Fluorwavellite $Al_3(PO_4)_2(OH)_2F{\cdot}5H_2O$

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 (+). α = 1.522(1) β = 1.531(1) γ = 1.549(1) 2V(meas.) = 71(1)° 2V(calc.) = 71.2° *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)
Al_2O_3	36.79	36.68	36.94
P_2O_5	34.66	34.31	34.29
F	4.74	4.08	4.59
H_2O	[26.65]	[26.52]	26.11
$-O = F_2$	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, H_2O calculated from structure; corresponds to $Al_{2.96}(PO_4)_2(OH)_{1.98}F_{1.02}{\cdot}5H_2O$. (2) Wood mine, Cocke County, Tennessee, USA; average of 9 electron microprobe analyses supplemented by Raman and FTIR spectroscopy and CHN analysis, H_2O calculated from structure; corresponds to $Al_{2.98}(PO_4)_2(OH)_{2.11}F_{0.89}{\cdot}5H_2O$. (3) $Al_3(PO_4)_2(OH)_2F{\cdot}5H_2O$.

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 > ½ 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, $Al_3(PO_4)_2(OH)_2F{\cdot}5H_2O$, the fluorine analog of wavellite. Amer. Mineral., 102, 909-919.