Sideronatrite $Na_2Fe^{3+}(SO_4)_2(OH)\cdot 3H_2O$

Crystal Data: Orthorhombic (2*O* polytype) or monoclinic (2*M* polytype). *Point Group*: 2/*m* 2/*m* 2/*m* or 2/*m*. Rarely in good crystals, lathlike to acicular, to 3 cm; commonly fibrous, earthy, pulverulent, in efflorescences and crusts, nodular, massive.

Physical Properties: *Cleavage*: On {010}, perfect; on {100}, fair. *Tenacity*: Slightly flexible. Hardness = 1.5-2.5 D(meas.) = 2.22-2.35 D(calc.) = 2.276 Soluble in boiling H_2O, separating Fe_2O_3; reversibly dehydrates to metasideronatrite depending on relative humidity and sunlight.

Optical Properties: Semitransparent. *Color*: Lemon-yellow, straw-yellow, pale orange, yellow-brown; in transmitted light, nearly colorless to pale yellow. *Streak*: Pale yellow. *Luster*: Vitreous. *Optical Class*: Biaxial (+). *Pleochroism*: *X* = nearly colorless; *Y* = very pale amber-yellow; *Z* = pale amber-yellow. *Orientation*: *X* = *a*; *Y* = *b*; *Z* = *c*. *Dispersion*: *r* > *v*, strong. α = 1.508(3) β = 1.525(3) γ = 1.586(3) 2V(meas.) = n.d. 2V(calc.) = 58(5)°

Cell Data: *Space Group*: $P2_12_12_1$ *a* = 7.265(2) *b* = 20.522(6) *c* = 7.120(2) Z = 4 (2*O*)
$P12_1/n1$. *a* = 7.1559(14) *b* = 7.2845(15) *c* = 20.889(4) β = 99.37(3)° Z = 4 (2*M*)

X-ray Powder Pattern: Sierra Gorda [district], Chile.
10.15 (FFF), 3.01 (FF), 3.38 (F), 2.68 (F), 6.78 (mF), 3.58 (mF), 5.00 (f)

Chemistry:

	(1)	(2)	(3)
SO_3	42.98	43.87	43.49
Fe_2O_3	22.40	21.88	20.95
Na_2O	17.00	16.98	15.43
H_2O	17.75	17.27	17.33
Total	100.13	100.00	99.31

(1) Sierra Gorda [district], Chile; corresponds to $Na_{1.96}Fe_{1.00}(SO_4)_{1.92}(OH)_{1.12}\cdot 2.96H_2O$.
(2) $Na_2Fe(SO_4)_2(OH)\cdot 3H_2O$. (3) Xitieshan lead-zinc deposit, Qinghai Province, China; total includes K_2O = 0.23, MgO = 0.1, Al_2O_3 = 0.42, FeO = 0.8, CaO = 0.56; corresponds to $(Na_{1.83}Ca_{0.04}Fe_{0.04}K_{0.02}Mg_{0.01})_{\Sigma=1.94}(Fe^{3+}_{0.97}Al_{0.03})_{\Sigma=1.00}(SO_4)_2(OH)(H_2O)_3$ (2*M* polytype).

Polymorphism & Series: 2*O* and 2*M* polytypes.

Occurrence: An uncommon secondary mineral in the oxidized zone of iron-rich deposits in very arid climates, may be post-mine; also formed by alteration of pyrite by saline water in metallic veins, coal measures, and in sea-spray environments.

Association: Metasideronatrite, ferrinatrite, copiapite, voltaite, melanterite, halotrichite, uklonskovite, jurbanite, jarosite, pyrite, marcasite.

Distribution: In Chile, from the San Simon mine, Huantajaya, Tarapacá; in the Compania mine, Sierra Gorda district, southwest of Calama, and at Chuquicamata, Antofagasta. From Potosí, Bolivia. At the Santa Bárbara sulfur mine, El Palmar district, Jujuy Province, Argentina. On the Urus Plateau, Cheleken Peninsula, Caspian Sea, Turkmenistan. From north of Ballybunion, Co. Kerry, Ireland. At Barton-on-Sea, Hampshire, on Trerubies Cliff, near Delabole, Cornwall, and in the Rising Sun colliery, Backworth, Northumberland, England. From Winterslag and Eisden, Belgium. In the Polish Turoszow brown coal mine, Turoszow, Poland. From the Cetine mine, 20 km southwest of Siena, Tuscany, Italy. At the New Milo mine, Wadnaminga, South Australia. Large crystals in the Hot Springs Point sulfur mine, Crescent Valley, Eureka Co., Nevada, USA. From the Xitieshan lead-zinc deposit, Qinghai Province, China (2*M* polytype).

Name: From the Greek for iron, *sideros*, and sodium, *natrium*, in its chemical composition.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 604-605. (2) Cesbron, F. (1964) Contribution à la minéralogie des sulfates de fer hydratés. Bull. Soc. fr. Minéral., 87, 125-143 (in French). (3) Scordari, F. and G. Ventruti (2009) Sideronatrite, $Na_2Fe(SO_4)_2(OH)\cdot 3H_2O$: Crystal structure of the orthorhombic polytype and OD character analysis. Amer. Mineral., 94, 1679-1686. (4) Yang, Z., G. Giester, K. Ding, and H. Li (2015) Crystal structure of sideronatrite-2*M*, $Na_2Fe(SO_4)_2(OH)(H_2O)_3$, a new polytype from Xitieshan lead-zinc deposit, Qinghai Province, China Eur. J. Mineral., 27, 427-432.