

**Ammoniozippeite****(NH<sub>4</sub>)<sub>2</sub>[(UO<sub>2</sub>)<sub>2</sub>(SO<sub>4</sub>)O<sub>2</sub>]·H<sub>2</sub>O**

**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 (+).  $\alpha = 1.678(2)$   $\beta = 1.724(3)$   $\gamma = 1.779(3)$   $2V(\text{meas.}) = 81.1(5)^\circ$   
 $2V(\text{calc.}) = 87.4^\circ$  *Dispersion:*  $r < v$ ; weak. *Orientation:*  $X = b, Y = c, Z = a$ .  
*Pleochroism:*  $X = \text{colorless}, Y = \text{orange-yellow}, Z = \text{yellow-orange}$ . *Absorption:*  $X \ll Y < Z$ .

**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 <sub>4</sub> ) <sub>2</sub> O	7.29	7.36	7.21
Na <sub>2</sub> O	0.13	0.19	
K <sub>2</sub> O	–	0.43	
SO <sub>3</sub>	11.45	11.00	11.09
UO <sub>3</sub>	81.10	81.90	79.21
H <sub>2</sub> O	[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<sub>2</sub>O calculated from structure; corresponds to [(NH<sub>4</sub>)<sub>1.97</sub>Na<sub>0.03</sub>]<sub>Σ=2.00</sub>(U<sub>1.00</sub>O<sub>2</sub>)<sub>2</sub>(S<sub>1.01</sub>O<sub>4</sub>)O<sub>2</sub>·H<sub>2</sub>O.

(2) Blue Lizard mine, San Juan County, Utah, USA; average of 4 electron microprobe analyses, H<sub>2</sub>O calculated from structure; corresponds to [(NH<sub>4</sub>)<sub>1.99</sub>K<sub>0.06</sub>Na<sub>0.04</sub>]<sub>Σ=2.09</sub>(U<sub>1.01</sub>O<sub>2</sub>)<sub>2</sub>(S<sub>0.97</sub>O<sub>4</sub>)O<sub>2</sub>·H<sub>2</sub>O.

(3) (NH<sub>4</sub>)<sub>2</sub>[(UO<sub>2</sub>)<sub>2</sub>(SO<sub>4</sub>)O<sub>2</sub>]·H<sub>2</sub>O.

**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, chalcantite, 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<sub>4</sub>)<sup>+</sup> in place of K<sup>+</sup>.

**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).