Philolithite

$\mathbf{Pb_{12}Mn^{2+}(Mg,Mn^{2+})_2}$
$\mathbf{(Mn^{2+},Mg)_4O_6(SO_4)(CO_3)_4Cl_4(OH)_{12}}$

Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. Crystals are square tabular, {001}, {111}, modified by {110}, {112}, to 0.3 mm; may be aggregated in crusts. *Twinning:* Sectorial in four zones about [001], observed optically.

Physical Properties: *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 3–4
D(meas.) = n.d. D(calc.) = 5.91

Optical Properties: Semitransparent. *Color:* Pale to medium apple-green. *Streak:* White. *Luster:* Adamantine.
Optical Class: Biaxial (+), anomalous. *Pleochroism:* Very weak; pale green to pale yellow-green. *Orientation:* $X \wedge a = 45°$. $n = > 1.92$. ω = n.d. ϵ = n.d. 2V(meas.) = 60°

Cell Data: *Space Group:* $P4_2/nnm$. a = 12.627(9) c = 12.595(9) Z = 2

X-ray Powder Pattern: Långban, Sweden.
2.975 (100), 3.99 (30), 2.752 (30), 8.95 (20), 7.30 (20), 2.473 (20), 1.716 (20)

Chemistry:

	(1)	(2)
SO_3	1.7	[2.2]
CO_2	[4.9]	[4.9]
MnO	10.3	8.7
PbO	73.7	75.9
MgO	1.8	2.1
Cl	3.4	4.4
H_2O	[3.0]	[3.0]
$-O = Cl_2$	0.8	1.0
Total	[98.0]	[100.2]

(1) Långban, Sweden; by energy dispersive analysis, presence of $(SO_4)^{2-}$, $(CO_3)^{2-}$, $(OH)^{1-}$ confirmed by IR; $(CO_3)^{2-}$, H_2O calculated from crystal-structure analysis; corresponds to $Pb_{12.29}(Mn_{5.41}Mg_{1.66})_{\Sigma=7.07}O_{6.45}(SO_4)_{0.79}(CO_3)_{4.14}Cl_{3.57}(OH)_{12.40}$. (2) Do.; by electron microprobe; $(SO_4)^{2-}$, $(CO_3)^{2-}$, H_2O calculated from crystal-structure analysis; corresponds to $Pb_{12.32}(Mn_{4.45}Mg_{1.89})_{\Sigma=6.34}O_{5.31}(SO_4)_{1.00}(CO_3)_{4.04}Cl_{4.50}(OH)_{12.07}$.

Occurrence: Very rare in a metamorphosed Fe–Mn orebody.

Association: Lead, copper, mendipite, braunite, hausmannite, pyrochroite, manganoan phlogopite, allactite, calcite.

Distribution: From Långban, Värmland, Sweden.

Name: From the Greek for *loving* and *stone*, in honor of the Friends of Mineralogy organization.

Type Material: Swedish Museum of Natural History, Stockholm, Sweden, 37389, 225116; Canadian Museum of Nature, Ottawa, Canada, 58623; Los Angeles Co. Museum, Los Angeles, California, USA, 41794.

References: (1) Kampf, A.R., P.B. Moore, E.J. Jonsson, and G.H. Swihart (1998) Philolithite, a new mineral from Långban, Värmland, Sweden. Mineral. Record, 29, 201–206. (2) (1999) Amer. Mineral., 84, 686–687 (abs. ref. 1). (3) Moore, P.B., A.R. Kampf, and P.K. Sen Gupta (2000) The crystal structure of philolithite, a trellis-like open framework based on cubic closest-packing of anions. Amer. Mineral., 85, 810–816.