Geology 9

The Composition and Paragenesis of the Ore of The Highland Bell Mine Beaverdell Area, B. C.

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Acknowledgments

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Contents

Geology of the Beaverdell Area

Within the Beaverdell area occurs the Wallace group of volcanic rocks with subordinate sediments, schists and coarse-grained intrusives, the greater part of which has been tentatively referred to as Mesozoic. They have been intruded and metamorphosed first by the Westkettle quartz-diorite batholith of Jurassic age, and later by the Beaverdell quartz monzonite batholith probably of Eocene age. The Curry Creek series of Oligocene conglomerates and tuffs lies unconformably over the older rocks. The youngest rocks are a series of lavas probably of Miocene age which overlie the Curry Creek as well as the other formations unconformably. A blanket of unconsolidated glacial drift overlies the Upland, and terraces of river alluvium are found upon the valley floors.

The Wallace Group

The Wallace group is a complex composed of andesites and andesitic tuffs largely, with basic intrusives which occur in dykes and small stocks. Among these igneous rocks are found small and irregular bodies of crystalline limestone and

hornfels. The greater part of the formation is more or less intensely metamorphosed. Limestone appears to be the oldest formation present and after it come hornfels and tuffs which are in places interbedded. Both sediments and tuffs are cut by andesite dykes and they in turn are intruded by hornblende diorite porphyries. Certain of the schists are also intruded by hornblende diorite porphyries, other grade into them. From their manner of occurrence and position, the basic intrusives are thought to form the deep-seated and more coarsely crystalline portion of a large body of augite andesite, but the evidence upon this point is not definite.

The Wallace group comprises the oldest rocks within the Beaverdell area. The horneblende diorite porphyries may closely precede the intrusion of the next succeeding quartz diorite batholith, while the limestones are much older. In this group there has been intruded both the Westkettle and Beaverdell batholiths and their associated dykes. The conglomerates of the Curry Creek series contain pebbles of all the members of the complex, and this series with the Nipple Mountain lavas following it, overlies the Wallace in several places.

The Westkettle Quartz diorite

The Westkettle quartz diorite is a grey, granular rock resembling granite. It outcrops along the greater part of the valley bottom of the Westkettle River from Trapper Creek to the south end of the Beaverdell map area. It is of especial interest because it contains the silver and gold ores of the district, and is in fact the only formation in which commercially valuable ores have been found up to the present time (1915).

The Westkettle diorite has been metamorphosed in comparatively small degree. Gneissic structure occurs over small areas in several places but the greater part of its mass is not banded. In some cases in and near breaks and shear zones the rock has been altered to a greenish white mass. This alteration is intense in places but is generally confined to narrow zones. Along these altered zones sulphides of the metals have been deposited and the silver ores upon Wallace Mountain occur in them.

In most cases the gneissic phases of the quartz diorite occur near masses of the Beaverdell quartz monzonite and their planes of foliation lie roughly parallel to the line of contact with these masses. The banded structure has probably been produced by the intense heat and pressure caused by the intrusion of the Beaverdell batholith which

mashed the surrounding rocks and injected heated and mineral-laden waters into them. The hot waters not only helped the rocks to recrystallize in banded form but they moved along fractures in the broken rock mass and produced such altered masses of rocks as are found filling the shear zones in the mines on Wallace Mountain.

The Beaverdell Quartz Monzonite

The Beaverdell quartz monzonite occupies the northern part of the map area and a branch of this mass runs down the eastern side as far as Triple Lakes. A smaller area is found on Crystal Mountain, and a still smaller oval-shaped area on the sides of the Westkettle at Beaverdell. No ore bodies have been found in the quartz monzonite but ores in Wallace Mountain and at Carmi are believed to have been formed by the hot waters which accompanied or followed the intrusion of the oval-shaped mass at Beaverdell.

The main mass of the Beaverdell batholith is pinkish white quartz monzonite - medium to coarse-grained of granitoid texture. Orthoclase occurs in conspicuous pink crystals and quartz in dull greasy grains.

A few dykes of quartz latite porphyry radiate out from the main mass. They are porphyritic with phenocrysts of pink feldspar and quartz in a grey groundmass.

The Beaverdell batholith is older than the Oligocene sediments of the Curry Creek series and younger than the Westkettle quartz diorite.

The Curry Creek Series

A series of sediments and tuffs is found upon the high south-western portion of Wallace Mountain and a smaller patch lies on Kloof Ridge south of Canon Creek. They are well-exposed at the headwaters of Curry Creek on Wallace Mountain and are here called the Curry Creek series.

The series consists of 200 feet of very fine-grained white tuff overlying about 2500 feet of conglomerates. Within the conglomerates are occasional beds of arkosic sandstone and clastic material of volcanic origin.

