THE SYSTEM OF

MINERALOGY

of James Dwight Dana and Edward Salisbury Dana
Yale University 1837–1892

SEVENTH EDITION
Entirely Rewritten and Greatly Enlarged

By

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VOLUME II

HALIDES, NITRATES, BORATES, CARBONATES, SULFATES, PHOSPHATES, ARSENATES, TUNGSTATES, MOLYBDATES, ETC.

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Ref.

1. See Schiff, *Zs. Kr.*, **87**, 379 (1934), on structure cell; de Schulten, *C.R.*, **107**, 405 (1888), on morphology.
2. Larsen (159, 1921).

28.3.3 **CHALCOCYANITE** [$CuSO_4$]. Idrociano *Scacchi* (*Acc. Napoli, Att.*, **5**, 26, 1873). Hydrocyan. Hydrocyanite. Hydrokyanite.

Cryst.[1] Orthorhombic; dipyramidal—$2/m\ 2/m\ 2/m$.

$$a:b:c = 0.7971:1:1.1300; \qquad p_0:q_0:r_0 = 1.4176:1.1300:1$$

$$q_1:r_1:p_1 = 0.7971:0.7054:1; \qquad r_2:p_2:q_2 = 0.8850:1.2545:1$$

Forms:[2]

	ϕ	$\rho = C$	ϕ_1	$\rho_1 = A$	ϕ_2	$\rho_2 = B$
b 010	0°00′	90°00′	90°00′	90°00′	.....	0°00′
m 110	51 26½	90 00	90 00	38 33½	0°00′	51 26½
k 120	32 02½	90 00	90 00	57 57½	0 00	32 02½
u 102	90 00	35 19½	0 00	54 40½	54 40½	90 00
e 012	0 00	29 28	29 28	90 00	90 00	60 32
d 011	0 00	48 29½	48 29½	90 00	90 00	41 30½
μ 112	51 26½	42 11	29 28	58 19	54 40½	65 15

Less common:

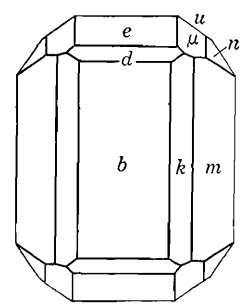
c 001	*p* 232	*n* 212

Habit. Variable; often tabular {010} and slightly elongated [001].

Phys. Cleavage not observed. H. 3½. G. 3.65 ± 0.05.[3] Pure artificial crystals are colorless; natural crystals are pale green, brownish or yellowish, also sky-blue. Transparent to translucent.

Opt. In transmitted light, colorless.

ORIENTATION		n(Na)[4]	
X	*b*	1.724 ± 0.003	Biaxial negative (−).
Y	*a*	1.733 ± 0.003	$2V$ large.
Z	*c*	1.739 ± 0.003	$r > v$, extreme.



Chem. Anhydrous cupric sulfate, $CuSO_4$.

Anal.

	1	2
CuO	49.85	49.47
SO_3	50.15	50.30
Total	100.00	99.77

1. $CuSO_4$. 2. Vesuvius.[2]

Occur. Found with dolerophanite, melanothallite, eriochalcite, and euchlorin as a sublimate in fumaroles of the eruption of 1868 of Vesuvius. Also observed [5] during the eruptions of 1880 and 1895.

Alter. Chalcocyanite is very hygroscopic, and readily soluble in water. On exposure to moist air the crystals rapidly turn blue, owing to the formation of the pentahydrate, and may ultimately fall to a powder of chalcanthite.

Name. From χαλκός, *copper*, and κύανος, *azure-blue*, in allusion to the composition and color change noted above. The original name hydrocyanite is objectionable for an anhydrous substance.

Ref.

1. Angles and unit of Scacchi (1873); orientation of Dana (912, 1892) to show the relation to the barite group.
2. Scacchi (1873).
3. Range of best reported values.
4. Posnjak and Tunell, *Am. J. Sc.*, **18**, 27 (1929).
5. Zambonini (158, 1935).

TYPE 4. $A_mB_n(XO_4)_p$

28.4.1 **VANTHOFFITE** [$Na_6Mg(SO_4)_4$]. *Kubierschky* (*Ak. Berlin, Ber.*, **21**, 404, 1902).

Found only massive, in anhedral grains or bedded aggregates.

Phys. Fracture uneven to flat conchoidal. Friable. H. $3\frac{1}{2}$. G. 2.694.[1] Luster vitreous to pearly. Colorless. Transparent.

Opt.[1] In transmitted light, colorless.

	n (Hall, Tyrol)	
X	1.485	Biaxial negative (−).
Y	1.488	$2V$ 84° (meas.).
Z	1.489	$r < v$, weak.

Chem. A sulfate of sodium and magnesium, $Na_6Mg(SO_4)_4$.

Anal.

	Na_2O	MgO	SO_3	Total	G.
1.	34.03	7.38	58.59	100.00	
2.	33.64	7.37	58.54	99.55	2.694

1. $Na_6Mg(SO_4)_4$. 2. Hall, Tyrol.[1]

Occur. Found only in oceanic salt deposits. First found in the Wilhelmshall potash mine near Halberstadt. With loeweite and langbeinite in halite at the Berlepsch mine near Stassfurt, and elsewhere in the German potash deposits. Sparingly in bloedite at Hall, Tyrol.

Artif. Can be made by heating a compressed mixture of the constituent sulfates at 80°.[2] Crystallizes from an aqueous solution above 57° at which temperature the solution is also in equilibrium with bloedite and thenardite.[3] From a solution containing the ions Na, K, Mg, SO_4, Cl and saturated with NaCl, corresponding to the brines of the oceanic salt deposits, it may crystallize above 46°.[4]

Name. After the Dutch physical chemist Jacobus Henricus van't Hoff (1852–1911), whose studies on equilibria in salt solutions were fundamental to an understanding of the formation of vanthoffite and other minerals of the oceanic salt deposits.

Ref.

1. Görgey, *Min. Mitt.*, **28**, 334 (1909).
2. Ide, *Kali*, **29**, 83 (1935)—*Min. Abs.*, **6**, 351 (1936).
3. *Int. Crit. Tables*, **4**, 350 (1928).
4. As determined by van't Hoff and co-workers and summarized in Doelter, **4** [2], 93 (1926).