Cylindrite $Pb_3Sn_4FeSb_2S_{14}$

Crystal Data: Triclinic. *Point Group:* $\overline{1}$. In concentric spherical or tubular shells and aggregates, up to 5 cm across and 2–3 cm in length, rarely terminated; also massive.

Physical Properties: *Cleavage:* {100}, excellent. *Tenacity:* Slightly malleable. Hardness = 2.5 VHN = 54–93 (100 g load). D(meas.) = 5.42–5.49 D(calc.) = 5.443

Optical Properties: Opaque. *Color:* In reflected light, galena-white. *Streak:* Black. *Luster:* Metallic. *Pleochroism:* Weak in air, stronger in oil. *Anisotropism:* Distinct, gray to pale yellowish or brownish gray.
R_1–R_2: (400) 34.5–40.3, (420) 34.3–40.1, (440) 34.1–40.1, (460) 33.6–39.8, (480) 33.1–39.4, (500) 32.5–38.9, (520) 31.8–38.3, (540) 31.2–37.8, (560) 30.7–37.2, (580) 30.3–36.7, (600) 29.9–36.3, (620) 29.6–35.9, (640) 29.3–35.5, (660) 28.9–35.1, (680) 28.6–34.7, (700) 28.4–34.4

Cell Data: *Space Group:* Two subcells are recognized, both $P\overline{1}$: the first (pseudotetragonal) has $a = 11.733(5)$ $b = 5.790(8)$ $c = 5.810(5)$ $\alpha = 90.00(0.20)°$ $\beta = 92.38(0.20)°$ $\gamma = 93.87(0.20)°$ Z = 2 and the second (pseudohexagonal) has $a = 11.709(5)$ $b = 3.670(8)$ $c = 6.320(5)$ $\alpha = 90.00(0.20)°$ $\beta = 92.58(0.20)°$ $\gamma = 90.85(0.20)°$ Z = 2

X-ray Powder Pattern: Poopó, Bolivia.
3.85 (100), 2.885 (100), 3.9 (90), 3.06 (65), 2.849 (65), 2.044 (65), 2.026 (65)

Chemistry:

	(1)	(2)	(3)	(4)
Pb	34.91	35.5	33.72	33.70
Sn	25.38	26.8	27.37	25.74
Fe	2.79	2.7	2.70	3.03
Ag	0.39	0.5		
Sb	12.64	12.0	11.68	13.20
S	23.86	23.3	24.68	24.33
Total	99.97	100.8	100.15	100.00

(1) Poopó, Bolivia; average of two analyses; corresponds to $Pb_{3.17}Sn_{4.02}Fe_{0.94}Ag_{0.07}Sb_{1.95}S_{14.00}$. (2) Do.; by electron microprobe; corresponds to $Pb_{3.30}Sn_{4.35}Fe_{0.93}Ag_{0.09}Sb_{1.90}S_{14.00}$. (3) Do.; by electron microprobe; corresponds to $Pb_{2.96}Sn_{4.19}Fe_{0.88}Sb_{1.75}S_{14.00}$. (4) $Pb_3Sn_4FeSb_2S_{14}$ [average from structure, not charge balanced; see ref. 3].

Occurrence: In tin-bearing hydrothermal veins.

Association: Franckeite, stannite, incaite, potosiite, teallite, jamesonite, boulangerite, cassiterite, galena, pyrite, sphalerite.

Distribution: In Bolivia, with fine examples from Poopó, in the Santa Cruz [TL] and Trinacria mines; at the Porvenir and Maria Francisca mines, Huanuni; from the Nueva Virginia vein, Colquechaca; and from the Purisima vein, all in Oruro; also from Llallagua, Potosí. In the Smirnovsk deposit, Transbaikalia, Russia.

Name: In allusion to its typical cylindrical habit.

Type Material: Mining Academy, Freiberg, Germany; The Natural History Museum, London, England, 84255.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 482–483. (2) Makovicky, E. (1974) Mineralogical data on cylindrite and incaite, Neues Jahrb. Mineral., Monatsh., 235–256. (3) Makovicky, E. (1976) Crystallography of cylindrite. Part I. Crystal lattices of cylindrite and incaite. Neues Jahrb. Mineral., Abh., 126, 304–326. (4) Wang, S. and P. Busek (1992) Cylindrite: the relation between its cylindrical shape and modulated structure. Amer. Mineral., 77, 758–764. (5) Ramdohr, P. (1969) The ore minerals and their intergrowths, (3rd edition), 739–740. ??ck?? (6) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 132.