

GEOLOGY 409
Mineralogy of the
Little Gem Prospect
by
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600168

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A B S T R A C T

A study of several samples of cobalt nickel minerals with associated uranium of The Little Gem Property was made. The relative abundance of the various minor elements which have been studied is discussed and the characteristic distribution of some of these minor elements are compared with well known cobalt uranium deposits of the world.

What elements

English

ACKNOWLEDGEMENTS

This work could not have been undertaken had it not been for Dr. R. M. Thompson and Dr. W. White who provided the author with many samples. Dr. R. M. Thompson also gave much useful advice and assistance and he, together with Dr. H. V. Warren, must be especially mentioned for the support and inspiration they have given me.

Last, but not least, the author wishes to thank Mr. J. Donnan, who furnished the author with a complete and ready to use polishing laboratory.

INTRODUCTION

The microscopic analysis of several samples taken from the Little Gem Prospect in British Columbia, most of these samples contain, in addition to cobalt, arsenic, iron and small amounts of minor elements. These elements, in general, are quantitatively of minor importance and are usually referred to as minor elements. Occasionally, these minor elements are of economic importance, but their chief value at the present time seems to be that it may be possible, by studying their occurrence and distribution, to add a little to our knowledge of the genesis of ore deposits.

no sense!

These minor elements have an additional use, which involves utilizing the fact that some elements and minerals which are of economic importance are hard to discover and determine in the field, but are distributed in minute amounts in other minerals which can more readily be found and determined. It happens that in Western Canada there is evidence that uranium, in modest amounts, is widespread. Until 1948 no commercial deposits have been found. It was in an effort to assist in finding commercial uranium deposits that the author studied these new possible prospects, and compared them with well known producers to see if there is any relationship existing between these deposits.

LOCATION

The Little Gem group of claims is situated close to the top of a 7000-foot ridge near Roxy creek, which is a tributary of Gun creek in the Lillooet Mining Division of British Columbia.

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GENERAL GEOLOGY (1)

The most important rock in the area is a medium-grained, light coloured biotite quartz-diorite which runs in the form of a tongue from a larger body of similar composition, conspicuous in Gun Creek. This tongue is about 2000 feet in width by $2\frac{1}{2}$ miles in length. It is bordered on its north west flank by a large body of serpentine which along the contact with the biotite quartz diorite is badly sheared and broken and has a banded appearance. Except on the northwest the rocks surrounding the plutonics are a series of effusives, many of which are andesitic in composition. These effusives are considered to belong to the Bridge River formation of possible carboniferous age.

Near the mineral occurrence the plutonic is altered to speckled reddish rock. This alteration is thought to be the result of weathering and leaching by surface waters acting on a country rock already subjected to metasomatism by ore-bearing solutions. Numerous apletic and few basic dykes occur in the biotite quartz diorite.

The ore may possibly be best considered as rich sulphide lenses in a shear zone. The shear zone itself is from six to twelve feet wide and, locally at least, contains sufficient cobalt to be considered ore. Two sulphide lenses have been found, and they have been exposed for from 50 to 100 feet in length and vary from six inches to several feet in width, averaging about six feet. The depth is as yet

undetermined. The ore so far disclosed consists of a mixture of arsenopyrite, molybdenite, loellingite, gangue quartz, feldspar and altered country rock. Where the ore has been oxidized at the surface the uranium forms canary yellow carnotite. The samples examined by the author were near the surface, thus there was no primary pitchblende found.

What about molybdenite on MoS_2 red specimens.

Properties of pitchblendes I II III based on the study of polished sections.

PITCHBLENDE I	PITCHBLENDE II	PITCHBLENDE III
Color..... light grey, smooth surface.	dull gray rough surface.	light gray smooth surface
Hardness..... <u>F-hard</u>	<u>C-soft</u> ?	<u>F-hard</u>
C Crossed Nicols... Isotropic	Isotropic	Isotropic
Etching:		
HNO ₃ effervesces, turns brown to black - shallow pits	effervesces, rapidly blackens with deep pits	effervesces (?) and turns brown
HCl..... negative	some specimens tarnish gray	negative
KCN..... negative	negative	negative
FeCl ₃ tarnishes brownish-gray	same	same
KOH..... negative	negative	negative
HgCl ₂ negative	negative	negative
Relative UO ₂ to UO ₃ UO ₂ > UO ₃	UO ₂ < UO ₃	UO ₂ < UO ₃ (inferred)

When from

THE MINERALOGY OF THE ORE OF THE
LITTLE GEM PROSPECT

*macroscopic
microscopic?*

In the samples which have been examined, the following minerals with a metallic luster have been identified:

ARSENOPYRITE

LOELLINGITE

MOLYBDENITE

SPHALERITE

ARSENOPYRITE (FeAsS): Arsenopyrite was identified in all sections from the Little Gem Prospect. Identification was based upon microchemical analyses, because certain of the cobalt-nickel minerals are indistinguishable from arsenopyrite by ordinary etch tests.

