

Hydrochlorborite

Ca₂B₄O₄Cl(OH)₇•7H₂O

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Crystal Data: Monoclinic. *Point Group:* 2/m. As well-formed tabular {001} crystals, with wedgelike terminations, to 13 mm; {001}, {110}, { $\bar{2}11$ } define the typical habit, with four other forms reported; in dense masses.

Physical Properties: *Cleavage:* On {001}, good. *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 2.5 D(meas.) = 1.83–1.85 D(calc.) = 1.841 Soluble in H₂O.

Optical Properties: Transparent. *Color:* Colorless. *Luster:* Vitreous to dull. *Optical Class:* Biaxial (+). *Orientation:* Y = b; X ∧ c = 25°. *Dispersion:* r < v. α = 1.499–1.501 β = 1.502–1.504 γ = 1.520–1.521 2V(meas.) = 45°–45.8°

Cell Data: *Space Group:* I2/a. a = 22.783(3) b = 8.745(1) c = 17.066(1) β = 96.705(1)° Z = 8

X-ray Powder Pattern: Salar Carcote, Chile. 8.48 (100), 6.01 (24), 3.604 (9), 2.798 (8), 2.825 (7), 2.186 (7), 8.18 (6)

Chemistry:	(1)	(2)	(3)
SO ₃	trace		
B ₂ O ₅	29.50	29.2	29.75
FeO		0.04	
MgO	0.00	0.01	
CaO	23.31	24.0	23.96
Na ₂ O	trace		
K ₂ O	0.00		
Cl	7.62	7.2	7.58
H ₂ O	41.91	41.5	40.42
–O = Cl ₂	1.72	1.62	1.71
Total	100.62	100.33	100.00

(1) China; corresponds to Ca_{1.94}B_{3.94}O₄Cl(OH)₇•7.8H₂O. (2) Salar Carote, Chile; corresponds to Ca_{2.04}B_{4.00}O₄Cl_{0.97}(OH)₇•7.5H₂O. (3) Ca₂B₄O₄Cl(OH)₇•7H₂O established by crystal-structure analysis.

Occurrence: A rare dry-season evaporite mineral in playa sediment (Salar Carcote, Chile).

Association: Ulexite, halite, gypsum (China).

Distribution: From China, at an unspecified locality [the Qinghai-Xizang Plateau, Tibet]. From Salar Carote, Antofagasta, Chile.

Name: In allusion to the essential chemical components, water, chlorine and borate.

Type Material: National Museum of Natural History, Washington, D.C., USA, 131036.

References: (1) Chien Tzu-Chiang and Chen Shu-Chen (1965) Brief note on preliminary results of study of a new borate mineral – hydrochlorborite: (Ca₄B₅O₁₅Cl₂•22H₂O). *Scientica Sinica*, 14, 945–946 (in Russian). (2) (1965) *Amer. Mineral.*, 50, 2099 (abs. ref. 1). (3) Hurlbut, C.S., Jr., L.F. Aristarain, and R.C. Erd (1977) Hydrochlorborite from Antofagasta, Chile. *Amer. Mineral.*, 62, 147–150. (4) Brown, G.E. and J.R. Clark (1978) Crystal structure of hydrochlorborite, Ca₂[B₃O₃(OH)₄•OB(OH)₃]Cl•7H₂O, a seasonal evaporite mineral. *Amer. Mineral.*, 63, 814–823.