Penfieldite $Pb_2Cl_3(OH)$

Crystal Data: Hexagonal. *Point Group:* $\overline{6}$. Crystals, to 3 cm, commonly prismatic ‖ [0001], or steeply pyramidal, terminated by {0001}, with many less-common forms; may be in groups in parallel. *Twinning:* About $[21\overline{3}0]$ on {0001} and on $\{41\overline{5}4\}$, both as contact twins.

Physical Properties: *Cleavage:* {0001}, distinct. Hardness = n.d. D(meas.) = 5.82–6.61 D(calc.) = 6.00 Soluble in H_2O leaving a yellowish white lead oxychloride residue.

Optical Properties: Transparent. *Color:* Colorless, white, may be yellowish or bluish with impurities; colorless in transmitted light. *Luster:* Adamantine to greasy.
Optical Class: Uniaxial (+). $\omega = 2.13(1)$ $\epsilon = 2.21(1)$

Cell Data: *Space Group:* $P\overline{6}$. $a = 11.393(3)$ $c = 4.024(1)$ Z = 36

X-ray Powder Pattern: Laurium, Greece.
3.73 (FFF), 3.14 (FF), 3.31 (F), 2.744 (F), 2.563 (F), 2.266 (F), 5.70 (mF)

Chemistry:

	(1)	(2)	(3)
Pb	76.55	78.41	77.06
O	1.47	[3.30]	1.49
F		0.09	
Cl	19.82	19.31	19.78
H		[0.21]	
H_2O	1.59		1.67
insol.	0.14		
Total	99.57	[101.32]	100.00

(1) Laurium, Greece. (2) Baratti Beach, Italy; by electron microprobe, average of three points; corresponding to $Pb_2Cl_{2.88}[(OH)_{1.09}F_{0.03}]_{\Sigma=1.12}$. (3) $Pb_2Cl_3(OH)$.

Occurrence: An alteration product of lead-bearing slag immersed in seawater (Laurium, Greece; Baratti Beach, Italy); in an oxidized hydrothermal lead deposit (Sierra Gorda district, Chile).

Association: Paralaurionite, phosgenite (Laurium, Greece); fiedlerite, cotunnite (Baratti Beach, Italy).

Distribution: From Laurium, Greece, in slag. Along Baratti Beach, Tuscany, Italy, in slag. At the Margarita mine, Sierra Gorda district, southwest of Calama, Antofagasta, Chile.

Name: To honor Professor Samuel Lewis Penfield (1856–1906), American mineralogist and mineral chemist, Yale University, New Haven, Connecticut, USA.

Type Material: n.d.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 66–67. (2) Cesbron, F. and H.-J. Schubnel (1968) Nouvelles données sur la penfieldite. Bull. Soc. fr. Minéral., 91, 407–408 (in French). (3) Merlino, S., M. Pasero, N. Perchiazzi, and A. Gianfagna (1995) X-ray and electron diffraction study of penfieldite: average structure and multiple cells. Mineral. Mag., 59, 341–347.