Arsenopyrite occurs as small irregular or diamond-shaped grains in the quartz which in one case forms "blebs" in the molybdenite and in another case forms euhedral quartz crystals in the loellingite.

LOELLINGITE (nickeliferous), (Fe,Ni)As₂: Loellingite closely resembles arsenopyrite and occurs as massive irregular patches. It is only possible to recognize this mineral by etch and microchemical tests on polished sections. Even this is feasible only when positively identified minerals are available for comparative control tests.

Loellingite is found in non-metallic-lustered gangue. Here, however, it is not easily identified, because the

the slight differences in hardness and colour between it and arsenopyrite are useless for determinative purposes. Where these two minerals are actually in contact, slight differences in colour and hardness may be readily observed. When the two minerals are not in contact, only etch and microchemical tests serve to distinguish one from the other. *See*

MOLYBDENITE (MoS_2): Molybdenite is present in all the sections. The strong anisotropism; with polarization colors white, light violet, black, and the nearly parallel extinction and four extinctions per revolution help to identify the mineral. It occurs consistently as well defined lath-shaped crystals. Its position in the paragenesis is not established, but it seems probable that it preceded the final consolidation of the quartz, since it was not found in the gangue.

SPHALERITE (ZnS): Sphalerite is only of mineralogical interest. It is rare, but where seen it is usually as small corroded grains in the gangue.

URANIUM: The uranium in these specimens has been altered to soft amorphous, canary-yellow mineral. This mineral forms a crust on the outer part of the sample. Other minerals remained unaltered.

Since there is no etch test for this secondary mineral, a small sample had to be chemically analyzed by means of the "Bead test", to prove the presence of uranium.

The bead test comprises the fusion, on the tip of a platinum wire with a loop in the end, of an inorganic salt like borax or calcium fluoride with a small amount of the unknown. The bead may be formed in the flame and then dipped into a solution of the unknown, re-fused, re-dipped, re-fused and so on, until a fairly large bead is obtained.

Sodium, potassium, or calcium fluoride is the best bead material for uranium tests. A pure, non-fluorescent fluorite can also be used. Borax proves satisfactory. While fine particles of the mineral sample can be fused directly into the bead, it is best to dip the bead into a solution of the sample during the test. When the bead is completely formed and after it has cooled, it is examined under the lamp. If uranium is present the bead will fluoresce a bright green, yellow-green or lemon yellow color. The sensitivity of bead test, when ultraviolet inspection is used is great, as little as 1 molecule of uranium compound in 10,000,000 molecules of bead material causing fluorescence.

Before using the bead tests, pure uranium compounds and samples of pitchblende or carnotite should be used to make up standards comparisons. The bead test may be used quantitatively, but special equipment and standardized working conditions are required.

GANGUE MINERALS

Examination of polished sections is, at best, a very unsatisfactory method of determining non-metallic minerals. Therefore, gangue minerals in these ores cannot be satisfactorily discussed. However, the relationship of the more important gangue minerals are well seen in the specimens, and will be described.

QUARTZ: Quartz is widespread and important, and is the predominant gangue mineral. It forms the enclosing gangue for the early arsenopyrite. The quartz forms well defined euhedral crystals in the loellingite, and appears as "blebs" in the molybdenite.

^{to what}
CARBONATES: The quartz and loellingite are almost universally crossed by a network of tiny stringers and veinlets of carbonate. The carbonate was difficult to determine, and tests failed in most cases to establish identity.

DISCUSSION OF OTHER
COBALT - NICKEL - URANIUM RELATIONSHIPS

Pitchblende occurs sparsely in all of the western Erzgebirge districts and in Cornwall and abundantly at Great Bear Lake, Canada. In these districts there can be little doubt that it was deposited from solutions from the same source as those from which the cobalt and nickel minerals were deposited. *blank statement*

At Joachimsthal in the Erzgebirge, opportunities for studying underground the relations of pitchblende to the cobalt and nickel minerals are poor, and recourse must be had to museum specimens. In several specimens pitchblende has been deposited on top of cobalt and nickel arsenides. Proustite and calcite commonly coat pitchblende or occupy fractures in it. In two of the mines, the cobalt-nickel-silver ores gave way in depth to quartz-calcite-pitchblende ores carrying a little smaltite a variation interpreted by Step and Becke as primary. Keil noted that in the ores of Joachimsthal crystalline dendrites of bismuth and of native silver are encrusted not only by cobalt and nickel arsenides but in places by pitchblende. In places, pitchblende encrusts smaltite and elsewhere appears to have crystallized simultaneously with niccolite and rammelsbergite.

