The Mineralogy of Some Specimens of Hardscrabble Sulphides.

A Geology 9. Report

by

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Introduction:

During the spring term the writer has examined, with a reflecting microscope, polished sections of quartz-sulphide specimens from the property of Columbia Tungstens Limited on Hardscrabble Creek in the Cariboo District. The minerals were determined by observation, by the use of an arc lamp, and by etch tests. The galenobismutite (?) was determined by etch tests and checked with the latest, unpublished determinations of Short, Warren, et al. By previous determinative etch test data, the mineral would have been named cosalite. A positive microchemical test for bismuth was made on this mineral.

Acknowledgments:

The writer is indebted to Dr. H. V. Warren for help and suggestions in determinative tests and technique. The writer is also indebted to Messrs. Charles Ney and Alfred Allen for help in preparing the specimens, checking the tests, and determining the paragenesis.

Location of the Property:

The property of the Columbia Tungstens Company, Limited is located on Hardscrabble Creek, just above its junction with the Willow River, and is about five miles, by motor road, north-west from Wells.

Geology and Mineralization, as Reported:

Reference: Stevenson, J. S., Tungsten Deposits of British Columbia, B. C. Dept. of Mines, Bull. 10, 1941, pp. 58-67.

The rocks of the area are part of the pre-Cambrian Cariboo Series. They lie in an area of much faulting and it is doubtful as to what part of the series they belong.

"The rocks, as exposed in the underground workings are mainly grey, fissile quartzites and black to grey phyllites. They range in strike from north 65 degrees east to south 85 degrees east and in dip from 20 degrees to 47 degrees north-ward, nearly vertical dips were observed in only one place. These rocks are cut by two fault-zones, the larger of which strikes north 20 degrees west and dips steeply south-westward, and the other strikes in general, north 70 degrees west and dips 60 degrees north-eastward.

Mineralization has resulted in three kinds of veins (1) a gold-bearing lenticular quartz vein, (2) two apparently non-gold-bearing, quartz veins and (3) scheelite-bearing quartz veinlets or stringers.

On Number 3 level, at a point 10 feet west of the shaft, a quartz-sulphide lens that contains appreciable gold values has been cut; this has been referred to as the "Gold Vein" At the time of the writer's visit the lens had been tightly lagged because of bad ground, however, as seen between the lagging, the lens ranged in width from 6 inches to 2 feet. Two samples taken across 10-inch and 2-foot widths assayed: Gold, 0.26 ounces and Gold 1.2 ounces per ton, respectively. Surface dump material, reported to be from this vein, was examined and several specimens were seen to contain free gold.

The two non-gold-bearing quartz-sulphide veins occur in Numbers 2 and 3 levels; a small one on Number 2 level, and a large one on Number 3 level at a point 20 feet northerly from the shaft. The foot-wall of each vein is bounded by fault-gouge. The clean-cut nature of both walls and the fault-gouge on one wall of each vein suggests that these are quartz-filled fissure-veins. The vein-filling consists of quartz and the sulphides---- pyrite, sphalerite and galena. Although sulphides are abundant, the amount of gold is negligible. A picked sample of vein-matter from the vein in Number 3 level assayed: Gold, nil; lead, 21-2 per cent; zinc, 17.5 per cent.

The scheelite-bearing veinlets comprise two types, (1) filled "tension" joints that transect the bedding of the rocks, and (2) veins or stringers that follow the bedding and schistosity of the enclosing rocks.

The veinlets that occupy tension joints strike north 32 degrees east and dip steeply south-eastward; they definitely cut the bedding which, in the immediate vicinity of the joints strikes from north 65 degrees east to due east and dips 25 degrees north-westward. These veinlets range in length from a few inches to several feet, in width from 1/4-inch to 3 inches, and in spacing intervals from a few inches to several feet.

The bedding-plane veinlets and lenses tend to be more lenticular and discontinuous than those filling tension joints; a definitely lenticular cross-section is common. Although most of these follow the bedding, some of the lenses tend to cross it at small angles in the form of irregular veinlets. The lenticular veinlets range from 1 inch to several inches in width and from a few inches to approximately 1 foot in length.

