

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Crystals, tabular on {010}; elongated along [100], to 6 cm, striated on {010}, may be warped or bent; typically, in spherical, rosette or cauliflowerlike aggregates of thin plates; commonly massive, radiated, or foliated. *Twinning:* Complex twinning with [010] as a twin axis.

Physical Properties: *Cleavage:* {010}, perfect. *Tenacity:* Flexible, inelastic; slightly malleable. Hardness = 2.5-3 VHN = n.d. D(meas.) = n.d. D(calc.) = 8.98

Optical Properties: Opaque. *Color:* Grayish black. *Streak:* Grayish black. *Luster:* Metallic. *Anisotropism:* Weak.

R₁-R₂: (400) 38.2-39.4, (420) 37.9-39.2, (440) 37.6-39.0, (460) 37.3-38.7, (480) 36.9-38.5, (500) 36.6-38.2, (520) 36.2-37.9, (540) 35.8-37.6, (560) 35.4-37.3, (580) 35.0-36.9, (600) 34.6-36.5, (620) 34.2-36.1, (640) 33.8-35.7, (660) 33.4-35.3, (680) 33.0-34.9, (700) 32.6-34.5

Cell Data: *Superspace Group:* $C\bar{1}$. Z = 2 Pseudo-hexagonal H layers (MS₂, M = Sn⁴⁺, Fe²⁺); a = 3.665(8) b = 6.2575(16) c = 17.419(5) $\alpha = 95.25(2)^\circ$ $\beta = 95.45(2)^\circ$ $\gamma = 89.97(2)^\circ$. Pseudotetragonal Q slabs (MS, M = Pb²⁺, Sn²⁺, Sb³⁺); a = 5.805(8) b = 5.856(16) c = 17.338(5).

X-ray Powder Pattern: Bolivia.

3.44 (100), 2.91 (100), 2.86 (100), 2.82 (100), 2.05 (75), 4.30 (50), 3.11 (50)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
Pb	50.57	46.23	50.14	Sn	12.34	17.05	13.06
Fe	2.48	2.69	2.60	Sb	10.51	11.56	12.45
Zn	1.22	0.57		S	21.04	21.12	21.49
Ag		0.97	0.77	rem.	0.71		
Cu			0.02	Total	98.87	100.19	100.53

(1) Chocaya, Bolivia. (2) Poopó, Bolivia. (3) San Jose, Bolivia; electron microprobe analysis; corresponds to Pb_{20.54}Ag_{0.60}Cu_{0.03}Sn_{9.34}Fe_{3.95}Sb_{8.68}S_{56.87}.

Mineral Group: Cyndrite-franckeite family.

Occurrence: In hydrothermal Ag-Sn deposits (Bolivia); in a limestone contact metamorphic deposit (Kalkar quarry, California, USA).

Association: Cyndrite, teallite, plagionite, zinkenite, cassiterite, wurtzite, pyrrotite, marcasite, arsenopyrite, galena, pyrite, sphalerite, siderite (Bolivia); cassiterite, galena, stannite, teallite, cyndrite (Russia).

Distribution: In Bolivia, from Chocaya [TL], Poopó, Oruro, Llallagua, Huanuni, Colquechaca, and Cerro Rico, Potosí. At the Pirquitas mine, Jujuy Province, Argentina. In the Thompson mine, Darwin district, Inyo Co., and the Kalkar quarry, Santa Cruz, Santa Cruz Co., California, USA. From near the headwaters of the east branch of the Coal River, Yukon Territory, Canada. At Vens Haut, Cantal, France. In the Sinantscha zinc deposit, Sichota-Alin, and from Smirnowsk, Transbaikalia, Russia. At the Changpo-Tongkeng tin deposit, Dachang district, Guangxi Autonomous Region, China. From the Hoei tin mine, Oita Prefecture, Japan. At the Renison Bell mine, Tasmania, and the Wallah Wallah mine, Rye Park, New South Wales, Australia.

Name: Honors the mining engineers Carl and Ernest *Francke*.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 448-450. (2) Moh, G. (1987) Mutual Pb²⁺/Sn²⁺ substitution in sulfosalts. *Mineral. Petrol.*, 36, 191-204. (3) Williams, T.B. and B.G. Hyde (1988) Electron microscopy of cyndrite and franckeite. *Phys. Chem. Minerals*, 15, 521-544. (4) Wang, S. and K.H. Kuo (1991) Crystal lattices and crystal chemistry of cyndrite and franckeite. *Acta Cryst.*, A47, 381-392. (5) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 175. (6) Makovicky, E., V. Petříček, M. Dušek, and D. Topa (2011) The crystal structure of franckeite, Pb_{21.7}Sn_{9.3}Fe_{4.0}Sb_{8.1}S_{56.9}. *Amer. Mineral.*, 96, 1686-1702.