Pezzottaite, Cs(Be$_2$Li)Al$_2$Si$_6$O$_{18}$, A Spectacular New Mineral Related to the Beryl group, from Madagascar

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ABSTRACT

Pezzottaite is a new mineral from the Sakavalana mine 3 km south of the village of Mandozonoro, close to the town of Antsirabe, 140 km west of Ambatofinandrahana, central Madagascar. It usually occurs as isolated crystals that can have three distinct habits: (1) irregularly shaped flat masses that fill cavities between cleavlandite, quartz and tourmaline; (2) subhedral-to-euhedral hexagonal tabular crystals up to 7 cm in diameter; (3) small euhedral-to-flat-to-elongated crystals attached to faces of large tourmaline crystals. The form {001} is dominant, with minor {100} and {110}; no twinning was observed. Pezzottaite is raspberry red to pink, with moderate dichroism: $\varepsilon$ = pink-orange and $\omega$ = purplish pink to pinkish purple. The streak is colorless to white, crystals are transparent to translucent with a vitreous luster and no observable fluorescence in long- and short-wave ultraviolet light. Crystals are brittle with both conchoidal and irregular fracture, have an imperfect cleavage parallel to {001}, and no observable parting. Mohs hardness is 8, the observed density is 2.97 g/cm$^3$ and the calculated density is 3.06 g/cm$^3$. Pezzottaite is uniaxial negative with $\varepsilon$ = 1.608 and $\omega$ = 1.616, both $\pm$ 0.001. It is strongly pleochroic, orange-red $|| \varepsilon$ and purple-violet $|| \omega$.

Pezzottaite is hexagonal, space group R3c, with the following unit-cell parameters refined from X-ray powder-diffraction data: a 15.973(4), b 15.973(4), c 27.803(8) Å, V 6122(2) Å$^3$, Z = 18. The ten strongest lines in the X-ray powder-diffraction pattern are as follows: d(), 1, (hkl): 3.272, 100, (0 3 6); 2.871, 52, (-1 5 3); 3.027, 41, (-2 4 6); 3.019, 29, (-1 5 0); 2.215, 14, (-2 7 0); 1.636, 14, (0 6 12); 2.229, 12, (-1 2 12); 1.749, 12, (-3 6 12); 1.743, 12, (-3 9 0); 1.518, 11, (-3 9 9). Chemical analysis by electron microprobe and ICP (Li) gave SiO$_2$ 56.52, Al$_2$O$_3$ 15.60, Sc$_2$O$_3$ 0.03, FeO 0.01, MnO 0.09, Na$_2$O 0.52, K$_2$O 0.15, Rb$_2$O 0.56, Cs$_2$O 13.57, Li$_2$O 2.16, BeO$_{\text{calc}}$ 8.05, H$_2$O 0.28, sum 97.74 wt.%, where the amount of H$_2$O was determined by crystal-structure analysis. The resulting empirical formula, calculated on
the basis of 18 structural O atoms, is $(\text{Cs}_{0.62}\,\text{Rb}_{0.05}\,\text{K}_{0.02}\,\text{Na}_{0.11})_\Sigma=0.80$
$(\text{Be}_{2.07}\,\text{Li}_{0.93})(\text{Al}_{1.97}\,\text{Mn}_{0.01})_\Sigma=1.98\,\text{Si}_{6.05}\,\text{O}_{18}\,(\text{H}_2\text{O})_{0.10}$. Chemical analysis by LA-ICP-MS gave $\text{SiO}_2\,54.58$, $\text{TiO}_2\,0.01$, $\text{Al}_2\text{O}_3\,16.88$, $\text{FeO}\,0.02$, $\text{MnO}\,0.02$, $\text{CaO}\,0.22$, $\text{Na}_2\text{O}\,0.46$, $\text{K}_2\text{O}\,0.14$, $\text{Rb}_2\text{O}\,0.44$, $\text{Cs}_2\text{O}\,18.23$, $\text{Li}_2\text{O}\,2.12$, $\text{BeO}\,8.14$ sum 101.27 wt.%.

The resulting empirical formula, calculated on the basis of 18 structural O atoms, is $(\text{Cs}_{0.84}\,\text{Rb}_{0.03}\,\text{K}_{0.02}\,\text{Na}_{0.10})_\Sigma=0.98\,(\text{Be}_{2.10}\,\text{Li}_{0.92})_\Sigma=3.02\,\text{Al}_{2.00}\,(\text{Si}_{5.86}\,\text{Al}_{0.14})\,\text{O}_{18}$. The end-member formula of pezzottaite is $\text{Cs}(\text{Be}_2\,\text{Li})\,\text{Al}_2\,\text{Si}_6\,\text{O}_{18}$. The mineral is named for Dr. Federico Pezzotta of the Museo Civico, Milano, Italy, for his major role in characterizing the granitic pegmatites of Madagascar.

Pezzottaite has been approved by the Commission of New Minerals and Mineral Names of the International Mineralogical Association. Pezzottaite is related to the minerals of the beryl group, but differs in having essential Cs and a superstructure that arises from ordering of Be and Li in tetrahedral coordination.