

Chestermanite

Mg₂(Fe³⁺, Mg, Al, Sb⁵⁺)O₂BO₃

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Crystal Data: Orthorhombic. *Point Group:* 2/m 2/m 2/m. Typically fibrous to asbestiform on [001], curved along {001} and flattened on {010}, to 2 mm. Crystals ubiquitously striated || [011] and diamond-shaped in cross section. Of the nine forms noted, {110}, {210}, and {010} dominate.

Physical Properties: *Fracture:* Uneven to conchoidal, produced more easily ⊥ to length. *Tenacity:* Brittle, tougher than ludwigite. Hardness = 6 D(meas.) = 3.72(2) D(calc.) = 3.650

Optical Properties: Semitransparent. *Color:* Grayish green to black; surface (diffraction grating) iridescence is typical. *Streak:* Pale grayish green. *Luster:* Vitreous to silky. *Optical Class:* Biaxial (+). *Pleochroism:* X = dark greenish blue; Y = green; Z = pale yellowish brown. *Absorption:* X ≫ Y > Z. α = 1.753–1.759 β = 1.763–1.767 γ = 1.791–1.797 2V(meas.) = n.d. 2V(calc.) = 63°

Cell Data: *Space Group:* Pbam. a = 18.525(4) b = 12.272(2) c = 3.0218(4) Z = 8

X-ray Powder Pattern: Twin Lakes region, California, USA; shows strong preferred {hk0} orientation.

5.114 (100), 2.559 (91), 2.169 (57), 2.746 (34), 1.9975 (32), 2.475 (19), 1.5300 (19)

Chemistry:

	(1)		(1)
Sb ₂ O ₅	10.3	MgO	48.0
TiO ₂	0.8	CaO	0.1
B ₂ O ₃	[18.22]	F	0.1
Al ₂ O ₃	5.3	—O = F ₂	0.04
Fe ₂ O ₃	16.0	Total	98.88
MnO	0.1		

(1) Twin Lakes region, California, USA; by electron microprobe, average of eight analyses, total Fe as Fe₂O₃, confirmed by Mössbauer spectroscopy, B₂O₃ calculated for stoichiometry; corresponds to Mg₂(Fe_{0.38}³⁺Mg_{0.28}Al_{0.20}Sb_{0.12}⁵⁺Ti_{0.02})_{Σ=1.00}O₂B(O_{2.99}F_{0.01})_{Σ=3.00}. (2) Do.; from crystal-structure analysis, corresponds to Mg_{2.00}(Fe_{0.43}³⁺Al_{0.16}Mg_{0.25}Sb_{0.13}Ti_{0.02})_{Σ=0.99}O₂BO₃.

Mineral Group: Ludwigite group.

Occurrence: Rare, in veins and disseminated in a brucite marble lens contained in a multiply metamorphosed roof pendant between two plutons in a granodiorite batholith.

Association: Magnesian–aluminian ludwigite, magnesian calcite, fluoborite, wightmanite, spinel, brucite, safflorite, löllingite.

Distribution: From the north side of Kaiser Crest, about five km north of the easternmost end of Huntington Lake, Twin Lakes region, Fresno Co., California, USA.

Name: Honors Charles Wesley Chesterman (1913–1991), geologist and mineralogist, California Division of Mines and Geology, San Francisco, USA, who discovered the first specimens.

Type Material: National Museum of Natural History, Washington, D.C., USA, 160270, 165968.

References: (1) Erd, R.C. and E.E. Foord (1988) Chestermanite, a new member of the ludwigite–pinakiolite group from Fresno County, California. *Can. Mineral.*, 26, 911–916. (2) (1990) *Amer. Mineral.*, 75, 431 (abs. ref. 1). (3) Alfredsson, V., J.-O. Bovin, R. Norrestam, and O. Terasaki (1991) The structure of the mineral chestermanite, Mg_{2.25}Al_{0.16}Fe_{0.43}Ti_{0.02}Sb_{0.13}O₂BO₃. A combined single crystal X-ray and HREM study. *Acta Chem. Scand.*, 45, 797–804. (4) Cooper, M.A. and F.C. Hawthorne (1998) The crystal structure of blatterite, Sb₃⁵⁺(Mn³⁺, Fe³⁺)₉(Mn²⁺, Mg)₃₅(BO₃)₁₆O₃₂, and structural hierarchy in Mn³⁺–bearing zigzag borates. *Can. Mineral.*, 36, 1171–1193, esp. 1191.

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