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MONAZITE FROM THE MOUNT PLEASANT DEPOSIT, NEW BRUNSWICK

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Samples from the 750 adit of the Fire Tower area, Mount Pleasant deposit of Brunswick Tin Mines Limited in New Brunswick were studied at the Mines Branch (renamed CANMET) from 1970 to 1975 to determine ore characteristics and solve ore beneficiation problems. The geological setting and mineralogy of the deposit were described by Petruk (1973). Only a few monazite grains, most smaller than 5 microns in diameter, were found during the intial study and analyzed semi-quantitatively. These grains occurred as inclusions in arsenopyrite and as separate grains in gangue near rutile, zircon and xenotime (referred to by Petruk 1973 as a ytterbium-erbium phosphate). In 1974, a wolframite concentrate containing about 15% monazite and 2% xenotime was produced from a composite sample of ore from the 750 adit while conducting ore-dressing tests in CANMET laboratories. The monazite and xenotime grains in the concentrate were up to 100 microns in diameter (mean 20 microns) and unzoned. They were identified by *x*-ray diffraction using a 57.3 mm-diameter Debye-Scherrer powder camera. Seven monazite grains were analyzed with a Materials Analysis Company (MAC) electron microprobe operated at 25 kV using the following standards: apatite for Ca and P, uranothorite for Th, uraninite for U, monazite for La, synthetic CeO_2 for Ce, synthetic $YFeO_3$ for Y and Fe, synthetic $NdFeO_3$ for Nd, synthetic $SmFeO_3$ for Sm, and synthetic $GdFeO_3$ for Gd (Table 1). Trace amounts of Dy (< 1.0 wt %) were detected but not analyzed for because of lack of adequate standards. Other elements were looked for, but rare-earth elements (including praseodymium) could not be detected because suitable standards were not available and because of interference by the major rare-earth elements in the mineral. The data were processed with a computer program of Rucklidge & Gasparrini (1969).

TABLE 1: ELECTRON MICROPROBE ANALYSES OF MONAZITE GRAINS

Wt. %	1	2	3	4	5	6	7	Average
P_2O_5	29.9	29.3	30.4	30.4	26.6	30.1	31.2	29.7
Ce_2O_3	33.3	32.6	31.2	31.0	29.2	29.0	27.3	30.6
La_2O_3	15.6	17.3	14.0	16.1	15.4	11.7	10.3	14.3
Nd_2O_3	10.2	13.1	13.9	13.8	10.3	14.2	14.0	12.8
Gd_2O_3	3.3	3.8	4.1	4.0	3.2	4.3	5.8	4.1
Y_2O_3	0.0	0.0	1.4	0.7	0.8	3.4	3.1	1.4
Sm_2O_3	1.8	1.8	2.2	2.0	1.5	3.3	4.8	2.5
Fe_2O_3	0.0	0.1	0.2	0.2	0.2	0.1	0.0	0.1
U_3O_8	1.7	0.6	0.5	0.4	1.3	0.0	0.4	0.7
ThO_2	6.8	2.1	3.2	3.1	7.0	1.0	2.2	3.6
CaO	1.1	0.1	0.6	0.5	0.5	0.2	0.6	0.5
Total	103.7	100.8	101.7	102.2	96.0	97.3	99.7	100.3

The analyses for individual grains show some compositional variation for the mineral. In particular, it is noted that mineral grains enriched in ThO_2 and U_3O_8 have reduced Nd_2O_3 contents and grains enriched in Gd_2O_3 and Sm_2O_3 have reduced La_2O_3 contents (Table 1).

Previous workers have successfully correlated monazites on the basis of the ThO_2 contents and ratios of certain rare-earth elements. A summary of the geologic occurrences of monazite by Overstreet (1967) shows that the ThO_2 content is variable, but monazites in crystalline rocks of the epizone generally have low ThO_2 contents (less than 1 wt %), those of the mesozone have moderate ThO_2 contents, and those of the katazone have high ThO_2 contents (greater than 7 wt %). The ThO_2 content of the Mount Pleasant monazite (3.6 wt %), which occurs in a greisenized acid volcanic rock, corresponds with the ThO_2 contents of monazites from cassiterite and/or wolframite granites of the mesozone (Overstreet 1967).

The ratios (in atomic %) for some rare-earth-element pairs in an average Mount Pleasant monazite are Ce/La = 2.1, Ce/Nd = 2.4, La/Nd = 1.2 and Nd/Sm = 5.2. These values are nearly the same as the average for Malayan alluvial monazite from a tin placer deposit (Flinter *et al.* 1963), and are similar to values for monazites from granites and granite pegmatites (Murata *et al.* 1953, 1957, 1958).

The Mount Pleasant monazite has a fairly high and uniform Gd_2O_3 content. Richartz (1961) studied magnetic fractions of a monazite from Brazil and found that Gd_2O_3 and Dy_2O_3 are strongly paramagnetic, and monazite with high concentrations of these elements has a high magnetic susceptibility. It is concluded that the Mount Pleasant monazite was concentrated with wolframite in the magnetic fraction because it has a high magnetic susceptibility due to its Gd_2O_3 content.

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