The mineralogy of both types of veins is similar. The minerals, listed in order of abundance are: quartz, ankerite, calcite, scheelite and traces of sphalerite and galena. All of them are not always present in the same vein."

The Specimens:

The specimens which the writer examined were picked from the mine dump by Dr. H. V. Warren during a brief visit in the summer of 1940. All were examined for scheelite with the ultra-violet lamp and none was observed. It is thus safe to say that they come from the first and second types of veins referred to by Stevenson. Only one specimen contained gold, and very likely came from the "Gold Vein" on Number 3 level. The others apparently came from the non-gold-bearing quartz-sulphide veins, but, of course, cannot be located.

Descriptions of Specimens:

Section H2 (Hand Specimen II)
-see plate one, figures 1 & 2.

Pyrite. Fractured masses exhibit some straight edges, contacting quartz, or calcite which has replaced quartz. Other boundaries are ragged and the pyrite appears to be replaced by quartz, galena, and calcite. This calcite probably replaced previous quartz and galena. Fracture fillings in the pyrite are quartz.

Quartz. The quartz has mutual boundaries with pyrite and occurs also as fracture filling in pyrite. It appears to replace pyrite along some of the fractures.

Galena. The galena replaces pyrite mainly, and quartz to some extent. It carries small grains of chalcopyrite (mostly .05 mm.) which appear to be contemporaneous.

Calcite. The calcite seems to replace the quartz, and also the the galena, leaving the chalcopyrite behind.

Chalcopyrite. Besides the small specks in the galena and calcite, one small speck was observed in the pyrite.

Proposed Paragenesis:

Pyrite _____

Quartz _____

Galena _____

Calcite _____

Chalcopyrite _____

Section H8 & H5 (Hand Specimen III)

Quartz. The quartz has regular fractures, well spaced, but is otherwise semi-transparent and massive. It is replaced along widened fractures. The replacing minerals are sericite and galena.

Sericite. Sericite appears to be the earliest replacing mineral, being itself replaced by galena. The sericite flakes out in small cleavage plates.

Galena. The galena replaces quartz along fractures, and is closely intergrown with sericite along the continuations of the same fractures, where sericitization has occurred.

Proposed Paragenesis:

Quartz _____

Sericite _____

Galena _____

Section H7 (Hand Specimen I)
-see plate two, figure 1.

Sphalerite. The sphalerite occurs as fractured irregular masses with chalcopyrite disseminated throughout. In places the sphalerite appears to be replacing quartz and pyrite, and in other places veined by quartz. Galena and chalcopyrite replace the sphalerite.

Pyrite. The pyrite occurs as fractured masses, exhibiting some straight edges, but usually with rounded or irregular boundaries. It is replaced by sphalerite, and to a slight extent, by galena, and it is fracture- filled by quartz.

Galena. The galena occurs mainly between or around sphalerite masses. Also it occurs, to some extent, following cracks in the quartz, or along contacts with pyrite. There appears to be some replacement of pyrite, but the main replacement is of the sphalerite, which has previously replaced pyrite and quartz. There is a mutual contact with one grain of chalcopyrite.

Chalcopyrite. Besides being disseminated in the sphalerite, this mineral occurs having a mutual contact with galena (in quartz), and having a mutual contact with sphalerite, and as a few specks replacing quartz.

Quartz. Quartz appears to be present as two generations. First generation: straight mutual contacts with pyrite, and replaced by sphalerite, galena, and chalcopyrite. Second generation: fracture filling pyrite (may be end of first generation) and replacing sphalerite along fractures.

Proposed Paragenesis:

Pyrite _____

Quartz _____ ____

Sphalerite _____

Chalcopyrite - - - - - - _____

Galena _____

Section H5 (Hand Specimen V)

This section is similar to H7 (above).

Section H6 (Hand Specimen VI)
-see plate two, figure 1. and
plate three, figures 1 & 2.

