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MINERALOGRAPHIC STUDY OF THE

HASKIN MOUNTAIN ZINC-LEAD PROPERTY

Geology 409

Dr. R. M. Thompson

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April 30, 1956.

2265 Acadia Road

Vancouver, British Columbia,

April 30, 1956.

Dr. H. C. Gunning,
Dean of the Faculty of Applied Science
University of British Columbia.

Dear Sir:

Please find enclosed my essay entitled "Mineralographic Study of the Haskin Mountain Zinc-Lead Property", which partially fulfils the requirements of Geology 409 as laid down in the 1955-1956 Calendar of the University of British Columbia.

Yours truly,

John James McGraw

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ILLUSTRATIONS

ACKNOWLEDGMENTS

It is the writer's wish to express his appreciation for the kind interest and helpful guidance shown him by Dr. R. M. Thompson and Mr. W. M. Smitheringale in his mineralographic study, and by Mr. J.A. Donnan in the preparation of thin-sections and polished sections.

SUMMARY

The purpose of this report was to carry out a mineralographic study on samples from the Haskin Mountain zinc-lead property. This property is located four miles north of Mile 70 on Cassiar Road and 15 miles due east of Cassiar, British Columbia. At present the property is approximately 500 miles from Skagway via the Alaska Highway. By the proposed Stewart road the property would be 300 miles from the coast.

The Haskin Mountain property has been known since before 1920 when Haskin tried to promote it, and since that time sporadic interest has been shown with the latest work being that of Dr. A. E. Aho who examined the property for the British Yukon Exploration Company in 1955.

The rocks on the property belong to the Atlin group and are of Cambrian age. They consist of brown and white quartzites, brown to black argillites, limestones, dolomites and grey cherts.

Megascopic and microscopic examination has shown the following minerals to be present: sphalerite, galena, pyrrhotite, marcasite, pyrite, chalcopyrite, magnetite, hematite, and scheelite. These minerals occur as massive to disseminated bodies in scarn type rocks. The gangue minerals identified include: diopside, termolite, lime garnet, chlorite, and some carbonate remnants.

The following principal textures noted during the microscopic examination were:

1) "Bird's-eye" Texture formed as a result of the replacement of pyrrhotite by marcasite.

2) Ex-solution texture was exhibited by the following pairs of minerals: sphalerite-chalcopyrite, chalcopyrite-pyrrhotite, sphalerite-pyrrhotite.

3) Rim texture was indicated by a tongue of chalcopyrite which separates pyrrhotite from sphalerite.

4) Brecciation texture was exhibited by pyrite which is cemented by the later arriving sphalerites.

The paragenetic sequence based on structural and textural evidence is believed to be as follows: magnetite, pyrite, pyrrhotite (marcasite at a lower temperature), sphalerite, chalcopyrite, and galena. It is also believed that the ore minerals were introduced after the formation of the scarn minerals.

The assemblage of gangue minerals and metallic minerals present and the lack of an igneous contact near the deposit indicate that the deposit should be classified as a pyrometasomatic deposit with the temperature of the formation ranging from 400° - 600° C.

MINERALOGRAPHIC STUDY OF THE HASKIN MOUNTAIN PROPERTY

PURPOSE

The purpose of this essay is to carry out a mineralogical examination of the samples taken from the Haskin Mountain zinc-lead property. This examination will attempt the identification of the metallic minerals present, determination of their paragenetic sequence and also their relationships to the non-metallic minerals present.

LOCATION AND ACCESSIBILITY OF THE PROPERTY

The Haskin Mountain property is located 4 miles north of Mile 70 on Cassiar road 15 miles due east of Cassiar, British Columbia. The property is accessible by trail. At present the access to markets is by Alaska Highway to Whitehorse, Yukon Territory, a distance of 340 miles, then to Skagway and down the coast. By the proposed Stewart road the property is 300 miles from the coast.

