

Paratacamite

$\text{Cu}_2\text{Cl}(\text{OH})_3$

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Crystal Data: Hexagonal. *Point Group:* $\bar{3}$. As rhombohedral crystals, with prominent $\{10\bar{1}1\}$, $\{02\bar{2}1\}$, $\{01\bar{1}2\}$, $\{0001\}$, a number of other forms; twins elongated along $[10\bar{1}1]$, to 1.5 cm; granular massive, powdery as incrustations. *Twinning:* Common on $\{10\bar{1}1\}$, may be polysynthetic.

Physical Properties: *Cleavage:* $\{10\bar{1}1\}$, good. *Fracture:* Conchoidal to uneven. Hardness = 3 D(meas.) = 3.72–3.74 D(calc.) = 3.75

Optical Properties: Translucent to nearly opaque. *Color:* Green to dark green, greenish black; in transmitted light, green. *Streak:* Green. *Luster:* Vitreous.

Optical Class: Uniaxial (+); commonly anomalously biaxial. *Dispersion:* $r > v$. $\omega = 1.843\text{--}1.844$ $\epsilon = 1.848\text{--}1.849$ $2V(\text{meas.}) = \leq 50^\circ$

Cell Data: *Space Group:* $R\bar{3}$. $a = 13.654(5)$ $c = 14.041(6)$ $Z = 24$

X-ray Powder Pattern: Sierra Gorda [district], Chile; almost identical to clinoatacamite. (ICDD 19-389).

5.46 (100), 2.750 (80), 2.258 (60), 1.704 (45), 1.813 (35), 2.888 (30), 4.67 (25)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
Cu	14.27	14.60	14.88	H_2O^+		13.10	
CuO	56.10	55.98	55.87	H_2O^-		0.03	
Cl	15.97	16.29	16.60	H_2O	14.10		12.65
				Total	100.44	[100.00]	100.00

(1) Generosa mine, Chile; same material later shown by electron microprobe to also contain Zn 2.45%. (2) Remolinos, Chile; recalculated to 100% after deduction of insoluble 0.97%.

(3) $\text{Cu}_2\text{Cl}(\text{OH})_3$.

Polymorphism & Series: Polymorphous with atacamite, botallackite, and clinoatacamite.

Occurrence: An oxidation product of other copper minerals, especially under arid, saline conditions; in fumarolic deposits; a weathering product of sulfides in subsea black smoker deposits.

Association: Clinoatacamite, caracolite, schwartzembergite, osarizawaite-beaverite, boleite (Sierra Gorda district, Chile).

Distribution: In Chile, from the Generosa and Herminia mines, Sierra Gorda district, the Quetena mine, west of Calama, and at Chuquicamata, Antofagasta; from Nantoko, Copiapó district, and Remolinos, Atacama. At the Cerro Negro volcano, Nicaragua. In the USA, at the Lost Soldier mine, Weeks, Churchill district, and at the Douglas Hill mine and Mason Pass, Yerington district, Lyon Co., Nevada; large crystals from Bisbee, Cochise Co., and in the Mammoth-St. Anthony mine, Tiger, Pinal Co., Arizona. From the Botallack and other mines, St. Just, and several other places in Cornwall, England. On Vesuvius, Campania, Italy. At Laurium, Greece, in slag. In the Tchah Khuni and Kali Kafi mines, near Anarak, Iran. In Australia, from Moonta-Wallaroo, and at the Dome Rock mine, north of Mingary, South Australia; in the Nangaroo mine, Murrin-Murrin, and the Carr Boyd Rocks mine, Western Australia; and at Broken Hill, New South Wales. Along the Mid-Atlantic Ridge, in the TAG hydrothermal field. A few other localities have been confirmed.

Name: From the Greek for *near*, and for its relation to *atacamite*.

Type Material: The Natural History Museum, London, England, 86958; National Museum of Natural History, Washington, D.C., USA, 95146.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 74–76. (2) Fleet, M.E. (1975) The crystal structure of paratacamite, $\text{Cu}_2(\text{OH})_3\text{Cl}$. *Acta Cryst.*, 31, 183–187. (3) Jambor, J.L., J.E. Dutrizac, A.C. Roberts, J.D. Grice, and J.T. Szymański (1996) Clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$, and its relationship to paratacamite and “anarakite”. *Can. Mineral.*, 34, 61–72. (4) Grice, J.D., J.T. Szymański, and J.L. Jambor (1996) The crystal structure of clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$. *Can. Mineral.*, 34, 73–78.

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