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RELATIONSHIP OF SOME SILVER MINERALS

from the

HIGHLAND BELL MINE

D. J. Berryman

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INTRODUCTION

This report of work done in the Geology 9 laboratory course of microchemistry and polished section microscopy is based on the study of a suite of polished sections of ore from the Highland Bell mine at Beaverdell, B. C., with the object of determining the minerals present and the relationship of the silver bearers.

CONCLUSIONS and SUGGESTIONS

Polybasite replaces pyrargyrite, galena, tetrahedrite and sphalerite. Pyrargyrite is almost always found with polybasite.

The use of etch reagents to bring out color contrast before photographing is recommended. (See plates 2 and 3).

Because photographic plates are more sensitive to the blue end of the spectrum than to the green, yellow and red end, a set of filters, at least blue, green and yellow, would be very useful for the laboratory camera. (See Short,[1] p 53). For example, the contrast between pyrite and polybasite in plate 5 might have been increased by using a yellow filter. The filter would cut out the blue reflected from the polybasite, thus darkening it, darken the sphalerite, brighten the pyrite and leave the silver about the same.

LOCATION

The Highland Bell mine is located on Wallace Mountain about four miles from the town of Beaverdell on the Westkettle River in southern British Columbia. Beaverdell is about 25 miles north of the International Boundary. There is a good gravel road from Kelowna ~~or~~ and Rock Creek, and the Kettle Valley branch of the Canadian Pacific Railway passes through the town.

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[1] Short M.N., Microscopic Determination of the Ore Minerals, U.S. Dept. of the Interior, Geological Survey bulletin 914.

TOPOGRAPHY

The district is drained by the Kettle River and its tributary the Westkettle. The maximum relief within the area is 3,250 feet. About two-thirds of the district is upland. The remainder consists of steep sided valleys. The upland is rolling, with average slopes from hill tops to main drainage lines of about 200 feet to 300 feet to the mile. The maximum relief within the upland is nearly 2000 feet. The main valleys are steep sided with flat terraced bottoms. The streams within them are of low gradient. Evidences of a recent disorganization of the drainage are plentiful upon the upland.

GENERAL GEOLOGY

The Wallace Group [2] is a complex consisting of limestone, argillites, andesites, tuffs, schists and basic plutonic rocks. Most of the formation has been highly metamorphosed. The rocks of the Wallace Group have been intruded and metamorphosed first by the Westkettle quartz diorite batholith, and later by the Beaverdell quartz monzonite batholith. The Beaverdell batholith is believed to have been the source of the hydrothermal solutions which deposited the main ore bodies of the Beaverdell mines. McKinstry [3] concludes that the similarity in composition of the two intrusives

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(2) Reinecke, L., Ore Deposits of the Beaverdell Map Area, Can. Geol. Survey. Mem. 79, 1915.

(3) McKinstry, A.E., Silver Mineralization at Beaverdell, B. C., Economic Geology, Vol. XXIII, No. 4, p435, 1928.

suggests that they are differentiates of the same magma. The Beaverdell batholith, which is litte more than a stock, intrudes the earlier Westkettle batholith, the sediments, and the volcanics. It is surrounded by the productive veins, which, passing upward into the older Wallace Group, lose their values.

Ore Deposits (2)(3)

The veins strike east and west, and most of them dip southward, although a few are vertical or dip northerly. They vary in width from a few inches to six or eight feet though the individual ore-bearers are seldom more than a foot or so in width.

The gangue is mainly quartz. The first generation of vein filling minerals consisted of pyrite with some arsenopyrite, sphalerite, galena, tetrahedrite and pyrargyrite. Some veins were predominant in either pyrite, sphalerite or galena. A second type of vein filling which is later than the earliest faulting carries calcite, argentite and native silver.

Ore from other mines near the valley bottom consists of coarse grained sphalerite and galena with decidedly lower silver content and higher gold.

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(2)(3) Reinecke and McKinstry, ref. p 3.

Assays of Picked Minerals

	Sphalerite	Pyrargyrite Crystals Sp.gr.5.86	Pyrargyrite Massive Sp.gr.5.63	Polybasite ~~Crystals~~ massive Sp.gr.6.26	Xels 6.33	Acanthite Crystals*	Acanthite Massive
Ag	0.02%	59.85%	58.15%	69.72%	67.13	86.15* %	85.98*%
Sb	Trace	20.51	21.70	10.15	9.50	Trace	0.57
As	Trace	1.75	0.52	0.63	.78		
S	32.27	17.67	18.15	15.68	16.94	12.72	12.39
Zn	58.30	0.15	Trace		Tr	0.40	0.31
Cu	1.20			3.70	2.23	0.18	0.31
Fe	7.15		Trace		.31	0.25	0.21
Pb			0.10		2.41		
Cd	0.55						
Mn	0.09						
Insol	0.24		0.75				
Bi					.80		
	99.84%	99.93%	99.37%	99.88%	100.1	99.70%	99.77%
*Plus Undetermined Residue						0.27	0.21
						99.97%	99.98%

The above assays are recorded here mainly as a record.

