Ferrowyllieite \((\text{Na}, \text{Ca}, \text{Mn}^{2+})_2(\text{Fe}^{2+}, \text{Mn}^{2+})(\text{Fe}^{2+}, \text{Fe}^{3+}, \text{Mg})\text{Al(PO}_4\text{)}_3\)

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Crystal Data: Monoclinic. \textit{Point Group}: 2/m. Crude euhedral crystals, to 10 cm, in interlocking aggregates; rimming arrojadite.

Physical Properties: \textit{Cleavage}: On \{010\}, perfect; on \{010\}, distinct. \textit{Tenacity}: Very brittle. Hardness = > 4 \textit{D(meas.)} = 3.601(3) \textit{D(calc.)} = 3.60


\textit{Optical Class}: Biaxial (+). \textit{Pleochroism}: Observable in thick plates; \(X\) = smoky bluish gray; \(Y\) = smoky bluish green; \(Z\) = green. \textit{Dispersion}: \(r < v\), strong. \textit{Absorption}: \(Z > Y \approx X\). \(\alpha = 1.688(2)\) \hspace{0.2cm} \(\beta = 1.691(2)\) \hspace{0.2cm} \(\gamma = 1.696(2)\) \hspace{0.2cm} \(2V(meas.) = \sim 50^\circ\)

Cell Data: \textit{Space Group}: \(P2_1/n\). \(a = 11.868(15)\) \hspace{0.2cm} \(b = 12.382(12)\) \hspace{0.2cm} \(c = 6.354(9)\)

\(\beta = 114.52(8)^\circ\) \hspace{0.2cm} \(Z = 4\)


Chemistry:

\[
\begin{array}{cccc}
\text{P}_2\text{O}_5 & 43.8 & 44.6 & \text{MgO} & 1.97 & 4.8 \\
\text{SiO}_2 & 0.8 & 0.1 & \text{CaO} & 2.5 & 0.95 \\
\text{Al}_2\text{O}_3 & 7.9 & 7.1 & \text{Li}_2\text{O} & 0.01 & 0.01 \\
\text{Fe}_2\text{O}_3 & 0.33 & 4.8 & \text{Na}_2\text{O} & 8.0 & 7.1 \\
\text{FeO} & 29.2 & 20.2 & \text{K}_2\text{O} & 0.05 & 0.00 \\
\text{MnO} & 4.3 & 9.6 & \text{H}_2\text{O}^{+} & 0.70 & 0.60 \\
\text{ZnO} & 0.04 & 0.08 & \text{Total} & 99.6 & 99.94
\end{array}
\]

(1) Victory mine, South Dakota, USA; \(\text{H}_2\text{O}\) by calorimetry, corresponds to \((\text{Na}_{1.25}\text{Mn}_{0.30}^{2+}\text{Ca}_{0.22}\text{Fe}_{0.01}^{2+})\Sigma=1.78\text{Fe}^{2+}\Sigma=1.00(\text{Fe}_{0.96}\text{Li}_{0.03}\text{Mg}_{0.01})\Sigma=1.00(\text{Al}_{0.77}\text{Mg}_{0.23}\text{Fe}_{0.02}^{3+})\Sigma=1.00(\text{PO}_4)^{3-}\). (2) G.E. Smith mine, New Hampshire, USA; corresponds to \((\text{Na}_{1.07}\text{Mn}_{0.43}^{2+}\text{Ca}_{0.08})\Sigma=1.58(\text{Fe}_{0.84}\text{Mn}_{0.16})\Sigma=1.00(\text{Fe}_{0.48}\text{Mg}_{0.48}\text{Li}_{0.03})\Sigma=0.99(\text{Al}_{0.63}\text{Fe}_{0.28}\text{Mg}_{0.07})\Sigma=1.00(\text{PO}_4)^{3-}\).

Polymorphism & Series: Forms two series, with wyllieite, and with rosemaryite; \(\text{Fe}^{2+} > \text{Mn}^{2+}\) in \text{M}(1); \(\text{Fe}^{2+}\) dominant in \text{M}(2a).

Occurrence: A primary phosphate in zoned granite pegmatites.

Association: Arrojadite, muscovite, schorl, plagioclase, quartz (Victory mine, South Dakota, USA).

Distribution: In the USA, from the Victory mine, four km northeast of Custer, Custer Co., South Dakota, and at the G.E. Smith mine, Newport, Sullivan Co., New Hampshire.

Name: As a mineral with dominant \textit{ferrous} iron, and its relation to \textit{wyllieite}.
