage combined with the paragenetic data indicates that the ore is of the mesothermal type. The first minerals to be deposited, arsenopyrite and pyrrhotite, are characteristic of high temperature. Boulangerite, one of the last minerals, is characteristic of leptothermal ores. not mesothermal. Pyrite, galena, chalcopyrite, sphalerite, and calcite, although not characteristic of any temperature, are commonly found in mesothermal deposits. The courseness of the mineral grains as well as the absence of substractures (u) and mineral characteristics of epithermal deposits sugget that deposition took place above 250 degrees Centigrade.

Figure I. Suite I, Section 2. Boulangerite (red) replacing sphalerite (purple). Sphalerite replacing pyrite. X 40.

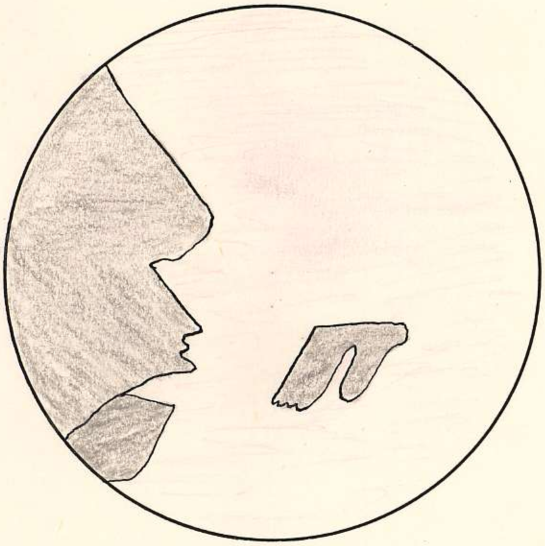


Figure 2. Suite I, Section 6. Corroded arsenopyrite (gray), partially replaced by boulangerite (red) X 60

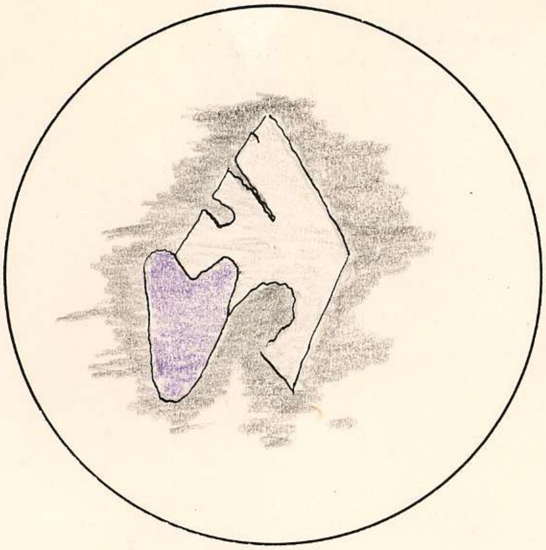


Figure 3. Suite 1. Section 6. Arsenopyrite (light gray) replaced by calcite (black) and sphalerite (purple). X 40

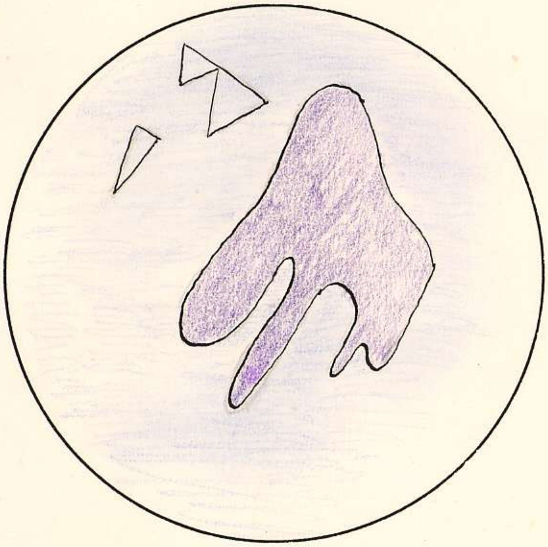
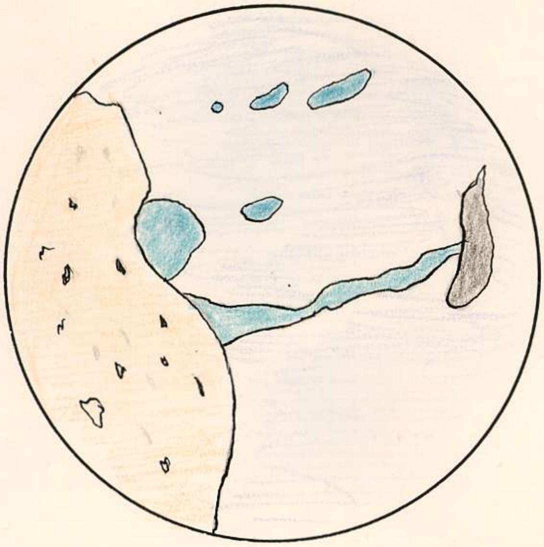


Figure 4. Suite 75 Section 2. Galena (blue) replacing a bleb of sphalerite. X 25

or sphalerite replacing galena.



