Nickelhexahydrite $(Ni, Mg, Fe^{2+})SO_4 \cdot 6H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. In crystalline crusts and coatings, which may be formed only during relatively dry seasons.

Physical Properties: *Cleavage:* On {010}, probable, perfect; on {100}, less perfect. Hardness = n.d. D(meas.) = 2.036 D(calc.) = 2.05 Soluble in H_2O.

Optical Properties: Semitransparent. *Color:* Bluish green. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Orientation:* $Z \wedge c = 45°$. α = 1.469–1.470 β = n.d. γ = 1.493–1.494 2V(meas.) = n.d.

Cell Data: *Space Group:* $C2/c$ (synthetic). $a = 9.880(3)$ $b = 7.288(2)$ $c = 24.130(3)$ $\beta = 98.32(2)°$ Z = 8

X-ray Powder Pattern: Noril'sk, Russia.
4.35 (10), 2.89 (9), 3.98 (8), 1.994 (8), 1.856 (7), 5.41 (6), 5.07 (6)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SO_3	30.82	30.67	30.46	CuO	0.26		
Fe_2O_3	0.18			ZnO	0.00		
FeO	2.63			MgO	2.43	4.07	
MnO	0.07			CaO	0.00		
CoO	0.03	0.21		H_2O	41.05	41.96	41.12
NiO	22.57	22.69	28.42	Total	100.04	99.60	100.00

(1) Noril'sk, Russia; corresponds to $(Ni_{0.77}Mg_{0.16}Fe_{0.10})_{\Sigma=1.03}(SO_4)_{0.99} \cdot 5.84H_2O$. (2) Jáchymov, Czech Republic; corresponds to $(Ni_{0.78}Mg_{0.26}Co_{0.01})_{\Sigma=1.05}(SO_4)_{0.99} \cdot 5.99H_2O$. (3) $NiSO_4 \cdot 6H_2O$.

Polymorphism & Series: Dimorphous with retgersite.

Mineral Group: Hexahydrite group.

Occurrence: Precipitated from mine waters in the bottom of an open-pit nickel mine, and on nickel-bearing gabbro-dolerite rocks in the oxidation zone (Noril'sk region, Russia); in shear zones in talc overlying ultramafic rocks (Lahnaslampi deposit, Finland); formed from H_2O solution below 31.5 °C.

Association: Morenosite.

Distribution: From the Severnaya mine, Noril'sk, western Siberia, and in the Izumrudnye Kopi emerald mines, Asbest district, Ural Mountains, Russia. At the Lahnaslampi talc deposit, Finland. From the Riffelalp and Pollux, near Zermatt, Valais, Switzerland. At Droskovac, near Vares, Bosnia-Herzegovina. From Jáchymov (Joachimsthal), Czech Republic. At the Bauhaus mine, Richelsdorfer Mountains, Hesse, Germany. In Australia, from Noddy's Creek, Tasmania, and from Kambalda, 56 km south of Kalgoorlie, Western Australia.

Name: As the *nickel*-dominant analog of *hexahydrite*.

Type Material: Mineralogical Institute, Tomsk Polytechnical Institute, Tomsk, Russia.

References: (1) Oleinikov, B.V., S.L. Shvartsev, N.T. Mandrikova, and N.N. Oleinikova (1965) Nickelhexahydrite – a new mineral. Zap. Vses. Mineral. Obshch., 93, 534–547 (in Russian). (2) (1966) Amer. Mineral., 51, 259 (abs. ref. 1). (3) Angel, R.J. and L.W. Finger (1988) Polymorphism of nickel sulfate hexahydrate. Acta Cryst., C44, 1869–1873. (4) Ondruš, P., F. Veselovský, J. Hloušek, R. Skála, I. Vavřín, J. Frýda, J. Čejka, and A. Gabašová (1997) Secondary minerals of the Jáchymov (Joachimsthal) ore district. J. Czech Geol. Soc., 42(4), 3–76, esp. 39–40.