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MINERALOGICAL EXAMINATION OF A COARSE TANTALUM CONCENTRATE FROM TANTALUM MINING CORPORATION (TANCO), BERNIC LAKE, MANITOBA

by

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INTRODUCTION

In May, 1972, Mr. D. Raicevic of the Mineral Processing Division requested a mineralogical examination of concentrates from the Tanco ore body, Bernic Lake, Manitoba. The first samples were dated March 23, 1972 and labelled "Ta Cleaner Concentrate," Test DR-5. Analysis of this sample gave 35.77% Ta_2O_5 and approximately 8% Sn. A second sample was dated April 25, 1972 and labelled as "average size fraction from secondary rougher grind","Tanco" ore, November 25, 1971. The purpose of the study was to identify the main constituents, in particular the Ta-bearing minerals, approximate amounts of other minerals, and the degree of liberation of Ta minerals in an effort to increase the Ta_2O_5 content to 50%.

METHOD OF INVESTIGATION

Polished sections were prepared from the concentrates, examined under an ore microscope to identify the minerals and their textural relations. All mineral compositions were obtained by electron microprobe analyses of the polished sections.

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MINERALOGY

The minerals identified in the concentrates consist of wodginite, tantalite, microlite, cassiterite (some Ta-bearing), ilmenite, magnetite, rutile, arsenopyrite, pyrite, stannite, pyrrhotite, galena, chalcopyrite, niccolite, native bismuth, native silver, several Pb-Bi sulphosalts, and metallic iron spherules. All the minerals are liberated except some of the tantalite and wodginite which contain gangue inclusions.

TANTALUM MINERALS

Tantalite, wodginite and microlite are the principal tantalum-bearing minerals. Due to their similar optical properties under reflected light, these minerals could not be distinguished from each other. Microlite is rare because few grains were detected in the concentrate.

Although wodginite is a distinct mineral species, it can be considered as a high-tin tantalite. The general formula of wodginite is given as $X_1Y_1O_4$ whereas tantalite is written as $X_2Y_4O_{12}$ where X = Mn, Fe, Sn, Ti, Y = Ta, Nb.

Using the electron probe to help distinguish the various phases in the concentrate, most of the tantalite grains contain considerable amounts of tin, as high as 17.8% SnO_2, which conform to wodginite. Analyses of five such grains are given in Table 1.

TIN MINERALS

Cassiterite is fairly abundant in the concentrate, but due to its similar color to tantalite-wodginite, its relative proportion could not be determined. About half of the cassiterite grains contain up to 4.4% Ta. As

shown above, tin also occurs in significant amounts in the wodginite grains. The number of tin-bearing minerals in the concentrate suggest that the assay (8% Sn) is too low.

SULPHIDE MINERALS

Several sulphide minerals were identified in the concentrates and, based on grain counting, they constitute approximately 20% (Figure 1). The principal sulphides are arsenopyrite and pyrite with minor to trace amounts of pyrrhotite, chalcopyrite, galena, native bismuth intergrown with an unidentified Ag-Pb-Bi sulphosalt, niccolite, native silver, and stannite. In a separate study currently in progress by the author, the following sulphides have been identified from this deposit; tetrahedrite, aikinite, cosalite, zincian hawleyite, and cubanite. The sulphides constitute about 20% of the concentrate.

METALLIC IRON SPHERULES

An unusually large number of metallic iron spherules were observed. These spherules were found in both the concentrate and the middlings. In composition, some of the spherules have a αFe core with an iron oxide rim of wüstite, whereas others consist solely of the wüstite phase (Figure 2). The exact origin of this material has not been determined. Their textures and compositions are similar to those of welding spatter, but similar spherules have been noted in placer concentrates from various localities in British Columbia and Quebec.

In the Tanco material, the spherules are too numerous to be attributed to contamination.

TABLE 1

Electron Microprobe Analyses of Some Wodginite Grains

MnO	9.6	9.6	8.7	9.8	11.3
FeO	3.1	2.3	4.0	5.0	5.1
Ta_2O_5	67.8	67.4	63.5	70.9	70.4
Nb_2O_5	1.3	3.6	3.5	0.9	0.9
SnO_2	17.8	12.5	13.2	13.5	10.2
TiO_2	1.2	5.0	4.3	1.8	1.8
Total	100.8	100.4	97.2	101.9	99.7

General Formula

$$X_1Y_1O_4$$

X = Mn, Fe, Sn, Ti

Y = Ta, Nb

CONCLUSIONS

Tantalite and wodginite are the principal Ta-bearing minerals. Cassiterite and wodginite are the Sn-bearing phases. All the minerals are well liberated. The concentrate would be upgraded towards the desired Ta_2O_5 content by floating the sulphides out of it. Tin is significant in the ore and it ought to be determined in all the product analyses.

