

Pseudomalachite

$\text{Cu}_5(\text{PO}_4)_2(\text{OH})_4$

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Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals are rare, to 6 mm, typically rough and rounded, with prominent {110}, {201}, {311}, {100}, {001}, and others. Commonly compact radiating and spherical, may be fibrous, in paintlike crusts and films, botryoidal, massive. *Twinning:* On {100}.

Physical Properties: *Cleavage:* Perfect on {100}. *Fracture:* Splintery. Hardness = 4.5–5 D(meas.) = 4.15–4.35 D(calc.) = 4.34

Optical Properties: Translucent. *Color:* Dark emerald-green, dark green, blackish green, bluish green; green to bluish green in transmitted light. *Streak:* Pale green to pale bluish green. *Luster:* Vitreous to resinous.

Optical Class: Biaxial (–), may be biaxial (+). *Pleochroism:* Weak; X = bluish green to pale green; Y = yellowish green; Z = deep bluish green to blue-green. *Orientation:* Z = b; X \wedge c = 21°–23°. *Dispersion:* $r < v$, strong; may be $r > v$. $\alpha = 1.789$ –1.80 $\beta = 1.835$ –1.86 $\gamma = 1.845$ –1.88 2V(meas.) = 46°–50°

Cell Data: *Space Group:* $P2_1/a$. $a = 17.02$ –17.08 $b = 5.75$ –5.77 $c = 4.47$ –4.50 $\beta = 90^\circ 57' - 91^\circ 32'$ Z = 2

X-ray Powder Pattern: Ehl and Rheinbreitbach, Germany. 4.48 (10), 2.39 (8), 2.42 (6), 3.46 (5), 2.32 (5), 2.23 (5), 1.728 (5)

Chemistry:

	(1)	(2)
P ₂ O ₅	23.86	24.65
FeO	0.19	
CuO	69.25	69.09
H ₂ O	6.76	6.26
Total	100.06	100.00

(1) Rheinbreitbach, Germany; corresponds to $(\text{Cu}_{4.98}\text{Fe}_{0.02})_{\Sigma=5.00}(\text{PO}_4)_{1.93}(\text{OH})_{4.30}$.

(2) $\text{Cu}_5(\text{PO}_4)_2(\text{OH})_4$.

Polymorphism & Series: Trimorphous with ludjibaite and reichenbachite.

Occurrence: A secondary mineral in the oxidized zone of hydrothermal copper deposits.

Association: Libethenite, malachite, cornetite, chrysocolla, quartz.

Distribution: Many localities, but usually in small amounts. In Germany, at Ehl, near Linz, and rich specimens from Virneberg, near Rheinbreitbach, Rhineland-Palatinate. At L'ubietová, near Baňská Bystrica (Libethen, near Neusohl), Slovakia. From Nizhni Tagil and Bogoslovsk, Ural Mountains, Russia. In England, at Caldbeck Fells, Cumbria; also from a number of mines in Cornwall. From Kakanda and M'sesa, near Kambove, Katanga Province, Congo (Shaba Province, Zaire). At Mindouli, Congo Republic. From the Bwana Mkubwa, Ndola, and the Nchanga mines, Chingola, Zambia. In the USA, from the Perkiomen and Ecton mines, Montgomery Co., Pennsylvania; in the Empire-Nevada mine, Yerington district, Lyon Co., Nevada; at Lone Star mine, near Safford, Graham Co., from Harquehala, La Paz Co., and elsewhere in Arizona. At Chuquicamata, Antofagasta, Chile. Rich examples from the West Bogan mine, near Tottenham, New South Wales, and at the Burra Burra mine, Mt. Lofty Ranges, South Australia.

Name: From the Greek for *false*, as the mineral closely resembles *malachite*.

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, 799–801. (2) Berry, L.G. (1950) On pseudomalachite and cornetite. Amer. Mineral., 35, 365–385. (3) Shoemaker, G.L., J.B. Anderson, and E. Kostiner (1977) Refinement of the crystal structure of pseudomalachite. Amer. Mineral., 62, 1042–1048.

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