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TAPIOLITE, STIBIOTANTALITE, AND ANTIMONIAN MICROLITE FROM THE ODD WEST PEGMATITE, SOUTHEASTERN MANITOBA

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Introduction and Occurrence

The Odd West pegmatite is about 1 km north of the western end of Rush Lake, in the Bird Lake mining district of southeastern Manitoba. It penetrates metagreywackes in the east-west trending belt of the Archean metasedimentary-metavolcanic Rice Lake Group, bordered on the south and north by granodioritic to granitic plutons. The pegmatite belongs to a group of Li, Rb, Cs, Ta, Sn-rich bodies in the vicinity of Rush and Bernic Lakes, the best known of them being the giant Tanco (formerly Montgary, Chemalloy) pegmatite (Černý & Turnock 1971; Crouse & Černý 1972; for detailed location see Davies 1955).

The pegmatite is an east-west trending lenticular body that dips about 45° northwards, and attains a width of about 4 meters. The marginal zones of the pegmatite consist predominantly of albite and quartz, with subordinate muscovite and microcline-perthite. Grain sizes increase gradually towards the centre of the body, which consists mainly of blocky microcline-perthite and quartz, with subordinate amounts of montebrasite and spodumene, and minor Li-mica. The zoning is poorly developed.

In a zone intermediate between the hanging-wall margins and the core, cassiterite (up to 5 cm in size) and brownish-black to dark green tourmaline are relatively abundant in a coarse-grained albite-quartz-muscovite matrix. Tapiolite, stibiotantalite, and antimonian microlite occur in this assemblage as rare grains, up to 2 cm long. In contrast to the lustrous cassiterite grains, their aggregates are dull and usually exhibit the two cleavages typical of stibiotantalite. This mineral has not previously been reported in Canada.

Tapiolite

Tapiolite forms rounded to subhedral grains embedded in stibiotantalite. In polished sections, tapiolite exhibits the low bireflectance, anisotropism, and inconspicuous dark red internal reflections typical of the species. Very high refractive indices (>2.00) and birefringence are characteristic, as is the strong pleochroism (ω reddish brown, ε black-brown).

The chemical analysis, averaged from three separate determinations on the same grain, is quoted in Table 1. In common with most tapiolites, the Odd West mineral is rich in Fe and Ta, poor in Mn and Nb. The formula conforms well to that of tapiolite: $(Fe_{.96}Mn_{.04})_{\sim 1.00}(Ta_{1.82}Nb_{.22})_{\Sigma 2.04}O_6$.

The unit cell dimensions agree with the chemical composition. The *c* period is characteristic of Fe-rich tapiolites (*e.g.* Permingeat 1955; Barsanov *et al.* 1964; Samsonova & Katayeva 1966); Mn-enriched specimens show higher values of *c* (Tchzhenj-De-Tsyan & Sidorenko 1962, quoted in Barsanov *et al.* 1964).

Stibiotantalite

This mineral forms subhedral and euhedral grains up to 2 cm in length, with well-developed prismatic cleavage. The colour is dark brown; luster is dull. In polished sections, stibiotantalite has higher reflectance but is softer than tapiolite. In transmitted light, it is poorly translucent, reddish brown, with high refractive indices (>2.00) and birefringence. It is optically positive, with large $2V$ dispersion $r < v$.

The chemical composition (Table 1) corresponds to that of a Nb-poor stibiotantalite; Bi was not detected. The deviation of the atomic ratio Sb/(Ta,Nb) = 1.04 from the theoretical value of 1.00, although small, had not been observed in previous analyses. This deviation could be due to the inaccuracy of the analysis or the oxidation state of the Sb, with both Sb^{3+} and Sb^{5+} present. The Sb^{5+} would substitute for $(Ta,Nb)^{5+}$. Thus the composition of our stibiotantalite could correspond to the formula: $Sb^{3+}_{1.00}(Ta_{.88}Nb_{.10}Sb^{5+}_{.02})_{\Sigma 1.00}O_{4.00}$ which satisfies both the analytical results and the charge balance of the general formula $A^{3+}B^{5+}O_4$.

The unit cell dimensions given in Table 1 agree well with the average values known for stibiotantalite (about $a = 4.92$, $b = 11.81$, $c = 5.53$Å; Dihlström 1938; Roth & Waring 1963;

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Knorring & Hornung 1963; Chistyakova *et al.* 1964; unpubl. data of the authors).

Antimonian microlite

As shown in Figure 1, antimonian microlite replaced stibiotantalite mainly along cleavage planes. The microlite has the lowest reflectance of the three associated minerals. The colour of larger fragments is brownish-yellow in transmitted light, and the refractive index is about 2.00. The mineral is perfectly crystalline, with the intensities of *x*-ray powder diffraction reflections not changing appreciably after heating.

