Hydrokenomicrolite, $\Box_3$H$_2$O$_2$Ta$_2$(O,OH)$_3$(H$_2$O), a new microlite-group mineral from Volta Grande pegmatite, Nazareno, Minas Gerais, Brazil

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ABSTRACT

Hydrokenomicrolite, $\Box_3$H$_2$O$_2$Ta$_2$(O,OH)$_3$(H$_2$O), is a new microlite-group mineral approved by the CNMNC (IMA 2011-103). It occurs as an accessory mineral in the Volta Grande pegmatite, Nazareno, Minas Gerais, Brazil. Associated minerals are: microcline, albite, quartz, muscovite, spodumene, “lepidolite”, cassiterite, tantalite-(Mn), monazite-(Ce), fluorite, “apatite”; beryl, “garnet”, epidote, magnetite, garnhite, zircon, “tourmaline”, bitite, and other microlite-group minerals under study. Hydrokenomicrolite occurs as euhedral octahedral crystals, occasionally modified by rhombododecahedra, untwinned, from 0.2 to 1.5 mm in size. The crystals are pinkish brown and translucent; the streak is white, and the luster is adamantine to resinous. It is non-fluorescent under ultraviolet light. Mohs hardness is 4½–5, tenacity is brittle. Cleavage is not observed; fracture is conchoidal. The calculated density is 6.666 g/cm$^3$. The mineral is isotropic, $n_{\text{calc}} = 2.055$. The infrared spectrum contains bands of O-H stretching vibrations and H-O-H bending vibrations of H$_2$O molecules. The chemical composition ($n = 3$) is [by wavelength-dispersive spectroscopy (WDS), H$_2$O calculated from crystal-structure analysis, wt%]: CaO 0.12, MnO 0.27, SrO 4.88, BaO 8.63, PbO 0.52, La$_2$O 0.52, Ce$_2$O 0.49, Nd$_2$O 0.55, Bi$_2$O$_3$ 0.57, UO$_2$ 4.54, TiO$_2$ 0.18, SnO$_2$ 2.60, Nb$_2$O$_5$ 2.18, Ta$_2$O$_5$ 66.33, SiO$_2$ 0.46, Cs$_2$O 0.67, H$_2$O 4.84, total 98.35. The empirical formula, based on 2 cations at the B site, is $\left[\Box_3\right](\text{H}_2\text{O})_3\text{Ba}_{0.10}\text{Sr}_{2.17}\text{U}_{0.29}\text{Ta}_{1.75}\text{Zn}_{0.02}\text{Nd}_{0.05}\text{Ce}_{0.07}\text{La}_{0.02}\text{Bi}_{0.01}\text{Pb}_{0.01}\text{Ti}_{0.02}\text{Sn}_{0.01}\Box_{2.00}\text{(Ta}_{2.17}\text{Nb}_{0.10}\text{Sn}_{0.10}\text{Si}_{0.04}\text{Ta}_{0.01}\Box_{2.00}\text{(O}_{3.77}\text{OH})_{2.02}\Box_{2.00}\text{[(H}_2\text{O})_{0.09}\text{Cs}_{0.03}]_{2.00}}$. The strongest eight X-ray powder-diffraction lines $\{d/$Å$\}$ are: 6.112(86)/111, 3.191(52)/311, 3.052(100)/222, 2.642(28)/400, 2.035(11)/511, 1.869(29)/440, 1.788(10)/531, and 1.594(24)/622. The crystal structure refinement ($R = 0.0363$) gave the following data: cubic, $Fd\bar{3}m$, $a = 10.454(1)$ Å, $V = 1142.5(2)$ Å$^3$, $Z = 8$. The Ta(OH)$_3$ octahedra are linked through all vertices. The refinement results and the approximate empirical bond-valences sums for the positions $A$ (1.0 v.u.) and $Y$ (0.5 v.u.), compared to valence calculations from electron microprobe analysis (EMPA) and ranges expected for H$_2$O molecules, confirm the presence of H$_2$O at the $A$ (16d) site and displaced from the $Y$ (8d) to the $Y$ (32e) position. The mineral is characterized by H$_2$O dominance at the $Y$ site, vacancy dominance at the $A$ site, and Ta dominance at the $B$ site.

Keywords: Hydrokenomicrolite, new mineral, Volta Grande pegmatite, Nazareno, Minas Gerais, Brazil, pyrochlore supergroup, microlite group, crystal structure

INTRODUCTION

Hydrokenomicrolite, $\Box_3$H$_2$O$_2$Ta$_2$(O,OH)$_3$(H$_2$O), from Volta Grande pegmatite, Nazareno, Minas Gerais, Brazil, is a new mineral (IMA 2011-103) named according to the nomenclature system for the pyrochlore supergroup of minerals approved by IMA-CNMNC (Atencio et al. 2010). The general formula of the pyrochlore-supergroup minerals is $A_{2-m}B_{2n}X_{1-n}Y_1$, where $m = 0$ to 1.7, $w = 0$ to 0.7, $n = 0$ to 1 (Lumpkin and Ewing 1995). In hydrokenomicrolite, the $A$ site is dominated by vacancies, the $B$ site is dominated by Ta, and the $Y$ site is dominated by H$_2$O. The discredited mineral species “bariomicrolite” (Hogarth 1977), identical with “rijkeboerite” (van der Veen 1963), is too poor in Ba to correspond to the name “bariomicrolite”. It apparently has a vacancy at the $A$ position, and as such is also probably hydrokenomicrolite. The “bariomicrolite” studied by Beurlen et al. (2005) is probably also hydrokenomicrolite (Atencio et al. 2010). Type material is deposited in the collections of the Museu de Geociências, Instituto  

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