

## Cobalt-zippeite

## $\text{Co}_2(\text{UO}_2)_6(\text{SO}_4)_3(\text{OH})_{10} \cdot 16\text{H}_2\text{O}$

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**Crystal Data:** Orthorhombic (?). *Point Group:* n.d. As minute tabular {010} grains and petallike aggregates. *Twinning:* Simple and polysynthetic twins common in synthetic material.

**Physical Properties:** *Cleavage:* On {010}, perfect (synthetic). Hardness = ~2 (synthetic). D(meas.) = > 3.3 D(calc.) = n.d. Radioactive.

**Optical Properties:** Semitransparent. *Color:* Tan to brownish yellow, yellow-orange. *Optical Class:* Biaxial (-) (synthetic). *Pleochroism:* X = colorless; Y = pale yellow; Z = yellow. *Orientation:* Z = c.  $\alpha = 1.747$   $\beta = 1.779$   $\gamma = 1.84$  2V(meas.) = Large.

**Cell Data:** *Space Group:* n.d. Z = n.d.

**X-ray Powder Pattern:** Synthetic, nearly identical to nickel-zippeite. 7.21 (100), 3.59 (46), 3.12 (28), 3.47 (22), 1.963 (12), 2.491 (11), 2.653 (10)

Chemistry:	(1)	(2)
SO <sub>3</sub>	10.55	9.67
UO <sub>3</sub>	67.2	69.07
FeO	0.57	
MnO	0.27	
MgO	0.56	
NiO	1.87	
CoO	1.98	6.03
H <sub>2</sub> O	17.0	15.23
Total	[100.00]	100.00

(1) Happy Jack mine, Utah, USA; recalculated to 100% after deduction of SiO<sub>2</sub> 0.80%, (TiO<sub>2</sub> + Al<sub>2</sub>O<sub>3</sub> + Ce<sub>2</sub>O<sub>3</sub>) 0.98%, sodium-zippeite 8.0%, johannite 1.6%; corresponds to (Co<sub>0.68</sub>Ni<sub>0.64</sub>Mg<sub>0.36</sub>Fe<sub>0.22</sub>Mn<sub>0.10</sub>)<sub>Σ=2.00</sub>(UO<sub>2</sub>)<sub>6</sub>(SO<sub>4</sub>)<sub>3</sub>(OH)<sub>10</sub> · 16H<sub>2</sub>O. (2) Co<sub>2</sub>(UO<sub>2</sub>)<sub>6</sub>(SO<sub>4</sub>)<sub>3</sub>(OH)<sub>10</sub> · 16H<sub>2</sub>O.

**Occurrence:** Rarely as efflorescences on the mine walls in oxidized portions of a uraninite deposit containing gersdorffite.

**Association:** Sodium-zippeite, uranopilite, johannite, zeunerite, chalcantinite, antlerite, siderotil, bieberite, erythrite, epsomite, gypsum.

**Distribution:** From the Happy Jack mine, White Canyon, San Juan Co., Utah, USA.

**Name:** For its dominant content of *cobalt* and relation to other *zippeite* group species.

**Type Material:** The Natural History Museum, London, England, 1981,537 and 1981,538.

**References:** (1) Frondel, C., J. Ito, R.M. Honea, and A.M. Weeks (1976) Mineralogy of the zippeite group. *Can. Mineral.*, 14, 429–436. (2) Haacke, D.F. and P.A. Williams (1979) The aqueous chemistry of uranium minerals. Part I. Divalent cation zippëite. *Mineral. Mag.*, 43, 539–541.