Leucophosphite $KFe_2^{3+}(PO_4)_2(OH)\cdot 2H_2O$

Crystal Data: Monoclinic, pseudo-orthorhombic. *Point Group:* $2/m$. Crystals are diamond-shaped, to 1 cm, showing {100}, {210}, {111}, {$\overline{1}$11}; fine-grained, chalklike massive, amorphous in part.

Physical Properties: *Cleavage:* {100}, perfect. Hardness = n.d. D(meas.) = 2.948 D(calc.) = 2.911

Optical Properties: Semitransparent. *Color:* White, buff, yellow-brown, orange-brown, pink, greenish brown, brownish purple; may be grayish green in daylight, purplish gray in incandescent light. *Luster:* Vitreous to waxy, chalky.
Optical Class: Biaxial (+). *Orientation:* $X = b$; $Z \wedge c = 26°$. *Dispersion:* $r < v$, very strong. $\alpha = 1.707(2)$ $\beta = 1.721(2)$ $\gamma = 1.739(2)$ 2V(meas.) = n.d. 2V(calc.) = 84°

Cell Data: *Space Group:* $P2_1/n$. $a = 9.782(9)$ $b = 9.658(9)$ $c = 9.751(9)$ $\beta = 102.24(12)°$ Z = 4

X-ray Powder Pattern: Sapucaia mine, Brazil.
6.79 (10), 5.99(7), 3.06 (7), 2.916 (4), 2.829 (4), 7.60 (3), 4.76 (3)

Chemistry:

	(1)	(2)		(1)	(2)		(1)	(2)
P_2O_5	34.99	36.05	Mn_2O_3	0.57		H_2O	11.29	11.44
Al_2O_3	0.25		Na_2O	0.53		Total	[100.00]	100.00
Fe_2O_3	41.35	40.55	K_2O	11.02	11.96			

(1) Sapucaia mine, Brazil; recalculated after deduction of insoluble 0.45% from an original total of 99.66%; corresponds to $(K_{0.93}Na_{0.04})_{\Sigma=0.97}(Fe_{2.05}Mn_{0.03}Al_{0.02})_{\Sigma=2.10}(PO_4)_{1.95}(OH)_{0.45}\cdot 2.01H_2O$.
(2) $KFe_2(PO_4)_2(OH)\cdot 2H_2O$.

Occurrence: Formed by reaction between bat or bird guano and earlier iron-bearing minerals; by hydrothermal alteration of iron-rich phosphates in complex granite pegmatites; crosscutting fluorapatite nodules in black shale; replacing fossil wood; in phosphate rock deposits.

Association: Variscite, "chalcedony", "opal" (Ninghanboun Hills, Australia); strengite, phosphosiderite (Liberia); cyrilovite, phosphosiderite, manganoan lipscombite, frondelite (Sapucaia mine, Brazil); vivianite, aluminian strengite, diadochite, ferrostrunzite, fluorapatite (Bethel Church, Indiana, USA); rockbridgeite, triphylite (Tip Top mine, South Dakota, USA).

Distribution: In Australia, from the Ninghanboun Hills, on the shore of Weelhamby Lake, Western Australia; in the Moculta phosphate quarry, northeast of Angaston, and at the Fairview quarry, near Robertstown, South Australia. In the Bomi Hill, Bambuta, and other caves, Liberia. In Namibia, from the Tsaobismund pegmatite, 60 km south of Karibib, and in the Sandamap pegmatite, west of Usakos. At Marivolanitra, Ambatofindrahana, Madagascar. From the Sapucaia pegmatite mine, about 50 km east-southeast of Governador Valadares, and in a cave at the west end of the Serra do Tamanduá, Minas Gerais, Brazil. In the USA, at the Palermo #1 mine, near North Groton, Grafton Co., New Hampshire; from near Bethel Church, Pike Co., Indiana; large crystals in the Tip Top pegmatite, 8.5 km southwest of Custer, also at the Gap Lode, White Elephant, and Bull Moose mines, near Custer, Custer Co., South Dakota. In England, at Wheal Gorland, Gwennap, and the Gunheath china clay pit, St. Austell, Cornwall. From the Mangualde pegmatite, near Mesquitela, Portugal. On Rockall Island, North Atlantic. Several other minor localities are known.

Name: From the Greek for *white* and the *phosphate* in its composition.

Type Material: Western Australian Museum, Perth, Australia, M.69.1991, MDC6129; The Natural History Museum, London, England, 1932,1092; Harvard University, Cambridge, Massachusetts, 103879; National Museum of Natural History, Washington, D.C., USA, 96772.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 936. (2) Lindberg, M.L. (1957) Leucophosphite from the Sapucaia pegmatite mine, Minas Gerais, Brazil. Amer. Mineral., 42, 214–221. (3) Moore, P.B. (1972) Octahedral tetramer in the crystal structure of leucophosphite, $K_2[Fe_4^{3+}(OH)_2(H_2O)_2(PO_4)_4]\cdot 2H_2O$. Amer. Mineral., 57, 397–410.