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MICROSCOPIC STUDY OF THE ORE MINERALS

FOUND IN THE

JESSIE MINE OF THE OMENICA DISTRICT.

D.C. Malcolm.

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PLAN

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Location and Description

LOCATION

The Jessie mine is located on Hudson Bay mountain, between the north and south forks of Simpsons creek. This creek, a tributary of the Bulkley river, is a small eastward flowing creek about 4 miles in length.

The mine is only 3 to 4 miles west of Smithers and only 2 to 2½ miles from the Canadian National Railway.

Smithers is a town on the railway 230 miles from Prince Rupert.

A good trail leads from the railway, at an elevation of 2000 feet, to the mine at an elevation of 4700 feet. Another trail leads to Smithers, but this latter is longer and so, seldom used.

The mine is located on the eastern slopes of Hudson Bay mountain.

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Key Map showing the location of the Jessie Mine

General Geology

GENERAL GEOLOGY

The district is near the eastern contact of the Coast range batholith. This contact, or the contact of a large tongue of the intrusives, is situated only 25 miles southwest of Smithers.

Hudson Bay mountain, one of the many block mountains near the eastern contact, forms the watershed between the Bulkley river on the east and the Zymoetz river on the west. This mountain rises to an elevation of about 9000 feet.

TABLE OF FORMATIONS

Period	Formation	Lithology
Recent & Pleistocene		Recent aluvian glacial till.
Lower Cretaceous	Skeena Form	Conglomerate, shale, sandstone coal.
Upper Jurrasic to Post-Lower Creek	Coast Intrusives	Dyke rocks.
Upper? Jurassic Lower Middle Jurassic Lower? Jurassic	Hazelton Group	Upper sedimentary division. Upper volocanic " Middle sedimentary " Lower volcanic "

DESCRIPTION OF FORMATIONS

Hazelton Group

Lower Volcanic Division

The rocks of this division are widespread in occurrence and compose much of the Hudson Bay mountain. They consist chiefly of andesitic flows, limestone, and fragmental rocks. Tuffs and breccias predominate. The limestone is intensley anamorphosed and grades upwards into tuffs and breccias.

Middle Sedimentary Division

The middle sedimentary division is found on the southern part of Hudson Bay mountain.

The rocks consist of well-bedded limestones, and cherty sandstone with some shaley bands. In the sandy layers, or possibly tuffaceous rocks, zones of limey rock and limestone are numerous. The age of these beds are definitely correlated by use of fossils.

Upper Volcanic Division

Rocks of this division outcrop over the greater part of the area and underlie much of the southern slopes. They consist of flows, breccias, tuffs, and agglomerates, ranging in composition from andesite, to dacite and rhyolite. All these types show alteration as well as anamorphism.

Upper Sedimentary Division

Rocks of this division occur on the eastern side of the mountain. They underlie much of the area immediately north of the Jessie mine.

The rocks consist largely of argillites and shales, with a smaller amount of well cemented sandstone, bands of conglomerate, and coal seams. Although much of this division has been eroded, the thickness is estimated to be 2000 feet at present.

This division is cut by dykes and irregular quartz-feldspar porphyries, and at several places is mineralized by galena, pyrite and sphalerite.

SKEENA SERIES

Overlying the Hazelton series on the western slopes of the mountain, outcrops of this series are found. The rocks at the base of this series consist of a coarse conglomerate. This member grades into a finer conglomerate with pebbles of the Hazelton series up to one-half inch diameter. The top members of this series consist mainly of black carbonaceous shale and these members contain coal seams.

The relation between the two series has not definitely been worked out. The conglomerate at the base of the Skeena series seems to point to an unconformity. In the north, in the Groundhog area, the two series cannot be separated in the field or in the labratory, as one series grades into the other.

INTRUSIVE ROCKS

Intrusive rocks on Hudson Bay mountain consist of stocks and irregular masses, varying in composition from granodiorite to diorite. In addition, dykes, and possibly sills, varying from diorites to quartz-feldspar porphyries, are present. These masses are correlated with the Coast Range Intrusives partly on lithology ~~grounds~~ and partly on their occurrence.