Sample 5. Suite I, Section 4. Vein of tetrahedrite (green) cutting through galena (blue). Also unsoporte nuclei structure of tetrahedrite in galena. Other minerals: pyrrhotite (orange) and calcite (black). X50

Figure 6. Suite A, Section 1. Chalcopyryte (light yellow) replacing galena (blue). Pyrrhotite (orange) showin mossaic texture. Other minerals are sphalerite (purple) and pyrite (yellow). X25

Plate I. Under cross nicols. Pyrrhotite (dark gray) cutting and partly replacing arsenopyrite (white). X 50

Plate 2. Owyheeite (Light gray and acicular) growing into boulangerite (gray). Other minerals are pyrite, sphalerite (black), and arsenopyrite (white). X 75.

Plate 3. Owyheeite (acicular) growing into boulangerite (light gray). Other minerals are sphalerite (black blebs), arsenopyrite (white) and pyrite). X100

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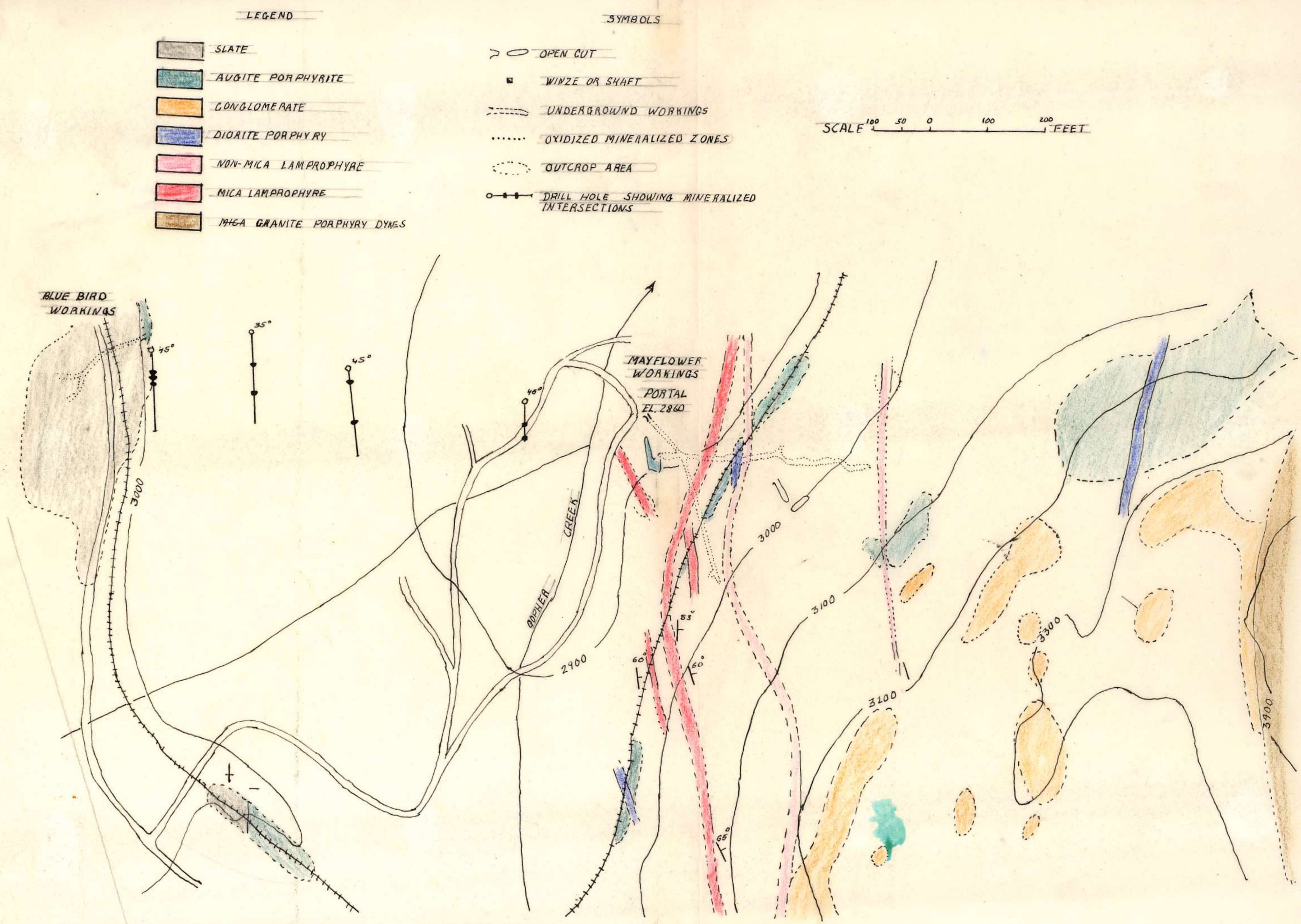

SURFACE GEOLOGY NEAR MAYFLOWER WORKINGS