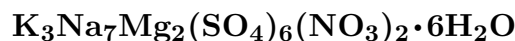


Humberstonite



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Crystal Data: Hexagonal. *Point Group:* $\bar{3}$. As hexagonal crystals, platy on {0001}, with {10 $\bar{1}$ 1}, to 0.3 mm; typically in massive aggregates.

Physical Properties: *Cleavage:* Perfect on {0001}. *Fracture:* Irregular. *Tenacity:* Brittle. Hardness = ~ 2.5 D(meas.) = 2.252 D(calc.) = 2.252 Soluble in H₂O.

Optical Properties: Transparent. *Color:* Colorless. *Luster:* Vitreous. *Optical Class:* Uniaxial (-). $\omega = 1.474(2)$ $\epsilon = 1.436(2)$

Cell Data: *Space Group:* $R\bar{3}$. $a = 10.9055(3)$ $c = 24.3949(9)$ $Z = 3$

X-ray Powder Pattern: Oficina Alemania, Chile.

3.39 (100), 2.724 (70), 8.14 (60), 8.80 (35), 4.53 (35), 2.583 (35), 1.866 (35)

Chemistry:

	(1)	(2)
SO ₃	42.99	42.31
N ₂ O ₅	9.14	9.51
MgO	7.47	7.10
Na ₂ O	18.43	19.11
K ₂ O	12.17	12.45
H ₂ O ⁺	9.78	
H ₂ O ⁻	0.40	
H ₂ O		9.52
Total	100.38	100.00

(1) Oficina Alemania, Chile; after removal of NaNO₃ impurity with acetone, (SO₄)²⁻ and (NO₃)¹⁻ confirmed by IR. (2) K₃Na₇Mg₂(SO₄)₆(NO₃)₂•6H₂O.

Occurrence: Formed by repeated natural leaching of nitrate ore with reprecipitation in irregular pods above the local regolith.

Association: Blödite, nitratine, kieserite.

Distribution: In Chile, from near Oficina Alemania and ten km west of Oficina María Elena; an ore in the Taltal nitrate district, Antofagasta; locally abundant in near-surface nitrate layers throughout the Atacama Desert.

Name: Honors James Thomas Humberstone (1850–1939), industrial chemist whose contributions permit economical extraction of nitrate from the Chilean deposits.

Type Material: National Museum of Natural History, Washington, D.C., USA, 120898.

References: (1) Mrose, M.E., J.J. Fahey, and G.E. Ericksen (1970) Mineralogical studies of the nitrate deposits of Chile. III. Humberstonite, K₃Na₇Mg₂(SO₄)₆(NO₃)₂•6H₂O, a new saline mineral. *Amer. Mineral.*, 55, 1518–1533. (2) Burns, P.C. and F.C. Hawthorne (1994) The crystal structure of humberstonite, a mixed sulfate-nitrate mineral. *Can. Mineral.*, 32, 381–385.