

# Hilgardite

# Ca<sub>2</sub>B<sub>5</sub>O<sub>9</sub>Cl•H<sub>2</sub>O

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**Crystal Data:** Monoclinic or triclinic. *Point Group:* *m* or 1. Distorted triangular crystals are tabular on {010} and hemimorphic, to 2 cm, with 18 forms described.

**Physical Properties:** *Cleavage:* On {010}, perfect; on {100}, good. *Fracture:* Conchoidal. Hardness = 5 D(meas.) = 2.67–2.71 D(calc.) = 2.688–2.694 Piezoelectric.

**Optical Properties:** Transparent to translucent. *Color:* Colorless, slightly reddish brown; colorless in transmitted light. *Streak:* White. *Luster:* Vitreous.

*Optical Class:* Biaxial (+). *Orientation:*  $Y = b$ ;  $Z \wedge c = 1.5^\circ$ . *Dispersion:*  $r > v$ , moderate.  $\alpha = 1.623\text{--}1.630$   $\beta = 1.628\text{--}1.636$   $\gamma = 1.656\text{--}1.664$   $2V(\text{meas.}) = 34(2)^\circ$

**Cell Data:** *Space Group:* *Aa* (4M polytype), with  $a = 11.438(2)$   $b = 11.318(2)$   $c = 6.318(1)$   $\beta = 90.06(1)^\circ$   $Z = 4$ , or *Space Group:* *P1* (1A polytype), with  $a = 6.452(1)$   $b = 6.559(1)$   $c = 6.286(1)$   $\alpha = 61.60(1)^\circ$   $\beta = 118.72(1)^\circ$   $\gamma = 105.86(1)^\circ$   $Z = 1$

**X-ray Powder Pattern:** Choctaw salt dome, Louisiana, USA (4M polytype). 2.859 (100), 2.839 (100), 2.113 (80), 2.109 (80), 2.096 (80b), 1.985 (80), 2.755 (60)

**X-ray Powder Pattern:** Choctaw salt dome, Louisiana, USA (1A polytype). 2.87 (100), 2.83 (100), 2.755 (80), 2.12 (80), 2.033 (80), 5.7 (60), 3.14 (60)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
B <sub>2</sub> O <sub>3</sub>	50.22	[52.1]	52.48	Cl	10.59	10.2	10.69
CaO	35.14	31.3	33.81	H <sub>2</sub> O	6.44	[5.4]	5.43
SrO		1.5		–O = Cl <sub>2</sub>	2.39	2.3	2.41
Total					[100.00]	[98.2]	100.00

(1) Choctaw salt dome, Louisiana, USA; recalculated to 100% after removal of insoluble 1.89%; corresponds to Ca<sub>2.02</sub>B<sub>4.65</sub>O<sub>9</sub>Cl<sub>0.98</sub>•1.15H<sub>2</sub>O. (2) New Brunswick, Canada; by electron microprobe, B and H<sub>2</sub>O calculated for stoichiometry. (3) Ca<sub>2</sub>B<sub>5</sub>O<sub>9</sub>Cl•H<sub>2</sub>O.

**Polymorphism & Series:** 4M, 1Tc, 3Tc, and 1A polytypes are known.

**Occurrence:** In marine evaporite deposits.

**Association:** Boracite, anhydrite, danburite, dolomite, magnesite, pyrite, hauerite, calcite, quartz, sulfur, gypsum (Choctaw salt dome, Louisiana, USA); boracite, szaibélyite (New Brunswick, Canada).

**Distribution:** In the USA, from the Choctaw salt dome, Iberville Parish, Louisiana, and in Wayne Co., Mississippi; in the Louann Salt Formation, Clarke Co., Alabama. From the Penobsquis and Salt Springs evaporite deposits, near Sussex, New Brunswick, Canada. At the Königshall-Hindenburg potash mine, Reyershausen, near Göttingen, Lower Saxony, Germany. In the Boulby potash mine, northwest of Whitby, Yorkshire, England. In the Chelkar salt dome, Ak-sai Valley, Uralsk district, Kazakhstan. From the Ilga Basin, eastern Siberia, Russia. In the Sedom Formation, on Mount Sedom, Dead Sea, Israel.

**Name:** Honors Eugene Woldemar Hilgard (1833–1916), German–American geologist, one of the first to study the Louisiana salt diapir deposits.

**Type Material:** Harvard University, Cambridge, Massachusetts, 100899, 100947, 106583; National Museum of Natural History, Washington, D.C., USA, R7822.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 382–384. (2) Ghose, S. (1985) A new nomenclature for the borate minerals in the hilgardite (Ca<sub>2</sub>B<sub>5</sub>O<sub>9</sub>Cl•H<sub>2</sub>O)–tyretskite (Ca<sub>2</sub>B<sub>5</sub>O<sub>9</sub>OH•H<sub>2</sub>O) group. *Amer. Mineral.*, 70, 636–637. (3) Rachlin, A.L., J.A. Mandarino, B.L. Murowchick, R.A. Ramik, P.J. Dunn, and M.E. Back (1986) Mineralogy of hilgardite-4M from evaporites in New Brunswick. *Can. Mineral.*, 24, 689–693. (4) Burns, P.C. and F.C. Hawthorne (1994) Refinement of the structure of hilgardite-1A. *Acta Cryst.*, C50, 653–655. (5) Braitsch, O. (1959) 1Tc-Strontiohilgardite [= strontian hilgardite-1Tc], (Ca, Sr)<sub>2</sub>[B<sub>5</sub>O<sub>8</sub>(OH)<sub>2</sub>Cl] und seine Stellung in der Hilgarditgruppe, X<sub>2</sub>[B<sub>5</sub>O<sub>8</sub>(OH)<sub>2</sub>Cl]. *Beiträge Mineral. u. Petrog.*, 6, 233–247.

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