From the polished sections one may infer that pyrargyrite, polybasite and silver came in that order, that is, the solutions became richer in silver and lower in antimony and sulphur as time passed. Conversely, therefore, from the assays one may infer that a possible order of deposition is tetrahedrite, freibergite, pyrargyrite, polybasite, acanthite and silver.

Acanthite has not been discovered in polished sections of this ore.

Crystals of acanthite, covered with a black coating of pyrargyrite have been isolated. There may have been a secondary deposition of pyrargyrite, or an overlaping of the acanthite.

SILVER MINERALS

Much of the tetrahedrite, pyrargyrite, and polybasite seem to have been deposited simultaneously. There is, though, a possibility of overlap and that they were deposited in order of increasing silver content.

Native silver is apparently the last metallic mineral to be deposited.

Tetrahedrite was identified by its color, hardness and lack of reaction with etch reagents. Drawing a needle a cross the boundary of galena, tetrahedrite and polybasite or pyrargyrite left a scratch noticeably deeper in the softer minerals. In contact with galena, polybasite or pyrargyrite this mineral appeared to be tan grey. It was always observed to occur with one or both of the ruby silvers, especially polybasite.

There is a possibility that the mineral here called tetrahedrite is really freibergite, an argentiferous variety. The close association of high silver minerals with tetrahedrite make this probable. As yet, all showings of tetrahedrite have been too small and dispersed to be picked clean for assaying.

Pyrargyrite was recognized by its blue-grey color, its etch reactions, its brilliant red reflection of inclined light and its hardness. It is bluer and softer than polybasite. It often replaces galena. Pyrargyrite is usually associated with other silver sulfo-salts, and often with native silver.

Polybasite was determined by its color, hardness and etch reactions. Its color, smooth dull grey is often difficult to distinguish from the slightly tan grey of tetrahedrite. The two are easily separated by hardness. Polybasite is less common than pyrargyrite in most sections. It commonly replaces galena, particularly in narrow veinlets where galena has replaced sphalerite. In plate 2 the polybasite seems to be replacing tetrahedrite, but it is not plain whether polybasite is also replacing galena. Plate 3 shows galena replaced by tetrahedrite and polybasite. It is most likely that tetrahedrite replaced galena and was in turn replaced by polybasite.

Native silver is distinguished by its sectile scratch, its etch tests and its isotropism. Silver was found in sections composed mostly of sphalerite, where it is associated with pyrargyrite, polybasite, tetrahedrite or pyrite. It tarnishes to a bright golden brown in the air, and is then apt to be confused with other minerals, particularly with chalcopyrite, or by some people with gold.

MICROPHOTOGRAPHS

The following plates are numbered the same as the corresponding negatives which Dr. Warren has classified in his office.

Minerals are designated as follows:

g	galena
pb	pollybasite
pr	pyrargyrite
py	pyrite
sp	sphalerite
T	tetrahedrite
Ag	silver

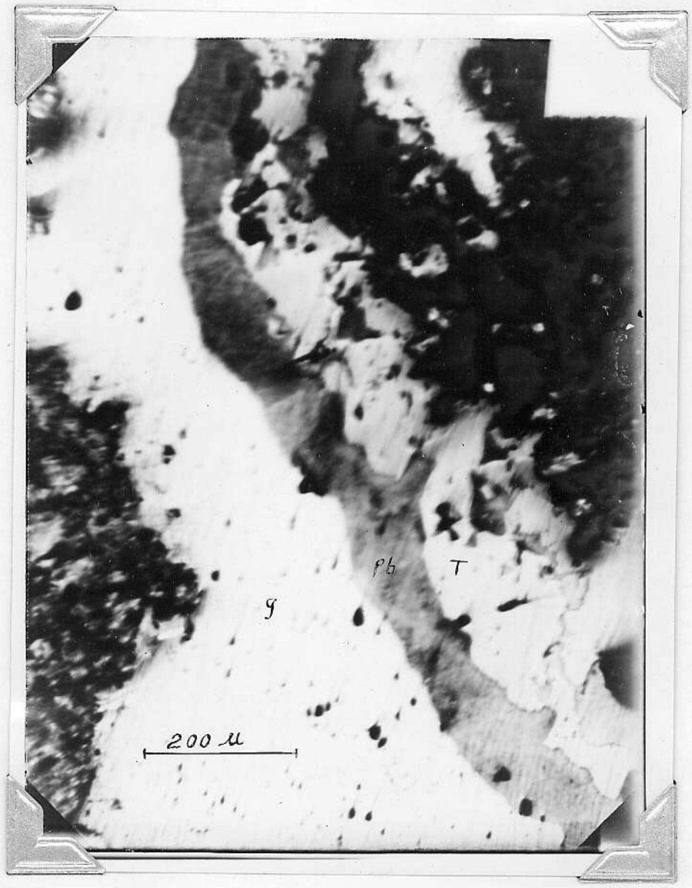

Plate 2. Left to right - fractured pyrite, galena, polybasite etched with $Hg\ Cl_2$, tetrahedrite and quartz. X 80.

