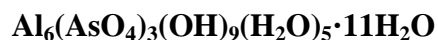


Bettertonite

Crystal Data: Monoclinic. *Point Group:* 2/m. As curved rectangular laths, flattened on {010}, to 0.20 μm ; as divergent sprays and hemispherical clusters.

Physical Properties: *Cleavage:* Perfect on (010). *Fracture:* Irregular. *Tenacity:* Flexible. Hardness = n.d. D(meas.) = n.d. D(calc.) = 2.02 Dehydrates to penberthycroftite between 67 and 97° C.

Optical Properties: Translucent. *Color:* White, rarely pale orange. *Streak:* White.

Luster: Vitreous to pearly, somewhat silky.

Optical Class: Biaxial (+). $\alpha = 1.511(1)$ $\beta = 1.517(1)$ $\gamma = 1.523(1)$ 2V(meas.) = n.d. 2V(calc.) = 60.2° *Orientation:* $X = c$, $Y = b$, $Z = a$.

Cell Data: *Space Group:* $P2_1/c$. $a = 7.773(2)$ $b = 26.991(5)$ $c = 15.867(3)$ $\beta = 94.22(3)^\circ$ $Z = 4$

X-ray Powder Pattern: Penberthy Croft mine, St. Hilary, Cornwall, England.

13.65 (100), 13.51 (50), 7.805 (50), 7.461 (30), 5.880 (20), 3.589 (20), 2.857 (14)

Chemistry:	(1)	(2)
Al ₂ O ₃	29.5	30.1
Fe ₂ O ₃	2.0	
As ₂ O ₅	30.1	33.7
SO ₃	1.8	
Cl	0.5	
H ₂ O	[36.2]	36.2
Total	100.0	100.0

(1) Penberthy Croft mine, St. Hilary, Cornwall, England; average of 4 electron microprobe analyses, H₂O calculated from structure; corresponds to Al_{5.86}Fe_{0.26}(AsO₄)_{2.65}(SO₄)_{0.23}(OH)_{9.82}Cl_{0.13}(H₂O)_{15.5}.

(2) Al₆(AsO₄)₃(OH)₉(H₂O)₅·11H₂O.

Occurrence: Extremely rare, in quartz veins in a multi-stage, polymetallic hydrothermal deposit; probably formed from leaching and the replacement of Al to Fe in pharmacosiderite. Dehydrates to penberthycroftite at temperatures likely on oxidizing mine dumps.

Association: Arsenopyrite, chamosite, liskeardite, penberthycroftite, pharmacoalumite, pharmacosiderite, brochantite, chalcopyrite, cassiterite.

Distribution: From the Penberthy Croft mine, ~1.5 km from the village of Golsithney, St. Hilary, Cornwall, England.

Name: Honors Mr. John Betterton (b. 1959) a museum geologist/mineralogist at Haslemere Educational Museum, Haslemere, Surrey, England, for his extensive contributions to the characterization of minerals from the Penberthy Croft mine for more than 30 years.

Type Material: Museum Victoria, Melbourne, Victoria, Australia (M53274) and the Natural History Museum, London, England (BM.2014,100).

References: (1) Grey, I.E., A.R. Kampf, J.R. Price and C.M. Macrae (2015) Bettertonite, [Al₆(AsO₄)₃(OH)₉(H₂O)₅]·11H₂O, a new mineral from the Penberthy Croft mine, St. Hilary, Cornwall, UK, with a structure based on polyoxometalate clusters. *Mineral. Mag.*, 79(7), 1849-1858. (2) (2016) *Amer. Mineral.*, 101, 2124 (abs. ref. 1). (3) Grey, I.E., H.E.A. Brand, and J. Betterton, (2016) Dehydration phase transitions in new aluminium arsenate minerals from the Penberthy Croft mine, Cornwall, UK. *Mineral. Mag.*, 80(7), 1205-1217.