Metatorbernite $Cu(UO_2)_2(PO_4)_2 \cdot 8H_2O$

Crystal Data: Tetragonal. *Point Group:* $4/m$ (with $4/m$ $2/m$ $2/m$ pseudosymmetry). Typically pseudomorphous after torbernite, as square tabular crystals, flattened on {001} and modified by {011}, in lamellar or subparallel to sheaflike aggregates, and as rosettes, to 2 cm.

Physical Properties: *Cleavage:* Perfect on {001}; indistinct on {010}. *Tenacity:* Brittle. Hardness = 2.5 D(meas.) = 3.52–3.70 D(calc.) = 3.70–3.71 Radioactive.

Optical Properties: Transparent to translucent. *Color:* Pale green to dark green.
Luster: Vitreous, subadamantine, pearly on {001}.
Optical Class: Uniaxial (+) or uniaxial (–); anomalously biaxial in sectors. *Pleochroism:* Weak; O = green; E = pale green to blue. *Dispersion:* $r > v$, extreme. *Absorption:* $O > E$.
ω = 1.618–1.631 ϵ = 1.622–1.628

Cell Data: *Space Group:* $P4/n$. $a = 6.969$–6.972 $c = 17.277$–17.306 Z = 2

X-ray Powder Pattern: Schneeberg, Germany.
8.71 (100), 3.678 (100), 3.480 (80), 3.232 (80), 5.44 (75), 4.93 (75), 2.931 (70)

Chemistry:

	(1)	(2)
UO_3	59.67	61.01
P_2O_5	14.00	15.14
SiO_2	0.40	
CuO	8.50	8.48
H_2O	15.00	15.37
Total	97.57	100.00

(1) Gunnislake mine, England. (2) $Cu(UO_2)_2(PO_4)_2 \cdot 8H_2O$.

Mineral Group: Meta-autunite group.

Occurrence: Typically a secondary mineral, a dehydration product of torbernite formed during weathering; formed directly above 75 °C.

Association: Torbernite, meta-autunite.

Distribution: Widespread; probably occurs at all localities for torbernite (q.v.). First described from Schneeberg, Saxony, Germany. Material from the Gunnislake mine, Calstock, Cornwall, England, is thought to be primary.

Name: The prefix *meta* indicates the dehydration product of *torbernite*.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 991–992. (2) Frondel, C. (1958) Systematic mineralogy of uranium and thorium. U.S. Geol. Sur. Bull. 1064, 208–211. (3) Ross, M., H.T. Evans, Jr., and D.E. Appleman (1964) Studies of the torbernite minerals (II): the crystal structure of meta-torbernite. Amer. Mineral., 49, 1603–1621. (4) Stergiou, A.C., P.J. Rentzeperis, and S. Sklavounos (1993) Refinement of the crystal structure of metatorbernite. Zeits. Krist., 205, 1–7.