Fencooperite $Ba_6Fe^{3+}_3Si_8O_{23}(CO_3)_2Cl_3 \cdot H_2O$

Crystal Data: Hexagonal. *Point Group*: 3*m*. As anhedral to platy grains, to 100 μm, that form aggregates to 2 mm.

Physical Properties: *Cleavage*: None. *Tenacity*: Brittle. *Fracture*: Uneven to subconchoidal. VHN = 269-367, 321 average (10 g load). Hardness = 4.5-5 D(meas.) = n.d. D(calc.) = 4.338 Nonfluorescent.

Optical Properties: Opaque except at thin edges. *Color*: Jet-black to gray-brown. *Streak*: Grayish black. *Luster*: Vitreous to adamantine. *Optical Class*: Uniaxial (-). ω = 1.723(4) ε = 1.711(2) *Pleochroism*: Very strong; *O* = blue black, *E* = light greenish gray. *Absorption*: *O* >> *E*.

Cell Data: *Space Group*: *P*3*m*1. *a* = 10.7409(5) *c* = 7.0955(4) Z = 1

X-ray Powder Pattern: Trumbull Peak, Mariposa County, California, USA.
3.892 (100), 2.820 (90), 2.685 (80), 3.148 (40), 2.208 (40), 2.136 (40), 1.705 (35)

Chemistry:

	(1)	(2)
BaO	50.51	50.31
Fe_2O_3	12.77	13.10
MnO	0.15	
Al_2O_3	1.35	
SiO_2	27.38	26.29
P_2O_5	0.16	
Cl	3.23	5.82
CO_2	[4.81]	4.81
H_2O	[0.98]	0.98
-O = Cl	0.73	1.31
Total	100.61	100.00

(1) Trumbull Peak, Mariposa County, California, USA; average electron microprobe analysis, H_2O and CO_2 calculated from structure; corresponds to $Ba_{5.89}(Fe^{3+}_{2.86}Mn^{2+}_{0.04})_{\Sigma=2.90}(Si_{8.14}Al_{0.47}P_{0.04})_{\Sigma=8.65}O_{23.18}(CO_3)_{1.95}(Cl_{1.63}O_{1.37})_{\Sigma=3.00} \cdot 0.97H_2O$. (2) $Ba_6Fe^{3+}_3Si_8O_{23}(CO_3)_2Cl_3 \cdot H_2O$.

Occurrence: In gillespite-rich zones in sanbornite-quartz lenses in low-grade metasedimentary rocks.

Association: Titantaramellite, anandite, kinoshitalite, celsian, alforsite, barite, diopside, pyrrhotite.

Distribution: At Trumbull Peak, near El Portal, Mariposa County and at the Esquire no. 7 claim, Fresno County, California, USA.

Name: Honors mineral collector Joseph Fenimore ("*Fen*") *Cooper*, Jr. (b. 1937), of Santa Cruz, California, USA, who helped collect the samples in which the new phase was identified.

Type Material: National Mineral Collection, Geological Survey of Canada, Ottawa, Ontario (NMCC 68089).

References: (1) Roberts, A.C., J.D. Grice, G.E. Dunning, and K.E. Venance (2001) Fencooperite, $Ba_6Fe^{3+}_3Si_8O_{23}(CO_3)_2Cl_3 \cdot H_2O$, a new mineral species from Trumbull Peak, Mariposa County, California. Can. Mineral., 39, 1059-1064. (2) Grice, J.D. (2001) The crystal structure of fencooperite: unique $[Fe^{3+}_3O_{13}]$ pinwheels cross-connected by $[Si_8O_{22}]$ islands. Can. Mineral., 39, 1065-1071. (3) (2002) Amer. Mineral., 87, 765-766 (abs. refs. 1 and 2).