Magnetoplumbite $Pb(Fe^{3+},Mn^{3+})_{12}O_{19}$

Crystal Data: Hexagonal. *Point Group:* $6/m\ 2/m\ 2/m$. Crystals are steep dipyramids, to 6 mm; granular, massive.

Physical Properties: *Cleavage:* {0001}, perfect. Hardness = 6 VHN = 755–777 (Mn-rich, 100 g load); 841–868 (Fe-rich, 100 g load). D(meas.) = 5.517 D(calc.) = 5.57 (synthetic $PbFe^{3+}_{12}O_{19}$). Strongly magnetic.

Optical Properties: Opaque. *Color:* Gray-black; gray in reflected light. *Streak:* Dark brown. *Luster:* Metallic, brilliant.
Optical Class: Uniaxial. *Pleochroism:* Weak. *Anisotropism:* Distinct.
R_1–R_2: (400) 25.6–28.5, (420) 25.1–27.6, (440) 24.6–26.7, (460) 24.2–26.0, (480) 23.8–25.6, (500) 23.6–25.3, (520) 23.3–25.0, (540) 23.0–24.6, (560) 22.7–24.2, (580) 22.3–23.8, (600) 22.0–23.5, (620) 21.7–23.2, (640) 21.3–22.8, (660) 21.1–22.6, (680) 20.9–22.3, (700) 20.7–22.2

Cell Data: *Space Group:* $P6_3/mmc$. $a = 5.9015$-5.926 $c = 23.023$–23.230 $Z = 2$

X-ray Powder Pattern: Långban, Sweden.
2.766 (10), 2.953 (8), 2.427 (8), 2.235 (7), 1.476 (7), 4.99 (6), 1.667 (6)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
Sb_2O_5		0.01	1.87	ZnO		0.86	0.72
TiO_2	4.14	4.14	10.24	PbO	20.02	19.16	18.80
Al_2O_3	1.86	1.05	1.67	MgO	0.15	0.11	0.56
Fe_2O_3	52.22	52.89	50.44	CaO	0.28		
Mn_2O_3	17.27	18.91	5.90	BaO		0.09	0.37
Cr_2O_3	0.25	0.16	0.11	H_2O	0.08		
MnO	3.73	2.83	9.20	Total	100.00	100.21	99.88

(1) Långban, Sweden; corresponds to $Pb_{1.05}(Fe^{3+}_{7.66}Mn^{3+}_{2.56}Mn^{2+}_{0.62}Ti_{0.60}Al_{0.42}Ca_{0.06}Mg_{0.04}Cr_{0.04})_{\Sigma=12.00}O_{19}$. (2) Do.; by electron microprobe, Mn^{2+}:Mn^{3+} from charge balance; corresponds to $Pb_{1.00}(Fe^{3+}_{7.72}Mn^{3+}_{2.79}Ti_{0.60}Mn^{2+}_{0.47}Al_{0.24}Zn_{0.12}Mg_{0.03}Cr_{0.02}Ba_{0.01})_{\Sigma=12.00}O_{19}$. (3) Do.; by electron microprobe, Mn^{2+}:Mn^{3+} from charge balance; corresponds to $(Pb_{0.98}Ba_{0.02})_{\Sigma=1.00}(Fe^{3+}_{7.34}Mn^{2+}_{1.51}Ti_{1.49}Mn^{3+}_{0.87}Al_{0.38}Mg_{0.16}Sb_{0.13}Zn_{0.10}Cr_{0.02})_{\Sigma=12.00}O_{19}$.

Mineral Group: Magnetoplumbite group.

Occurrence: In skarns associated with metamorphosed Fe–Mn orebodies (Sweden).

Association: Melanotekite-kentrolite, hematite, jacobsite, hedyphane, braunite, pyrophanite, manganoan phlogopite, calcite, andradite, celsian (Sweden).

Distribution: In Sweden, from Långban; in the Harstigen mine, near Persberg; and at Jakobsberg, Värmland.

Name: For being a MAGNETic oxide of iron, manganese, and lead, *plumbum*.

Type Material: Swedish Museum of Natural History, Stockholm, Sweden, 24639.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 728. (2) Burke, E.A.J. (1980) New data on magnetoplumbite from Långban, Sweden. Neues Jahrb. Mineral., Monatsh., 141–148. (3) Moore, P.B., P.K. Sen Gupta, and Y. Le Page (1989) Magnetoplumbite, $Pb^{2+}Fe^{3+}_{12}O_{19}$: refinement and lone-pair splitting. Amer. Mineral., 74, 1186–1194. (4) Holtstam, D. (1994) Mineral chemistry and parageneses of magnetoplumbite from the Filipstad district, Sweden. Eur. J. Mineral., 6, 711–724.