Pyrite. Pyrite occurs as what appears to be remnants of original crystals in parallel arrangement, as islands, and as scattered specks in the sphalerite . It is by far the most fractured of all the minerals, and, from the above description, is assumed to be replaced by sphalerite. It is also either fracture-filled or replaced by quartz.

Quartz. Quartz occurs in the pyrite and is replaced by sphalerite. Galenobismutite (?) appears to replace quartz in fractures, but on closer examination, seems always to replace earlier sphalerite. Where gold replaces the quartz, it is not associated with other minerals, but in clean irregular cracks. Minor replacement by chalcopyrite was noted.

Sphalerite. The sphalerite replaces both pyrite and quartz, and is itself replaced by gold and galenobismutite (?). Chalcopyrite is mainly contemporaneous, but may, in part, be later.

Chalcopyrite. As usual, the chalcopyrite occurs as a fine dissemination in the sphalerite. There are also rather numerous larger grains in the sphalerite. These may be contemporaneous or just later. Chalcopyrite, without sphalerite, replaces quartz in very small amounts.

Galenobismutite (?). This mineral caused some trouble in determination. It is positive to $FeCl_3$, quickly positive to HCl. quickly positive to and deeply etched by HNO_3 (effervescence noted along one grain--probably due to minute amount of calcite along boundary with quartz--none observed from surface, or from

another grain tested), negative to other reagents, slightly anisotropic, galena-white in color, and gave a positive bismuth test with CsCl. According to Dr. Warren, it reacts like galenobismutite, except that it does not form free sulphur with HNO_3.

The mineral has its main occurrence in sphalerite, replacing either irregularly, but in a general band, or more regularly at a quartz contact.

Gold. Gold replaces quartz in tiny fractures well away from the sulphides, and also occurs along the contact between quartz and sphalerite, being in both. Where it is in the sphalerite, it is associated with the galenobismutite (?), as well as the chalcopyrite always present. One small grain was found which appeared to replace galenobismutite (?) along a quartz contact.

Grain sizes: .35 x .08 mm. in sphalerite.
.13 x .10 mm. in galenobismutite (?).
Those in quartz are long, thin, and branching.

Proposed Paragenesis:

Pyrite ————————

Quartz ————————————

Sphalerite ————————————

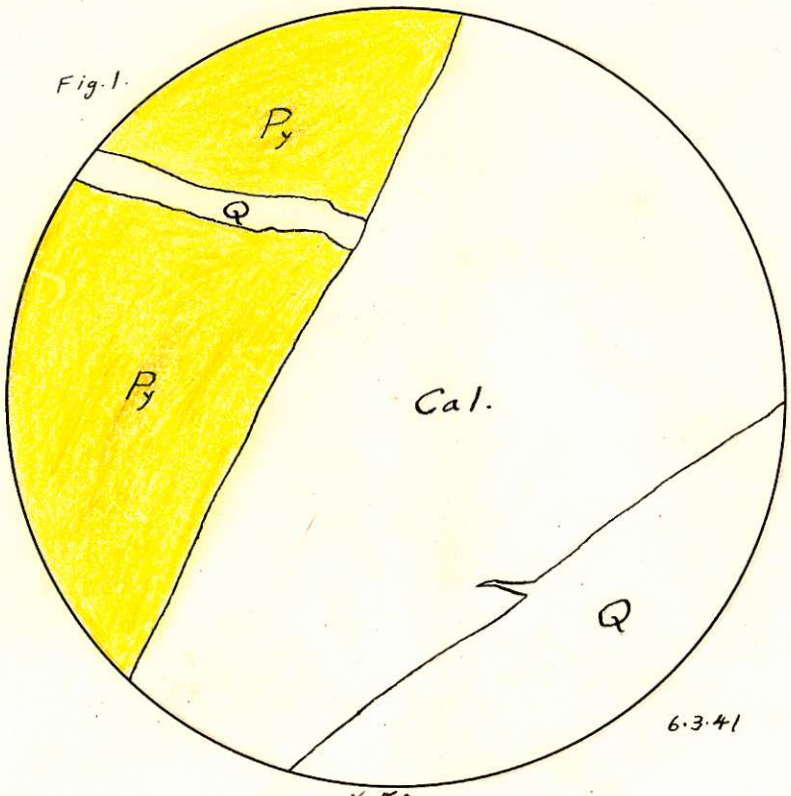
Chalcopyrite - - - - - ————

Galenobismutite (?) ————————

Gold ————————

PLATE ONE

Fig. 1.



