

Paulscherrerite from the Number 2 Workings, Mount Painter Inlier, Northern Flinders Ranges, South Australia: “Dehydrated schoepite” is a mineral after all

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ABSTRACT

Paulscherrerite, $\text{UO}_2(\text{OH})_2$, occurs as an abundant dehydration product of metaschoepite at the Number 2 Workings at Radium Ridge, Northern Flinders Ranges, South Australia. The mineral name honors the contribution of Swiss physicist Paul Scherrer (1890–1969) to mineralogy and nuclear physics. Individual paulscherrerite crystals are tabular, reaching a maximum of 500 nm in length. Paulscherrerite has a canary yellow color and displays no fluorescence under UV light. Chemically, paulscherrerite is a pure uranyl hydroxide/hydrate, containing only traces of other metals (<1 wt% in total). Bulk (mg) samples always contain admixtures of metaschoepite (purest samples have ~80 wt% paulscherrerite). A thermogravimetric analysis corrected for the presence of metaschoepite contamination leads to the empirical formula $\text{UO}_3 \cdot 1.02\text{H}_2\text{O}$, and the simplified structural formula $\text{UO}_2(\text{OH})_2$. Powder diffraction shows that the crystal structure of paulscherrerite is closely related to that of synthetic orthorhombic $\alpha\text{-UO}_2(\text{OH})_2$. However, splitting of some X-ray diffraction lines suggests a monoclinic symmetry for type paulscherrerite, with $a = 4.288(2)$, $b = 10.270(6)$, $c = 6.885(5)$ Å, $\beta = 90.39(4)^\circ$, $V = 303.2(2)$ Å³, $Z = 4$, and possible space groups $P2$, $P2_1$, $P2/m$, or $P2_1/m$.

Paulscherrerite-like material was synthesized using various methods, including heating metaschoepite in water at 150 °C and slow hydration of $\text{UO}_3(\text{am})$ in air; material synthesized using hydrothermal techniques displayed peak splitting indicative of monoclinic symmetry. Paulscherrerite has been reported under the name “dehydrated schoepite” as an early weathering product of uraninite/pitchblende in several deposits, such as Shinkolobwe, Zaire; Nopal I deposit, Mexico; and the granitic pegmatites of New Hampshire, U.S.A.

Keywords: Paulscherrerite, new mineral, uranyl hydroxide, “dehydrated schoepite,” powder diffraction, Number 2 Workings, Radium Ridge, Northern Flinders Ranges, South Australia