NAUMANNITE FROM REPUBLIC, WASHINGTON

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In 1949, while cataloguing some specimens which had been previously donated to the University, I noticed a specimen showing several thin black metallic bands in milky crustified quartz, and labelled "petzite, Republic, Washington." A preliminary investigation of the microscopic properties suggested that one of the minerals comprising the black bands was naumannite (Ag_2Se) and later confirmation was obtained by microchemical tests and an *x*-ray powder photograph.

The hand specimen shows three concentric black metallic bands about 4 mm. in thickness alternating with bands of crustified quartz. A polished surface shows that each black band consists of a groundmass of argentian tetrahedrite in which small particles of gold, electrum, pyrite, chalcopyrite and naumannite are embedded. In places the assemblage approaches an emulsion texture.

The identification of naumannite from Republic is of interest because it has been known for many years that the element selenium occurs in the ore from this district. M. H. Joseph, (*Eng. and Mining Jour.*, Nov. 25, 1899) lists selenite of silver amongst several ore minerals of the Republic camp but gives no details. Later, Umpleby (*Wash. Geol. Survey* Bull. No. 1 p. 39, 1910) suggests that silver is partly in the form of silver selenide and partly as gray copper. Palmer (Lindgren & Bancroft, *U.S.G.S.* Bull. 550, 148, 1924) suggests the possible presence of gold selenide (Au_2Se_3) in the ore, because after the removal of free gold with an alkaline sulphide solution the ratio of gold to selenium was approximately constant and equal to 2:3. The synthesis of gold selenide has been reported and this compound may occur in Republic ores but in view of the occurrence of naumannite it appears the latter is responsible in part, if not entirely, for the selenium content. A complete modern mineralographic study of this striking and unusual ore would be of interest.

I would like to express my thanks to Dr. James W. Earley who compared the *x*-ray powder pattern with patterns of naumannite from type localities.

MINERAL OCCURRENCES IN WESTERN CANADA

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These notes continue the reporting of some of the rarer ore minerals found in British Columbia. Most of the minerals described below are believed to be first occurrences in British Columbia.

Kobellite. $6PbS \cdot FeS \cdot 2Bi_2S_3 \cdot Sb_2S_3$. Dodger Tungsten Mine, near Salmo, Nelson M.D., B.C. Mr. C. C. Rennie, geologist at the Dodger Tungsten Mine for Canadian Exploration, Limited, submitted a small hand specimen of milky quartz with lead gray capillary crystals protruding from a vug and embedded in the quartz at one end of the specimen. Mr. Rennie describes the occurrence as follows: "the specimen is from a quartz mass containing coarse crystals of scheelite, abundant sericite mica, some molybdenite and minor pyrite, about three feet above a flat lying granite contact. The same mineral has been noted in a specimen from a quartz-calcite vein at the granite contact.

The country rock of the ore zone consists of altered limestones and skarn, containing abundant pyrrhotite, in contact with granite. The ore zone is considerably veined and partially replaced by quartz."

An *x*-ray powder photograph was taken and identified as kobellite by direct comparison with the pattern of kobellite from Hvena, Sweden (Nuffield, *Univ. Toronto Studies, Geol. Ser.* **52,** 86–89, 1948). Mr. Rennie kindly made further samples available but the lead-gray minerals contained in the quartz or dolomitic gangue proved to be bismuthinite or boulangerite. It is hoped that additional material will be found in order that a necessary new analysis of this rare mineral may be made.

Sperrylite, $PtAs_2$ and *thorianite,* ThO_2. Mr. Ernie Howard of Minto, B.C. submitted a sample of black sand from the Fraser River near Lytton for identification of the radioactive minerals. The sample is composed of the following minerals listed in order of their abundance: magnetite (67 per cent by weight), garnet, ilmenite, zircon, rutile, olivine, platinum, gold, quartz, epidote, thorianite, chromite, feldspar, cinnabar, muscovite, calcite, scheelite, and sperrylite.

Thorianite is present in all screen sizes below 60 mesh and an assay of 5 per cent U_3O_8 equivalent was obtained on the minus 200 mesh size using a scaling type geiger counter. The mineral occurs in blackish grains from 50 to 150 microns in diameter. Many grains are rounded and others are almost perfect cubes. An *x*-ray powder photograph is in exact agreement with thorianite ($a = 5.58$ Å) from Balangoda, Ceylon. The mineral is probably the uranoan variety because the grains gave a positive uranium bead test. The resulting radiation tracks on nuclear track plates proved useful in distinguishing irregular thorianite grains from other black minerals. This occurrence makes interesting speculation as there are no known radioactive lode deposits in the vicinity.

One highly modified cubic crystal and several hard tin-white rounded grains were observed in the $-80+100$ fraction. The *x*-ray powder pattern of these grains is in good agreement with the pattern of sperrylite from the Vermilion mine, near Sudbury, Ontario. Although platinum is of fairly frequent occurrence in this section of the Fraser River, the writer believes that this is the first recorded identification of sperrylite.