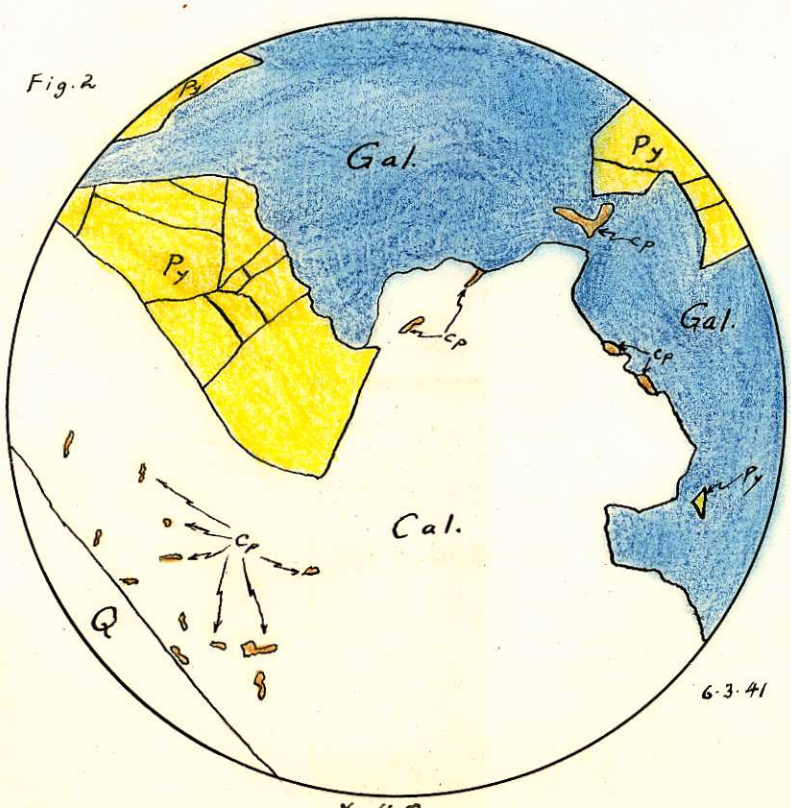
H2

6.3.41

X 50

Showing pyrite fractured filled by quartz, and calcite replacing quartz.

