Ferraioloite  \( \text{MgMn}^{2+}\text{(Fe}^{2+}0.5\text{Al}^{3+}0.5)\text{Zn}_4\text{(PO}_4\text{)}_8\text{(OH)}_4\text{(H}_2\text{O})_{20} \)

Crystal Data: Monoclinic.  Point Group: 2/m.  As plates or blades to 0.2 mm, in books or rosettes to 0.4 mm. Crystals display {010}, {100} and {011} and may have curved faces.

Physical Properties:  Cleavage: Perfect on {100}.  Fracture: Irregular.  Tenacity: Flexible.  Hardness = \( \sim 2 \)  \( \text{D(meas.) = n.d.} \)  \( \text{D(calc.) = 2.59} \)

Optical Properties:  Transparent.  Color: Greenish gray to lemon-yellow.  Streak: n.d.  Luster: Vitreous.  Optical Class: Biaxial (-).  \( \alpha = 1.575\text{(calc.)} \)  \( \beta = 1.5825\text{(5)} \)  \( \gamma = 1.5835\text{(5)} \)  \( 2\text{V(meas.) = 40(5)^\circ} \)  Dispersion: Weak, \( r > v \).  Orientation: \( X = a, Y = b, Z = c \).  Absorption: \( Y >> X \approx Z \).

Pleochroism: \( X = \text{colorless}, Y = \text{blue-gray} \).

Cell Data:  Space Group: \( I2/m \).  \( a = 25.333\text{(3)} \)  \( b = 6.299\text{(1)} \)  \( c = 15.161\text{(3)} \)  \( \beta = 90.93\text{(3)^\circ} \)  \( Z = 2 \)

X-ray Powder Pattern:  Foote mine, Kings Mountain district, North Carolina, USA.  2.6648 (100), 2.924 (8), 3.245 (7), 3.499 (5), 2.869 (5), 4.78 (4), 4.22 (4)

Chemistry: (1)  \( \text{CaO} \) 0.65  \( \text{MgO} \) 1.09  \( \text{MnO} \) 16.05  \( \text{ZnO} \) 18.90  \( \text{FeO} \) 8.02  \( \text{Al}_2\text{O}_3 \) 5.58  \( \text{P}_2\text{O}_5 \) 30.90  \( \text{H}_2\text{O} \) [21.30] 102.49 (100.00)  

(1) Foote mine, Kings Mountain district, North Carolina, USA; average of 10 electron microprobe analyses, \( \text{H}_2\text{O} \) calculated; corresponds to \( \text{Ca}_{0.21}\text{Mg}_{0.50}\text{Mn}^{2+}_{4.16}\text{Fe}^{2+}_{2.05}\text{Al}^{3+}_{2.01}\text{Zn}_{4.27}\text{P}_{8.00}\text{H}_{43.59}\text{O}_{56} \).

(2) \( \text{MgMn}^{2+}_{4}\text{(Fe}^{2+}_{0.5}\text{Al}^{3+}_{0.5})_{\text{Zn}_4\text{(PO}_4\text{)}_8\text{(OH)}_4\text{(H}_2\text{O})_{20}} \).

Occurrence: A secondary phase in sugary pegmatite.

Association: Vivianite, fairfieldite/messelite, phosphophyllite, scholzite/parascholzite, rittmannite, mangangordonite, kingsmountite, kastningite, metaswitzerite.

Distribution: At the Foote Lithium Company mine, Kings Mountain district, Cleveland County, North Carolina, USA.


Type Material: Museum Victoria, Melbourne, Australia (M53492 and M53493) and the Natural History Museum of Los Angeles County, Los Angeles, California, USA (65593 and 65594).

References: (1) Mills, S.J., I.E. Grey, A.R. Kampf, C.M. Macrae, J.B. Smith, C.J. Davidson, and A.M. Glenn (2016) Ferraioloite, \( \text{MgMn}^{2+}\text{(Fe}^{2+}0.5\text{Al}^{3+}0.5)\text{Zn}_4\text{(PO}_4\text{)}_8\text{(OH)}_4\text{(H}_2\text{O})_{20} \), a new secondary phosphate mineral from the Foote mine, USA. Eur. J. Mineral., 28(3), 655-661.  (2) (2016) Amer. Mineral., 101, 2779 (abs. ref. 1).