## Chalcosiderite $CuFe_6^{3+}(PO_4)_4(OH)_8 \cdot 4H_2O$

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**Crystal Data:** Triclinic. *Point Group:* $\overline{1}$. Crystals short prismatic, with a number of forms noted, typically in sheafs, to 3 mm; in crusts.

**Physical Properties:** *Cleavage:* One, perfect; another, less perfect. Hardness = 4.5 D(meas.) = 3.22 D(calc.) = [3.28]

**Optical Properties:** Transparent. *Color:* Pale siskin-green to dark green. *Streak:* White to greenish, pale green. *Luster:* Vitreous.
*Optical Class:* Biaxial (–). *Pleochroism:* Weak; $X$ = colorless; $Z$ = pale green. *Orientation:* $X$ (107°,57°); $Y$ (–143°,68°); $Z$ (–32°,40°) using ($\phi$,$\rho$). *Dispersion:* $r > v$, very strong, crossed. $\alpha = 1.775$ $\beta = 1.840$ $\gamma = 1.844$ 2V(meas.) = 22(2)°

**Cell Data:** *Space Group:* $P\overline{1}$. $a = 7.653(4)$ $b = 7.873(4)$ $c = 10.190(4)$ $\alpha = 67.57(2)°$ $\beta = 69.17(2)°$ $\gamma = 64.93(2)°$ Z = 1

**X-ray Powder Pattern:** Cornwall, England.
3.77 (100), 3.39 (70), 3.02 (60), 3.56 (40), 2.96 (40), 2.14 (40), 2.07 (40)

**Chemistry:**

| | (1) | (2) |
|---|---|---|
| $P_2O_5$ | 29.93 | 28.77 |
| $As_2O_5$ | 0.61 | |
| $Al_2O_3$ | 4.45 | |
| $Fe_2O_3$ | 42.81 | 48.56 |
| CuO | 8.15 | 8.06 |
| $H_2O$ | 15.00 | 14.61 |
| Total | 100.95 | 100.00 |

(1) West Phoenix mine, Cornwall, England. (2) $CuFe_6(PO_4)_4(OH)_8 \cdot 4H_2O$.

**Polymorphism & Series:** Forms a series with turquoise.

**Mineral Group:** Turquoise group.

**Occurrence:** A rare mineral in the oxidized zone of some hydrothermal mineral deposits.

**Association:** Dufrénite, goethite (West Phoenix mine, Cornwall, England); dufrénite, cyrilovite, leucophosphite (Gunheath china clay pit, Cornwall, England); sampleite, libethenite, crandallite, cyrilovite, pseudomalachite, saléeite, torbernite, ulrichite (Lake Boga quarry, Australia).

**Distribution:** In England, from the West Phoenix United mines, Linkinhorne, and the Gunheath china clay pit, St. Austell, Cornwall. In Germany, at Schneckenstein, and in the Tannenberg mine, Mühlleithen, Saxony; from Hagendorf, Bavaria. From the Miguel Vacas mine, Estremoz, Portugal. At Les Montmins, Auvergne, France. In the USA, from the Cole and Shattuck mines, Bisbee, Cochise Co., Arizona; in the Tyrone mine, Santa Rita, Grant Co., New Mexico; at the Mohawk mine, Clark Mountains, San Bernardino Co., California; from the King turquoise mine, Conejos Co., Colorado. In Australia, in the Lake Boga granite quarry, near Swan Hill, Victoria, and the Spring Creek mine, near Wilmington, South Australia.

**Name:** From the Greek for *copper* and *iron*, for those elements in the mineral's composition.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 946–951. (2) Giuseppetti, G., F. Mazzi, and C. Tadini (1989) The crystal structure of chalcosiderite, $CuFe_6^{3+}(PO_4)_4(OH)_8 \cdot 4H_2O$. Neues Jahrb. Mineral., Monatsh., 227–239. (3) Graham, R. (1948) X-ray study of chalcosiderite and turquoise. Univ. Toronto Studies, Geol. Series, 52, 39–53.

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