Fig. 2



H2

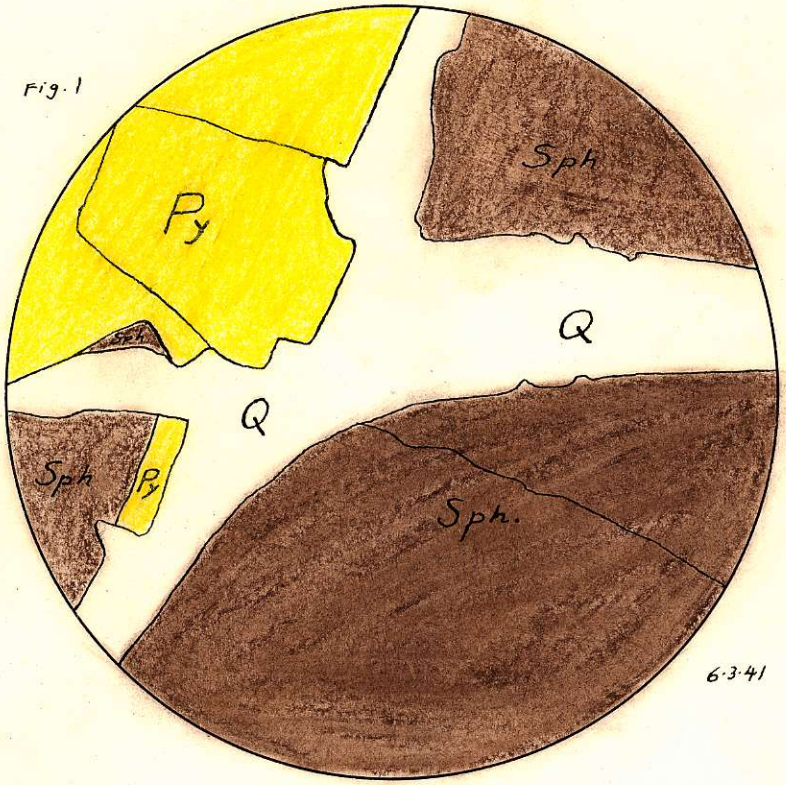
6.3.41

X 40

Showing galena replacing pyrite, chalcopyrite in galena, and calcite replacing galena but not chalcopyrite.

PLATE TWO

Fig. 1



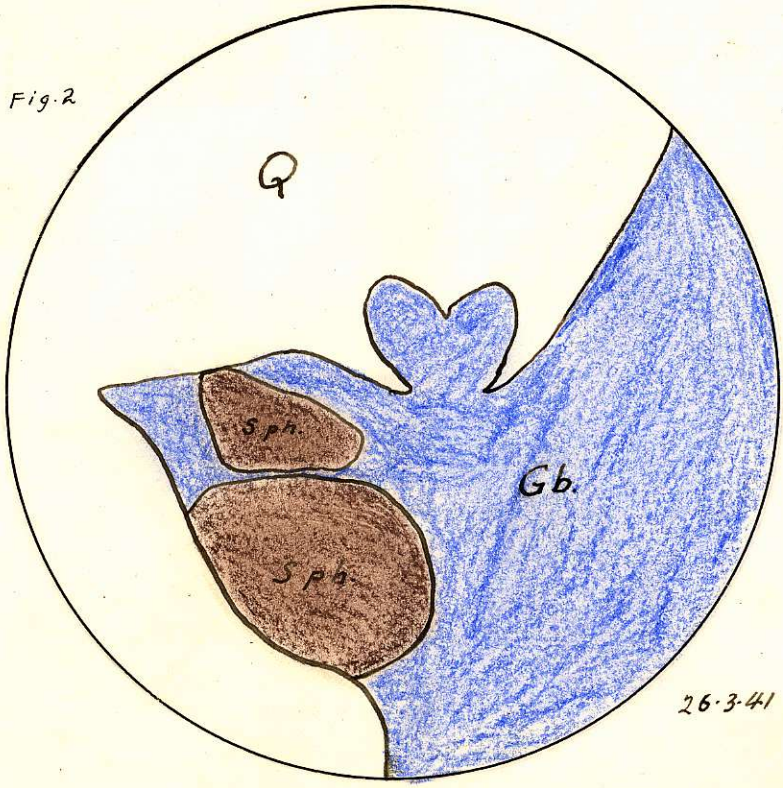
6·3·41

X 50

H 7

showing quartz (2nd gen.) after sphalerite after pyrite.

