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SPECIAL COLLECTION: APATITE: A COMMON MINERAL, UNCOMMONLY VERSATILE

Wayneburnhamite, $Pb_9Ca_6(Si_2O_7)_3(SiO_4)_3$, an apatite polysome: The Mn-free analog of ganomalite from Crestmore, California

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Abstract

Wayneburnhamite (IMA2015-124), $Pb_9Ca_6(Si_2O_7)_3(SiO_4)_3$, is a new mineral from the Commercial quarry, Crestmore, Riverside County, California, where it occurs as a metasomatic mineral on fracture surfaces in vesuvianite/wollastonite rock. Wayneburnhamite crystals are sky-blue hexagonal tablets and prisms up to 0.5 mm in maximum dimension. The streak is white. Crystals are transparent to translucent with vitreous to resinous luster. The Mohs hardness is 3½, the tenacity is brittle, the fracture is conchoidal, and there is no cleavage. The calculated density is 5.271 g/cm^3. The mineral is optically uniaxial (+), with $\omega = 1.855(5)$, and $\varepsilon = 1.875(5)$ (white light). The pleochroism is *E* sky blue and *O* lighter sky blue; $E > O$ weak. Raman and infrared spectra are consistent with the crystal structure, but suggest a very minor hydrous component. The empirical formula (based on 9 Si apfu) is $(Pb_{8.33}Sr_{0.04}\square_{0.63})_{\Sigma 9.00}(Ca_{5.40}Cu^{2+}_{0.27}\square_{0.33})_{\Sigma 6.00}Si_9S_{0.21}O_{32.64}Cl_{0.05}$. Wayneburnhamite is hexagonal, $P\overline{6}$, $a = 9.8953(9)$, $c = 10.2054(7)$ Å, $V = 865.40(17)$ Å^3, and $Z = 1$. The eight strongest lines in the X-ray powder diffraction pattern are [d_{obs} in Å(*I*)(*hkl*)]: 4.95(52)(110); 4.45(64)(111); 3.550(77)(112); 3.232(54)(120); 3.086(100)(121); 2.847(60)(300); 2.798(48)(113); and 2.734(83)(212). The structure determination ($R_1 = 3.01\%$ for 1063 $F_o > 4\sigma F$) shows wayneburnhamite to be an apatite polysome isostructural with ganomalite, differing only in that the site occupied dominantly by Mn in the structure of ganomalite is occupied dominantly by Ca in the structure of wayneburnhamite. The structure refinement of wayneburnhamite appears to represent a rare case in which the approximate locations of the Pb^{2+} $6s^2$ lone-electron pairs can be seen as electron density residuals.

Keywords: Wayneburnhamite, new mineral, crystal structure, spectroscopy, apatite polysome, ganomalite, lone-electron pairs, Crestmore, California