The conglomerates consist of rounded pebbles and boulders and of more angular fragments lying in a matrix of finer material. The pebbles consist of Westkettle quartz diorite, diorite, metamorphosed andesite, tuffs and sediments of the Wallace series, and occasionally Beaverdell quartz monzonite.

The Nipple Mountain series is made up of lava flows and dykes of which six main types were encountered. They include olivine basalt, augite andesite, hornblende andesite, biotite andesite, dacite, and trachyte. The lavas range in color from black through shades of brown and red to white.

An irregular blanket of glacial drift is spread over the greater part of the Upland.

Ore Deposits

Three types of ore are found within the Beaverdell area. They are:

(1) Mineralized shear zones,

(2) Stocks,

(3) Contact Metamorphic deposits.

By "mineralized shear zones" are meant a series of more or less tabular bodies of brecciated rock, quartz, and ore minerals which lie between well-defined walls. They include galena, sphalerite, pyrite silver-bearing ores and the chalcopyrite gold-bearing ores.

By "stocks" are meant a number of ore-bodies of irregular form within which the shattered country rock has been impregnated with metallic minerals and sometimes quartz.

By "contact metamorphic deposits" are meant mineral deposits formed in limestone by the intrusion of an igneous body.

The mineralized shear zones carrying values in silver which constitute the commercially valuable ores in the Beaverdell area are found over an area of about three square miles on Wallace Mountain.

The ore deposits on Wallace Mountain consist of pyrite, galena, sphalerite, tetrahedrite pyrargyrite, native silver, and perhaps argentite in a gangue of sericite, quartz,

barite, iron oxide, and calcite. Of the ore sulphides pyrite, galena and sphalerite are most commonly found.

The typical mineralized shear zones are found only in the Westkettle quartz diorite which is a grey rock resembling granite and made up of feldspar, quartz, biotite and hornblende.

The silver-bearing galena ores occurring in the mineralized shear zones are restricted almost completely to the Westkettle diorite. The material in the zones is either vein filling or altered and replaced country rock, and dyke matter. The filling may be in distinct single, parallel, or linked veins within the shear zone, but it is often an irregular filling between brecciated fragments with occasional veinlets into the walls of the shear zone.

Determination of Minerals

Arsenopyrite was determined by its color, hardness, and crystal form as well as its negative reaction to etch reagents. HNO_3 solution caused it to stain irridescent.

Pyrite was distinguished by its color and hardness, and also its crystal habit.

Quartz was determined by its hardness and its translucence under the rays of the arc-lamp.

CHALCOPYRITE was distinguished by its color and lack of reaction to KCN solution.

Sphalerite was determined by its honey-colored internal refraction under the arc-lamp.

Galena - The triangular cleavage pits, and the brightness served to distinguish galena.

Tetrahedrite - Etch tests were used to distinguish tetrahedrite. HNO_3 tarnished the mineral, KCN stained it brown.

Pyrargyrite was distinguished by its red internal reflection and its pale blue-green color. KCN solution stained it brown and brought out the scratches.

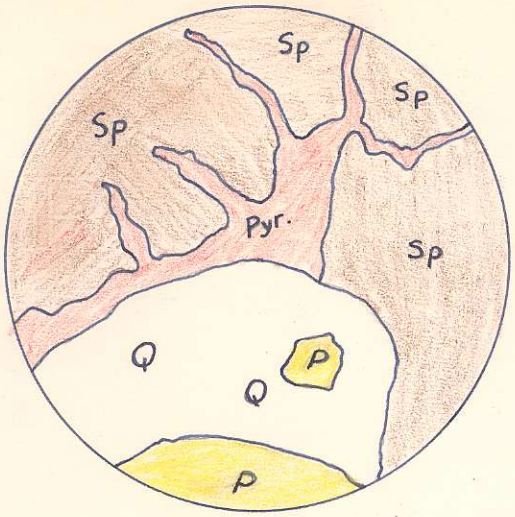
Paragenesis

From studies of the several polished sections of the ore of the Highland Bell Mine the author believes the following to be the paragenesis of that ore.

1st generation	Arsenopyrite Pyrite Quartz
2nd generation	Chalcopyrite Sphalerite Galena
3rd generation	Tetrahedrite Pyrargyrite

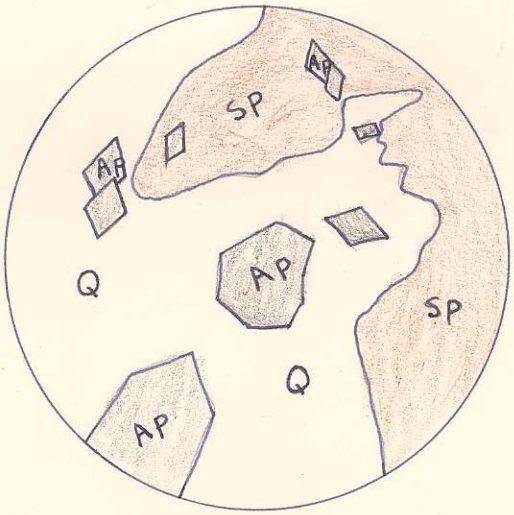
Sketches of some of the sections which led to the above conclusions are shown in the succeeding pages.