Fig. 2



26·3·41

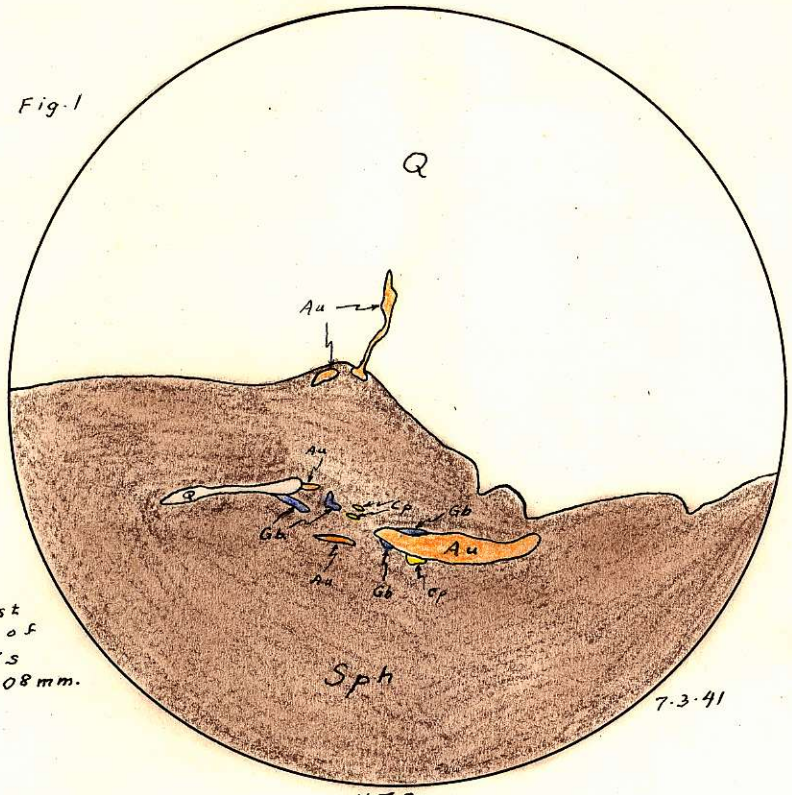
X 350

H 6

showing galenobismutite after sphalerite after quartz

PLATE THREE.

Fig. 1



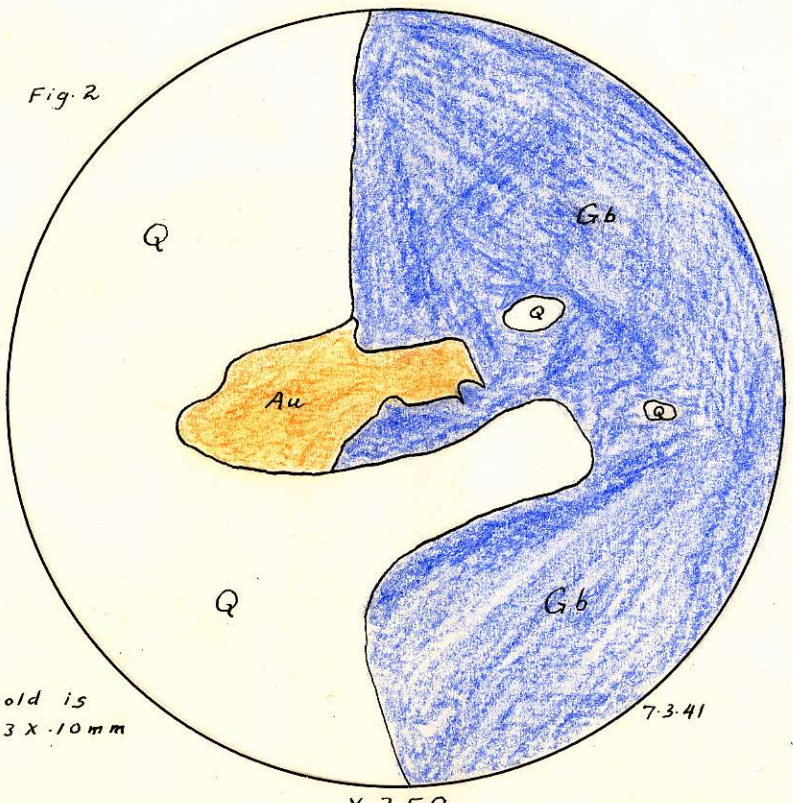
Largest piece of Gold is .35 x .08 mm.

X70

HG

Showing sphalerite after quartz, gold after quartz, and gold and galenobismutite(?) after sphalerite.

Fig. 2



Gold is .13 X .10 mm

X350

HG

showing gold after galenobismutite (?) along a quartz contact. (Gb had previously replaced Sph.)