At Annaberg and ~~Schnel~~berg, according to Miller, the pitchblende is a characteristic though minor component of the cobalt vein type. The conclusion seems justified that

in the Erzgebirge the pitchblende was deposited in the same veins with the cobalt, nickel minerals and in part contemporaneously with them.

In the well known Dolcath mine of Cornwall, pitchblende occurred "associated with native bismuth, and arsenical cobalt in a matrix of red compact quartz and purple fluorspar". At South Tresavean it occurred with niccolite, native silver, and rich argentiferous galena.

At Great Bear Lake, Canada, the pitchblende is closely associated with the cobalt and nickel minerals and seemingly nearly contemporaneous with them.

Other associations of pitchblende may be expected to throw some light on the genetic relationships. Its characteristic occurrence in granite pegmatites is especially well known as seen by the new rediscovery of pitchblende at Theano Point, in Ontario. It is found in feldspar quarries in such rocks near Middletown, Glastonbury and Branchville, Connecticut, and in mica mines in granite pegmatites in North Carolina. It occurs in the granite pegmatites of Llano County, Texas. Of the pitchblende occurrences described by Ellsworth in Ontario Canada nearly all (23 in number) are in granite pegmatite and one doubtful occurrence in syenite pegmatite. He states: "The radio-active minerals occur apparently mostly in the greatest abundance in the acid pegmatites...They are less abundant in the intermediate types and are not known to occur at all in the more basic varieties."⁴

Pitchblende occurs in the copper veins of Telemarkin, Norway, whose bismuth content and association with intrusive granites have been studied.

Uranium compounds, probably from the oxidation of pitchblende, occur in granite pegmatites cutting the granite massif of Northern Portugal.

The pitchblende deposits of Gilpin County, Colorado, appear to be a variant of the sulphide mineralization of the district and are associated with monzonites, monzonite porphyries and bostonites. There are no basic intrusives near the deposits.

The presence of pitchblende, therefore, strongly favors the view that the deposits in which it occurs were deposited by solutions derived from magmas of acid or at most of intermediate composition. It is notable, however, that not all the ores of the cobalt type carry pitchblende and that it has not been found in any of the ores of Cobalt on the neighboring Canadian camps.

No references

BIBLIOGRAPHY

- (1) Mineralogy of Two Cobalt Occurrences in B. ~~B.~~, H.V. Warren & R.M. Thompson.
- (2) Short, M.N., Microscopic Determination of the Ore Minerals. United States Geological Survey Bulletin 914.
- (3) Microscopic Character of Pritchcliffe Ore. M. Haycock, Can. Min. Journal Vol. 56, No. 4. 1935.
- (4) Thomson, Ellis, Economic Geology, Vol. XXV, No. 5, 1936.

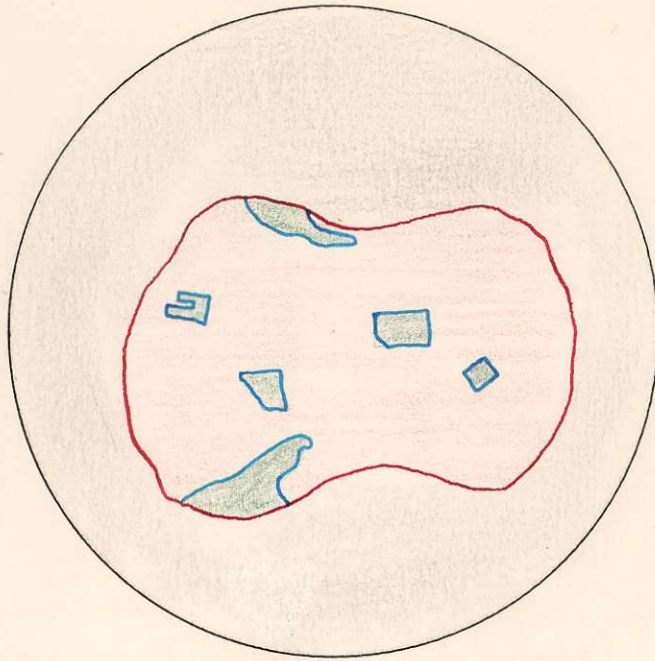





PLATE 2

-  Arsenopyrite
-  Quartz
-  Molybdenite

Arsenopyrite is enclosed in the quartz and the quartz occurs as blebs in molybdenite.