Plate 3. Galena replacement. Polybasite etched with $Hg\ Cl_2$, tetrahedrite, and some pyrargyrite. X 80.

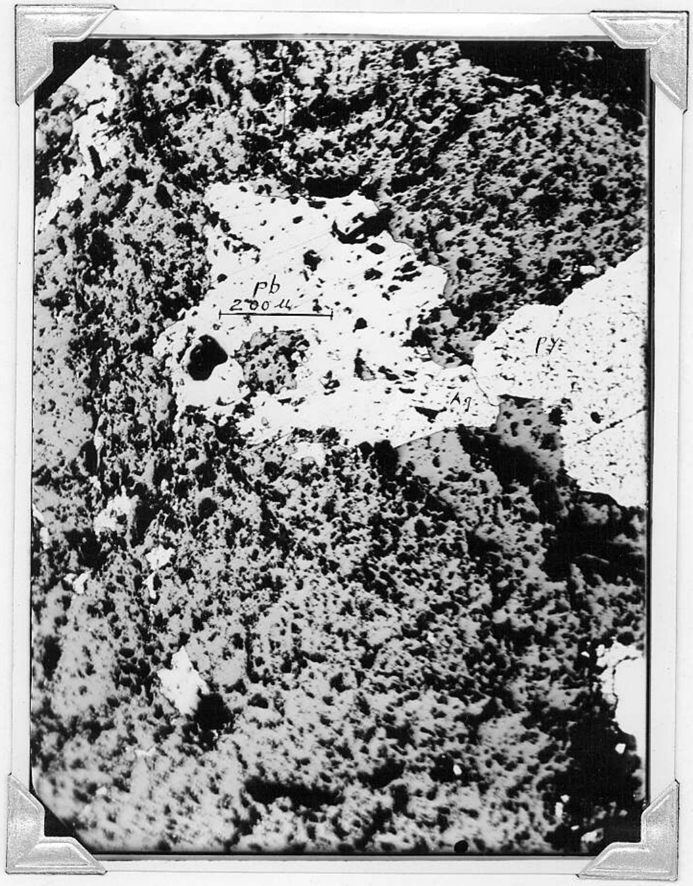

Plate 5. Crystal of polybasite (left), crystal of pyrite (right), silver between. Matrix sphalerite. X75.

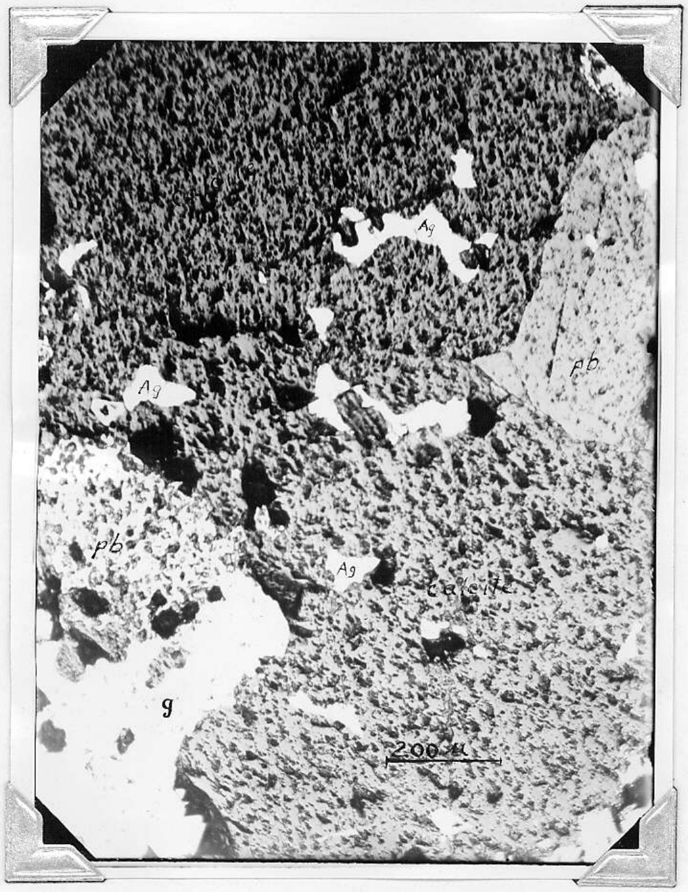

Plate 6. Silver in calcite. Calcite pseudomorphous after sphalerite. Galena and polybasite. X 75.