STRUCTURAL GEOLOGY

Block faulting, folding or doming, and overthrust faulting are the dominant factors controlling the structure of the Hudson Bay mountain. Lines of shearing are prevalent and mineralization appears to have been confined to zones of fracture.

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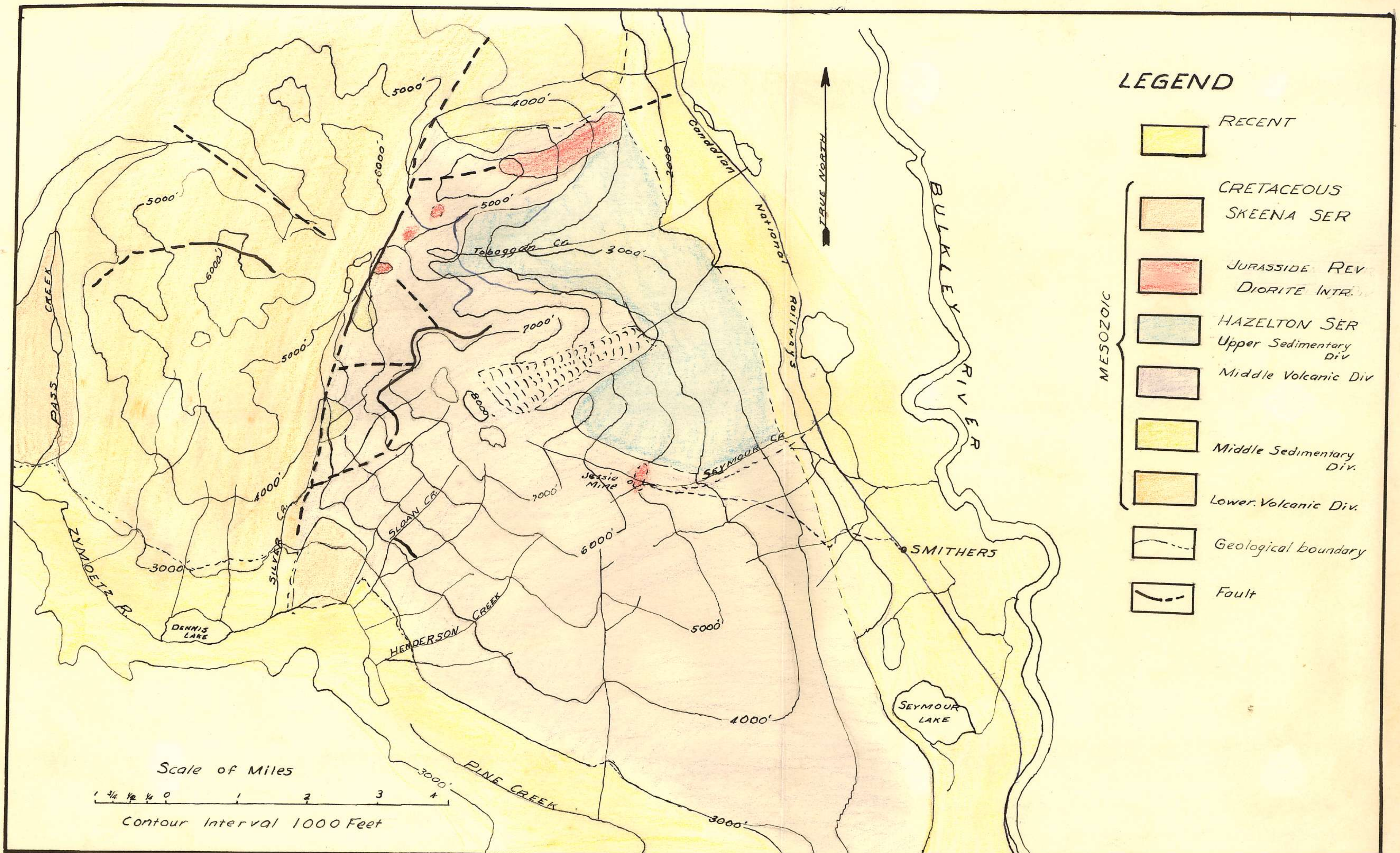
LEGEND
RECENT
CRETACEOUS
SKEENA SER
JURASSIDE REV
DIORITE INTR.
MESOZOIC
HAZELTON SER
Upper Sedimentary Div
Middle Volcanic Div
Middle Sedimentary Div.
Lower Volcanic Div.
Geological boundary
Fault
TRUE NORTH
BULKLEY RIVER
Canadian National Railways
SMITHERS
SEYMOUR LAKE
SEYMOUR CR.
Jessie Mine
Toboggan Cr.
SLOAN CR.
SILVER CR.
HENDERSON CREEK
PINE CREEK
DENNIS LAKE
ZYMOETZ R.
PASS CREEK
5000'
4000'
6000'
7000'
8000
3000'
2000'
Scale of Miles
1 3/4 1/2 1/4 0 1 2 3 4
Contour Interval 1000 Feet