KEY TO MINERALS



40 X

Section shows sphalerite, later than quartz, pyrite, being replaced by pyrargyrite



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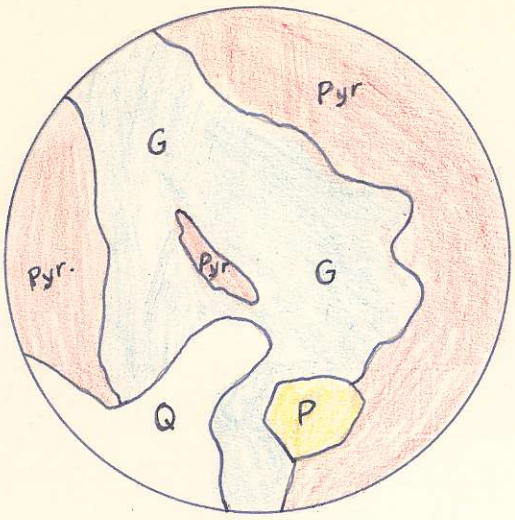
Sphalerite here is later than Arsenopyrite, quartz.



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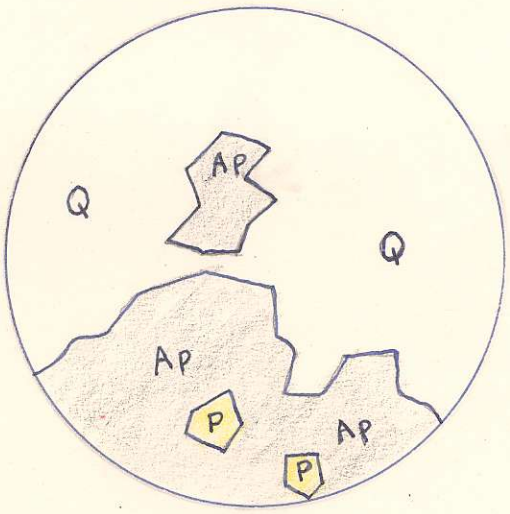
Pyrargyrite, galena later than quartz, pyrite



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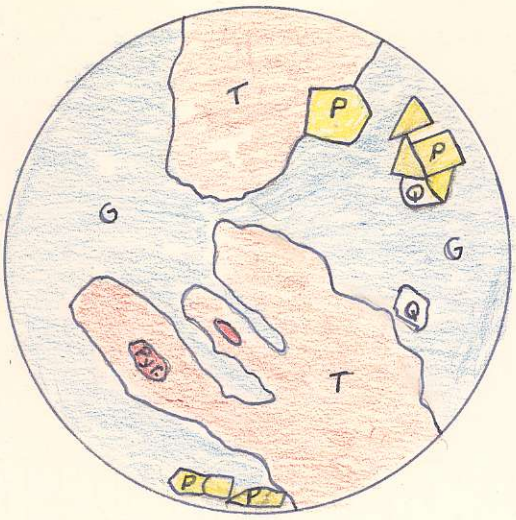
Arsenopyrite, pyrite and quartz of 1st generation



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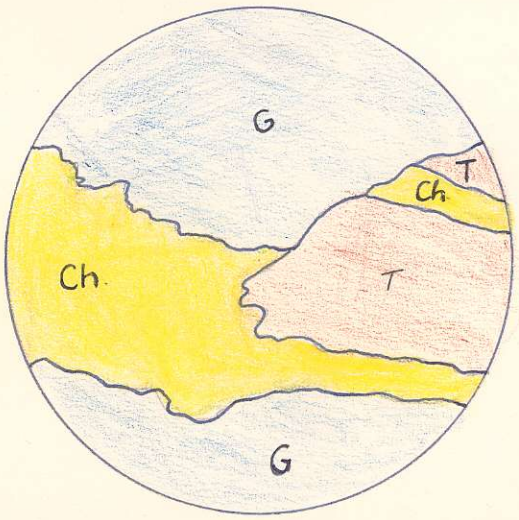
Tetrahedrite, pyrargyrite later than galena which is later than quartz, pyrite



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Tetrahedrite later than Chalcopyrite, galena.

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