

# Goldquarryite

# $\text{CuCd}_2\text{Al}_3(\text{PO}_4)_4\text{F}_2 \cdot 12\text{H}_2\text{O}$

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**Crystal Data:** Hexagonal. *Point Group:*  $\bar{3}$ . As thin tabular flakes with hexagonal outline or as blades, to 2 cm; in rosettelike aggregates.

**Physical Properties:** *Cleavage:* On {0001}, perfect. *Tenacity:* Flexible. Hardness =  $\sim 2.5$   
D(meas.) = 2.627 D(calc.) = 2.640

**Optical Properties:** Transparent to translucent. *Color:* Colorless to white, pale green if cuprian. *Luster:* Vitreous to pearly.

*Optical Class:* Uniaxial (-).  $\omega = 1.5607(8)$   $\epsilon = 1.5382(4)$

**Cell Data:** *Space Group:*  $P\bar{3}$ .  $a = 8.3556(3)$   $c = 13.025(1)$   $Z = 2$

**X-ray Powder Pattern:** San Francisco mine, Chile; strong preferred orientation on {0001}.  
12.95 (100), 6.501 (23), 4.339 (15), 3.258 (14), 2.967 (10), 2.523 (6), 2.676 (5)

## Chemistry:

	(1)	(2)
SO <sub>3</sub>	15.33	12.79
ZnO	52.85	51.99
Na <sub>2</sub> O	9.15	4.95
Cl	6.46	5.66
H <sub>2</sub> O	12.33	25.89
-O = Cl <sub>2</sub>	1.46	1.28
Total	94.66	100.00

(1) San Francisco mine, Chile; by electron microprobe, H<sub>2</sub>O by CHN analyzer; low analytical total due to loss of H<sub>2</sub>O during grinding, Na too high due to peak overlaps with Zn; after adjusting Na<sub>2</sub>O to 5.5% from AA, and partitioning H between H<sub>2</sub>O and (OH)<sup>1-</sup> according to crystal-structure analysis, corresponds to Na<sub>1.54</sub>Zn<sub>3.39</sub>(SO<sub>4</sub>)<sub>1.00</sub>(OH)<sub>6</sub>Cl<sub>0.95</sub>•6H<sub>2</sub>O.

(2) NaZn<sub>4</sub>(SO<sub>4</sub>)(OH)<sub>6</sub>Cl•6H<sub>2</sub>O.

**Occurrence:** In the oxidized portions of a Cu–Zn sulfide deposit (San Francisco mine, Chile); on weathered mine dumps (Helbra, Germany); on the outside oxidized portions of a sea floor chimney formed by the mixing of hydrothermal fluids with sea water (Juan de Fuca Ridge).

**Association:** Zincian paratacamite, anglesite, hemimorphite, christelite, quartz (San Francisco mine, Chile); connellite, anglesite, chlorian bromargyrite (Helbra, Germany); sphalerite, barite, pyrite, pyrrhotite, sulfur, iron hydroxides (Juan de Fuca Ridge).

**Distribution:** From the San Francisco mine, two km west of the Sierra Gorda railway station, Sierra Gorda district, Antofagasta, Chile. On the Juan de Fuca Ridge, southwest of Vancouver Island, Canada. From near Helbra, Mansfeld region, Saxony-Anhalt, Germany. At the Kamariza mine, Laurium, Greece.

**Name:** For the Sierra Gorda, Chile, from which the mineral was first fully characterized.

**Type Material:** University of Hamburg, Hamburg, Germany.

**References:** (1) Schlüter, J., K.-H. Klaska, K. Friese, G. Adiwidjaja, and G. Gebhard (1997) Gordaite, NaZn<sub>4</sub>(SO<sub>4</sub>)(OH)<sub>6</sub>Cl•6H<sub>2</sub>O, a new mineral from the San Francisco mine, Antofagasta, Chile. *Neues Jahrb. Mineral., Monatsh.*, 155–162. (2) (1998) *Amer. Mineral.*, 83, 185–186 (abs. ref. 1). (3) Adiwidjaja, G., K. Friese, K.-H. Klaska, and J. Schlüter (1997) The crystal structure of gordaite NaZn<sub>4</sub>(SO<sub>4</sub>)(OH)<sub>6</sub>Cl•6H<sub>2</sub>O. *Zeits. Krist.*, 212, 704–707. (4) Nasdala, L., T. Witzke, B. Ullrich, and R. Brett (1998) Gordaite [Zn<sub>4</sub>Na(OH)<sub>6</sub>(SO<sub>4</sub>)Cl•6H<sub>2</sub>O]: second occurrence in the Juan de Fuca Ridge, and new data. *Amer. Mineral.*, 83, 1111–1116.