Ore Deposits

DESCRIPTION OF JESSIE MINE

Ore deposits and prospects have been known on this mountain for over thirty years. Few of these have, however, developed into mines.

The ore deposits occur in many of the volcanic members of the Hazelton series and in some cases in the limestone members of the sedimentary series.

The deposits have a definite zoning in and around the intruded areas.

The minerals and vein materials have intruded and in part replaced zones of shearing and fissuring in the country rocks.

The Jessie mine is located in a series of shear zones or fissures in the Upper volcanic division of the Jurassic Hazelton series. The ore deposits consist of four intersecting replacement fractures, in the enclosing volcanic rock, in the vicinity of an intrusion of diorite. The country rock is replaced and altered to such an extent by the mineralization that, in many places, the rock cannot be told from the vein material. The deposits seem to be a replacement of sheared rock accompanied by fissure filling in the shear zone. There are three or possibly four of these veins, exposed over a length of 335 feet by many open cuts and 120 feet of tunneling.

No. I: This vein is only a few inches to 6 inches in width and intersecting vein No. 3. This vein is relatively unimportant.

No. 2: This most important vein strikes north 60 degrees west and dips into the hill with an angle of 30 degrees to 45 degrees. It is mineralized for a width of 4 to 5 feet.

No. 3. This vein diverges with an angle of about 25 degrees with No. 2. It has a steep dip to the south and a width of only 15 inches, but it has a length of 200 feet.

No. 4. This vein has as yet not been developed or opened up, but is known to be present.

METALLIC MINERALS

The metallic minerals found consist of arsenopyrite, sphalerite and galena with lesser amounts of pyrite, pyrrhotite, and chalcopyrite.

GANGUE

The gangue minerals are quartz and lesser amounts of calcite. The wall rocks will, in most cases, cause a considerable dilution of the ore, as veins are not sharply defined.

ASSAYS ON PROPERTY

The values in these deposits vary considerably. Vein No. 2. shows gold 0.38 ozs. per ton, silver 4.1 ozs. per ton, lead trace and zinc 7.5 per cent over a width of 2 feet.

Vein No. 3 shows gold 0.28 ozs. per ton, silver 7.6 ozs. per ton, lead 0.8 per cent, zinc 11.3 per cent over a width of 10 inches.

Intersection of two veins in a width of 1.5 feet show gold 0.3 ozs. per ton, silver 29.5 ozs. per ton, lead 24 per cent and zinc 5 per cent

Vein No. I. shows over a width of 6 inches much higher gold values namely gold 0.56 ozs. per ton, silver 21. ozs. per ton, lead trace and zinc 4 per cent.

These variations are almost entirely due to the relative amounts of galena and arsenopyrite found in the veins.

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Description of Specimens

HAND SPECIMANS--MEGASCOPIC STUDY

The hand specimans may be described as follows:

Specimen A: This specimen consists of a tough, hard, highly mineralized ore. It is made up of a series of bands of galena and arsenopyrite, with a little sphalerite associated with the galena. ~~There is little sphalerite associated with the galena.~~ There is little quartz or gangue present.

Specimen B: This ore represents a definite replacemnt of wall rock by arsenopyrite, quartz, and sphalerite. The specimen is very brittle andconsists of some massive, and some well crystallized, striated, arsenopyrite replacing the wall rock. There is a considerable amount of highly shattered sphalerite with lesser amounts of quartz. This ore shows no banding.

