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STRUCTURAL CHARACTERIZATION OF LANNONITE FROM THE ANNA MINE, ALSDORF, GERMANY

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Lannonite and wilcoxite were first described by WILLIAMS & CESBRON (1983) as two new fluosulfates from the Lone Pine mine, New Mexico, where both occur as weathering products of the primary pyrite-rich ore. The chemical formula was reported to be $HMg_2Ca_4Al_4(SO_4)_8F_9{\cdot}32H_2O$ and a tetragonal symmetry without centering was derived from X-ray powder data. Due to the quality of the type material, however, no structural information could be obtained for both minerals. Recently PETERSON & JOY (2013) presented a detailed structural description of wilcoxite, $MgAl(SO_4)_2F{\cdot}17H_2O$.
A second finding of lannonite from the Anna Mine, Alsdorf near Aachen, Germany, was reported by BLASS & STREHLER (1993), where lannonite is formed during the burning and weathering process of a coal dump after spontaneous ignition, i.e. mobilization of volatile components from the coal and formation of acidic solutions, which decompose the surrounding rock. Beside several ammonium and sulfate minerals, e.g. ammoniojarosite, anhydrite, or thermessaite-(NH_4), selenium is also observed in the lannonite-bearing paragenesis. The title compound occurs as clear, colourless, optically uniaxial, tetragonal (square) platelets, which are suitable for single-crystal X-ray investigations at ambient temperature. Even though lannonite has a reported H_2O content of 32 wt.%, it is a stable mineral with Mohs hardness of about 2 and a reported density of 2.22 g/cm^3
The extinction conditions revealed a tetragonal I-centered cell (a = 6.860(1), c = 28.053(5) Å, V = 1320.3(4) Å^3), and consecutive structure refinements applying the space groups of Laue class $4/m$ revealed the correct space group to be $I4/m$ ($R1_{all}$ = 4.25%). The first outcome of the refined structure model is a reduced H_2O and F content leading to $Mg_2Ca_4Al_4(SO_4)_8F_8{\cdot}24H_2O$ as the corrected chemical formula for lannonite (D_x of 2.100 g/cm^3) from this locality. The structure can be described by a columnar sequence along [001] of F-linked $CaFO_5$-$AlF_2(H_2O)_4$-$MgF_2(H_2O)_4$-$AlF_2(H_2O)_4$-$CaFO_5$ octahedra terminated by positionally disordered SO_4 tetrahedra. These columns are interlinked by a second type of SO_4 tetrahedra, connecting neighbouring $CaFO_5$ octahedra.
The crystal-structure determination, together with optical and chemical-analytical data and Raman spectroscopy of the material will be presented and discussed.

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