

Footemineite**Ca₂Mn²⁺₅Be₄(PO₄)₆(OH)₄·6H₂O**

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Prismatic to bladed, rough to curved barrel-shaped crystals to ~1.5 mm. *Twinning:* Simple, by reflection, twin boundaries cross the length of crystals.

Physical Properties: *Cleavage:* Good on {011} and {100}. *Fracture:* n.d. *Tenacity:* Brittle. Hardness = 4.5-5 (by analogy to other group members) D(meas.) = n.d. D(calc.) = 2.873

Optical Properties: Transparent. *Color:* Yellow. *Streak:* White. *Luster:* Vitreous to slightly pearly. *Optical Class:* Biaxial (-). $\alpha = 1.620(2)$ $\beta = 1.627(2)$ $\gamma = 1.634(2)$ $2V(\text{meas.}) = 80^\circ$ $2V(\text{calc.}) = 89.6^\circ$ *Orientation:* $X \wedge b \approx 12^\circ$, $Y \wedge c \approx 15^\circ$, $Z \wedge a \approx 15^\circ$; elongation along [001]. *Dispersion:* $r > v$ or $r < v$, weak. *Pleochroism:* $Y =$ brownish yellow, $X = Z =$ yellow. *Absorption:* $Y > X = Z$.

Cell Data: *Space Group:* $P\bar{1}$. $a = 6.788(2)$ $b = 9.972(3)$ $c = 10.014(2)$ $\alpha = 73.84(2)^\circ$ $\beta = 85.34(2)^\circ$ $\gamma = 87.44(2)^\circ$ $Z = 1$

X-ray Powder Pattern: Foote Mine, Kings Mountain, Cleveland Co., North Carolina, USA. 5.998 (100), 9.575 (53), 3.192 (44), 2.803 (38), 2.650 (29), 4.848 (26), 3.003 (14)

Chemistry:	(1)	(2)	(1)	(2)
Li ₂ O	0.23		FeO	2.77
BeO	9.54	8.80	Fe ₂ O ₃	0.62
CaO	9.43	9.87	Al ₂ O ₃	0.14
SrO	0.23		P ₂ O ₅	36.58 37.46
BaO	0.24		SiO ₂	0.42
MgO	0.18		H ₂ O	13.1 12.68
MnO	26.16	31.19	Total	99.64 100.00

(1) Foote Mine, Kings Mountain, Cleveland Co., North Carolina, USA; average electron microprobe analysis supplemented by Mössbauer and ICP-OES spectroscopy, H₂O by TGA; corresponds to (Ca_{1.89}Sr_{0.03}Ba_{0.02}) $\Sigma=1.94$ (Mn²⁺_{0.90}□_{0.10}) $\Sigma=1.00$ (□_{0.78}Li_{0.17}Mg_{0.05}) $\Sigma=1.00$ (Mn²⁺_{3.25}Fe²⁺_{0.43}Fe³⁺_{0.09}Al_{0.03}) $\Sigma=3.80$ Be_{4.30}(P_{5.81}Si_{0.08}O₂₄)[(OH)_{3.64}(H₂O)_{0.36}] $\Sigma=4.00$ ·6.00H₂O. (2) Ca₂Mn²⁺₅Be₄(PO₄)₆(OH)₄·6H₂O.

Polymorphism & Series: Dimorphous with roscherite.

Mineral Group: Roscherite group.

Occurrence: On thin fractures crossing quartz-microcline-spodumene pegmatite.

Association: Albite, analcime, eosphorite, siderite/rhodochrosite, fairfieldite, fluorapatite, quartz, milarite, pyrite.

Distribution: From the Foote Lithium Co. mine (Foote mine), Kings Mountain, Cleveland Co., North Carolina, USA.

Name: For the *Foote mine*, source of the first samples.

Type Material: Geology Museum, Geosciences Institute, University of São Paulo, Brazil (DR601) and the Museu de Ciências Naturais Jobas "José Bonifácio de Andrada e Silva," Santos, SP, Brazil.

References: (1) Atencio, D., P.A. Matioli, J.B. Smith, N.V. Chukanov, J.M.V. Coutinho, R.K. Rastsvetaeva, and S. Möckel (2008) Footemineite, the Mn-analog of atencioite, from the Foote mine, Kings Mountain, Cleveland County, North Carolina, U.S.A., and its relationship with other roscherite-group minerals. *Amer. Mineral.*, 93, 1-6. (2) Rastsvetaeva, R.K., N.V. Chukanov, I.A. Verin, and D. Atencio (2007) The crystal structure of footemineite. *Dokl. Akad. Nauk*, 416(1), 103-106 (in Russian); *Dokl. Earth Sci.*, 416, 1053-1056 (in English). (3) (2009) *Amer. Mineral.*, 94(2-3), 406 (abs. ref. 2).