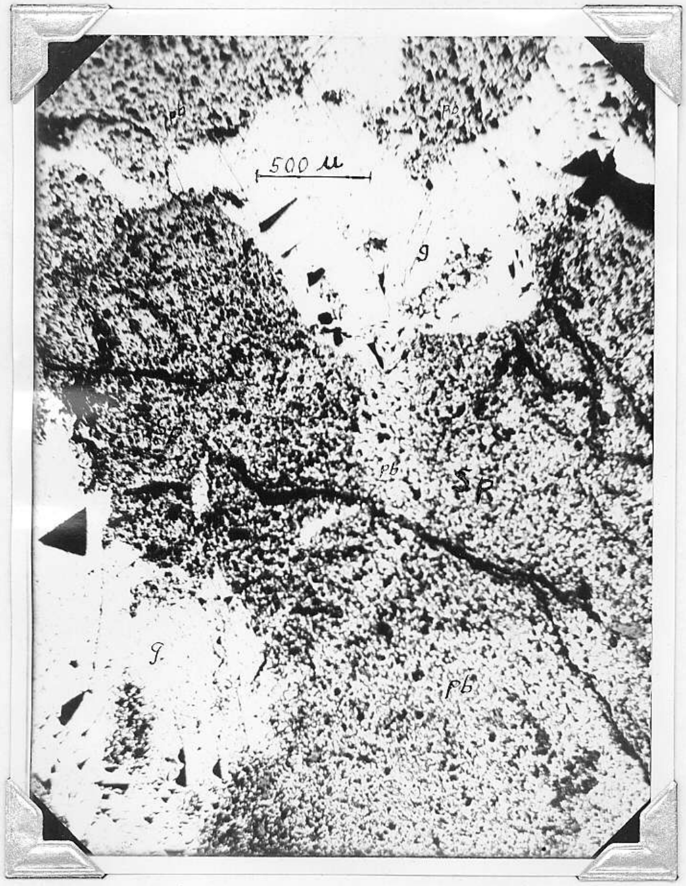

Plate 7. Polybasite pseudomorphous after sphalerite. Veinlet of polybasite through sphalerite. X30.

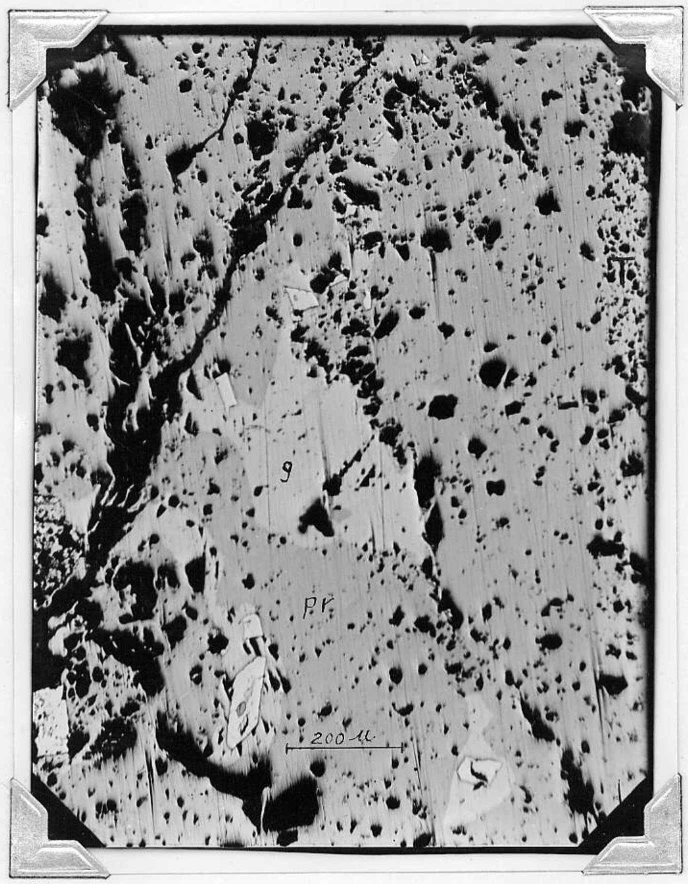

Plate 8. Galena in pyrargyrite. Tetrahedrite replacing pyrargyrite along quartz contact at upper right edge. X 75.

Plate 11. Left, tetrahedrite replacing galena. Bottom right, polybasite replacing galena. X75.

Plate 12. Pyrite cyrstals along galena - polybasite and galena - sphalerite contact. X 30.

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