Lapeyreite, Cu$_3$O[AsO$_3$(OH)]$_2$:0.75H$_2$O, a new mineral: Its description and crystal structure

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ABSTRACT

Lapeyreite, ideally Cu$_3$O[AsO$_3$(OH)]$_2$:0.75H$_2$O, was found in the old copper mines of Roua (Alpes-Maritimes, France). It is invariably in intimate association with trippkeite. Other associated minerals are olivenite, malachite, gilmarite, cornubite, connellite, theoparacelsite, brochantite, cuprite, native copper, algenodite, and domeyaite. Lapeyreite occurs in geodes of cuprite (0.5 mm diameter) as aggregates formed by perfect elongate rectangular crystals (up to 0.2 × 0.05 × 0.01 mm in size), acicular fibrous crystals or powdery masses. The mineral is translucent (transparent in thin fragments), dark pistachio-green. It has a vitreous to adamantine luster and yellowish green streak. The tenacity is brittle and the fracture conchoidal. The rectangular crystals are elongate parallel to [010], flattened on {001}, and have a perfect cleavage on {001}, and a good cleavage on {100}. All crystals, without exception, are twinned on the (001) plane. The recognizable crystal forms are {100}, {010}, and {001}. In transmitted light, the mineral is pistachio-green, with strong pleochroism: X = light yellow-green, Y = pistachio-green, Z = dark pistachio-green; dispersion: r < v, medium. Lapeyreite is biaxial (+), with n$_d$ ~ 1.82, n$_g$ ~ 1.85, n$_p$ ~ 1.90 (for λ = 589 nm). 2V$_{meas}$ = 76° (universal stage), 2V$_{calc}$ = 77°. The optical orientation is X° c ~ 12°, Y = a, Z = b. The mean chemical composition determined by electron microprobe is (wt%): CuO 46.49, As$_2$O$_5$, 45.82, H$_2$O (from crystal structure analysis) 6.50, total 98.61. The empirical formula calculated on the basis of nine structural O atoms (excluding molecular water) is Cu$_2$As$_2$O$_6$(OH)$_{0.77}$H$_2$O. Lapeyreite is monoclinic, C2/m, a = 19.158(3), b = 2.9361(6), c = 9.193(2) Å, β = 103.26(1)°, V = 503.32(6) Å$^3$, Z = 8/3. The calculated density is 4.385 g/cm$^3$ (based on the empirical formula). The strongest X-ray powder-diffraction lines are [d(Å) (I) (hkl)]: 7.36 (30) (201), 5.842 (40) (201), 4.476 (35) (002), 3.173 (90) (601), 2.984 (100) (100), 2.883 (30) (602), 2.484 (80) (311), 2.396 (40) (112), 2.337 (35) (800). The crystal structure of lapereyite was solved by direct methods (MoKα radiation) and refined on F$^2$ using all 617 observed reflections to R = 0.069. The structure of lapereyite is formed by a three-dimensional network of CuO$_4$ square pyramids and As$_2$O$_5$ tetrahedra with a water molecule in structural cavities. This structure shows some similarities to that of theoparacelsite. The mineral is named in honor of Laurent Lapeyre, an eminent mineral collector and expert on Roua minerals.

Keywords: Lapeyreite, new mineral, crystal structure, copper arsenate, Roua mines, Alpes-Maritimes, France

INTRODUCTION

Lapeyreite, Cu$_3$O[AsO$_3$(OH)]$_2$:0.75 H$_2$O, is a new mineral discovered in samples collected by Laurent Lapeyre, Danielle Mari, Pierre Rolland (mineral collectors), and Gilbert Mari (President of the Association of Naturalists of Nice and the Alpes-Maritimes) in the old copper mines of Roua (North and South group, districts of Guillaumes and Daluis, respectively), which are situated in the northwest part of the Alpes-Maritimes department (France), about 50 km from Nice.

The mineral is named in honor of Laurent Lapeyre (b. 1973), the mineral collector who found the sample containing the mineral. Both the mineral and its name have been approved by the Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (IMA). The holotype specimens are deposited in the Laboratory of Crystallography, University of Geneva, Switzerland (registration number CR.010) and in the University of Adnan Menderes, Vocational School of Memnune Inci, Karacasu-Aydın, Turkey (registration number KMY.25). Co-type material is deposited in the University of Dokuz Eylül, Vocational School of Izmir, Buca-Izmir, Turkey (registration number BM.73).

OCCURRENCE

The new mineral described in the present work occurs in the Roua copper deposits in the upper part of the Var valley (Daluis gorge) at the western margin of the Barrot Dome in the northeastern part of the Alpes-Maritimes area (France). The Dome is characterized by the presence of numerous shavings...