HISTORY

The Haskin Mountain property has been known since before 1920 when Haskin tried to promote it and did some stripping and trenching. It was then idle till late in 1940 when there was some sporadic interest shown. In 1955 Dr. A.E. Aho examined the property for the British Yukon Exploration Company, Limited.

GEOLOGY

The rocks on the property belong to the Atlin group and are of Cambrian age. They consist of brown and white quartzites,brown to black argillites, limestones, dolomites and grey cherts. According to Dr. Aho one of the main structures containing much of the mineralization appears to be a complex synclinal fold in which limestones and dolomites are overlain by several hundred feet of thin-bedded chert. These limestones and dolomites at the southeast end of the syncline are replaced by white and brown argillite and quartzite. This change in lithology along strike is probably due to a northwest-southeast trending strike on the northwest side of Haskin mountain.

AVERAGE GRADE

The average grade is about 5% - 6% zinc, 1% or less lead, 2 ounces per ton silver, .01 ounces per ton gold, and locally a fraction of a percent of copper. According to Dr. A. E. Aho there are possibilities for several million tons of this grade and a smaller tonnage of a slightly better grade.

MEGASCOPIC EXAMINATION

The samples containing ore mineralization were scarn type rocks. The mineralization consists of sphalerite, galena, pyrrhotite, marcasite, pyrite, magnetite, hematite, chalcopyrite and scheelite and it occurs as disseminated to massive bodies in the scarn rocks. The pyrite and galena show well developed crystal forms with pyrite cubes up to one-eighth inch and galena cubes up to one-sixteenth inch. Most of the samples have a brown hematitic stain on their surfaces. Several of the samples containing massive sphalerite have a banded appearance with alternation of sphalerite and lime garnet. This was the only texture noted in the megascopic examination. In all the other samples the mineralization seemed very randomly distributed through the gangue. The gangue minerals identifiable in megascopic examination were lime-garnet and pyroxene.

MICROSCOPIC EXAMINATION

The following minerals were identified in ten prepared polished sections by means of optical properties, etch reactions and microchemical tests. The laboratory results are listed in the appendix.

Sphalerite occurs as fine grained masses in the scarn rocks where it filled in fractures and cemented crystals of the gangue. As was mentioned above, in some of the specimens the sphalerite formed rude bands with the scarn minerals. Under the microscope this mineral appeared quite a dark grey and exhibited a reddish brown internal reflection indicative of sphalerite with a fairly high iron content. In most specimens it occurs with pyrrhotite and chalcopyrite with mutual boundaries exhibited by all three of the minerals (see figure 1). Much of the sphalerite contains ex-solution blebs and laths of chalcopyrite (see figures 2 and 3).

Galena is present in small amounts in the specimens examined. It exhibits excellent triangular cleavage pits (figure 4). This mineral was commonly associated with sphalerite and appears to replace sphalerite. In several of the specimens it shows an anomalous blue-grey color and it was only after X-ray that this variety was identified.

Pyrrhotite is present in granular masses, filling fractures in and cementing crystals of the lime silicate minerals. It encloses and is enclosed by sphalerite and chalcopyrite and is oxidized in some specimens to magnetite. A characteristic feature of the pyrrhotite is its alteration to marcasite, producing a "bird's-eye" texture (figure 5). Where this alteration has taken place only a core of pyrrhotite remains surrounded by marcasite bands.

Marcasite. As mentioned in the description of pyrrhotite, marcasite is produced from the alteration of pyrrhotite. This alteration occurs due to the instability of pyrrhotite under changing conditions of acidity and temperature in the mineralizing solutions. The marcasite occurs as irregular bands around a core of pyrrhotite.

Pyrite occurs as coarse grains showing rectangular and square outlines; fine grained spherical masses and coarse grained crystal fragments. It appears to have crystallized before the other sulphides only to be brecciated by the later arriving solutions. It has been cemented by the sphalerite but there is no evidence of corroding. Small amounts of pyrite were found in the sphalerite which may be remnants which were not replaced by the latter.

Magnetite was present in the specimens as irregular stringers and granular aggregates which have been largely replaced by hematite. It is also associated with pyrrhotite and chalcopyrite.

