

**Crystal Data:** Orthorhombic. *Point Group:*  $2/m\ 2/m\ 2/m$ . Prismatic crystals display {010}, {110}, and {101}, to 3 mm. Commonly in radial or bow-tie-like sprays.

**Physical Properties:** Essentially identical to wavellite in appearance and physical properties. *Cleavage:* Perfect on {110}, good on {101} and {010}. *Tenacity:* Brittle. *Fracture:* Uneven to conchoidal. Hardness = 3.5 D(meas.) = 2.30(1) D(calc.) = 2.345

**Optical Properties:** Transparent. *Color:* Colorless. *Streak:* White. *Luster:* Vitreous. *Optical Class:* Biaxial (+).  $\alpha = 1.522(1)$   $\beta = 1.531(1)$   $\gamma = 1.549(1)$   $2V(\text{meas.}) = 71(1)^\circ$   $2V(\text{calc.}) = 71.2^\circ$  *Orientation:*  $X = b, Y = a, Z = c$ . *Pleochroism:* None. *Dispersion:* Weak,  $r > v$ .

**Cell Data:** Space Group: *Pcmm*.  $a = 9.6311(4)$   $b = 17.3731(12)$   $c = 9.9946(3)$   $Z = 4$

**X-ray Powder Pattern:** Silver Coin mine or Wood mine, USA (unspecified). 8.53 (100), 3.223 (41), 3.430 (28), 2.580 (28), 5.65 (26), 4.81 (17), 2.101 (16)

Chemistry:	(1)	(2)	(3)
$\text{Al}_2\text{O}_3$	36.79	36.68	36.94
$\text{P}_2\text{O}_5$	34.66	34.31	34.29
F	4.74	4.08	4.59
$\text{H}_2\text{O}$	[26.65]	[26.52]	26.11
$-\text{O} = \text{F}_2$	2.00	1.72	1.93
Total	100.84	99.87	100.00

(1) Silver Coin mine, Valmy, Humboldt County, Nevada, USA; average of 9 electron microprobe analyses supplemented by Raman and FTIR spectroscopy,  $\text{H}_2\text{O}$  calculated from structure; corresponds to  $\text{Al}_{2.96}(\text{PO}_4)_2(\text{OH})_{1.98}\text{F}_{1.02}\cdot 5\text{H}_2\text{O}$ . (2) Wood mine, Cocke County, Tennessee, USA; average of 9 electron microprobe analyses supplemented by Raman and FTIR spectroscopy and CHN analysis,  $\text{H}_2\text{O}$  calculated from structure; corresponds to  $\text{Al}_{2.98}(\text{PO}_4)_2(\text{OH})_{2.11}\text{F}_{0.89}\cdot 5\text{H}_2\text{O}$ . (3)  $\text{Al}_3(\text{PO}_4)_2(\text{OH})_2\text{F}\cdot 5\text{H}_2\text{O}$ .

**Occurrence:** A low-temperature secondary mineral.

**Association:** Barite, fluorowardite, goethite, gypsum, kidwellite, quartz, rockbridgeite, chlorargyrite, crandallite, iangreyite, jarosite, lipscombite, metavariscite, turquoise, variscite (Silver Coin mine).

**Distribution:** From the Copper stope, Silver Coin mine, Valmy, Iron Point district, Humboldt County, Nevada, and the Wood mine, 5 miles NE of Del Rio, Cocke County, Tennessee, USA.

**Name:** As the fluorine analog of wavellite and with  $> \frac{1}{2}$  F per formula unit.

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA (65600 and 65601).

**References:** (1) Kampf, A.R., P.M. Adams, H. Barwood, and B.P. Nash (2017) Fluorwavellite,  $\text{Al}_3(\text{PO}_4)_2(\text{OH})_2\text{F}\cdot 5\text{H}_2\text{O}$ , the fluorine analog of wavellite. *Amer. Mineral.*, 102, 909-919.