Specimen C: Like the preceeding specimen this is a definite replacement. The wall rock is cut and replaced by quartz, pyrite, galena and sphalerite. The pyrite is well crystallized in tiny striated cubes which are, in many places entirely surrounded by well crystallized quartz. This quartz, in turn, is enveloped by massive, brittle sphalerite and some galena. The ore is, as a whole, brittle.

Specimen D: This specimen consists mainly of quartz bands, bands of altered rock, lense like bands of calcite, ~~and well crystalized bands of calcite~~ and well crystalized bands of arsenopyrite. The country rock is highly altered and the whole is toughened by the mineralization. There are lesser amounts of pyrrhotite, brittle sphalerite, pyrite, and small amounts of chalcopyrite. The quartz shows well developed crystals surrounded, in places, by calcite. With the exception of arsenopyrite the sulphides occur in large, and in small scattered patches in the gangue minerals.

POLISHED SECTIONS--MICROSCOPIC STUDY.

Specimen A.

1. The age relationship of the galena and arsenopyrite is definitely shown in this specimen. The arsenopyrite has definitely crystalized and been fractured afterwards. The galena is seen filling fissures in arsenopyrite and probably replacing some of the arsenopyrite. The galena may have been forced in after it had cooled, as it shows a definite gneissic structure.

2. This specimen shows good gneissic galena The cleavage pits show a very definite parallel arrangement.

Specimen B.

1. The relationship between the pyrite, quartz, galena, sphalerite, and chalcopyrite is well demonstrated. The pyrite is definitely crystalized and later fractured. The fractures are filled by clear quartz and sphalerite. The quartz does not vein the galena in this speciman. The galena and sphalerite also show mutual relationships. The chalcopyrite is all ~~contained~~ in dessiminated particals in the sphalerite.

2. This shows the galena veining the fractured pyrite. The sphalerite, in one place, seems to vein the galena but this is the only section showing this. Chalcopyrite is enclosed in both galena and sphalerite in the form of small particals.

3. This section is interesting as it shows a reversal of the relationship shown in preceeding section. Here the galena veins the sphalerite in one part.

Specimen C.

1. This section shows the age relationship of the quartz and arsenopyrite. The quartz definitely veins the arsenopyrite but seems to be earlier than the sphalerite. This is shown by the forming of the sphalerite around the quartz crystals.

The sphalerite veins the arsenopyrite, and probably has replaced it along the irregular boundaries.

Specimen D.

1. This again shows the relationship of the arsenopyrite to both the quartz and to the sphalerite but does not show definitely whether the quartz or the sphalerite was later in age.

2. The calcite, as it occurs in lense like bands is thought to be due partly to the replacement of the wall rock. It contains few sulphides and is usually pure white in color. It shows good cleavage and in this case mutual boundaries with the quartz.

Speciman A Veining of Arsenopyrite by Galena

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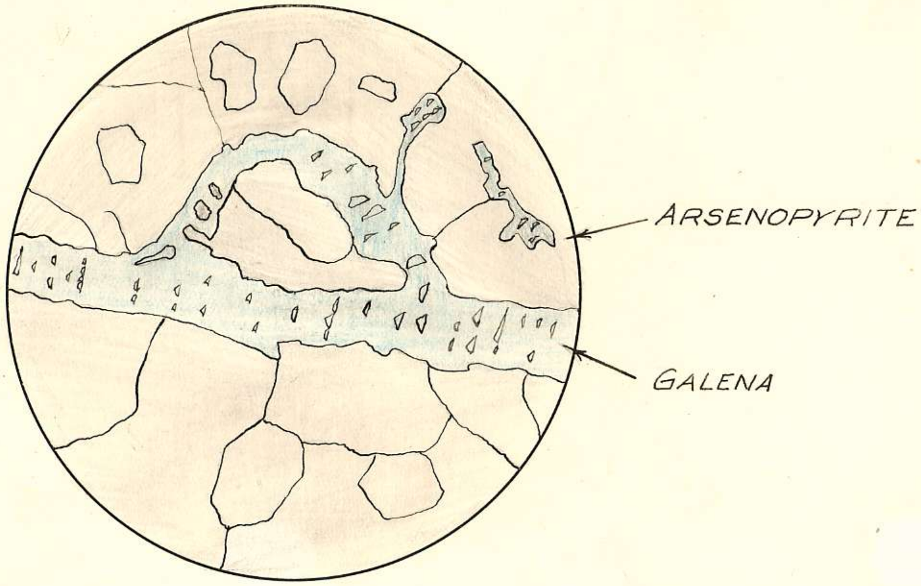

