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

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ABSTRACT

The new mineral plumbophyllite, PbSi4O10·H2O, 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) Å³, 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/cm³ and the calculated density is 3.940 g/cm³. Optical properties (589 nm): biaxial (+), α = 1.674(2), β = 1.684(2), γ = 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, SiO₂ 36.22 wt%, and CHN analysis provided H₂O 3.29 wt% for a total of 99.99 wt%. Powder IR spectroscopy confirmed the presence of H₂O and single-crystal IR spectroscopy indicated the H₂O to be oriented perpendicular to the b axis. Raman spectra were also obtained. The strongest powder X-ray diffraction lines are \[ d \quad (hkl) \]: 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 (\( R = 2.04% \)) consists of undulating sheets of silicate tetrahedra between which are located Pb atoms and channels containing H₂O (and Pb³⁺ lone-pair electrons). The silicate sheets can be described as consisting of zigzag pyroxene-like \((SiO₄)₃\) 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

INTRODUCTION

The first specimen of the new mineral species described herein was collected from adit C at the Blue Bell claims, near Baker, California, in 2000 by Garth Bricker of Fallbrook, California. In March of 2007, Brent Thorne of Bountiful, Utah, and Joe Marty of Salt Lake City, Utah, collected specimens of the mineral from the same site, which they made available to the authors for study. Subsequently, in October of 2007, Joe Marty and one of the authors (J.M.H.) collected additional specimens of the mineral.

The mineral is named for its essential Pb content and its silicate sheet structure. The new mineral and name have been approved by the Commission on New Minerals, Nomenclature and Classification of the International Mineralogical Association (IMA 2008-025). Four cotype specimens are deposited in the Natural History Museum of Los Angeles County, catalog numbers 58829, 58830, 58831, and 58832.

OCCURRENCE

The Blue Bell claims consist of a group of mostly small workings and one longer branching adit, all located on small Joe Dandy Hill in the SW ¼ of section 2, T. 13 N., R. 7 E. in the Soda Mountains, about 11 km west of Baker, San Bernardino County, California (35°14′31″N, 116°12′17″W). At various times in the past the long adit has been known as the Atkinson mine and most of the other workings have been known as the Hard Luck mine. Mineralization was first discovered in the area before 1885 and some of the workings were at that time mined for silver as the May Queen claim (Vredenburgh 1994). The only recorded small shipments of ore from the Blue Bell claims occurred during the interval from 1949–1951 (Wright et al. 1953; Goodwin 1957), although exploratory work apparently continued until 1958 (Maynard et al. 1984). The main values were in lead and silver, although some copper, zinc, and gold were recovered.

For several decades the Blue Bell claims have been a popular mineral collecting site. As early as 1949, roughly coincident with the first ore shipments, rich specimens of linarite, caledonite, and leadhillite were known from the deposit (Murdoch and Webb 1956). National attention was first called to the locality when John Crowley (Crowley 1977) identified and described a suite of 15 minerals that could then be found in what is now known as the A2 site or the A site glory hole. Following this, a dedicated group of volunteers from the San Bernardino County Museum, with the support of then curator of Earth Sciences,