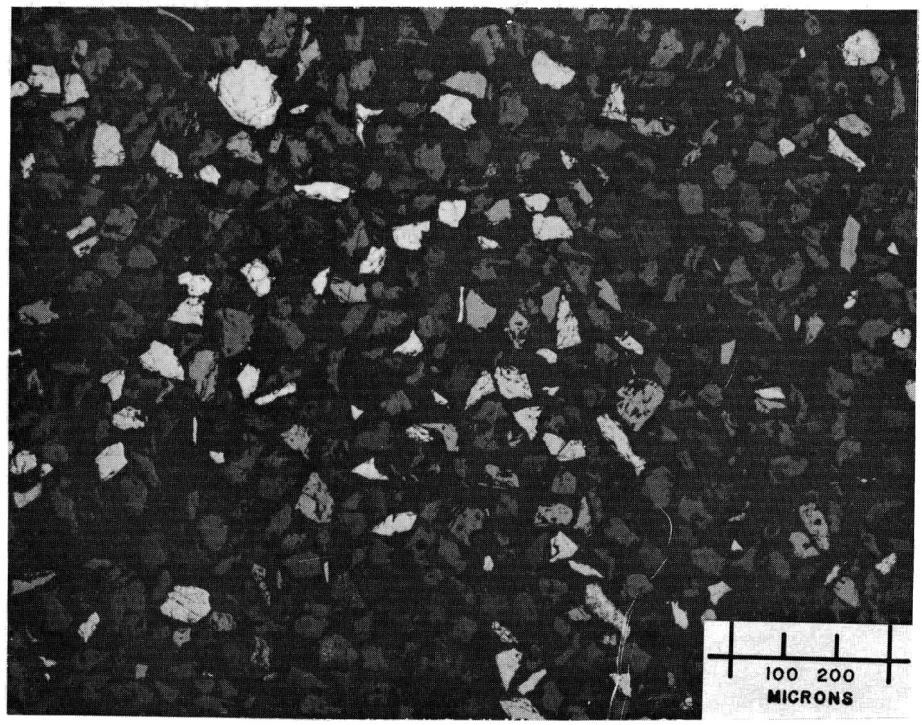

Figure 1. Photomicrograph of the coarse tantalum cleaner concentrate to illustrate the content of sulphides (white) and degree of liberation.

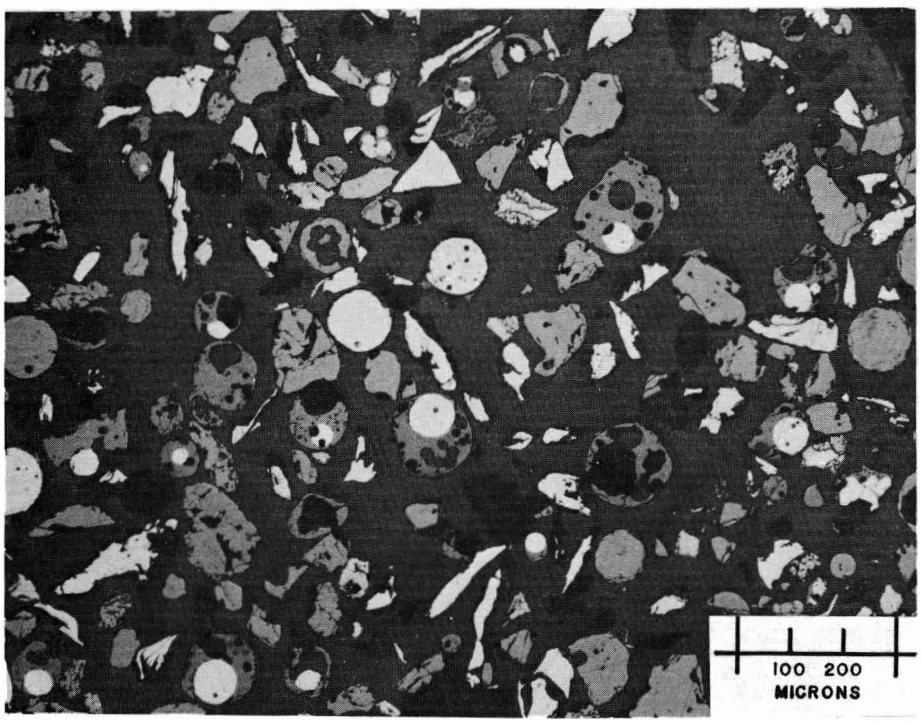

Figure 2. Photomicrograph showing the characteristics of the metallic iron spherules. This material was obtained from the middlings using a hand magnet.

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