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

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° and 125.5°; distinct on {010} and {100}. *Tenacity:* Brittle; fibers are elastic. Hardness = 5.5–6 D(meas.) = ∼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 = clove-brown, brown-gray, brownish; Z = clove-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 $Z = Y > X$. α = 1.603–1.679 β = 1.617–1.685 γ = 1.627–1.690 2V(meas.) = ∼80°

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:

	(1)		(1)		(1)
SiO_2	58.08	FeO	10.18	Na_2O	0.05
TiO_2	0.04	MnO	0.20	K_2O	0.01
Al_2O_3	0.30	MgO	27.99	H_2O	[2.20]
Fe_2O_3	0.65	CaO	0.17	Total	[99.87]

(1) Ochsenkogel, Gleinalpe, Austria; by electron microprobe, Fe^{2+}:Fe^{3+} by wet chemical analysis, H_2O calculated from stoichiometry; corresponding to $(Mg_{5.71}Fe^{2+}_{1.17}Fe^{3+}_{0.07}Ca_{0.02}Mn_{0.02}Na_{0.01})_{\Sigma=7.00}(Si_{7.95}Al_{0.05})_{\Sigma=8.00}O_{22}(OH)_{2.00}$.

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

Mineral Group: Amphibole (Fe–Mn–Mg) group: 0.1 $Mg/(Mg + Fe^{2+})$ 0.89; $(Ca + Na)_B < 1.34$; Li < 1.0; Si ≥ 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 Heřmanov, Czech Republic. In Greenland, from Fiskenæsset. In the USA, from Chesterfield, Hampshire Co., Massachusetts; the Carleton talc mine, near Chester, Windsor Co., Vermont; near Media, Delaware Co., Pennsylvania; the Day Book 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.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 384–385. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 2, chain silicates, 211–229. (3) Rabbitt, J.C. (1948) A new study of the anthophyllite series. Amer. Mineral., 33, 263–323. (4) Beatty, S. (1950) X-ray diffraction patterns of asbestos. Amer. Mineral., 35, 579–589. (5) Walitzi, E.M., F. Walter, and K. Ettinger (1989) Verfeinerung der Kristallstruktur von Anthophyllit vom Ochsenkogel/Gleinalpe, Österreich. Zeits. Krist., 188, 237–244 (in German). (6) Phillips, W.R. and D.T. Griffen (1981) Optical mineralogy, 223–225.