Magnification 23 X

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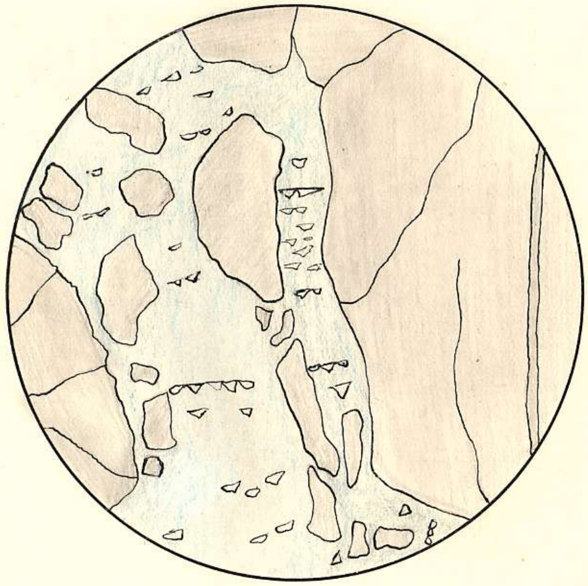

Magnification 23 X

Specimen B1

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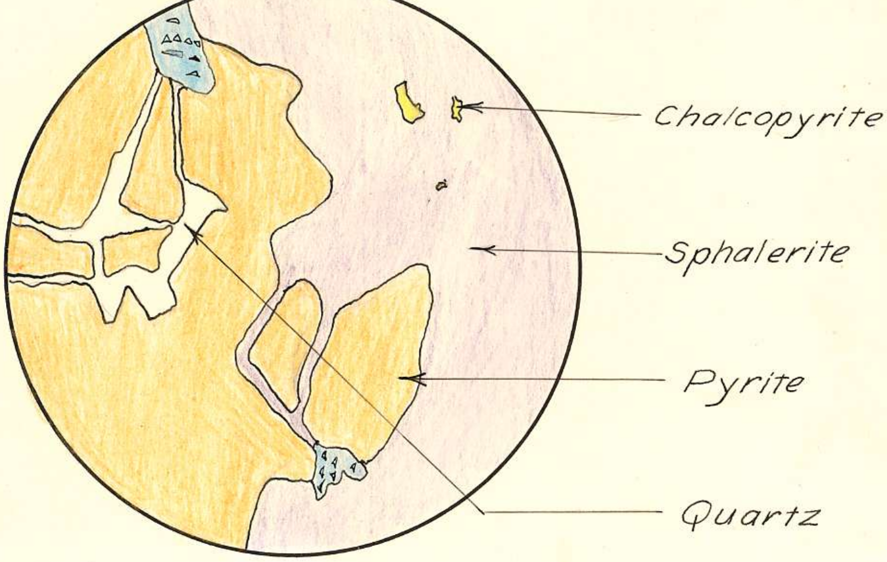

Magnification 45 X

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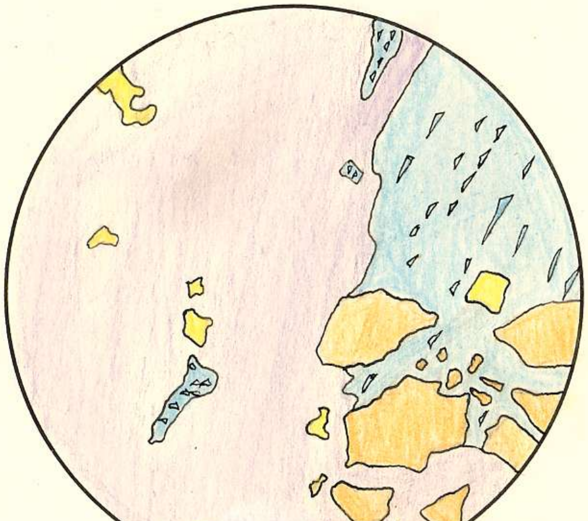

