Orthoserpierite $Ca(Cu,Zn)_4(SO_4)_2(OH)_6 \cdot 3H_2O$

Crystal Data: Orthorhombic. *Point Group:* $mm2$. Typically as platy crystals, flattened on {001}, elongated along [010], to 0.2 mm, in rosettes, fibrous masses, and crusts.

Physical Properties: *Fracture:* Splintery. Hardness = n.d. D(meas.) = 3.00(5) D(calc.) = 3.07 Fluoresces mauve under LW and SW UV.

Optical Properties: Transparent. *Color:* Sky-blue. *Streak:* Pale green. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Pleochroism:* Weak; X = colorless or very pale green; $Y = Z$ = pale green. *Orientation:* $X = c$; $Y = a$; $Z = b$. *Dispersion:* $r > v$, medium strong. $\alpha = 1.586(2)$ $\beta = 1.645(2)$ $\gamma = 1.650(2)$ 2V(meas.) = 32(2)° 2V(calc.) = 32°

Cell Data: *Space Group:* $Pca2_1$. $a = 22.10(2)$ $b = 6.20(2)$ $c = 20.39(2)$ Z = 8

X-ray Powder Pattern: Chessy, France.
10.21 (100), 5.10 (90), 3.400 (90), 2.384 (60), 3.184 (50), 2.610 (50), 2.558 (50)

Chemistry:

	(1)	(2)
SO_3	21.20	
CuO	43.61	42.4
ZnO	7.29	7.8
CaO	9.33	7.1
H_2O	[18.57]	
Total	[100.00]	

(1) Chessy, France; by electron microprobe, H_2O by difference; $Ca_{1.08}(Cu_{3.54}Zn_{0.58})_{\Sigma=4.12}(SO_4)_{1.71}(OH)_{6.98} \cdot 3.18H_2O$. (2) Glücksrad mine, Germany; partial analysis.

Polymorphism & Series: Dimorphous with serpierite.

Occurrence: A rare secondary mineral formed in the dump from a hydrothermal copper mine (Chessy, France); precipitated from vadose waters transecting the oxidized zone of a hydrothermal copper deposit (Copper Creek district, Arizona, USA).

Association: Devilline, gypsum, calcite (Chessy, France); chrysocolla, malachite (Copper Creek district, Arizona, USA).

Distribution: From Chessy, near Lyon, Rhône, France. In the Tynagh mine, near Loughrea, Co. Galway, Ireland. From Vezzani, Corsica, France. In the Glücksrad mine, near Oberschulenberg, Harz Mountains, Germany. From near the Childs-Aldwinkle mine, Copper Creek district, Pinal Co., Arizona, and at Sterling Hill, Ogdensburg, Sussex Co., New Jersey, USA.

Name: As an ORTHOrhombic mineral related to *serpierite*.

Type Material: Natural History Museum, Geneva, Switzerland, 435/76.

References: (1) Sarp, H. (1985) Orthoserpiérite $Ca(CuZn)_4(SO_4)_2(OH)_6 \cdot 3H_2O$, un nouveau minéral de la Mine de Chessy, France, polymorphe de la serpiérite. Schweiz. Mineral. Petrog. Mitt., 65, 1–7 (in French with English abs.). (2) (1987) Amer. Mineral., 72, 1026 (abs. ref. 1). (3) Krause, W. and H. Täuber (1992) Zum Kenntnisstand der Minerale Serpierit, Orthoserpierit und Devillin. Aufschluss, 43(1), 1–25 (in German).