Plumbogummite $PbAl_3(PO_4)(PO_3OH)(OH)_6$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}$ 2/*m*. Crystals hexagonal or bladed, prismatic, to 5 mm, in parallel to subparallel aggregates; microscopically radially fibrous or spherulitic; usually as crusts, botryoidal, reniform, stalactitic, globular, compact massive.

Physical Properties: *Fracture*: Uneven to subconchoidal. *Tenacity*: Brittle. Hardness = 4.5-5 D(meas.) = 4.01 D(calc.) = [4.08]

Optical Properties: Transparent to translucent. *Color*: Grayish white, grayish blue, yellowish gray, yellowish brown, green, pale blue. *Streak*: White. *Luster*: Vitreous, resinous to dull. *Optical Class*: Uniaxial (+); segments of crystals may be biaxial. ω = 1.653-1.688 ε = 1.675-1.704

Cell Data: *Space Group*: $R\bar{3}\,m$. a = 7.017(1) c = 16.75(1) Z = 3

X-ray Powder Pattern: Ivanhoe mine, Australia.
2.969 (10), 5.71 (9), 2.220 (8), 3.51 (7), 1.905 (6), 3.44 (5), 4.93 (4)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SO_3	0.67	0.07		CuO	0.92		
P_2O_5	22.47	17.2	24.42	PbO	38.90	36.0	38.41
As_2O_5	0.04	1.53		CO_2		4.80	
Al_2O_3	25.45	21.3	26.32	H_2O	[11.54]	13.0	10.85
Fe_2O_3	0.01			Total	[100.00]	94.1	100.00
CaO		0.20					

(1) Ivanhoe mine, Australia; by electron microprobe, H_2O by difference, $(OH)^{1-}$ confirmed by IR; leading to $Pb_{1.02}Cu_{0.07}Al_{2.92}[(PO_4)_{1.85}(SO_4)_{0.05}]_{\Sigma=1.90}(OH)_{5.29}\cdot 0.73H_2O$. (2) Dry Gill mine, Caldbeck Fells, Cumbria, England; electron microprobe, IR confirms CO_3^{2-}. (3) $PbAl_3(PO_4)(POOH)(OH)_6$.

Mineral Group: Crandallite group.

Occurrence: An uncommon secondary mineral in the oxidized zone of lead deposits.

Association: Pyromorphite, mimetite, duftite, cerussite, anglesite, wulfenite.

Distribution: In France, from Huelgoat, Finistère. In England, from Roughton Gill, Red Gill, Dry Gill, and other mines, Caldbeck Fells, Cumbria; in Cornwall, from Wheal Gorland, Gwennap; at the Penberthy Croft mine, St. Hilary; in the Buttern Hill placers, Altarnum; and from Wheal Alfred, Gwinear. At Leadhills, Lanarkshire, and Wanlockhead, Dumfriesshire, Scotland. From the Horcajo mines, 35 km south of Brazatortas, Cuidad Real Province, Spain. At Moldava, 20 km northwest of Teplice, Czech Republic. In the USA, at the Canton mine, Cherokee Co., Georgia; from the Tyrone mine, Santa Rita, Grant Co., and the Mex-Tex mine, near Bingham, Hansonburg district, Socorro Co., New Mexico; in the Hahns Peak district, Routt Co., Colorado; at the Copper Cities deposit, Gila Co., Arizona; in the Silver Coin mine, near Valmy, Iron Point district, Humboldt Co., and the San Rafael mine, Nye Co., Nevada. In Australia, from the Ivanhoe mine, Tennant Creek district, Northern Territory; in the Teutonic Bore deposit, 300 km north of Kalgoorlie, Western Australia; at Broken Hill, New South Wales. Several other minor localities are known.

Name: From the Latin for *lead* and *gum*, which it may resemble.

Type Material: Natural History Museum, Paris, France.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 831-832. (2) Slansky, E. (1977) Plumbogummite from Ivanhoe mine, Northern Territory, Australia. Neues Jahrb. Mineral., Monatsh., 45-53. (3) Grey, I.E., F.L. Shanks, N.C. Wilson, W.G. Mumme, and W.D. Birch (2011) Carbon incorporation in plumbogummite-group minerals. Mineral. Mag., 75, 145-158.