Vanthoffite $Na_6Mg(SO_4)_4$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Anhedral granular, bedded massive.

Physical Properties: *Fracture:* Uneven to flat conchoidal. *Tenacity:* Friable. Hardness = 3.5 D(meas.) = 2.694 D(calc.) = 2.687 Soluble in H_2O, slightly bitter taste.

Optical Properties: Transparent. *Color:* Colorless, gray, pale yellow. *Luster:* Vitreous to pearly.
Optical Class: Biaxial (–). *Dispersion:* $r < v$, weak. $\alpha = 1.485$–1.486 $\beta = 1.488$ $\gamma = 1.489$ 2V(meas.) = 83°–84°

Cell Data: *Space Group:* $P2_1/c$. $a = 9.781(2)$ $b = 9.196(2)$ $c = 8.197(2)$ $\beta = 113.61(2)°$ Z = 2

X-ray Powder Pattern: Synthetic.
3.431 (100), 4.032 (95), 3.114 (75), 3.917 (70), 2.909 (70), 2.846 (60), 2.832 (60)

Chemistry:

	(1)	(2)
SO_3	58.54	58.60
MgO	7.37	7.38
Na_2O	33.64	34.02
Total	99.55	100.00

(1) Hall, Austria. (2) $Na_6Mg(SO_4)_4$.

Occurrence: Restricted to evaporite deposits of oceanic origin.

Association: Löweite, langbeinite, halite (Berlepsch mine, Germany); blödite (Hall, Austria).

Distribution: In Germany, from the Wilhelmshall potash mine, northwest of Halberstadt, Saxony; in the Berlepsch mine and at Douglashall, Stassfurt-Westeregeln district, Magdeburg, Saxony-Anhalt. At Hall, Tirol, Austria. From Borislav, Ukraine. In the "Q" Basin [Jianghan Plain] potash deposits, Hubei Province, China. From the Bikaner evaporite district, Rajasthan, India. In the USA, at Bertram Siding, Imperial Co., California; and about 36 km east of Carlsbad, Eddy Co., New Mexico.

Name: To honor Professor Jacobus Henricus van't Hoff (1852–1911), German physical chemist, University of Berlin, Berlin, Germany, who elucidated the equilibria involved in formation of oceanic salt deposits.

Type Material: n.d.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 430. (2) Madsen, B.M. (1966) Loewite, vanthoffite, bloedite, and leonite from southeastern New Mexico. U.S. Geol. Surv. Prof. Paper 550-B, B125–B129. (3) Kuhn, R. (1983) Ergänzungen zur Mineralogie des Vanthoffits. Kali und Steinsalz, 8(12), 411–415 (in German). (4) Nag, D.K., R. Guha, and G.L. Dwivedi (1986) Structure of natural vanthoffite from Rajasthan, India. Indian Minerals, 40(1), 1–12.