Hematite. As was mentioned above hematite occurs replacing magnetite. A deep red internal reflection is characteristic of some of the hematite. In the specimens examined the hematite was found bordering the magnetite but not associated with any of the sulphides except pyrrhotite.

Scheelite occurred in two of the specimens as minute blebs (80 microns) within the silicate minerals. It was identified by its property of fluorescing white under the ultra-violet lamp, together with its other physical properties.

Gangue Minerals. The following gangue minerals were identified in two prepared thin sections: diopside, tremolite, lime-garnet, chlorite and some remnants of carbonate. The sulphide solutions have, in some areas of the slide, corroded and brecciated the gangue minerals.

TEXTURES

The following textures were noted during the examination of the ten prepared polished sections:

"Bird's-eye texture".

This texture was developed by the replacement of pyrrhotite by marcasite. This replacement takes place due to a change in acidity and temperature of the residual mineralizing fluids which causes the pyrrhotite to beoome unstable and dissolve spontaneously. Marcasite is re-precipitated almost immediately and is stable under the new conditions.

Ex-solution texture.

The following ex-solution intergrowths were noted:

(i) sphalerite - chalcopyrite (figure 2)

(ii) chalcopyrite - pyrrhotite (figure 3)

(iii) sphalerite - pyrrhotite (figure 3)

In the case of the intergrowth between sphalerite and chalcopyrite minute blebs of chalcopyrite occur in sphalerite. In one case the chalcopyrite appears in laths indicating a possible crystallographic control (figure 2), but in most cases the distribution is random and the blebs range from 20 microns to 50 microns giving a mottled texture.

The intergrowth between chalcopyrite and pyrrhotite shows fine laths and blebs of chalcopyrite in pyrrhotite. According to A.B. Edwards the chalcopyrite dissolves in pyrrhotite at 600° C. and unmixes on cooling.

The ex-solution intergrowths of sphalerite and pyrrhotite indicate that both these minerals appear as host. In both cases either the sphalerite or the pyrrhotite appear as inclusions in whichever is the host.

Rim Texture.

A tongue of chalcopyrite was observed which separates pyrrhotite from sphalerite (figure 6). It is believed by the writer that this was due to ex-solution of the chalcopyrite from the sphalerite or pyrrhotite and its localization along the contact between the two host minerals.

Brecciation texture.

This texture was exhibited by pyrite which appears to have been brecciated and then cemented by the later arriving sphalerite, pyrrhotite and chalcopyrite.

PARAGENESIS

A study of the prepared polished sections shows that the mineralizing solutions came in after the crystallization of the gangue minerals (figure 7).

The order of crystallization of the ore minerals appears to be as follows: magnetite, pyrite, pyrrhotite (marcasite at a lower temperature), sphalerite, chalcopyrite and galena. This possible order of deposition was based on textural and structural evidence gathered from the prepared polished sections.

Magnetite is believed to have crystallized first because wherever it occurs it is surrounded by the other ore minerals. Pyrite was probably the next to crystallize as it exhibits a brecciated texture with the later arriving sphalerite, pyrrhotite, or chalcopyrite cementing the fragments.

With regard to the order of deposition of the pyrrhotite, sphalerite and chalcopyrite the examination indicated that sulphide solutions were introduced into the already formed scarn rocks and that these three minerals were crystallized simultaneously. Evidence is that the pyrrhotite may have crystallized slightly before the chalcopyrite and sphalerite since in some sections these minerals fill small fractures in the pyrrhotite. Temperature criteria would favor this since pyrrhotite is generally considered to be a higher temperature mineral than chalcopyrite or sphalerite.

Temperature criteria indicates that the galena would crystallize at a lower temperature than the sphalerite or chalcopyrite. However, no evidence could be found from polished sections to substantiate this fact.

The tiny blebs of scheelite with lime garnet and epidote indicate that the scheelite was introduced with these two gangue minerals.

