Ammoniovoltaite $(NH_4)_2Fe^{2+}_5Fe^{3+}_3Al(SO_4)_{12}(H_2O)_{18}$

Crystal Data: Cubic. *Point Group*: $4/m\,\bar{3}\,2/m$. As distorted, crystals that display combinations of {001} and {111}, to 50 μm.

Physical Properties: *Cleavage*: None. *Fracture*: Conchoidal. *Tenacity*: Brittle. Hardness = 3-3.5 D(meas.) = n.d. D(calc.) = 2.529 Water soluble.

Optical Properties: Opaque to translucent on thin edges. *Color*: Black; greenish gray in transmitted light. *Streak*: n.d. *Luster*: Vitreous.
Optical Class: Isotropic. n = 1.602(2)

Cell Data: Space Group: $Fd\bar{3}\,c$. a = 27.322(1) Z = 16

X-ray Powder Pattern: North Kambalny geothermal field, Kamchatka, Russia.
3.560 (100), 3.418 (100), 5.58 (84), 9.67 (74), 7.90 (56), 2.8660 (37), 2.0914 (33)

Chemistry:

	(1)	(2)
FeO	[13.26]	18.08
Fe_2O_3	[11.58]	12.06
MgO	2.33	
ZnO	0.04	
Al_2O_3	2.74	2.56
SO_3	47.46	48.36
K_2O	0.19	
CaO	0.11	
$(NH_4)_2O$	2.96	2.62
H_2O	[16.03]	16.32
Total	96.70	100.00

(1) North Kambalny geothermal field, Kamchatka, Russia; EDS analysis supplemented by IR and Mössbauer spectroscopy, H_2O calculated from structure, FeO/Fe_2O_3 from Mössbauer analysis of total Fe; corresponds to $[(NH_4)_{1.88}K_{0.08}Ca_{0.04}]_{\Sigma=2.00}(Fe^{2+}_{3.74}Mg_{1.17}Fe^{3+}_{0.05}Zn_{0.01})_{\Sigma=4.97}(Fe^{3+}_{2.89}Al_{0.09})_{\Sigma=2.98}Al_{1.00}(SO_4)_{12.00}(H_2O)_{18.00}$. (2) $(NH_4)_2Fe^{2+}_5Fe^{3+}_3Al(SO_4)_{12}(H_2O)_{18}$.

Mineral Group: Voltaite group.

Occurrence: As efflorescence that covers walls in cracks around gas/steam (~100°C.) vents in strongly hydrothermally-altered andesite-basalt in a geothermal region characterized by a high ammonium concentration.

Association: Alunogen, tschermigite, pyrite.

Distribution: From the North Kambalny geothermal field, Kambalny volcanic ridge, Kamchatka, Russia.

Name: Emphasizes that this is the *ammoni*um analogue of *voltaite*.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (5030/1).

References: (1) Zhitova, E.S., O.I. Siidra, D.I. Belakovsky, V.V. Shilovskikh, A.A. Nuzhdaev, and R.M. Ismagilova (2018) Ammoniovoltaite, $(NH_4)_2Fe^{2+}_5Fe^{3+}_3Al(SO_4)_{12}(H_2O)_{18}$, a new mineral from the Severo-Kambalny geothermal field, Kamchatka, Russia. Mineral. Mag., 82(5), 1057-1077.
(2) (2019) Amer. Mineral., 104(5), 779 (abs. ref 1).