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Plumbophyllite, a new species from the Blue Bell claims near Baker, San Bernardino County, California

Anthony R. Kampf,[1,*] George R. Rossman,[2] and Robert M. Housley[2]

[1]Mineral Sciences Department, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, U.S.A.
[2]Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91125, U.S.A.

Abstract

The new mineral plumbophyllite, $Pb_2Si_4O_{10}·H_2O$, is orthorhombic with space group *Pbcn* and cell parameters $a = 13.2083(4)$, $b = 9.7832(3)$, $c = 8.6545(2)$ Å, $V = 1118.33(5)$ Å^3, and $Z = 4$. It occurs as colorless to pale blue prismatic crystals to 3 mm, with wedge-shaped terminations at the Blue Bell claims, about 11 km west of Baker, San Bernardino County, California. It is found in narrow veins in a highly siliceous hornfels in association with cerussite, chrysocolla, fluorite, goethite, gypsum, mimetite, opal, plumbotsumite, quartz, sepiolite, and wulfenite. The streak is white, the luster is vitreous, the Mohs hardness is about 5, and there is one perfect cleavage, {100}. The measured density is 3.96(5) g/cm^3 and the calculated density is 3.940 g/cm^3. Optical properties (589 nm): biaxial (+), $\alpha = 1.674(2)$, $\beta = 1.684(2)$, $\gamma = 1.708(2)$, $2V = 66(2)°$, dispersion $r > v$ (strong); $X = b$, $Y = c$, $Z = a$. Electron microprobe analysis provided PbO 60.25, CuO 0.23, SiO_2 36.22 wt%, and CHN analysis provided H_2O 3.29 wt% for a total of 99.99 wt%. Powder IR spectroscopy confirmed the presence of H_2O and single-crystal IR spectroscopy indicated the H_2O to be oriented perpendicular to the *b* axis. Raman spectra were also obtained. The strongest powder X-ray diffraction lines are [*d* (*hkl*) *I*]: 7.88(110)97, 6.63(200)35, 4.90(020)38, 3.623(202)100, 3.166(130)45, 2.938(312/411/222)57, 2.555(132/213)51, and 2.243(521/332)50. The atomic structure ($R_1 = 2.04\%$) consists of undulating sheets of silicate tetrahedra between which are located Pb atoms and channels containing H_2O (and Pb^{2+} lone-pair electrons). The silicate sheets can be described as consisting of zigzag pyroxene-like $(SiO_3)_n$ chains joined laterally into sheets with the unshared tetrahedral apices in successive chains pointed alternately up and down, a configuration also found in pentagonite.

Keywords: Plumbophyllite, new mineral, phyllosilicate, crystal structure, Blue Bell claims, California, IR spectroscopy, Raman spectroscopy