Boltwoodite $HK(UO_2)(SiO_4)\cdot 1.5H_2O$

Crystal Data: Monoclinic. *Point Group:* 2. Radiating acicular to fibrous, elongated along [010], to 1 cm.

Physical Properties: *Cleavage:* {010} perfect, {001} imperfect. Hardness = 3.5–4 D(meas.) = ∼4.7 D(calc.) = [4.46] Fluoresces dull green in both SW and LW UV; radioactive.

Optical Properties: Transparent to translucent. *Color:* Pale yellow. *Luster:* Pearly; radial aggregates vitreous to silky; dull to earthy in microcrystalline pseudomorphs.
Optical Class: Biaxial (–). *Pleochroism:* Weak; X = colorless; $Y = Z$ = yellow; anomalous blue interference colors. $\alpha = 1.668$–1.670 $\beta = 1.695$–1.696 $\gamma = 1.698$–1.703 2V(meas.) = Large.

Cell Data: *Space Group:* $P2_1$. $a = 7.073(2)$ $b = 7.064(1)$ $c = 6.638(1)$ $\beta = 105°45(1)'$ Z = 2

X-ray Powder Pattern: Delta mine, Utah, USA.
6.81 (100), 3.40 (90), 2.95 (80), 3.54 (70), 2.91 (70), 6.40 (50), 5.45 (50)

Chemistry:

	(1)	(2)	(3)
SiO_2	14.8	13.27	14.00
Fe_2O_3		0.52	
UO_3	68.5	67.19	66.64
CaO		1.59	
Na_2O	0.4	2.54	
K_2O	9.4	7.83	10.97
H_2O	6.9		8.39
LOI		6.91	
Total	[100.0]	99.85	100.00

(1) Delta mine, Utah, USA; original total given as 99.88%, after deduction of CuO 9.61% and SO_3 2.12% as brochantite, remainder Al_2O_3, V_2O_5, PbO, CaO, MgO 0.34%, insoluble 0.19%, recalculated to 100.0%. (2) Swakopmund, Namibia; loss on ignition taken as H_2O; corresponds to $(H_3O)_{0.55}(K_{0.78}Na_{0.39}Ca_{0.14})_{\Sigma=1.31}(UO_2)(SiO_4)\cdot H_2O$. (3) $HK(UO_2)(SiO_4)\cdot 1.5H_2O$.

Occurrence: In the outer silicate zone of alteration surrounding hydrated uranyl oxides incrusting primary uraninite; also filling fractures at some distance from primary uraninite. From pegmatite and Colorado-Plateau-type sandstone uranium deposits.

Association: Uraninite, becquerelite, fourmarierite, phosphouranylite, gypsum, fluorite.

Distribution: In the USA, from the Delta mine, Emery Co., Utah; the New Method mine, near Amboy, San Bernardino Co., California; in the Marshall Pass district, at the Little Indian No. 36 mine, Gunnison Co. and the Lookout No. 22 mine, Saguache Co., and in Unaweep Canyon, Mesa Co., Colorado; in the Green Monster mine, Goodsprings district, Clark Co., Nevada; and in the Williams quarry, near Easton, Northampton Co., Pennsylvania. Exceptionally developed at the Rössing mine, near Swakopmund, Namibia. From near Dalbeattie, Kirkcudbrightshire, Scotland. At Karago, Rwanda. From Quebrada del Tigre, Córdoba Province, and near Guandacol, La Rioja Province, Argentina. From near Myponga, South Australia. In the Togo mine, Tottori Prefecture, Japan. Other minor occurrences are known.

Name: For Bertram Borden Boltwood (1870–1927), radiochemist of Yale University, New Haven, Connecticut, USA, who devised the U–Pb method of measuring geologic time.

Type Material: National Museum of Natural History, Washington, D.C., USA, 112710.

References: (1) Frondel, C. and J. Ito (1956) Boltwoodite, a new uranium silicate. Science, 124, 931. (2) (1957) Amer. Mineral., 42, 307 (abs. ref. 1). (3) Honea, R.M. (1961) New data on boltwoodite, an alkali uranyl silicate. Amer. Mineral., 46, 12–25. (4) Kato, T. and Y. Miura (1974) Cell dimensions of boltwoodite. Mineral. J. (Japan), 7, 400–404. (5) Strunz, H. and C. Tennyson (1981) Symmetry and twinning in boltwoodite. Kristallografiya (Sov. Phys. Crystal.), 26, 1288–1292 (in Russian). (6) Stohl, F.V. and D. K. Smith (1981) The crystal chemistry of the uranyl silicate minerals. Amer. Mineral., 66, 610–625.