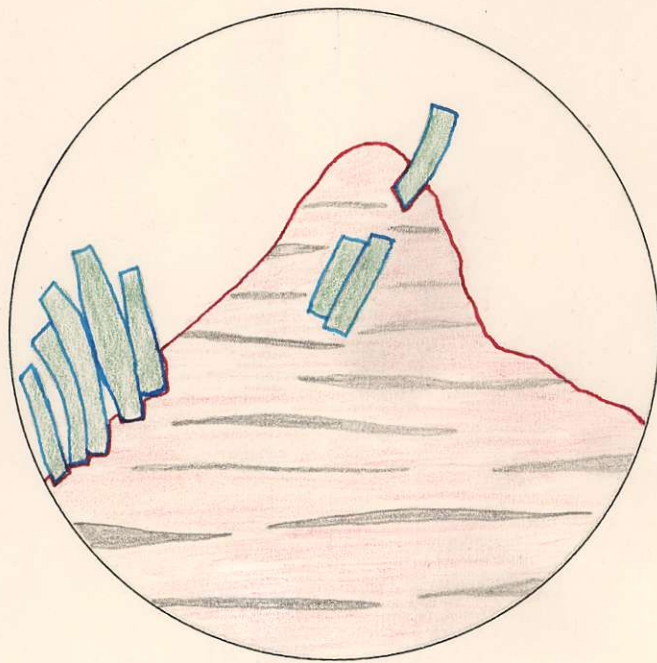



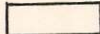


PLATE 3

-  Carbonate
-  Loellingite
-  Molybdenite
-  Brown gangue

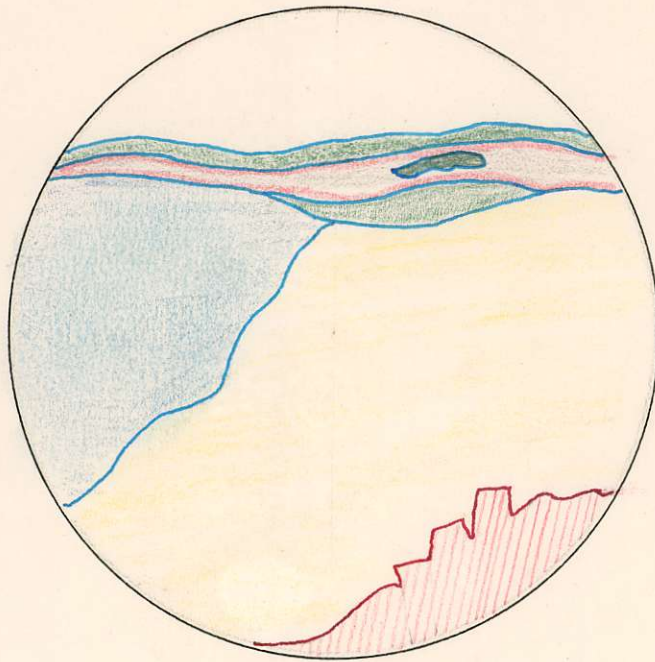






PLATE 4

-  Secondary Pitchblende
-  Molybdenite
-  Brown gangue
-  Loellingite

The pitchblende has been altered to a bright yellow and green amorphous mineral which forms crusts or bands on the outcrops of deposits.

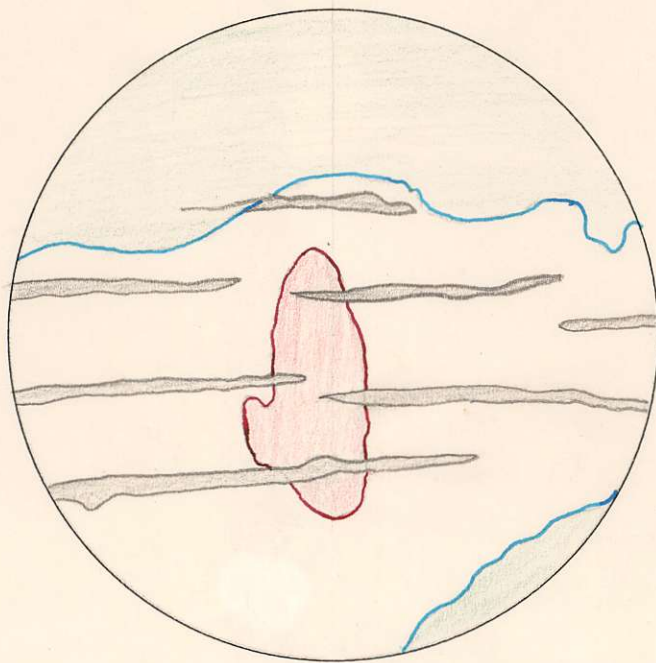
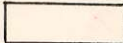


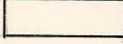



PLATE I.

-  Arsenopyrite
-  Quartz
-  Brown gangue
-  Loellingite
-  Carbonate

Carbonate replacing quartz and loellingite but not the brown gangue. This carbonate has a parallel characteristic