Natromarkeyite $Na_2Ca_8(UO_2)_4(CO_3)_{13}(H_2O)_{24}\cdot 3H_2O$

Crystal Data: Orthorhombic. *Point Group*: 2/*m* 2/*m* 2/*m*. As euhedral blades and tablets to ~0.2 mm, flattened on {001} and elongated along [100], that display {100}, {010}, {001}, {110}, {101}, {011} and {111}.

Physical Properties: *Cleavage*: Perfect on {001}, good on {100} and {010}. *Tenacity*: Brittle. *Fracture*: Irregular. Hardness = 1.5-2 D(meas.) = 2.70(2) D(calc.) = 2.695 Bright bluish white fluorescence (405 nm laser). Dissolves very slowly in H_2O (minutes) and immediately with effervescence in dilute HCl.

Optical Properties: Transparent. *Color*: Pale yellow-green. *Streak*: White. *Luster*: Vitreous, pearly. *Optical Class*: Biaxial (-). α = 1.528(2) β = 1.532(2) γ = 1.533(2) 2V(meas.) = 46.5(7)° 2V(calc.) = 53.0° *Dispersion*: $r > v$, weak. *Pleochroism*: Weak: X = pale green-yellow, $Y \approx Z$ = light green-yellow. *Absorption*: $X < Y \approx Z$. *Orientation*: $X = b$, $Y = a$, $Z = c$.

Cell Data: *Space Group: Pmmn*. a = 17.882(1) b = 18.3030(4) c = 10.2249(3) Z = 2

X-Ray Diffraction Pattern: Markey mine, Red Canyon, San Juan Co., Utah, USA.
5.43 (100), 6.40 (92), 10.21 (88), 4.141 (55), 5.07 (42), 4.009 (42), 2.975 (36)

Chemistry:

	(1)	(2)
Na_2O	2.35	2.28
CaO	16.90	16.53
CuO	0.15	
MgO	0.04	
UO_3	43.25	42.17
CO_2	[21.63]	21.09
H_2O	[18.35]	17.93
Total	102.67	100.00

(1) Markey mine, Red Canyon, Utah, USA; average electron microprobe and Raman spectroscopic analyses, H_2O and CO_2 from stoichiometry, high analytical total from loss of loosely bound H_2O under vacuum; corresponds to $Na_{2.01}Ca_{7.97}Mg_{0.03}Cu_{0.05}(UO_2)_4(CO_3)_{13}(H_2O)_{24}\cdot 3H_2O$ (- 0.11 H).
(2) $Na_2Ca_8(UO_2)_4(CO_3)_{13}(H_2O)_{24}\cdot 3H_2O$.

Occurrence: Secondary phase on asphaltum in sandstones by oxidation of primary uraninite, montroseite, and coffinite in a humid underground environment.

Association: Andersonite, calcite, gypsum.

Distribution: From the Markey mine, Red Canyon, White Canyon District, San Juan Co., Utah, USA.

Name: The prefix indicates the sodium-analogue of *markeyite*, named for the Markey mine.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA (67487 holotype and 67488 cotype).

References: (1) Kampf, A.R., T.A. Olds, J. Plášil, P.C. Burns, and J. Marty (2020) Natromarkeyite and pseudomarkeyite, two new calcium uranyl carbonate minerals from the Markey mine, San Juan County, Utah, USA. Mineral. Mag., 84, 753-765.