Magnification 150 X

Speciman B1

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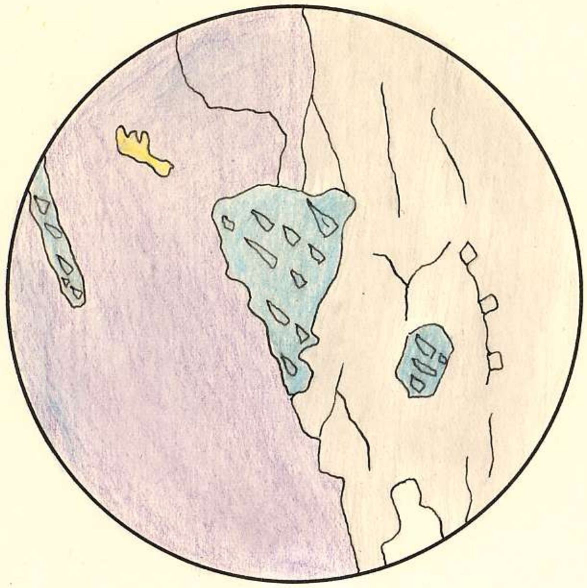
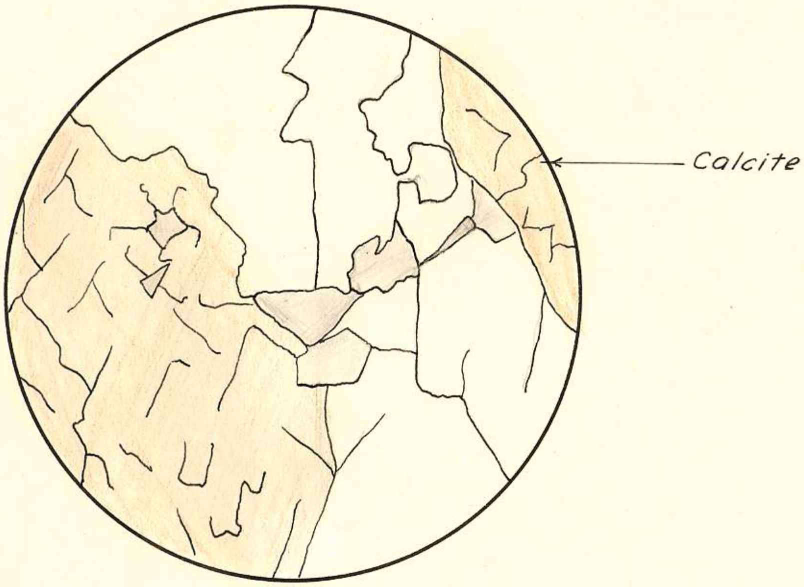


Speciman D

Magnification 150X

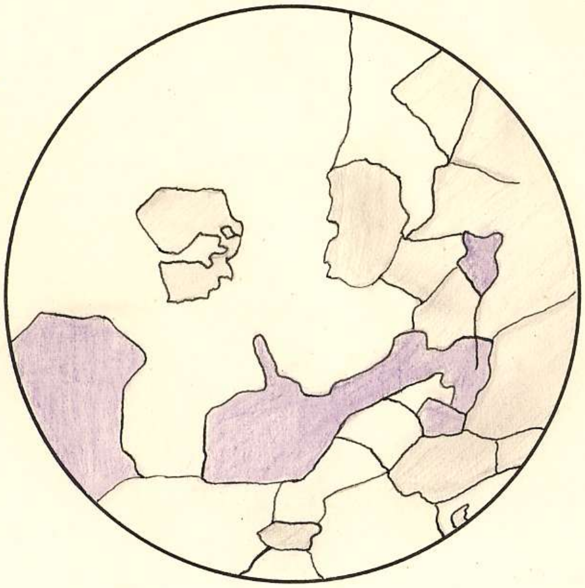
(2)



Magnification 23X

Speciman D

(1)



