

# Wupatkiite

# (Co, Mg)Al<sub>2</sub>(SO<sub>4</sub>)<sub>4</sub>•22H<sub>2</sub>O

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**Crystal Data:** Monoclinic. *Point Group:* 2/m. Fibers, to 8 mm, in incrustations composed of cross-fiber veins.

**Physical Properties:** *Cleavage:* One at 70° to fiber length. Hardness = 1.5, in aggregates. D(meas.) = 1.92 D(calc.) = 1.87 Soluble in H<sub>2</sub>O.

**Optical Properties:** Semitransparent. *Color:* Rose-red. *Streak:* White. *Luster:* Silky in masses.

*Optical Class:* Biaxial. *Pleochroism:* Weak; very pale pink || fiber bundles. *Orientation:* Z ∧ extinction up to 12°. α = 1.477 β = n.d. γ = 1.484 2V(meas.) = n.d.

**Cell Data:** *Space Group:* [P2<sub>1</sub>/c] (by analogy to halotrichite). a = 6.819(4) b = 24.234(10) c = 21.204(10) β = 100.33(5)° Z = [4]

**X-ray Powder Pattern:** Cameron district, Arizona, USA.

4.790 (100), 3.494 (92), 3.768 (33), 4.295 (27), 3.945 (26), 6.03 (22), 4.106 (22)

Chemistry:	(1)	(2)	(1)	(2)	
SO <sub>3</sub>	35.97		CuO	0.12	
Al <sub>2</sub> O <sub>3</sub>	11.30	9.81	MgO	1.63	0.31
Fe <sub>2</sub> O <sub>3</sub>		[2.43]	CaO	0.10	
FeO	0.15	[3.25]	H <sub>2</sub> O	42.26	
MnO	0.17	0.15	insol.	[4.37]	
CoO	3.41	3.92	Total	[100.00]	
NiO	0.52	0.29			

(1) Cameron district, Arizona, USA; by AA, CoO by colorimetry, CaO by ICP-ES, H<sub>2</sub>O by the Penfield method, insoluble by difference, quartz and clay; corresponds to (Co<sub>0.42</sub>Mg<sub>0.38</sub>Ni<sub>0.06</sub>Mn<sub>0.02</sub>Fe<sub>0.02</sub>Ca<sub>0.02</sub>Cu<sub>0.01</sub>)<sub>Σ=0.93</sub>Al<sub>2.06</sub>(SO<sub>4</sub>)<sub>4.18</sub>•21.83H<sub>2</sub>O. (2) Lorena deposit, Australia; by ICP, after deduction of insoluble 2.5%, original partial analysis here converted to oxides; FeO:Fe<sub>2</sub>O<sub>3</sub> partitioned for stoichiometry; corresponds to (Co<sub>0.47</sub>Fe<sub>0.41</sub>Mg<sub>0.07</sub>Ni<sub>0.04</sub>Mn<sub>0.02</sub>)<sub>Σ=1.01</sub>(Al<sub>1.73</sub>Fe<sub>0.27</sub>)<sub>Σ=2.00</sub>(SO<sub>4</sub>)<sub>4</sub>•22H<sub>2</sub>O.

**Mineral Group:** Halotrichite group.

**Occurrence:** A rare post-mine oxidation product of sooty U–Co–Ni–Mo primary mineralization (Cameron district, Arizona, USA).

**Association:** Pickeringite, moorhouseite, nickel-boussingaultite, quartz, clay (Cameron district, Arizona, USA).

**Distribution:** From a prospect 13 km east-southeast of Gray Mountain, Cameron district, Coconino Co., Arizona, USA. Abundant in the Lorena gold deposit, near Cloncurry, Queensland, Australia.

**Name:** For the prehistoric Wupatki Indian pueblos, now a National Monument, nearby the Cameron district, Arizona, USA.

**Type Material:** National School of Mines, Paris, France.

**References:** (1) Williams, S.A. and F.P. Cesbron (1995) Wupatkiite from the Cameron uranium district, Arizona, a new member of the halotrichite group. *Mineral. Mag.*, 59, 553–556. (2) (1996) *Amer. Mineral.*, 81, 518 (abs. ref. 1). (3) Lawrence, L.J., V. Munro-Smith, A.R. Ramsden, J.L. Sharpe, and P.A. Williams (1999) Geology and mineralogy of the Lorena gold mine, Cloncurry district, north-west Queensland. *J. & Proc. Royal Society of New South Wales*, 132, 29–35.

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