

Lavinskyite, $K(\text{LiCu})\text{Cu}_6(\text{Si}_4\text{O}_{11})_2(\text{OH})_4$, isotypic with plancheite, a new mineral from the Wessels mine, Kalahari Manganese Fields, South Africa

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ABSTRACT

A new mineral species, lavinskyite, ideally $K(\text{LiCu}^{2+})\text{Cu}_6^{2+}(\text{Si}_4\text{O}_{11})_2(\text{OH})_4$ (IMA 2012-028), has been found in the Wessels mine, Kalahari Manganese Fields, Northern Cape Province, South Africa. Associated minerals include wesselsite, pectolite, richterite, sugilite, and scottyite. Lavinskyite crystals are tabular [parallel to (010)]. The mineral is light blue, transparent with very pale blue streak and vitreous luster. It is brittle and has a Mohs hardness of ~5; cleavage is perfect on {010} and no parting was observed. The measured and calculated densities are 3.61(3) and 3.62 g/cm³, respectively. Optically, lavinskyite is biaxial (+), with $\alpha = 1.675(1)$, $\beta = 1.686(1)$, $\gamma = 1.715(1)$, $2V_{\text{meas}} = 64(2)^\circ$. An electron microprobe analysis produced an average composition (wt%) of SiO₂ 42.85(10), CuO 46.13(23), K₂O 4.16(2), MgO 1.53(17), Na₂O 0.27(4), BaO 0.18(6), and MnO 0.08(1), plus Li₂O 1.38 from the LA-ICP-MS measurement and H₂O 3.22 (added to bring the analytical total close to 100%), yielding a total of 99.79% and an empirical chemical formula $(\text{K}_{0.99}\text{Ba}_{0.01})_{\Sigma=1.00}(\text{Li}_{1.04}\text{Cu}_{0.93}\text{Na}_{0.10})_{\Sigma=2.07}(\text{Cu}_{5.57}\text{Mg}_{0.43}\text{Mn}_{0.01})_{\Sigma=6.01}(\text{Si}_{4.00}\text{O}_{11})_2(\text{OH})_4$.

Lavinskyite is isotypic with plancheite, $\text{Cu}_8(\text{Si}_4\text{O}_{11})_2(\text{OH})_4 \cdot \text{H}_2\text{O}$, an amphibole derivative. It is orthorhombic, with space group *Pcnb* and unit-cell parameters $a = 19.046(2)$, $b = 20.377(2)$, $c = 5.2497(6)$ Å, and $V = 2037.4(4)$ Å³. The key difference between lavinskyite and plancheite lies in the coupled substitution of K⁺ and Li⁺ in the former for H₂O and Cu²⁺ in the latter, respectively. The structure of lavinskyite is characterized by the undulating, brucite-like layers consisting of three distinct octahedral sites occupied mainly by Cu. These layers are sandwiched by the amphibole-type double silicate chains extending along the *c* axis, forming a sheet structure of compact silicate-Cu-silicate triple layers. Adjacent sheets are linked together by K and M4 (= Cu + Li) cations, as well as hydrogen bonding. The M4 site is split, with Cu and Li occupying two different sites. Lavinskyite exhibits more amphibole-like structural features than plancheite, as a consequence of K in the large cavity between the two back-to-back double silicate chains.

Keywords: Lavinskyite, $K(\text{LiCu})\text{Cu}_6(\text{Si}_4\text{O}_{11})_2(\text{OH})_4$, plancheite, crystal structure, X-ray diffraction, Raman spectra