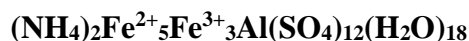


**Ammoniovoltaite**

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

**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)

<b>Chemistry:</b>	(1)	(2)
FeO	[13.26]	18.08
Fe <sub>2</sub> O <sub>3</sub>	[11.58]	12.06
MgO	2.33	
ZnO	0.04	
Al <sub>2</sub> O <sub>3</sub>	2.74	2.56
SO <sub>3</sub>	47.46	48.36
K <sub>2</sub> O	0.19	
CaO	0.11	
(NH <sub>4</sub> ) <sub>2</sub> O	2.96	2.62
H <sub>2</sub> O	[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<sub>2</sub>O calculated from structure, FeO/Fe<sub>2</sub>O<sub>3</sub> from Mössbauer analysis of total Fe; corresponds to  $[(\text{NH}_4)_{1.88}\text{K}_{0.08}\text{Ca}_{0.04}]_{\Sigma=2.00}(\text{Fe}^{2+}_{3.74}\text{Mg}_{1.17}\text{Fe}^{3+}_{0.05}\text{Zn}_{0.01})_{\Sigma=4.97}(\text{Fe}^{3+}_{2.89}\text{Al}_{0.09})_{\Sigma=2.98}\text{Al}_{1.00}(\text{SO}_4)_{12.00}(\text{H}_2\text{O})_{18.00}$ . (2)  $(\text{NH}_4)_2\text{Fe}^{2+}_5\text{Fe}^{3+}_3\text{Al}(\text{SO}_4)_{12}(\text{H}_2\text{O})_{18}$ .

**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 *ammonium* 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,  $(\text{NH}_4)_2\text{Fe}^{2+}_5\text{Fe}^{3+}_3\text{Al}(\text{SO}_4)_{12}(\text{H}_2\text{O})_{18}$ , 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).