Larderellite $(NH_4)B_5O_7(OH)_2 \cdot H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals are rhombic, flattened on {001}, to 0.1 mm; typically powdery.

Physical Properties: *Cleavage:* On {100}, {010}, perfect. Hardness = n.d.
D(meas.) = 1.905(4) D(calc.) = 1.887

Optical Properties: Semitransparent. *Color:* White, pale yellow if impure.
Optical Class: Biaxial (+). *Orientation:* $Y = b$; $Z \wedge c \simeq 15°$. *Dispersion:* $r > v$ or $r < v$.
$\alpha = 1.493(1)$ $\beta = 1.509(1)$ $\gamma = 1.561(1)$ 2V(meas.) = 58°

Cell Data: *Space Group:* $P2_1/a$. $a = 11.63$–11.65 $b = 7.615$–7.63 $c = 9.447$–9.47
$\beta = 96°45'$–$97°05'$ Z = 4

X-ray Powder Pattern: Larderello, Italy.
4.70 (100), 2.921 (100), 2.887 (100), 5.44 (71), 2.960 (71), 9.45 (50), 5.12 (50)

Chemistry:

	(1)	(2)
B_2O_3	71.64	68.49
$(NH_4)_2O$	9.93	10.24
H_2O	[18.43]	21.27
Total	[100.00]	100.00

(1) Larderello, Italy; average of four analyses, H_2O by difference. (2) $(NH_4)B_5O_7(OH)_2 \cdot H_2O$.

Occurrence: In boric-acid-rich fumarolic lagoons.

Association: Sassolite, ammonioborite, santite.

Distribution: From Larderello, Val di Cecina, Tuscany, Italy.

Name: Honoring Francesco de Larderel (1848–1925), principal operator of the Tuscan borax works.

Type Material: Natural History Museum, Paris, France, 100.1384, 100.1386, 100.1388.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 365–366. (2) Clark, J.R. (1960) X-ray crystallography of larderellite, $NH_4B_5O_6(OH)_4$. Amer. Mineral., 45, 1087–1093. (3) Merlino, S. and F. Sartori (1969) The crystal structure of larderellite, $NH_4B_5O_7(OH)_2.H_2O$. Acta Cryst., 25, 2264–2270.