Magnification 23 X

Speciman C

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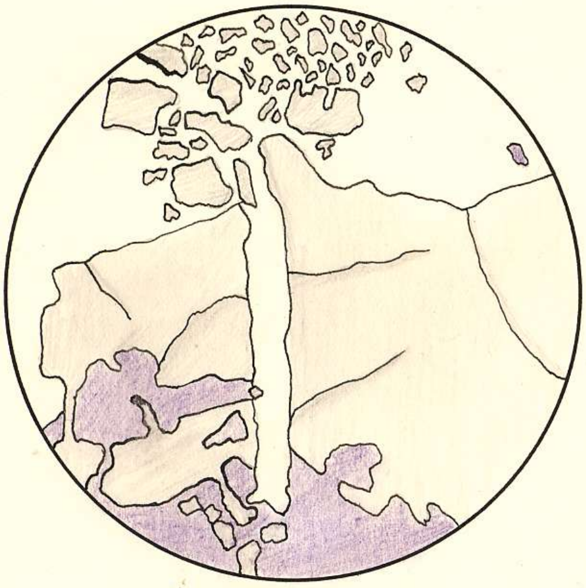

Magnification 23 X

The fact that the minerals (arsenopyrite) are found near the borders of the calcite seem to point to these sulphides having replaced, in part, the calcite.

PARAGENISIS

On the other properties in this area considerable work has been done by R. H. B. Jones. He has found three main types of ore, namely:

(a) Pyrrhotite-sphalerite ore with pyrite, and some arsenopyrite and chalcopyrite.

(b) Sphalerite-arsenopyrite ores with chalcopyrite and pyrite.

(c) Galena-sphalerite ore with some chalcopyrite, pyrite tetrahedrite and arsenopyrite.

In these cases the age relations are as follows:

Quartz, galena, sphalerite, arsenopyrite, chalcopyrite, pyrite, tetrahedrite, silver ores, and tetrahedrite amongst the last minerals to be deposited.

In the Jessie mine, however, the ore falls into two definite classes, namely:

(a) Arsenopyrite with some sphalerite, pyrrhotite, pyrite and chalcopyrite.

(b) Arsenopyrite-sphalerite-galena with some accessory sulphides.

No native silver or tetrahedrite was found and very little chalcopyrite, pyrite or pyrrhotite was seen.

There was only one distinct generation of quartz seen.

The following order is the general paragenises of the minerals.

(a) Arsenopyrite and pyrite.

(b) Quartz.

(c) Sphalerite, galena and chalcopyrite.

The age of the chalcopyrite is doubtful, and as no contacts between pyrite and arsenopyrite were seen, the age relations of these minerals one to another is doubtful.

Conclusions

FINENESS OF GRINDING.

The grinding of this ore with the view of a complete separation will be a problem. It will depend on the amounts of chalcopyrite and pyrite in the ore.

The separation of the aresnopyrite from the other minerals would require little grinding but to separate galena, pyrite, sphalerite and chalcopyrite would require grinding to at least 250 mesh. This would be necessary as the chalcopyrite, and the pyrite, is found in small patches of from 0.1 to .01 millimeters in size.

The most feasable treatment would be to grind to 200 mesh, and concentrate the ore by selective flotation of (1) arsenopyrite (2) galena and (3) Sphalerite, with greatest amounts of the chalcopyrite included in this latter; and (4) pyrite.

These four products would have to be shipped to a smelter where the chalcopyrite could be separated from the zinc in the electrolytic refining of this latter mineral.

MINERALS TO BE RECOVERED

The minerals to be saved are the four above mentioned, namely arsenopyrite, pyrite, galena and sphalerite. It is probable that the galena carries the silver, and the arsenopyrite, pyrite, and sphalerite carry the gold values. This was not well shown by the assays of pure minerals which ran as follows:

Pure	Arsenopyrite	Gold 0.35 oz. per ton.
"	Sphalerite	Gold Trace.
"	Galena	Gold Trace.
"	Arsenopyrite and quartz	Gold 0.20 ozs. per ton.
"	Pyrite and quartz	Gold 0.10 ozs per ton.

The assays for silver were not taken. It is probable that the galena carries most of the silver in solid solutions.

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