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Tillmannsite, $(Ag_3Hg)(V,As)O_4$, a new mineral: its description and crystal structure

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Abstract: Tillmannsite, $(Ag_3Hg)(V,As)O_4$, was found in the old copper mines of Roua (Alpes-Maritimes, France), associated with pecoraite, vésigniéite, olivenite, kolfanite, janggunite, chlorargyrite, cuprite, native copper, native silver, native silver containing 2 % of mercury, domeykite, djurleite and algodonite. It forms aggregates (0.2 mm diameter) consisting of pseudooctahedral crystals (50 μm maximum dimension). The crystals are red, brownish red. The mineral is tetragonal, $I\bar{4}$, a = 7.727(7) Å, c = 4.648(5) Å, V = 277.5(5) Å^3, Z = 2 and D_{calc} = 7.733(3) g/cm^3 . The strongest lines in the X-ray powder diffraction pattern (d_{obs} in Å, (hkl), I_{vis}) are: 5.45, (110), 25; 2.772, (211), 100; 2.324, (002), 30; 2.254, (301), 20. Luster is adamantine translucent, streak is brownish red; crystals are uniaxial (+) with ω ~ 2.3, ε ~ 2.5 at 589 nm. Pleochroism is intense with ε = red orange intense, ω = orange brown. The crystal structure was solved from data collected using synchrotron radiation by traditional direct methods and refined using 350 observed unique reflections to R(F) = 0.037, Rw(F^2) = 0.075. The structure of tillmannsite containes isolated tetrahedra $(V,As)O_4$ and tetrahedral clusters (Ag_3Hg) formed by metallic atoms. Each (Ag,Hg) metallic atom is coordinated by 3 metallic neighbors and by 3 oxygens.

Key-words: tillmannsite, crystal structure, vanadate, silver, mercury, Roua (France).

Introduction

Tillmannsite, $(Ag_3Hg)(V,As)O_4$, 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 honors Professor Ekkehart Tillmanns (born 1941) from Institute of Mineralogy and Crystallography of Wien, Austria. 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. 478.006.

Occurrence

The new mineral herewith described occurs in the Roua copper occurrences in the upper part of the Var valley (the Daluis gorge) at the western margin of the Barrot Dome. The metallogeny and geology of this Dome have been studied by Vinchon (1984) and Mari (1992). In the Roua ore deposit, the cupriferous mineralisation is hosted in a gangue formed by dolomite, calcite and aragonite, and consists of native copper, cuprite, domeykite, algodonite, koutekite and native silver. Detailed mineralogical study of this ore deposit produced several secondary, rare and unknown mineral species (Sarp *et al*., 1994, 1995, 1996). The new mineral described here occurs in small geodes in association with pecoraite, vésigniéite, olivenite, kolfanite, janggunite, chlorargyrite, cuprite, native copper, native silver, native silver containing 2 % of mercury, domeykite, djurleite and algodonite. It is a secondary alteration mineral.

Physical and optical properties

Tillmannsite occurs as aggregates of maximum size 0.2 mm in diameter, which are formed by pseudooctahedral crystals of maximum size 50 μm. The crystals are occasionally twinned by contact on (100) and they do not

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