Ammoniozippeite $(NH_4)_2[(UO_2)_2(SO_4)O_2]\cdot H_2O$

Crystal Data: Orthorhombic. *Point Group*: 2/*m* 2/*m* 2/*m*. Crystals acicular along [100] to bladed flattened on {001}, usually tapering to a point or with rectangular (square) terminations, to 2 mm. As lozenge-shaped crystals with prominent {001} and {010} and rounded spear-like terminations.

Physical Properties: *Cleavage*: Perfect on {010} and {001}, good on {100}. *Tenacity*: Brittle. *Fracture*: Splintery. Hardness = 2.5 D(meas.) = n.d. D(calc.) = 4.427-4.470
Fluoresces dull green-yellow under 405 nm laser light.

Optical Properties: Transparent. *Color*: Yellow to yellowish orange. *Streak*: Pale yellow. *Luster*: Vitreous.
Optical Class: Biaxial (+). α = 1.678(2) β = 1.724(3) γ = 1.779(3) 2V(meas.) = 81.1(5)° 2V(calc.) = 87.4° *Dispersion*: $r < v$; weak. *Orientation*: $X = b$, $Y = c$, $Z = a$.
Pleochroism: X = colorless, Y = orange-yellow, Z = yellow-orange. *Absorption*: $X << Y < Z$.

Cell Data: *Space Group*: *Ccmb*. a = 8.7944(3) b = 14.3296(7) c = 17.1718(12) Z = 8

X-ray Powder Pattern: Burro mine, San Miguel County, Colorado, USA.
7.17 (100), 3.138 (63), 3.489 (42), 3.580 (21), 1.6966 (18), 3.670 (14), 1.7505 (14)

Chemistry:	(1)	(2)	(3)
$(NH_4)_2O$	7.29	7.36	7.21
Na_2O	0.13	0.19	
K_2O	–	0.43	
SO_3	11.45	11.00	11.09
UO_3	81.10	81.90	79.21
H_2O	[2.56]	[2.56]	2.49
Total	102.53	103.44	100.00

(1) Burro mine, San Miguel County, Colorado, USA; average of 5 electron microprobe analyses, H_2O calculated from structure; corresponds to $[(NH_4)_{1.97}Na_{0.03}]_{\Sigma=2.00}(U_{1.00}O_2)_2(S_{1.01}O_4)O_2\cdot H_2O$.
(2) Blue Lizard mine, San Juan County, Utah, USA; average of 4 electron microprobe analyses, H_2O calculated from structure; corresponds to $[(NH_4)_{1.99}K_{0.06}Na_{0.04}]_{\Sigma=2.09}(U_{1.01}O_2)_2(S_{0.97}O_4)O_2\cdot H_2O$.
(3) $(NH_4)_2[(UO_2)_2(SO_4)O_2]\cdot H_2O$.

Occurrence: A secondary mineral on the walls of mines in U-V deposits that replaced wood and other organic material in sandstones and conglomerate (roll-front type U-V deposits).

Association: Blödite, bobcookite, brochantite, chalcanthite, devilline, dickite, ferrinatrite, gerhardtite, gypsum, johannite, krönkite, magnesiozippeite, natrozippeite, pentahydrate, pickeringite, plášilite, posnjakite, redcanyonite, wetherillite (Blue Lizard mine); asphaltum, quartz, calcite, gypsum, natrojarosite, natrozippeite, ammoniomathesiusite (Burro mine).

Distribution: From the Blue Lizard mine (and Green Lizard, Markey, and Giveaway-Simplot mines), Red Canyon, White Canyon mining district, San Juan County, Utah, and the Burro mine, Slick Rock district, San Miguel County, Colorado, USA.

Name: As the ammonium analogue of *zippeite*, with $(NH_4)^+$ in place of K^+.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA (66625 and 66626).

References: (1) Kampf, A.R., J. Plášil, T.A. Olds, B.P. Nash, and J. Marty (2018) Ammoniozippeite, a new uranyl sulfate mineral from the Blue Lizard Mine, San Juan County, Utah, and the Burro Mine, San Miguel County, Colorado, USA. Can. Mineral., 56(3), 235-245.
(2) (2018) Amer. Mineral., 103, 2036-2037 (abs. ref. 1).