Mckelveyite-(Y) $Na(Ca,U)Ba_3Y(CO_3)_6 \cdot 3H_2O$

Crystal Data: Triclinic, pseudorhombohedral. *Point Group:* 1. Crystals are tabular to pyramidal, with pseudorhombohedral $\{10\bar{1}2\}$, $\{10\bar{1}1\}$, $\{000\bar{1}\}$, small $\{0001\}$, may be rough, to 5 cm. *Twinning:* By three-fold rotation about pseudorhombohedral [0001] in 120° increments.

Physical Properties: Hardness = 3.5–4 D(meas.) = 3.25(5) D(calc.) = 3.37 Radioactive.

Optical Properties: Transparent to opaque. *Color:* Lime-yellow, greenish gray, reddish brown, black from contained organic material; transparent in thin section. *Luster:* Vitreous to dull. *Optical Class:* Uniaxial (–). *Pleochroism:* In greens. *Absorption:* $O > E$. $\omega = 1.644–1.66$ $\epsilon = 1.550–1.57$

Cell Data: *Space Group:* $P1$. $a = 9.170(3)$ $b = 9.169(3)$ $c = 7.075(2)$ $\alpha = 102.50(3)°$ $\beta = 115.63(3)°$ $\gamma = 59.99(3)°$ Z = 1

X-ray Powder Pattern: Sweetwater Co., Wyoming, USA.
2.942 (100), 4.47 (85), 2.648 (40), 6.40 (35), 3.32 (30), 2.040 (30), 4.15 (20)

Chemistry:

	(1)		(1)		(1)
CO_2	25.7	RE_2O_3	5.7	Na_2O	3.9
UO_2	4.6	CaO	4.0	K_2O	0.1
ThO_2	0.1	SrO	1.7	H_2O	6.1
Y_2O_3	7.7	BaO	40.6	Total	[100.2]

(1) Diamond Alkali No. 3 drillhole, Wyoming, USA; by a combination of gravimetric and spectrophotometric analyses, $RE_2O_3 = La_2O_3$ 0.09%, Ce_2O_3 0.16%, Pr_2O_3 0.05%, Nd_2O_3 0.26%, Sm_2O_3 0.34%, Eu_2O_3 0.19%, Gd_2O_3 1.18%, Tb_2O_3 0.38%, Dy_2O_3 1.00%, Ho_2O_3 0.28%, Er_2O_3 0.95%, Tm_2O_3 0.12%, Yb_2O_3 0.61%, Lu_2O_3 0.08%; recalculated to 100% mckelveyite after deduction of organic 3%, acmite 2.45%, "biotite" 9.40%, quartz 3.02%; then corresponds to $(Na_{1.26}K_{0.02})_{\Sigma=1.28}(Ca_{0.71}U_{0.17})_{\Sigma=0.88}(Ba_{2.64}Sr_{0.16})_{\Sigma=2.80}(Y_{0.68}RE_{0.31})_{\Sigma=0.99}(CO_3)_{5.98} \cdot 3.22H_2O$.

Occurrence: A rare mineral formed near trona beds in the Green River Formation (Wyoming, USA); in a differentiated alkalic massif (Khibiny massif, Kola Peninsula, Russia).

Association: Ewaldite, acmite, "biotite", quartz, labuntsovite, searlesite, leucosphenite (Wyoming, USA); ewaldite, belovite-(Ce), fluorite, nenadkevichite, ancylite-(Ce), synchysite-(Ce), kukharenkoite-(Y), burbankite, calcite, barite, orthoclase (Khibiny massif, Russia); dolomite, calkinsite-(Ce), carbocernaite, khanneshite, barite (Khanneshin complex, Afghanistan).

Distribution: In the USA, in the Westvaco trona mine, the John Hay, Jr. Well No. 1, the Diamond Alkali Daco No. 3 and Reid No. 2 drillholes, the Perkins Green River No. 3 drillhole, and the Texas Gulf Sulfur mine, all near Green River, Sweetwater Co., Wyoming. At Mont Saint-Hilaire, Quebec, Canada. In Russia, large crystals in the Khibiny and Sallanlatvi massifs, and the Vuoriyarvi carbonatite complex, Kola Peninsula. From the Khanneshin carbonatite complex, Afghanistan.

Name: To honor Vincent Ellis McKelvey (1916–1985), Director of the U.S. Geological Survey, Washington, D.C., USA, for his studies of the Phosphoria Formation of Wyoming and Idaho, USA.

Type Material: The Natural History Museum, London, England, 1971,138; National Museum of Natural History, Washington, D.C., USA, 121683, 162607.

References: (1) Milton, C., B. Ingram, J.R. Clark, and E.J. Dwornik (1965) Mckelveyite, a new hydrous sodium barium rare-earth uranium carbonate mineral from the Green River Formation, Wyoming. Amer. Mineral., 50, 593–612. (2) Donnay, G. and J.D.H. Donnay (1971) Ewaldite, a new barium calcium carbonate. Tschermaks Mineral. Petrog. Mitt., 15, 185–200. (3) Chao, G.Y., P.R. Mainwaring, and J. Baker (1978) Donnayite, $NaCaSr_3Y(CO_3)_6 \cdot 3H_2O$, a new mineral from Mont Saint-Hilaire, Québec. Can. Mineral., 16, 335–340. (4) Voloshin, A.V., V.V. Subbotin, V.N. Yakovenchuk, Y.A. Pakhomovskii, Y.P. Men'shikov, and A.N. Zaytsev (1990) Mckelveyite from carbonatites and hydrothermal metasomatites of Kola Peninsula alkaline rocks (first findings in the USSR). Zap. Vses. Mineral. Obshch., 119(6), 76–86 (in Russian with English abs.).