Thebaite-(NH_4) $(NH_4)_3Al(C_2O_4)(PO_3OH)_2(H_2O)$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As blades to ~0.1 mm, elongate on [010] and flattened on {001, that exhibit {100}, {001} and {320}.

Physical Properties: *Cleavage*: Two good in the [010] zone, probably {100} and {10 $\bar{2}$ }. *Tenacity*: Brittle. *Fracture*: Splintery. Hardness = 1.5-2 D(meas.) = n.d. D(calc.) = 2.093 Easily soluble in dilute HCl.

Optical Properties: Opaque. *Color*: Colorless. *Streak*: White. *Luster*: Vitreous. *Optical Class*: Biaxial (-). α = 1.490(2) β = 1.534(2) γ = 1.570(2) 2V(meas.) = 82.7(5)° 2V(calc.) = 82.0° *Dispersion*: Slight, $r > v$. *Orientation*: $X = b$, $Y \wedge c$ = 13° in obtuse β.

Cell Data: *Space Group: $P2_1/c$*. a = 11.156(9) b = 6.234(6) c = 18.65(2) β = 102.93(1)° Z = 4

X-Ray Diffraction Pattern: Rowley mine, near Theba, Maricopa Co., Arizona, USA. 3.112 (100), 9.21 (88), 5.39 (44), 2.964 (42), 3.350 (39), 4.56 (32), 4.93 (26), 7.88 (24)

Chemistry:

	(1)	(2)
$(NH_4)_2O$	[13.84]	20.61
K_2O	8.10	
Na_2O	1.52	
Al_2O_3	10.81	13.45
Fe_2O_3	2.14	
V_2O_3	0.81	
SiO_2	0.32	
P_2O_5	35.24	37.44
C_2O_3	[18.07]	19.00
H_2O	[9.15]	9.50
Total	100.00	100.00

(1) Rowley mine, near Theba, Maricopa Co., Arizona, USA; normalized average electron microprobe analysis supplemented by Raman spectroscopy, C, N and H constrained by the crystal structure; corresponding to $[(NH_4)_{2.12}K_{0.69}Na_{0.20}]_{\Sigma=3.01}(Al_{0.84}{}^{Fe3+}{}_{0.11}V^{3+}{}_{0.04})_{\Sigma=0.99}(C_2O_4)[(P_{0.98}Si_{0.02})O_3OH]_2(H_2O)$. (2) $(NH_4,K)_3Al(C_2O_4)(PO_3OH)_2(H_2O)$.

Occurrence: Part of a bat-guano-related, post-mining assemblage of phases in a hot and humid area underground.

Association: Antipinite, vanadinite.

Distribution: From the 125-foot level of the Rowley mine, ~20 km northwest of Theba, Maricopa Co., Arizona, USA.

Name: For *Theba*, Arizona, a small settlement and railroad depot ~20 km southeast of the Rowley mine. The (NH_4) suffix indicates $NH_4^+ > K^+$.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA (75082).

References: (1) Kampf, A.R., M.A. Cooper, A.J. Celestian, B.P. Nash, and J. Marty (2021) Thebaite-(NH_4), $(NH_4,K)_3Al(C_2O_4)(PO_3OH)_2(H_2O)$, a new phosphate-oxalate mineral from the Rowley mine, Arizona, USA. Mineral. Mag., 85, 379-386. (2) (2022) Amer. Mineral., 107, 319 (abs. ref. 1).