Blatterite $(Mn^{2+},Mg)_{35}(Mn^{3+},Fe^{3+})_9Sb_3^{5+}(BO_3)_{16}O_{32}$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Lathlike crystals, to 5 mm, elongated and striated parallel [001], showing {110}, poorly terminated, may be slightly curved.

Physical Properties: *Cleavage:* On {001}, perfect; on {100}, imperfect, a parting. *Tenacity:* Brittle. Hardness = ∼6 VHN = 814–940, 877 average (100 g load). D(meas.) = 4.7(4) D(calc.) = 4.25

Optical Properties: Opaque. *Color:* Black; exhibits red-orange internal reflections. *Streak:* Brown. *Luster:* Metallic to submetallic. *Optical Class:* Biaxial (–). *Orientation:* $X = a$; $Y = c$; $Z = b$. *Anisotropism:* Weak to distinct; shades of grayish brown. *Bireflectance:* Buff, creamy buff, pale buff. R_1–R_2: (400) 11.1–12.4, (420) 10.9–12.2, (440) 10.7–12.0, (460) 10.5–11.9, (480) 10.4–11.8, (500) 10.3–11.7, (520) 10.2–11.6, (540) 10.1–11.5, (560) 10.0–11.4, (580) 9.98–11.4, (600) 9.97–11.3, (620) 9.95–11.3, (640) 9.93–11.2, (660) 9.91–11.2, (680) 9.88–11.1, (700) 9.86–11.1

Cell Data: *Space Group: Pnnm.* $a = 37.654(8)$ $b = 12.615(3)$ $c = 6.2472(8)$ Z = 2

X-ray Powder Pattern: Nordmark, Sweden.
2.605 (100), 5.243 (45), 2.721 (40), 2.621 (35), 1.564 (35), 2.520 (30), 5.621 (20)

Chemistry:

	(1)	(2)
B_2O_3	14.4	[14.63]
Sb_2O_5	12.65	12.80
TiO_2		0.19
Al_2O_3		0.33
Fe_2O_3	3.48	1.96
Mn_2O_3	[9.9]	[16.03]
MnO	[46.2]	[38.89]
MgO	13.0	14.89
Total	[99.63]	[99.72]

(1) Nordmark, Sweden; by ICP, total Sb as Sb_2O_5, total Fe as Fe_2O_3, Mn^{2+}:Mn^{3+} calculated for charge balance; then corresponds to $(Mn^{2+}_{22.38}Mg_{12.62})_{\Sigma=35.00}(Mn^{3+}_{4.91}Fe^{3+}_{1.71}Mn^{2+}_{3.12})_{\Sigma=9.74}Sb^{5+}_{3.06}(B_{1.01}O_3)_{16.00}O_{32}$. (2) Långban, Sweden; by electron microprobe, total Sb as Sb_2O_5, total Fe as Fe_2O_3, Mn^{2+}:Mn^{3+} calculated for charge balance; then corresponds to $(Mn^{2+}_{20.87}Mg_{14.06})_{\Sigma=34.93}(Mn^{3+}_{7.73}Fe^{3+}_{0.93}Al_{0.25}Ti_{0.09})_{\Sigma=9.00}Sb^{5+}_{3.01}(BO_3)_{16.00}O_{32}$.

Occurrence: From metamorphosed Fe–Mn orebodies.

Association: Manganosite, pyrochroite, hausmannite, katoptrite, calcite.

Distribution: From [the Brattfors mine,] Nordmark, and at Långban, Värmland, Sweden.

Name: Honoring Fritz Blatter (1943–), German mineral collector, who provided the original material.

Type Material: Swedish Museum of Natural History, Stockholm, Sweden; Mineralogical-Geological Museum, University of Oslo, Oslo, Norway; The Natural History Museum, London, England1986,112, E.1168.

References: (1) Raade, G., M.H. Mladeck, V.K. Din, A.J. Criddle, and C.J. Stanley (1988) Blatterite, a new Sb-bearing $Mn^{2+}-Mn^{3+}$ member of the pinakiolite group, from Nordmark, Sweden. Neues Jahrb. Mineral., Monatsh., 121–136. (2) (1989) Amer. Mineral., 74, 1399 (abs. ref. 1). (3) Cooper, M.A. and F.C. Hawthorne (1998) The crystal structure of blatterite, $Sb_3^{5+}(Mn^{3+},Fe^{3+})_9(Mn^{2+},Mg)_{35}(BO_3)_{16}O_{32}$, and structural hierarchy in $Mn^{3+}-$bearing zigzag borates. Can. Mineral., 36, 1171–1193.