Kröhnkite $Na_2Cu(SO_4)_2 \cdot 2H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals are pseudo-octahedral, equant to short prismatic along [001] or [100], to 7 cm; typically they exhibit {110}, {011}, {010}, {021}, $\{\overline{1}11\}$, with over two dozen more forms recorded. In crusts and aggregates, granular, massive. *Twinning:* Common on {101}, may be heart-shaped.

Physical Properties: *Cleavage:* Perfect on {010}; poor on $\{\overline{1}01\}$. *Fracture:* Conchoidal. Hardness = 2.5–3 D(meas.) = 2.90 D(calc.) = 2.913 Easily soluble in H_2O.

Optical Properties: Transparent. *Color:* Sky-blue to pale blue or greenish blue, becoming green and opaque on exposure; pale blue to colorless in transmitted light. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Orientation:* $Y = b$; $X \wedge c = 48°$. *Dispersion:* $r < v$, weak, inclined. $\alpha = 1.544$ $\beta = 1.578$ $\gamma = 1.601$ 2V(meas.) = 78°

Cell Data: *Space Group:* $P2_1/c$. $a = 5.807(1)$ $b = 12.656(2)$ $c = 5.517(1)$ $\beta = 108.32(1)°$ Z = 2

X-ray Powder Pattern: Chuquicamata, Chile. (ICDD 11-90).
6.33 (100), 3.278 (90), 2.757 (90), 2.925 (80), 3.715 (60), 4.145 (40), 3.099 (40)

Chemistry:

	(1)	(2)
SO_3	47.60	47.42
CuO	23.25	23.56
Na_2O	18.89	18.35
H_2O	10.72	10.67
Total	100.46	100.00

(1) Chuquicamata, Chile. (2) $Na_2Cu(SO_4)_2 \cdot 2H_2O$.

Occurrence: An uncommon secondary mineral formed in the oxidized zone of copper deposits, typically in very arid climates.

Association: Atacamite, blödite, chalcanthite, antlerite, natrochalcite (Chuquicamata, Chile).

Distribution: In Chile, abundantly and in large crystals from Chuquicamata, at Quetena, west of Calama, and at Collahuasi, Antofagasta; from El Cobre de Mejillones and in the Incahuasi district, Atacama. In Wheal Hazard, St. Just, Cornwall, England. From the Recsk copper deposit, Mátra Mountains, Hungary. At Capo Calamita, Elba, Italy. From Broken Hill, New South Wales, Australia.

Name: Honoring B. Kröhnke, who provided the first analysis of the mineral.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 444–446. (2) Hawthorne, F.C. and R.B. Ferguson (1975) Refinement of the crystal structure of kröhnkite. Acta Cryst., 31, 1753–1755.