TYPE OF DEPOSIT

The assemblage of gangue minerals and metallic minerals indicate that this property would be classed as a pyrometasomatic deposit. According to W. Lingren the temperature of formation of such a pyrometasomatic deposit would be from 400° C to 600° C.

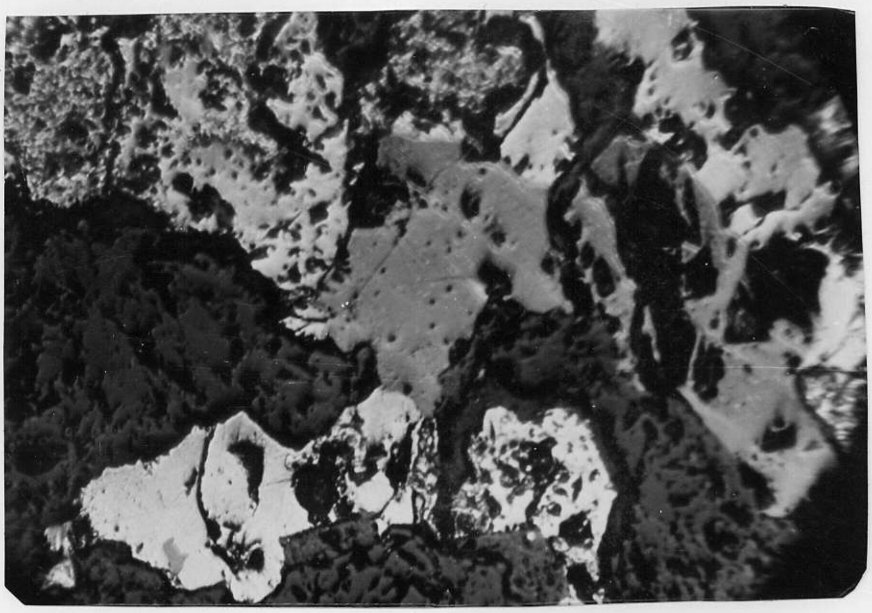


Figure 1 Pyrrhotite(light-gray, rough surface), sphalerite (dark-gray, smooth surface), chalcopyrite(light-gray, smooth surface) exhibiting mutual boundaries x 186

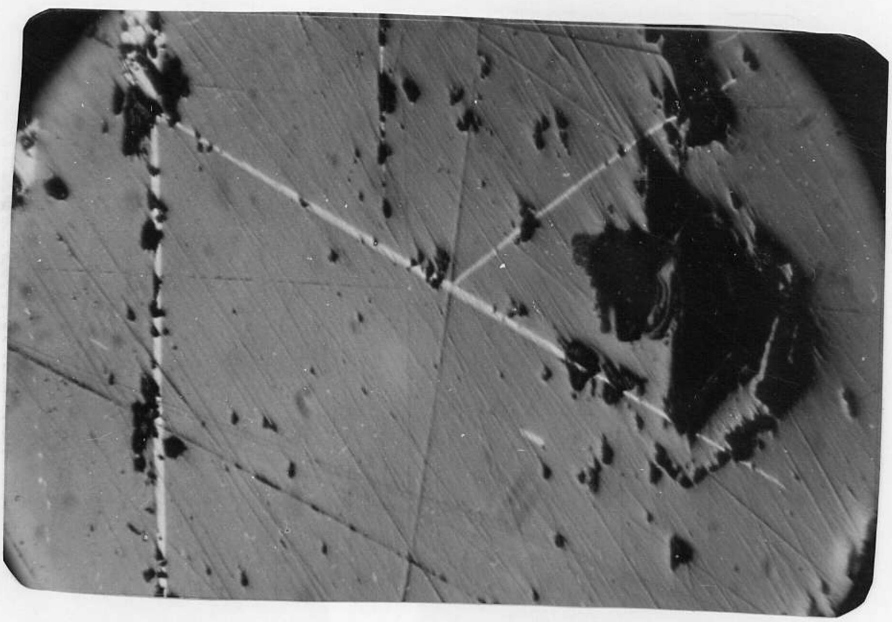
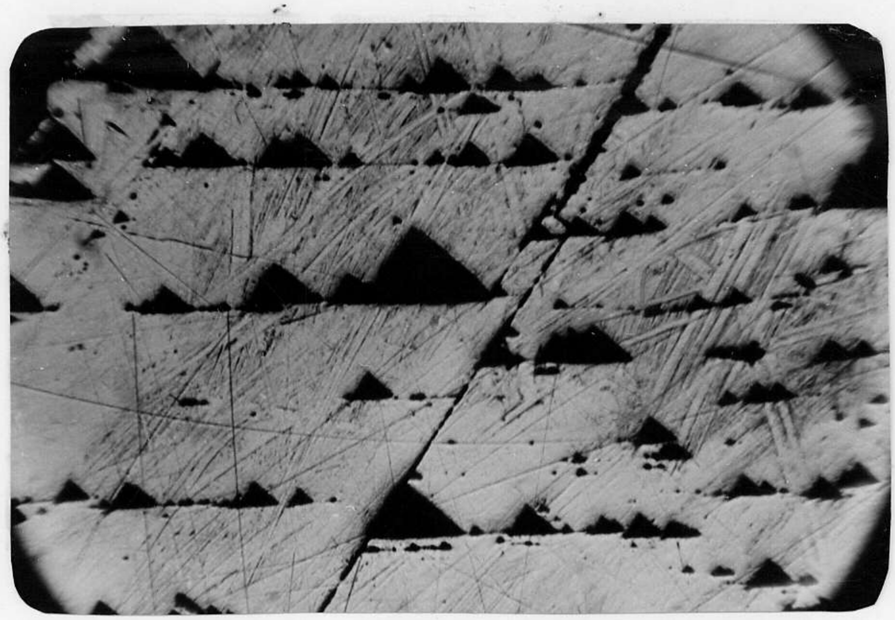


