Ferraioloite \(\text{MgMn}^{2+}_4(\text{Fe}^{2+\theta.5}\text{Al}^{3+\theta.5})_4\text{Zn}_4(\text{PO}_4)_8(\text{OH})_4(\text{H}_2\text{O})_{20}\)

Crystal Data: Monoclinic. \textbf{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: \textit{Cleavage:} Perfect on \{100\}. \textit{Fracture:} Irregular. \textit{Tenacity:} Flexible.
Hardness = \(~2\) \ \textbf{D(meas.)} = n.d. \ \textbf{D(calc.)} = 2.59

\textit{Luster:} Vitreous.
\textit{Optical Class:} Biaxial (-). \textit{\(\alpha = 1.575\)(calc.)} \ \textit{\(\beta = 1.5825(5)\)} \ \textit{\(\gamma = 1.5835(5)\)} \ \textit{2V(meas.)} = 40(5)\(^\circ\)
\textit{Dispersion:} Weak, \(r > v\). \textit{Orientation:} \(X = a\), \(Y = b\), \(Z = c\).
\textit{Absorption:} \(Y >> X \approx Z\).
\textit{Pleochroism:} \(X\), \(Z\) = colorless, \(Y\) = blue-gray.

Cell Data: \textit{Space Group:} \(I2/m\). \(a = 25.333(3)\) \(b = 6.299(1)\) \(c = 15.161(3)\) \ \textit{\(\beta = 90.93(3)\)°} \ \textit{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:

\begin{tabular}{lcc}

\textbf{Chemistry:} & (1) & (2) \\
\hline
\text{CaO} & 0.65 & \\
\text{MgO} & 1.09 & 2.17 \\
\text{MnO} & 16.05 & 15.26 \\
\text{ZnO} & 18.90 & 17.52 \\
\text{FeO} & 8.02 & 7.73 \\
\text{Al}_2\text{O}_3 & 5.58 & 5.48 \\
\text{P}_2\text{O}_5 & 30.90 & 30.54 \\
\text{H}_2\text{O} & [21.30] & 21.30 \\
\hline
\text{Total} & 102.49 & 100.00 \\
\end{tabular}

(1) Foote mine, Kings Mountain district, North Carolina, USA; average of 10 electron microprobe analyses, \(\text{H}_2\text{O}\) calculated; corresponds to \(\text{Ca}_{0.31}\text{Mg}_{0.50}\text{Mn}^{2+}_{4.16}\text{Fe}^{2+\theta.5}\text{Al}^{3+\theta.5})_4\text{Zn}_4(\text{PO}_4)_8(\text{OH})_4(\text{H}_2\text{O})_{20}\).

(2) \(\text{MgMn}^{2+}_4(\text{Fe}^{2+\theta.5}\text{Al}^{3+\theta.5})_4\text{Zn}_4(\text{PO}_4)_8(\text{OH})_4(\text{H}_2\text{O})_{20}\).

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, \(\text{MgMn}^{2+}_4(\text{Fe}^{2+\theta.5}\text{Al}^{3+\theta.5})_4\text{Zn}_4(\text{PO}_4)_8(\text{OH})_4(\text{H}_2\text{O})_{20}\), a new secondary phosphate mineral from the Foote mine, USA. \textit{Eur. J. Mineral.}, 28(3), 655-661. (2) (2016) Amer. Mineral., 101, 2779 (abs. ref. 1).