Lithiophorite $(Al, Li)Mn^{4+}O_2(OH)_2$

Crystal Data: Hexagonal. *Point Group:* $\overline{3}\ 2/m$. Very rarely in hexagonal crystals, to 1 cm; commonly scaly or very fine-grained, botryoidal, compact. *Twinning:* Sectoring observed on the basal plane of crystals may be due to twinning.

Physical Properties: *Cleavage:* {0001}, micaceous. *Tenacity:* Sectile, laminae somewhat flexible. Hardness = 2.5–3 D(meas.) = 3.14–3.37 D(calc.) = [3.30]

Optical Properties: Opaque. *Color:* Bluish black; light gray to dark brownish gray in reflected light. *Streak:* Blackish gray to greenish black. *Luster:* Dull to metallic.
Optical Class: Uniaxial. *Pleochroism:* Very strong. *Anisotropism:* Extreme; light gray to dark brown to bluish gray.
R_1–R_2: (400) 15.7–34.9, (420) 14.0–31.3, (440) 12.3–27.7, (460) 11.2–24.9, (480) 10.6–23.0, (500) 10.2–21.9, (520) 10.0–21.0, (540) 9.8–20.4, (560) 9.6–19.7, (580) 9.5–19.2, (600) 9.4–18.9, (620) 9.3–18.6, (640) 9.3–18.4, (660) 9.3–18.4, (680) 9.3–18.3, (700) 9.3–18.2

Cell Data: *Space Group:* $R\overline{3}m$. $a = 2.9247(4)$ $c = 28.169(6)$ Z = [3]

X-ray Powder Pattern: Krosnowice (Rengersdorf), Poland. (ICDD 41-1378).
4.714 (100), 9.428 (68), 2.371 (24), 1.880 (14), 3.143 (7), 1.453 (4), 1.447 (4)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2		0.30	BaO	2.78	
Al_2O_3	10.54	23.84	K_2O	0.73	
Fe_2O_3	1.48	0.96	Li_2O	1.23	3.30
Bi_2O_3	trace		O	10.28	9.01
MnO	55.12	48.15	H_2O^+		13.15
(Co, Ni)O	2.42		H_2O^-		1.45
CuO	1.74		H_2O	12.64	
CaO	trace	trace	Total	98.96	100.16

(1) Schneeberg, Germany. (2) Gloucester Farm, Postmasburg, South Africa; Mn^{4+}:Mn^{3+} assumed; corresponds to $(Al_{0.69}Li_{0.32})_{\Sigma=1.01}(Mn^{4+}_{0.66}Mn^{3+}_{0.34})_{\Sigma=1.00}O_2(OH)_2$.

Occurrence: A relatively common constituent of "wad" in the oxidized zones of hydrothermal ore deposits and sedimentary manganese deposits; in banded iron formations; from lithium-rich granite pegmatites; in some lateritic soils and bauxites.

Association: Cryptomelane, hollandite, braunite, nsutite, pyrolusite, bixbyite, gibbsite, kaolinite, hematite.

Distribution: From Schneeberg and Eibenstock, Saxony; at St. Andreasberg, Harz Mountains; from Saalfeld, Thuringia; and elsewhere in Germany. At Krosnowice (Rengersdorf), Silesia, Poland. From Salmchâteau, Belgium. At the Lecht mines, Tomintoul, Baniffshire, Scotland. In the USA, from Charlottesville, Virginia; on White Oak Mountain, Bradley Co., Tennessee; in the Artillery Mountains, Mohave Co., Arizona. In Sima Menor cave, Mt. Sarisariñama, Venezuela. On Groote Eylandt, Northern Territory, Australia. In the Sundargarh district, Orissa, India. Large crystals from Gloucester Farm, Postmasburg district, Transvaal, South Africa. At Kobokobo, Kivu Province, Congo (Zaire). Other localities are known, but some require modern confirmation.

Name: For its content of LITHIum and the Greek for *to bear*.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 566–572 [wad, part]. (2) De Villiers, J.E. (1945) Lithiophorite from the Postmasburg manganese deposits. Amer. Mineral., 30, 629–634. (3) Fleischer, M. and G.T. Faust (1963) Studies on manganese oxide minerals. VII. Lithiophorite. Schweiz. Mineral. Petrog. Mitt., 43, 197–216. (4) Mitchell, R.S. and R.E. Meintzer (1967) Lithiophorite from Charlottesville, Virginia. Amer. Mineral., 52, 1545–1549. (5) Post, J.E. and D.E. Appleman (1994) Crystal structure refinement of lithiophorite. Amer. Mineral., 79, 370–374.