

**Crystal Data:** Tetragonal. *Point Group:*  $4/m$ . Crystals are dipyramidal {111}, with {011}, {112}, less commonly flat tabular to paper-thin on {001}, with many minor forms, to 8 cm; may be aggregated into crusts, pulverulent, ocherous, massive.

**Physical Properties:** *Cleavage:* {112}, {011}, {001}, all indistinct. *Fracture:* Uneven. Hardness = 3.5–4 D(meas.) = 4.26 D(calc.) = 4.255 Fluoresces creamy white or yellow to golden yellow under SW UV.

**Optical Properties:** Transparent to translucent. *Color:* Straw-yellow, greenish yellow, yellow-brown, brown, colorless, may be zoned; blue to nearly black. *Luster:* Subadamantine, resinous, pearly.

*Optical Class:* Uniaxial (+). *Pleochroism:* In deeply colored specimens; *O* = blue; *E* = green.  $\omega = 1.974$   $\epsilon = 1.984$

**Cell Data:** *Space Group:*  $I4_1/a$  (synthetic).  $a = 5.222(1)$   $c = 11.425(3)$   $Z = 4$

**X-ray Powder Pattern:** Synthetic.

3.10 (100), 1.929 (30), 4.76 (25), 1.588 (20), 2.61 (16), 2.86 (14), 1.848 (14)

**Chemistry:**

	(1)	(2)
MoO <sub>3</sub>	71.67	71.96
CuO	0.34	
CaO	28.11	28.04
rem.	0.34	
Total	100.46	100.00

(1) Western Altai, Russia; CuO probably from malachite. (2) CaMoO<sub>4</sub>.

**Polymorphism & Series:** Forms a series with scheelite.

**Occurrence:** An uncommon secondary mineral, typically formed in the oxidation zone of molybdenum-bearing hydrothermal mineral deposits, rarely in basalts, tactites, and granite pegmatites.

**Association:** Molybdenite, ferrimolybdite, stilbite, laumontite, apophyllite.

**Distribution:** In the USA, from the Peacock Lode, Seven Devils district, Adams Co., Idaho; large crystals at the Isle Royale, Calumet & Hecla, Tamarack, and other mines, Houghton Co., Michigan; in the Pine Creek tungsten mine, near Bishop, Inyo Co., California; from the Tonopah-Divide mine, Divide district, Esmeralda Co., and many other places in Nevada. At Huepac, Sonora, Mexico. In Chile, from Chuquicamata, Antofagasta; at Inca de Oro and in the Las Escobas mine, near Copiapó, Atacama. From Ultevis, Lappland, Sweden. At Traprain Law, near Haddington, East Lothian, Scotland. Extraordinary crystals from Pandulena Hill, eight km south of Nasik, Maharashtra, India. At Tsumeb, Namibia. There are a number of other older localities known, most now considered quite minor.

**Name:** Honors Major John Wesley Powell (1834–1902), American geologist and explorer, and Director of the U.S. Geological Survey.

**Type Material:** National Museum of Natural History, Washington, D.C., USA, 80674.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 1079–1081. (2) Hazen, R.M., L.W. Finger, and J.W.E. Mariathasan (1985) High-pressure crystal chemistry of scheelite-type tungstates and molybdates. *J. Phys. Chem. Solids*, 46, 253–263. (3) (1956) NBS Circ. 539, 6, 22.

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