

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

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ABSTRACT

Lapeyreite, ideally $\text{Cu}_3\text{O}[\text{AsO}_3(\text{OH})]_2 \cdot 0.75\text{H}_2\text{O}$, 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, gilmartite, cornubite, connellite, theoparacelsite, brochantite, cuprite, native copper, algodonite, and domeykite. Lapeyreite occurs in geodes of cuprite (0.5 mm diameter) as aggregates formed by perfect elongate rectangular crystals (up to $0.2 \times 0.05 \times 0.01$ 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 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 $n_\alpha \sim 1.82$, $n_\beta \sim 1.85$, $n_\gamma \sim 1.90$ (for $\lambda = 589$ nm). $2V_{\text{meas}} = 76^\circ$ (universal stage), $2V_{\text{calc}} = 77^\circ$. The optical orientation is $X \wedge c \sim 12^\circ$, $Y = a$, $Z = b$. The mean chemical composition determined by electron microprobe is (wt%): CuO 46.49, As_2O_5 45.82, H_2O (from crystal structure analysis) 6.30, total 98.61. The empirical formula calculated on the basis of nine structural O atoms (excluding molecular water) is $\text{Cu}_{2.96}\text{As}_{2.01}\text{O}_{6.99}(\text{OH})_{2.01} \cdot 0.77\text{H}_2\text{O}$. Lapeyreite is monoclinic, $C2/m$, $a = 19.158(3)$, $b = 2.9361(6)$, $c = 9.193(2)$ Å, $\beta = 103.26(1)^\circ$, $V = 503.32(6)$ Å³, $Z = 8/3$. The calculated density is 4.385 g/cm³ (based on the empirical formula). The strongest X-ray powder-diffraction lines are [$d(\text{Å})$ (I) (hkl): 7.36 (30) ($\bar{2}01$), 5.842 (40) (201), 4.476 (35) (002), 3.173 (90) ($\bar{6}01$), 2.984 (100) (003), 2.883 (30) ($\bar{6}02$), 2.484 (80) (311), 2.396 (40) (112, $\bar{8}01$), and 2.337 (35) (800). The crystal structure of lapeyreite was solved by direct methods (MoK α radiation) and refined on F^2 using all 617 observed reflections to $R = 0.069$. The structure of lapeyreite is formed by a three-dimensional network of CuO_5 square pyramids and AsO_4 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