Rollandite, Cu$_3$(AsO$_4$)$_2$.4H$_2$O, a new mineral: its description and crystal structure

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Abstract

Rollandite, Cu$_3$(AsO$_4$)$_2$.4H$_2$O, was found in the old copper mines of Roua (Alpes-Maritimes, France), associated with olivenite, conichalcite, clinotyrolite, cornubite, kolfanite, pharmacosiderite, gerhardtite, atacamite, gilmarite, wallkilldellite-Fe, cuprite, domeykite, algodonite and native copper. It forms aggregates (1 mm diameter) consisting of perfect crystals (0.5 × 0.15 × 0.1 mm maximum dimension). The bottle-green crystals are elongated along $a$, slightly flattened on {010}, and have a good cleavage on {001}. They are not twinned. The mineral is orthorhombic, Pnma, $a = 5.6906(4)$ Å, $b = 17.061(1)$ Å, $c = 9.732(1)$ Å, $V = 944.9(1)$ Å$^3$, $Z = 4$, $D_{meas} = 3.9(1)$ g/cm$^3$ and $D_{calc} = 3.84$ g/cm$^3$. The strongest lines in the X-ray powder diffraction pattern (dobs in Å, (hkl), Ivis) are: 8.52, (020), 100; 3.721, (131), 60; 3.221, (141) (051), 90; 3.120, (132), 40; 2.817, (103)(033), 35; 2.795, (142), 35; 2.350, (143) (053), 25; 2.133, (080) (251), 25. Mohs' hardness is 4-4.5. Luster is vitreous transparent, streak is very light green; crystals are biaxial (-) with $\alpha = 1.745(5)$, $\beta = 1.755(5)$, $\gamma = 1.760(5)$ at 590 nm; 2V$_{obs} = 71(2)^\circ$, [...]

Reference


DOI: 10.1127/0935-1221/2000/0012-1045
Rollandite, Cu$_3$ (AsO$_4$)$_2$•4H$_2$O, a new mineral: its description and crystal structure

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Abstract: Rollandite, Cu$_3$ (AsO$_4$)$_2$•4H$_2$O, was found in the old copper mines of Roua (Alpes-Maritimes, France), associated with olivenite, conichalcite, clinoptyroline, cornubite, kolfanite, pharmacosiderite, gerhardtite, atacamite, gilmarite, wallkilldellite-Fe, cuprite, domeykite, algodonite and native copper. It forms aggregates (1 mm diameter) consisting of perfect crystals (0.5 x 0.15 x 0.1 mm maximum dimension). The bottle-green crystals are elongated along a, slightly flattened on {010}, and have a good cleavage on {001}. They are not twinned. The mineral is orthorhombic, Pnma, a = 5.6906(4), b = 17.061(1), c = 9.732(1) Å, V = 944.9(1) Å$^3$, Z = 4, D$_{\text{meas}}$ = 3.9(1) and D$_{\text{calc}}$ = 3.84 g/cm$^3$. The strongest lines in the X-ray powder diffraction pattern ($d_{\text{obs}}$ in Å, (hkl), $I_{\text{vis}}$) are: 8.52, (020), 100; 3.721, (131), 60; 3.221, (141) (051), 90; 3.102, (132), 40; 2.817, (103)(033), 35; 2.795, (142), 35; 2.350, (143) (053), 25; 2.133, (080) (251), 25. Mohs’ hardness is 4-4.5. Luster is vitreous transparent, streak is very light green; crystals are biaxial (-) with $\alpha$ = 1.745(5), $\beta$ = 1.755(5), $\gamma$ = 1.760(5) at 590 nm; 2$V_{\text{obs}}$ = 71(2)$^\circ$, 2$V_{\text{calc}}$ = 70.1(4)$^\circ$. Non pleochroic. The crystal structure was solved by direct methods (MoK$\alpha$ radiation) and refined using 1407 observed unique reflections to $R$ = 0.086, $R_e$ = 0.046. The structure of rollandite is formed by (020) sheets of Cu$_1$O$_6$ octahedra and [100] chains of Cu$_2$O$_5$ square pyramids linked by AsO$_4$ tetrahedra. The water molecule O$_6$H$_2$ is bonded by hydrogen bonds in the channels running along [100].

Key-words: rollandite, new mineral, powder pattern, crystal structure, arsenate, copper, hydrogen bonding.

Introduction

Rollandite, Cu$_3$ (AsO$_4$)$_2$•4H$_2$O, is a new mineral discovered in samples collected by Danielle Mari, Gilbert Mari and Pierre Rolland in the old copper mines of Roua, which are situated in the northwestern part of the Alpes-Maritimes department (France).

The mineral name honours Pierre Rolland (1940 -), an eminent mineral collector of the Roua mines who works in the well-known Oceano-graphic Museum of the principality of Monaco.

The mineral and mineral name have been approved by the Commission on New Minerals and Mineral Names of the International Mineralogical Association.

Type material is preserved in the Department of Mineralogy of the Natural History Museum of Geneva, Switzerland, under reference no. 447.008

Occurrence

The new mineral described occurs in the Roua...