

Beaverite

$\text{Pb}(\text{Fe}^{3+}, \text{Cu}, \text{Al})_3(\text{SO}_4)_2(\text{OH})_6$

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Crystal Data: Hexagonal. *Point Group:* $\bar{3}2/m$. As rhombohedral crystals or hexagonal plates, to 0.5 mm, typically aggregated into earthy or friable masses and powdery coatings.

Physical Properties: Hardness = $[\sim 3]$ $D(\text{meas.}) = 4.36$ $D(\text{calc.}) = 4.31$

Optical Properties: Semitransparent. *Color:* Canary-yellow, brownish yellow, pale brown. *Optical Class:* Uniaxial (-); strong birefringence. *Pleochroism:* O = dark yellow; E = pale yellow. $\omega = 1.83\text{--}1.87$ $\epsilon = 1.85$

Cell Data: *Space Group:* $R\bar{3}m$. $a = 7.205(5)$ $c = 16.994(32)$ $Z = 3$

X-ray Powder Pattern: Grand Reef mine, Arizona, USA.

5.87 (100), 3.054 (97), 3.61 (45), 2.280 (28), 3.066 (26), 2.932 (25), 1.807 (22)

Chemistry:

	(1)	(2)
SO_3	23.60	25.15
Al_2O_3	4.03	1.00
Fe_2O_3	19.13	20.38
CuO	10.74	13.95
PbO	32.50	33.08
H_2O	10.00	6.45
Total	[100.00]	100.01

(1) Horn Silver mine, Utah, USA; recalculated after deduction of 10.05% insoluble, then corresponding to $\text{Pb}_{0.99}(\text{Fe}_{1.62}^{3+}\text{Cu}_{0.92}\text{Al}_{0.54})_{\Sigma=3.08}(\text{SO}_4)_{2.00}(\text{OH})_6$. (2) Grand Reef mine, Arizona, USA; by electron microprobe, average of three analyses; corresponds to $\text{Pb}_{0.94}(\text{Fe}_{1.62}^{3+}\text{Cu}_{1.12}\text{Al}_{0.12})_{\Sigma=2.86}(\text{SO}_4)_{2.00}(\text{OH})_6$.

Mineral Group: Alunite group.

Occurrence: An uncommon secondary mineral in the oxidized zone of Pb–Cu deposits.

Association: Olivenite, conicalcite, duftite, beudantite, osarizawaite, hidalgoite, corkite, carminite, bindheimite, plumbojarosite, bayldonite, brochantite, chrysocolla, galena.

Distribution: In the USA, rich masses from the Horn Silver mine, near Frisco, San Francisco district, Beaver Co., at the Centennial Alta mine, Little Cottonwood Canyon district, Salt Lake Co., from the Hidden Treasure mine, Ophir district, Tooele Co., and elsewhere in Utah; in the Boss mine, Goodsprings district, Clark Co., Nevada; at Tombstone, Cochise Co., and from the Grand Reef mine, Graham Co., Arizona; in the Blanchard mine, near Bingham, Socorro Co., New Mexico. From a number of mines in Caldbeck and Carrock Fells, Cumbria, England. In the Cap Garonne mine, near le Pradet, Var, France. In Japan, at the Osarizawa mine, Kazuno, and the Kosaka mine, Akita Prefecture. From Tsumeb, Namibia. At Kipushi, Shaba Province, Congo (Zaire). In the Whim Creek copper mine, Pilbara district, Western Australia. At the Tui mine, Mount Te Aroha, New Zealand. Most occurrences are minor; a number of others are known.

Name: For Beaver Co., Utah, USA, from which the mineral was first recognized.

Type Material: Natural History Museum, Paris, France, 11244; The Natural History Museum, London, England, 1912,615; National Museum of Natural History, Washington, D.C., USA, 86986, R6314.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 568. (2) Morris, R.C. (1962) Osarizawaite from Western Australia. Amer. Mineral., 47, 1079–1093. (3) Breidenstein, B., J. Schlüter, and G. Gebhard (1992) On beaverite: new occurrence, chemical data, and crystal structure. Neues Jahrb. Mineral., Monatsh., 213–220.

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