

Description and crystal structure of Yvonite, $\text{Cu}(\text{AsO}_3\text{OH})_2\text{H}_2\text{O}$

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ABSTRACT

Yvonite, $\text{Cu}(\text{AsO}_3\text{OH})_2\text{H}_2\text{O}$, was found in the Salsigne mine near Carcassonne (Aude, France). It forms aggregates or radiating spherules consisting of individual crystals (maximal size $0.3 \times 0.15 \times 0.06$ mm) of turquoise blue color. They are elongated in c , flattened on (010), and have a perfect cleavage on (100). The mineral is triclinic, $P\bar{1}$, $a = 7.632(3)$, $b = 11.168(3)$, $c = 6.020(3)$ Å, $\alpha = 89.32(3)$, $\beta = 86.55(5)$, $\gamma = 74.43(3)^\circ$, $V = 493.4(3)$ Å³, $Z = 4$, $D_{\text{meas}} = 3.20(2)$ g/cm³, and $D_{\text{calc}} = 3.22(1)$ g/cm³. Mohs hardness 3.5–4. Luster vitreous transparent, streak blue; optically biaxial (-) with $\alpha = 1.615(2)$, $\beta = 1.660(2)$, and $\gamma = 1.700(2)$ at 589 nm; $2 V_{\text{obs}} = 82(2)^\circ$, $2 V_{\text{calc}} = 84(1)^\circ$. Pleochroism weak with $Z = \text{blue}$, $Y = \text{light blue}$, and $X = \text{light blue to colorless}$. Associated minerals: geminite, lindackerite, arsenopyrite, native bismuth, chalcopyrite, and pushcharovskite. The crystal structure was solved by direct methods (MoK α radiation) and refined using 1429 observed unique reflections to $R = 0.069$, $R_w = 0.043$. There are two symmetrically independent distorted $\text{CuO}_5(\text{H}_2\text{O})$ octahedra in the structure. They share edges and form cis $[\text{CuO}_5(\text{H}_2\text{O})]$ chains parallel to [001]. Two symmetrically independent distorted $\text{AsO}_3(\text{OH})$ tetrahedra cross-link these chains to form sheets parallel to (100). Two symmetrically independent H_2O molecules are located between the sheets, which are linked by a network of hydrogen bonds, accounting for the perfect cleavage of yvonite. The mineral is structurally related to geminite, $\text{Cu}(\text{AsO}_3\text{OH})(\text{H}_2\text{O})$, and fluckite, $\text{CaMn}[(\text{AsO}_3\text{OH})(\text{H}_2\text{O})]_2$.