

# The new mineral challacolloite, $\text{KPb}_2\text{Cl}_5$ , the natural occurrence of a technically known laser material

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With 2 figures and 4 tables

**Abstract:** The new mineral challacolloite has the ideal chemical formula  $\text{KPb}_2\text{Cl}_5$ . The type locality of challacolloite is the Challacollo silver mine SE of Iquique, Atacama desert, northern Chile. In the year of discovery challacolloite was also found on leucotephrite lava from the Vesuvius eruption of May 1855. It occurs closely associated with cotunnite as a hydrothermal phase (Chile) or as the product of fumarole activities (Italy). Chalcocolloite is colourless to white with an adamantine luster. Mohs's hardness is about 2–3. The calculated density is  $4.77\text{ g/cm}^3$ . Chalcocolloite is biaxial (+),  $2V_{\text{calc}} = 67^\circ$  with  $n\alpha = 2.004(2)$ ,  $n\beta = 2.010(2)$  and  $n\gamma = 2.024(3)$ . Chemical analyses of the type material give (wt.%) K 5.45, Pb 66.30, Cl 28.69. Chalcocolloite is monoclinic with space group  $P2_1/c$ . Cell parameters refined from powder diffraction data of the type material are  $a = 8.864(8)$ ,  $b = 7.932(8)$ ,  $c = 12.491(11)$  (Å),  $\beta = 90.153(5)^\circ$ ,  $V = 878.2(1)$  Å<sup>3</sup> with  $Z = 4$ . Chalcocolloite is isotypic with  $\text{NH}_4\text{Pb}_2\text{Cl}_5$  and  $\text{PbU}_2\text{Se}_5$ . Synthetic REE-doped equivalents of chalcocolloite are known as technical laser materials. The strongest reflections in the X-ray powder diffraction data of the type material are as follows [ $d_{\text{meas.}}(\text{Å})(l, hkl)$ ]: 3.686 (100, 211), 3.609 (49, 20–2), 2.669 (42, 22–2), 8.855 (39, 100) and 3.961 (31, 020). The mineral was named after its type locality.

Key words: Chalcocolloite, new mineral, cotunnite, potassium lead chloride, Chile, Atacama desert, Challacollo mine, Vesuvius volcano, IR-laser.

## Introduction

The type locality of the new mineral chalcocolloite is the famous Chilean silver mine Challacollo (S  $20^\circ 57'$ , W  $69^\circ 21'$ ), which is situated in the Atacama desert about 130 km southeast of Iquique. The argentiferous deposit, of the epithermal-epigenetic type, is bound to fissure veins and genetically related to acid intrusions of an acidic to intermediate subvolcanic complex of Upper Cretaceous to Lower Tertiary age (BOTTO 1975, CARRASCO & CHONG 1985). Chalcocolloite was discovered on mine dumps by ARTURO MOLINA, Iquique, in 2003. In the same year chalcocolloite was found by one of the authors (S. B.) on an old museum specimen from the Mineralogical Museum, Saint Petersburg State University, collected at the Vesuvius volcano, Naples, Campania, Italy, labelled as cotunnite. Chalcocolloite here occurs in cavernous leucotephrite lava from the eruption of May 1,

1855. Further natural occurrences of potassium lead chloride are reported from the Kudryavyi volcano, Iturup Island, Kuril Islands (TKACHENKO et al. 1999) and the Satsuma-Iwojima volcano, Japan (AFRICANO et al. 2002). Meanwhile chalcocolloite was found also on other Vesuvian “cotunnite samples” from different eruptions (e. g. the eruption of 1907) in the collection of the Mineralogical Museum, University of Hamburg.

Synthetic analogues of chalcocolloite doped with  $\text{REE}^{3+}$  cations are well-studied due to their technical usage. They serve as promising new laser host crystals for mid-IR solid-state laser and might also be efficient candidates for room-temperature up-conversion laser in the visible region (VIROVETS et al. 2001, ISAENKO et al. 2001, ROY et al. 2003).

The new mineral and its name were approved by the IMA Commission on New Minerals and Mineral Names in December 2004 (No. 2004-028). The name of the min-