Anthophyllite \( (Mg, Fe^{2+})_2(Mg, Fe^{2+})_5Si_8O_{22}(OH)_2 \)

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Crystal Data: Orthorhombic. Point Group: \( 2/m \ 2/m \ 2/m \). Crystals rare, to 25 cm; as bladed aggregates of unterminated prismatic crystals. Commonly lamellar or fibrous, asbestiform.

Physical Properties: Cleavage: Perfect on \( \{210\} \), intersecting at \( 54.5^\circ \) and \( 125.5^\circ \); distinct on \( \{010\} \) and \( \{100\} \). Tenacity: Brittle; fibers are elastic. Hardness = 5.5–6 D(meas.) = \( \sim 2.9–3.5 \) D(calc.) = 3.09

Optical Properties: Transparent to translucent. Color: Gray, brownish gray, yellowish brown, clove-brown, brownish green, emerald-green; in thin section, colorless to pale green or yellow. Streak: White or grayish. Luster: Vitreous, pearly on cleavage. Optical Class: Biaxial (+) or (−). Pleochroism: When Fe-rich, moderate; \( X \) = clove-brown, yellowish brown, grayish brown; \( Y \) = close-brown, brown-gray, brownish; \( Z \) = close-brown to dark brown, grayish blue to green, lilac. Orientation: \( X = a \); \( Y = b \); \( Z = c \). Dispersion: \( r > v \) or \( r < v \), weak to moderate. Absorption: \( Z > Y = X \) or \( Z = Y > X \). \( \alpha = 1.603–1.679 \) \( \beta = 1.617–1.685 \) \( \gamma = 1.627–1.690 \) \( 2V(\text{meas.}) = \sim 80^\circ \)

Cell Data: Space Group: \( Pnma \). \( a = 18.544(2) \) \( b = 18.026(2) \) \( c = 5.282(1) \) \( Z = 4 \)

X-ray Powder Pattern: Georgia, USA. 3.05 \( 100 \), 3.24 \( 60 \), 8.26 \( 55 \), 2.84 \( 40 \), 2.54 \( 40 \), 3.65 \( 35 \), 8.9 \( 30 \)

Chemistry:

\[ \begin{array}{llll}
\text{SiO}_2 & 58.08 & \text{FeO} & 10.18 \\
\text{TiO}_2 & 0.04 & \text{MnO} & 0.20 \\
\text{Al}_2\text{O}_3 & 0.30 & \text{MgO} & 27.99 \\
\text{Fe}_2\text{O}_3 & 0.65 & \text{CaO} & 0.17 \\
\end{array} \]

Total [99.87]

(1) Ochsenkogel, Gleinalpe, Austria; by electron microprobe, \( \text{Fe}^{2+}:\text{Fe}^{3+} \) by wet chemical analysis, \( \text{H}_2\text{O} \) calculated from stoichiometry; corresponding to \( (\text{Mg}_{5.71}\text{Fe}^{2+}_{1.17}\text{Fe}^{3+}_{0.07}\text{Ca}_{0.02}\text{Mn}_{0.02}\text{Na}_{0.01})\Sigma_{z=7.00} \text{Si}_{7.95}\text{A}_{0.05}\Sigma_{z=8.96}\text{O}_{22}(\text{OH})_{2.00} \).

Polymorphism & Series: Forms a series with magnesio-anthophyllite and ferro-anthophyllite.

Mineral Group: Amphibole (Fe–Mn–Mg) group: 0.1 \( \text{Mg}/(\text{Mg} + \text{Fe}^{2+}) \) 0.89; (Ca + Na) \( B < 1.34; \text{Li} < 1.0; \text{Si} \geq 7.0 \).

Occurrence: From medium- or high-grade metamorphism, in amphibolites, gneisses, metaquartzites, iron formations, granulites, and schists derived from argillaceous sediments, ultramafic, or mafic igneous rocks; a retrograde reaction product.

Association: Cordierite, talc, chlorite, sillimanite, mica, olivine, “hornblende,” gedrite, magnesio-cummingtonite, garnet, staurolite, plagioclase.

Distribution: From Kongsberg and Snarum, Norway. At Schneeberg, Saxony, Germany. From Norberg, Sweden; at Hermanow, Czech Republic. In Greenland, from Fiskenaeset. In the USA, from Chesterfield, Hampshire Co., Massachusetts; the Carleton talc mine, near Chester, Windsor Co., Vermont; near Media, Delaware Co., Pennsylvania; the Day Brook deposit, near Spruce Pine, Mitchell Co., North Carolina; in California, at the Winchester quarry, Riverside Co., and near Coffee Creek, Carrville, Trinity Co.; in the Copper Queen mine, Prairie Divide, Park Co., Colorado. From Munglinup, Western Australia.

Name: From the Latin anthophyllum, meaning clove, in allusion to the mineral’s color.