Figure 2 Laths of chalcopyrite (light-gray) exolved from sphalerite (dark-gray). x 186.

X186

Figure 3 Pyrrhotite(light cream-mauve), sphalerite(purple-gray), and chalcopyrite(yellow) exhibiting mutual boundaries, chalcopyrite showing mottled texture.



x21

Figure 4 Galena showing triangular cleavage pits.

x 21

Figure 5 Alteration of pyrrhotite(core) to marcasite(concentric rings). Taken under reflected light and one nicol.

x 186.

Figure 6 Pyrrhotite(white, top of picture), sphalerite(dark-gray) separated by a rim of chalcopyrite(bright-white tongue).

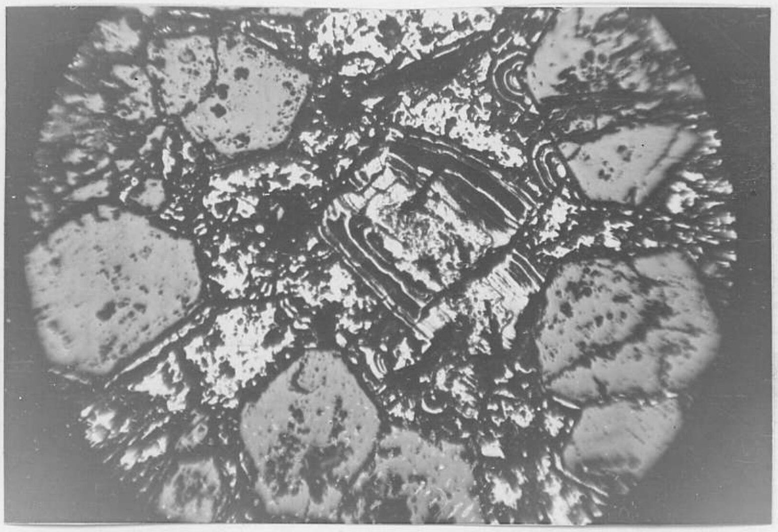


Figure 7 — Diopside crystals(dark-gray) cemented by pyrrhotite (white, massive) and marcasite("birds-eye" texture). x21