Empressite, $Ag_{2-x}Te$, *Rickardite*, $Cu_{2-x}Te$, and *Native tellurium*. Grotto Group (Kindle, *Geol. Surv. Canada*, Memoir 212, 1936) near Pitman, Skeena M.D., B.C. This property is situated on Hardscrabble creek about one mile west of the Canadian National railway and about 1½ miles from Pitman flag station. A quartz vein containing values in gold, silver, and copper, occurs along the contact of a 12 foot andesine diorite prophyry dike intrusive into andesite.

Dr. Joseph T. Mandy supplied the writer with several samples of ore in which he suspected telluride mineralization. The vein quartz is white to gray-black in colour and contains many thin (2 mm.) fractures which are partially filled with quartz crystals. Some surfaces are drusy and others show small flat vugs. Pyrite, chalcopyrite and specularite occur massive or disseminated throughout the quartz.

Native tellurium is present in the form of conspicuous tin-white prismatic crystals up to 3 mm. in length. It is less commonly found as small cleavage masses and as a paper-thin encrustation on drusy quartz.

Empressite occurs sparingly as small velvety-black masses embedded in quartz and showing a distinct conchoidal fracture. A mineral closely resembling empressite but with a superficial brown tarnish gave the same *x*-ray powder pattern as that of empressite? (material 4) described by Thompson, Peacock, Rowland & Berry (*Am. Mineral.* **36**, 467, 1951). At present there is not sufficient of this mineral for a chemical analysis.

Rickardite is present in traces and is best developed as a thin coating on a small cleavage mass of tellurium adjacent to an area of chalcopyrite. The rickardite may be of secondary origin. On account of the vuggy nature of the telluride rich portions of the ore, polished section relationships are difficult to obtain, but it is obvious that the tellurides are late in the paragenetic sequence.

Gold is present but the nature of its occurrence is unknown. The ratio of silver to gold varies but is in the order of 20:1.

Alabandite, MnS, *dyscrasite*, Ag_3Sb, and *native antimony*. Contact Group, McDame Creek, Liard M.D., B.C. These claims are located between the head waters of McDame and Cottonwood Creek's at an elevation of 6000 feet. The main showing consists of a vein cutting dolomitized limestone and is composed chiefly of galena, sphalerite, and magnetite. The writer is indebted to Mr. J. McDougall who collected specimens for study during the summer of 1951 while with the Geological Survey of Canada as a student assistant, and to Mr. E. H. Kohse and Mr. P. R. Wilson who assisted in the study of polished sections.

The vein material consists of fine grained masses of sphalerite, galena, and magnetite with practically no gangue minerals. A thin black coating of manganese oxide is present on most of the weathered surfaces. Magnetite occurs as subhedral to anhedral grains from 0.1 to 0.6 mm. in diameter and occasionally shows core replacement by galena, sphalerite or gangue. Pyrite is of similar occurrence in grains about 0.5 mm. in size. Pyrrhotite occurs as small irregular grains scattered through the matrix of galena and sphalerite and also as minute exsolution bodies in alabandite and sphalerite, Excellent examples of replacement of pyrrhotite by colloform marcasite are found. Sphalerite is associated with chalcopyrite and galena as irregular grains up to 1 cm. in size and is replaced by galena to some extent. It is intimately associated with and contains inclusions of alabandite and pyrrhotite. Arsenopyrite occurs in euhedral to subhedral crystals 0.1 mm. in length in the galena-sphalerite matrix. The crystals are partially replaced by galena, sphalerite, and pyrargyrite.

The presence of a primary manganese mineral was suspected when the black coating on the weathered surfaces was observed. The mineral proved to be alabandite. It was recognized by its violent reaction to HCl and was confirmed by an *x*-ray powder photograph. It occurs in what appear to be long narrow exsolution laths in sphalerite and as irregular grains up to 4 mm. in size.

Galena occurs as irregular veinlets ramifying through the sphalerite and forming a matrix enclosing many minerals. Widely scattered grains of a white, weakly anisotropic mineral ranging up to 1 mm. in size were identified as native antimony. Dyscrasite also occurs in the galena as pale yellowish grains up to 0.25 mm. in size. The mineral often shows rhombic outlines and tarnishes rapidly. It is rarely seen in contact with native antimony. In addition to the above, the galena contains minute inclusions of two unknown soft isotropic minerals and brilliant white distinctly anisotropic rhombs, prisms, and cubes of a third unknown up to 20 microns in size.

This deposit is unusual in that it shows minerals which are considered typical of both hypothermal and epithermal type mineralization. There is a possibility of more than one period of mineralization or that the assemblage represents a telescoped deposit. Further work is necessary to give a clearer picture of the paragenesis.