Mirabilite $Na_2SO_4 \cdot 10H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals short to long prismatic, with complex form development, also crude, to 10 cm, in interlocking masses; crystalline, granular to compact massive, commonly as efflorescences. *Twinning:* Rare on {001} or {100}.

Physical Properties: *Cleavage:* On {100}, perfect; on {010} and {001}, good to fair. *Fracture:* Conchoidal. Hardness = 1.5–2.5 D(meas.) = 1.464 D(calc.) = 1.467 Quickly dehydrates to thénardite in dry air; very soluble in H_2O, taste cool, then saline and bitter.

Optical Properties: Transparent to opaque. *Color:* Colorless to white; colorless in transmitted light. *Streak:* White. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Orientation:* $X = b$; $Z \wedge c = 31°$. *Dispersion:* $r < v$, strong, crossed. $\alpha = 1.391$–1.394 $\beta = 1.394$–1.396 $\gamma = 1.396$–1.398 2V(meas.) = 75°56′

Cell Data: *Space Group:* $P2_1/c$ (synthetic). $a = 11.512(3)$ $b = 10.370(3)$ $c = 12.847(2)$ $\beta = 107.789(10)°$ Z = 4

X-ray Powder Pattern: Synthetic. (ICDD 11-647).
5.49 (100), 3.21 (75), 3.26 (60), 3.11 (60), 4.77 (45), 3.83 (40), 2.516 (35)

Chemistry:

	(1)	(2)
SO_3	25.16	24.85
Na_2O	18.67	19.24
H_2O	55.28	55.91
Total	99.11	100.00

(1) Kirkby Thore, Westmoreland, England. (2) $Na_2SO_4 \cdot 10H_2O$.

Occurrence: Typically in salt pans, playas, and saline lakes, where deposition may be seasonal, and bedded deposits formed therefrom; rarely in caves and lava tubes; in volcanic fumaroles; a product of hydrothermal sericitic alteration; a post-mining precipitate.

Association: Gypsum, thénardite, halite, trona, glauberite, aphthitalite, blödite, epsomite.

Distribution: Only a few prominent localities are represented here. In Austria, at Hallein, Hallstatt, and Ischl. In Italy, on Vesuvius, and at Campi Flegrei, near Naples, Campania; on Vulcano, Lipari Islands. In the Salar de Pintados, near La Guaica, Atacama Desert, Tarapacá, and at Chuquicamata, Antofagasta, Chile. In the USA, at Soda Lake, San Luis Obispo Co., and in Searles Lake, San Bernardino Co., California; along Great Salt Lake, Davis Co., Utah; at Lake Lucero, west of Valmont, Doña Ana Co., New Mexico; around Downey and Union Pacific Lakes, Albany Co., Wyoming; in Mammoth Cave, southwest central Kentucky.

Name: From the Latin *sal mirable*, for *miracle salt*, expressing Glauber's surprise on its synthesis.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 439–442. (2) Ericksen, G.E., M.E. Mrose, and J.J. Fahey (1970) Ice-clear mirabilite from Salar de Pintados, northern Chile. Mineral. Record, 1, 12–25. (3) Levy, H.A. and G.C. Lisensky (1978) Crystal structures of sodium sulfate decahydrate (Glauber's salt) and sodium tetraborate decahydrate (borax). Redetermination by neutron diffraction. Acta Cryst., 34, 3502–3510.