Coconinoite $Fe_2^{3+}Al_2(UO_2)_2(PO_4)_4(SO_4)(OH)_2 \cdot 20H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$ or m. As lathlike to platy grains, to 20 μm, in microcrystalline aggregates, in seams and crusts.

Physical Properties: Hardness = Soft. D(meas.) = 2.70 D(calc.) = 2.68 Radioactive.

Optical Properties: Semitransparent. *Color:* Pale creamy yellow. *Optical Class:* Biaxial (–). *Pleochroism:* X = colorless; $Y = Z$ = pale yellow. *Orientation:* Y = elongation of laths with positive elongation; $Y \wedge$ 8°–25° to elongation of laths with negative elongation. $\alpha = 1.550(5)$ $\beta = 1.586(5)$ $\gamma = 1.590(5)$ 2V(meas.) = 28°–43°, average 40°.

Cell Data: *Space Group:* $C2/c$ or Cc. a = 12.50(3) $b = 12.97(3)$ $c = 23.00(3)$ $\beta = 106.6°$ Z = 4

X-ray Powder Pattern: Jomac mine, Utah, USA.
11.12 (100), 5.56 (42), 3.30 (22), 5.64 (18), 4.59 (14), 3.71 (12), 4.31 (10)

Chemistry:

	(1)	(2)	(3)
UO_3	34.2	34.9	36.30
SO_3	6.1	5.4	5.08
P_2O_5	17.7	18.3	18.01
CO_2	0.7	< 0.1	
Al_2O_3	6.5	6.6	6.47
Fe_2O_3	10.3	9.7	10.13
CaO	< 0.1	0.1	
Na_2O	0.1	< 0.1	
H_2O^+	23.4	24.0	24.01
insol.	1.0	0.5	
Total	100.0	99.5	100.00

(1) Jomac mine, Utah, USA; by spectrophotometry, Ca and Na by flame photometry, SO_3 by gravimetry, CO_2 and H_2O by CHN analyzer; after deduction of H_2O^- 18.8%, then corresponding to $Fe^{3+}_{2.16}Al_{2.12}(UO_2)_2(PO_4)_{4.16}(SO_4)_{1.28}(OH)_2 \cdot 19.72H_2O$. (2) Blackwater No. 4 mine, Arizona, USA; analytical methods as for (1); after deduction of H_2O^- 18.2%, then corresponding to $Fe^{3+}_{2.0}Al_{2.00}(UO_2)_2(PO_4)_{4.24}(SO_4)_{1.10}(OH)_2 \cdot 19.84H_2O$. (3) $Fe_2Al_2(UO_2)_2(PO_4)_4(SO_4)(OH)_2 \cdot 20H_2O$.

Occurrence: In the oxidized zone of vanadium-poor Colorado Plateau-type U–V deposits (Utah and Arizona, USA).

Association: Gypsum, jarosite, "limonite", quartz, clay minerals, coalized wood (Jomac mine, Utah, USA).

Distribution: In the USA, from the Jomac mine, White Canyon district, San Juan Co., Utah; in the Sun Valley mine and Huskon No. 7 mine, near Cameron, Coconino Co., and the Blackwater No. 4 mine, Apache Co., Arizona; at the Ruggles mine, Grafton, Grafton Co., New Hampshire; from an unspecified locality in Wyoming. From an unspecified locality in the Kyzylkum region, Uzbekistan.

Name: For Coconino Co., Arizona, USA, from which samples were obtained.

Type Material: National Museum of Natural History, Washington, D.C., USA, 119772.

References: (1) Young, E.J., A.D. Weeks, and R. Meyrowitz (1966) Coconinoite, a new uranium mineral from Utah and Arizona. Amer. Mineral., 51, 651–663. (2) (1993) Belova, L.N., A.I. Gorshkov, O.A. Doinikova, A.V. Mokhov, N.V. Trubkin, and A.V. Sivtsov (1993) New data on coconinoite. Doklady Acad. Nauk SSSR, 329, 772–775 (in Russian).