

Chalcophyllite

$\text{Cu}_{18}\text{Al}_2(\text{AsO}_4)_4(\text{SO}_4)_3(\text{OH})_{24}\cdot 36\text{H}_2\text{O}$

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Crystal Data: Hexagonal. *Point Group:* $\bar{3}$. Hexagonal platy crystals, to 1 cm, flattened on [0001], prominent {0112}, with numerous other forms noted, may be striated triangularly on {0001}; in rosettes, drusy, foliated massive. *Twinning:* On {10 $\bar{1}$ 0} as twin plane, probably universal.

Physical Properties: *Cleavage:* {0001}, perfect, micaceous; {10 $\bar{1}$ 1}, in traces. Hardness = 2 D(meas.) = 2.67–2.69 D(calc.) = 2.684

Optical Properties: Transparent to translucent. *Color:* Emerald-green, grass-green, bluish green, blue; green in transmitted light. *Streak:* Pale green to bluish green. *Luster:* Vitreous to subadamantine, pearly on {0001}.

Optical Class: Uniaxial (-). *Pleochroism:* *O* = bluish green; *E* = almost colorless. $\omega = 1.618$; 1.680 (dehydrated). $\epsilon = 1.552$; 1.618 (dehydrated).

Cell Data: *Space Group:* $R\bar{3}$. $a = 10.756(2)$ $c = 28.678(4)$ $Z = 1.5$

X-ray Powder Pattern: El Teniente mine, Chile.

9.47 (100), 2.58 (48), 2.34 (32), 4.71 (31), 2.67 (25), 7.10 (18), 3.59 (12)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SO ₃	7.98	6.67	7.75	CuO	46.56	46.54	46.21
P ₂ O ₅	0.64	0.67		H ₂ O ⁺		14.04	
As ₂ O ₅	13.26	13.23	14.84	H ₂ O ⁻		14.40	
SiO ₂		1.33		H ₂ O	28.21		27.91
Al ₂ O ₃	3.48	3.49	3.29	Total	100.13	100.37	100.00

(1) Cornwall, England. (2) El Teniente mine, Chile. (3) $\text{Cu}_{18}\text{Al}_2(\text{AsO}_4)_4(\text{SO}_4)_3(\text{OH})_{24}\cdot 36\text{H}_2\text{O}$.

Occurrence: A rare secondary mineral in the oxidized zone of some arsenic-bearing hydrothermal polymetallic deposits.

Association: Azurite, malachite, brochantite, chrysocolla, spangolite, connellite, cuprite, cyanotrichite, strashimirite, parnauite, lavendulan, cornubite, langite, clinoclase, pharmacosiderite, mansfieldite.

Distribution: In Germany, from [the Altväter samt Eschig mine, Mordelgrund,] near Sayda, and Schmiedeberg, Saxony; in the Virneberg mine, near Rheinbreitbach, Rhineland-Palatinate; at the Clara mine, near Oberwolfach, Black Forest. From Schwaz, Tirol, Austria. At Špania Dolina (Herregrund), Slovakia. From Moldava, 20 km northwest of Teplice, Czech Republic. At Nizhni Tagil, Ural Mountains, Russia. In England, large crystals from Wheals Gorland, Muttrell, and Unity, also the Ting-Tang mine, Gwennap, and a number of other places in Cornwall; in the Old Potts Gill mine, Caldbeck Fells, Cumbria. At the Cap Garonne mine, near le Pradet, Var, and in the Salsigne mine, 15 km north of Carcassone, Aude, France. In the USA, from the Calumet and Arizona mine, Bisbee, Cochise Co., Arizona; at the Majuba Hill mine, Antelope district, Pershing Co., Nevada; in the Mammoth and Ajax mines, Tintic district, Juab Co., Utah. Fine examples from the El Teniente mine, 67 km west of Rancagua, O'Higgins Province, Chile. In the Maharahara copper mine, near Woodville, Ruahine Mountains, New Zealand. Several other minor localities are known.

Name: From the Greek for *copper* and *a leaf*, for its prominent micaceous appearance.

Type Material: Mining Academy, Freiberg, Germany.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 1008–1010. (2) Sabelli, C. (1980) The crystal structure of chalcophyllite. *Zeits. Krist.*, 151, 129–140. (3) Read, A.J. (1986) Chalcophyllite and other rare hydroxy-sulfates from Maharahara, New Zealand. *Mineral. Record*, 17, 199–204. (4) Corbett, R.K. (1973) X-ray "powder" data for chalcophyllite. *Amer. Mineral.*, 58, 792–793.

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