Colemanite $Ca_2B_6O_{11}\cdot 5H_2O$

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Crystal Data: Monoclinic. *Point Group:* $2/m$. As equant to short prismatic crystals, with large {110} and multiple terminating forms, to 30 cm; pseudorhombohedral with large {110} and $\{\overline{3}01\}$; pseudo-octahedral with large $\{\overline{2}21\}$ and {011}; nearly 50 forms measured; cleavable massive, granular, most commonly nodular.

Physical Properties: *Cleavage:* On {010}, perfect; on {001}, distinct. *Fracture:* Uneven to subconchoidal. Hardness = 4.5 D(meas.) = 2.423(5) D(calc.) = 2.42 Bright pale yellow fluorescence, may phosphoresce pale green; pyroelectric and piezoelectric at very low temperature.

Optical Properties: Transparent to translucent. *Color:* Colorless, milky white, pale yellow, gray; colorless in transmitted light. *Luster:* Vitreous to adamantine.
Optical Class: Biaxial (+). *Orientation:* $X = b$; $Y \wedge c = -6°$; $Z \wedge c = 84°$. *Dispersion:* $r > v$, weak. $\alpha = 1.586$ $\beta = 1.592$ $\gamma = 1.614$ 2V(meas.) = 56°

Cell Data: *Space Group:* $P2_1/a$. $a = 8.712(2)$ $b = 11.247(3)$ $c = 6.091(1)$ $\beta = 110.12(2)°$ Z = 2

X-ray Powder Pattern: Twenty Mule Team Canyon, Death Valley, California, USA.
3.13 (100), 5.64 (50), 3.85 (50), 2.550 (50), 2.010 (50), 4.00 (36), 3.29 (36)

Chemistry:

	(1)	(2)
B_2O_3	50.70	50.81
MgO	0.10	
CaO	27.31	27.28
H_2O	21.87	21.91
Total	99.98	100.00

(1) Death Valley, California, USA. (2) $Ca_2B_6O_{11}\cdot 5H_2O$.

Occurrence: A common constituent in borate deposits formed in arid alkaline lacustrine environments, deficient in sodium and carbonate, typically under warm conditions.

Association: Howlite, ulexite, searlesite, priceite, nobleite, ginorite, gowerite, lüneburgite, kernite, gypsum, calcite, celestine.

Distribution: An important component of sedimentary borate deposits worldwide. In the USA, in California, from Death Valley, near Ryan, Furnace Creek district, in the Thompson mine and the Boraxo mine, fine crystals; at Borate, about 10 km northeast of Yermo, Calico Hills, San Bernardino Co.; from Boron, Kern Co.; at the Anniversary mine, Muddy Mountains district, Clark Co., Nevada. From the Penobsquis and Salt Springs evaporite deposits, near Sussex, New Brunswick, Canada. Large deposits at El Torreon and La Tinaja del Oso, near Magdalena, Sonora, Mexico. In Argentina, on the Salinas Grandes Playa, and at the Loma Blanca deposit, eight km southwest of Coranzulí, Jujuy Province; from the Sijes district, Salta Province. In the Inder borate deposit, Kazakhstan. Near Bela Stena, Jarandol Basin, Serbia, Yugoslavia. From a lake on West Samos Island, Greece. Extensive deposits with about one billion tons reserves in Turkey, as in the Bigadiç borate district, Balıkesir Province, large crystals; from the Kestelek borax deposit, Eskiçehir Province; at the Emet borate deposits, Kütahya Province; large crystals from Mustafakemalpasa, Bursa Province.

Name: Honors William Tell Coleman (1824–1893), pioneer developer of the borax industry in California, USA.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 349–353. (2) Burns, P.C. and F.C. Hawthorne (1993) Hydrogen bonding in colemanite: an X-ray and structure-energy study. Can. Mineral., 31, 297–304. (3) Christ, C.L. (1953) Studies of borate minerals: 1 – X-ray crystallography of colemanite. Amer. Mineral., 38, 411–415.

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