Hinsdalite $PbAl_3(SO_4)(PO_4)(OH)_6$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}\ 2/m$. As rhombohedra $\{10\bar{1}\ 1\}$, hexagonal plates, tabular on {0001}, or pseudocubic crystals, to 2 cm; massive or granular.

Physical Properties: *Cleavage*: Perfect on {0001}. Hardness = 4.5 D(meas.) = 3.65 D(calc.) = 4.030

Optical Properties: Translucent. *Color*: Colorless, pale green, pearly white. *Luster*: Vitreous to greasy.
Optical Class: Uniaxial (+); may exhibit biaxial sectors. $\omega = 1.671$ $\varepsilon = 1.689$

Cell Data: *Space Group*: $R\bar{3}\ m$. $a = 7.029(4)$ $c = 16.789(4)$ Z = 3

X-ray Powder Pattern: Golden Fleece mine, Colorado, USA.
2.78 (100), 2.96 (80), 5.59 (65), 5.70 (50), 2.222 (50), 3.50 (40), 1.896 (25)

Chemistry:

	(1)	(2)
SO_3	14.13	15.36
P_2O_5	14.50	13.61
Al_2O_3	26.47	29.33
PbO	31.75	21.40
SrO	3.11	9.94
H_2O	10.25	10.36
Total	100.21	100.00

(1) Golden Fleece mine, Colorado, USA. (2) $(Pb, Sr)Al_3(PO_4)(SO_4)(OH)_6$ with Pb:Sr = 1:1.

Mineral Group: Beudantite group.

Occurrence: A rare secondary mineral in the oxidized zone of polymetallic sulfide deposits.

Association: Barite, pyrite, galena, tetrahedrite, rhodochrosite (Golden Fleece mine, USA).

Distribution: In the USA, large crystals from the Golden Fleece mine, near Lake City, Hinsdale Co., Colorado; in the Mineral Park mine, Mohave Co., Arizona; and at the Daisy Creek prospect, 25 km north of Thompson Falls, Sanders Co., Montana. In the Sylvester mine, Zeehan, and the Comet mine, Dundas, Tasmania; from Broken Hill, New South Wales, Australia. At Penkiln Burn, 13 km north-northeast of Newton Stewart, Kirkcudbrightshire, Scotland. In the Colettes massif, about 45 km southeast of Montluçon, Allier, France. From Bad Ems, Rhineland-Palatinate, and the Schoene Aussicht mine, near Dernbach, Westerwald area, Germany.

Name: For *Hinsdale* County, Colorado, USA, source of the first specimens.

Type Material: Harvard University, Cambridge, Massachusetts, 101680, 101682, 101683; National Museum of Natural History, Washington, D.C., USA, 86987, 92971.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 1004. (2) Stanley, C.R. (1987) Hinsdalite and other products of oxidation at the Daisy Creek stratabound copper-silver prospect, northwestern Montana. Can. Mineral., 25, 213-220. (3) Nicolas, J. and A. De Rosen (1963) Phosphates hydrothermaux de basse température et kaolinisation: la gorceixite du massif des Colettes (Allier) et les minéraux associés (hinsdalite). Bull. Minéral., 86, 379-385 (in French). (4) Kolitsch, U., E.R.T. Tiekink, P.G. Slade, M.R. Taylor, and A. Pring (1999) Hinsdalite and plumbogummite, their atomic arrangements and disordered lead sites. Eur. J. Mineral., 11, 513-520.