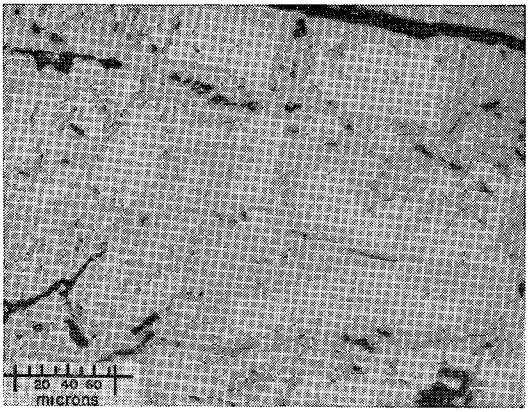

FIG. 1. Ragged relics of stibiotantalite (light grey) replaced by antimonian microlite (medium grey). The black areas are pits in the section.

The total of the electron microprobe analysis shown in Table 1 is less than 100 wt. %. Some of this discrepancy can be accounted for by the expected presence of H_2O, F_2 and low contents of Na_2O (<1%).

The mineral characteristically shows a variable chemical composition, particularly for the

TABLE 1. ELECTRON PROBE ANALYSES* AND UNIT CELL DIMENSIONS

Wt. %	tapiolite	stibiotantalite	antimonian microlite
CaO	-	0.1	8.3(7.5-9.4)
FeO	13.7(13.0-14.4)	-	1.9(1.4-2.8)
MnO	0.5(0.0- 0.7)	-	-
SnO_2	-	-	-
Ta_2O_5	79.5(78.3-80.2)	54.5(53.7-55.1)	72.1(69.7-74.0)
Nb_2O_5	5.8(5.4- 6.1)	4.0(3.5- 4.4)	5.1(4.8- 5.3)
Sb_2O_3	-	41.8(40.2-43.1)	1.6(1.3- 2.1)
Total	99.5	100.4	89.0
a (A°)	$4.755 \pm .001$	$4.920 \pm .002$	$10.42 \pm .01$
b (A°)		$11.832 \pm .006$	
c (A°)	$9.218 \pm .003$	$5.542 \pm .003$	
V (A°^{3})	$208.43 \pm .09$	$322.62 \pm .22$	$1131.3 \pm .4$

* average of three analyses with range given in brackets.

A-group cations. The Sb content is variable with up to 8 wt. % detected in areas which were seemingly free of stibiotantalite inclusions. The analyses given in Table 1 represent areas of lowest Sb content. The general formula of microlite is written as $A_{2-x}B_2(O,OH,F)_7$. Our analysis gave $A = (Ca_{1.64}Fe_{.28}Sb_{.06})_{\Sigma 1.98}$, $B = (Ta_{1.80}Nb_{.20})_{\Sigma 2.00}$. This seems to be the first experimentally-proven occurrence of antimonian microlite, the existence of which was suspected (and calculated from bulk compositions of mineral aggregates) in a similar assemblage by Quensel & Berggren (1938), Ödman (1941), and Quensel (1945). Synthetic phases corresponding to antimonian microlite were produced by Rosen & Westgren (1938).

ORIGIN

Sb, Bi, and As are characteristic trace elements in many well-differentiated Li-rich pegmatites. They occur in the form of native elements, sulphides, and oxidic compounds the last are commonly associated with late generations of Ta-Nb oxides. Stibiotantalite is presently known from about 10 localities in the world, all of them of this type. Besides this, stibiotantalite is known to be replaced by microlite in most of its occurrences (*e.g.*, Quensel 1956; Knorring & Hornung 1963; Stanek 1963; Chistyakova *et al.* 1964). The tapiolite-stibiotantalite-antimonian microlite association reported here also belongs to this type of occurrence. However, the minerals were formed in a relatively early albite-quartz-muscovite-tourmaline-cassiterite assemblage, not in a "lepidolite metasomatic complex" reported by Ginzburg (1956) to be its typical carrier. In the Odd West pegmatite, Li-bearing minerals are associated with allemontite (Černý & Harris 1972).

As mentioned in the introduction, the Odd West pegmatite is one of the group of closely-related pegmatites in the Bernic Lake — Rush Lake area. Many of these pegmatites carry minor sulphides as well as Ta, Nb oxides, or other members of its crystallochemical series which may also be expected to occur in them. This is particularly true of the Tanco Li, Ta, Cs deposit. With regards to the high Ta enrichment in this pegmatite and to the high concentration of Bi, As, and Sb in its sulphidic assemblages that occur mainly in the Ta ore zone (Crouse & Černý 1972), a find of bismutotantalite and/or stibiotantalite in this body seems to be very probable.

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