Aphthitalite $(K,Na)_3Na(SO_4)_2$

Crystal Data: Hexagonal. *Point Group:* $\overline{3}\ 2/m$. As crystals, tabular on {0001}, with trigonal appearance, to 7 cm; also in distorted pseudo-orthorhombic habits. In bladed aggregates, imperfectly mammillary, and in crusts. *Twinning:* On {0001} or repeated on $\{11\overline{2}0\}$, producing tabular pseudohexagonal composites.

Physical Properties: *Cleavage:* On $\{10\overline{1}0\}$, fair; on {0001}, poor. *Fracture:* Conchoidal to uneven. *Tenacity:* Brittle. Hardness = 3 D(meas.) = 2.66–2.71 D(calc.) = 2.697 Soluble in H_2O, taste saline and bitter.

Optical Properties: Transparent to opaque. *Color:* White, colorless; gray, blue, green due to inclusions and impurities; colorless in transmitted light. *Luster:* Vitreous to resinous. *Optical Class:* Uniaxial (+), may be anomalously biaxial. ω = 1.487–1.493 ϵ = 1.492–1.503 2V(meas.) = Small.

Cell Data: *Space Group:* $P\overline{3}m1$. $a = 5.677$ $c = 7.3331$ Z = 1

X-ray Powder Pattern: Synthetic $K_3Na(SO_4)_2$.
2.839 (100), 2.940 (75), 2.042 (45), 4.09 (30), 3.67 (20), 2.443 (16), 2.330 (14)

Chemistry:

	(1)	(2)
SO_3	47.46	48.17
Na_2O	10.67	9.32
K_2O	41.87	42.51
Total	[100.00]	100.00

(1) Eddy Co., New Mexico, USA; recalculated to 100% after deduction of NaCl 2.15% and insoluble 0.06%, from an original total of 99.88%. (2) $K_3Na(SO_4)_2$.

Occurrence: An uncommon incrustation around volcanic fumaroles; a component of evaporite deposits; in guano deposits, then typically ammonian.

Association: Thénardite, jarosite, sylvite, hematite (fumaroles); blödite, syngenite, mirabilite, picromerite, borax, halite (evaporites); syngenite, whitlockite, monetite, niter, gypsum (guano).

Distribution: From Italy, in Campania, at Vesuvius and Monte Somma, in the Cesano geothermal field, east of Lake Bracciano, Lazio, and on Etna, Sicily. At Douglashall, near Westeregeln, Saxony-Anhalt, Germany. At Stebnyk and Kalusz, Ukraine. In the Boulby potash mine, northwest of Whitby, Yorkshire, England. Large crystals from Kuh-E-Namak, Qom salt dome, Iran. In the "Q" Basin [Jianghan Plain] potash deposits, Hubei Province, China. In the USA, from Searles Lake, San Bernardino Co., California; in the Carlsbad potash district, Eddy Co., New Mexico; on Kilauea, Hawaii; and on the Mount St. Augustine volcano, Alaska. From Paricutín volcano, near Uruapan, Michoacán, Mexico. On the Merapi volcano, Indonesia. In the Murra-el-elevyn, Petrogale, and Toppin Hill Caves, Western Australia.

Name: From the Greek for *unalterable* and *salt*, in allusion to its stability in air.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 400–403. (2) Moore, P.B. (1973) Bracelets and pinwheels: a topological-geometrical approach to the calcium orthosilicate and alkali sulfate structures. Amer. Mineral., 58, 32–42. (3) Okada, K. and J. Ossaka (1980) Structures of potassium sodium sulphate and tripotassium sodium disulphate. Acta Cryst., 36, 919–921. (4) (1968) NBS Mono. 25, 6, 52.