

## **Bobfinchite, Na[(UO<sub>2</sub>)<sub>8</sub>O<sub>3</sub>(OH)<sub>11</sub>]·10H<sub>2</sub>O, a new Na-bearing member of the schoepite family**

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### **ABSTRACT**

The new mineral bobfinchite (IMA2020-082), Na[(UO<sub>2</sub>)<sub>8</sub>O<sub>3</sub>(OH)<sub>11</sub>]·10H<sub>2</sub>O, was found in the Burro mine, Slick Rock district, San Miguel County, Colorado, U.S.A., where it occurs as an oxidation product of uraninite on asphaltite matrix in intimate association with gypsum, natrozippeite, metaschoepite, and uranopilite. Bobfinchite crystals are transparent to translucent, yellow, lozenge-shaped disks up to 0.3 mm wide. Crystals are flattened on [100] and exhibit the forms {100}, {011}, {021}, {0 $\bar{2}$ 1}, and {0 $\bar{1}$ 1}. Bobfinchite has a pale-yellow streak and emits very dim yellow fluorescence under 365 nm ultraviolet illumination. The crystals are brittle with very good {100} cleavage and irregular, stepped fracture. The Mohs hardness is ca. 2 based on scratch tests. The calculated density is 5.044 g/cm<sup>3</sup> based on the empirical formula and 5.036 g/cm<sup>3</sup> for the ideal formula. Bobfinchite is optically biaxial (–), with  $\alpha = 1.690(5)$ ,  $\beta = 1.7205(5)$ , and  $\gamma = 1.730(5)$  (white light). The measured  $2V$ , estimated from the interference figure, is 55(5)° and the calculated value is 59.1°. Dispersion is moderate,  $r > v$ ; orientation:  $X = \mathbf{a}$ ,  $Y = \mathbf{b}$ ,  $Z = \mathbf{c}$ ; pleochroism:  $X$  nearly colorless,  $Y$  yellow,  $Z$  yellow;  $X < Y \approx Z$ . Electron microprobe analysis provided the empirical formula (Na<sub>0.99</sub>Pb<sub>0.02</sub>)[(UO<sub>2</sub>)<sub>7.99</sub>O<sub>3</sub>(OH)<sub>11</sub>]·10H<sub>2</sub>O. The five strongest X-ray powder diffraction lines are [ $d_{\text{obs}}$  in Å( $I$ )( $hkl$ )]: 7.34(100)(200), 3.59(50)(024), 3.23(60)(224), 3.18(36)(240), and 2.01(23)(624,551,208,640,346). Bobfinchite is orthorhombic,  $Pbcn$ ,  $a = 14.6249(9)$ ,  $b = 14.0389(10)$ ,  $c = 16.6923(10)$  Å,  $V = 3427.2(4)$  Å<sup>3</sup>, and  $Z = 4$ . The structure of bobfinchite ( $R_1 = 0.0330$  for 3770  $I > 4\sigma I$ ) is built from uranyl oxide-hydroxide sheets that adopt the fourmarierite topology, with interlayer Na<sup>+</sup> and H<sub>2</sub>O groups. Both the sheet and interlayer topology mimic those observed in natural and synthetic Na-metaschoepites studied previously, and as seen in other uranyl oxide hydrate minerals, charge balance is achieved at specific sites in the sheet through the substitution O<sup>2-</sup> ↔ (OH)<sup>-</sup>.

**Keywords:** New mineral, metaschoepite, schoepite family, uranyl oxide hydrate, X-ray crystallography, Raman spectroscopy