## Boussingaultite $(NH_4)_2Mg(SO_4)_2 \cdot 6H_2O$



**Crystal Data:** Monoclinic. *Point Group:* $2/m$. Crystals are short prismatic along [001], showing {001}, {010}, {110}, {111}, a number of other forms. Typically in stalactites, to 20 cm, or as fibrous crusts, massive.

**Physical Properties:** *Cleavage:* $\{\bar{2}01\}$, perfect (synthetic). Hardness = 2 D(meas.) = 1.722 (synthetic). D(calc.) = 1.718 Soluble in $H_2O$, with sharply astringent and saline taste.

**Optical Properties:** Transparent to translucent. *Color:* Colorless, white to yellowish pink; colorless in transmitted light. *Luster:* Silky.
*Optical Class:* Biaxial (+). *Orientation:* $Y = b$; $Z \wedge c \simeq 12°$. *Dispersion:* $r > v$, perceptible. $\alpha = 1.470$ $\beta = 1.472$ $\gamma = 1.479$ 2V(meas.) = 51°11′

**Cell Data:** *Space Group:* $P2_1/a$ (synthetic). $a = 9.324(7)$ $b = 12.597(9)$ $c = 6.211(5)$ $\beta = 107.14(2)°$ Z = 2

**X-ray Powder Pattern:** Synthetic; shows preferred orientation. (ICDD 17-135).
4.22 (100), 2.085 (95), 5.11 (85), 7.20 (70), 3.79 (70), 1.818 (65), 2.189 (55)

**Chemistry:**

| | (1) | (2) |
|---|---|---|
| $SO_3$ | 43.49 | 44.40 |
| $Al_2O_3$ | 0.04 | |
| $Fe_2O_3$ | 0.08 | |
| MgO | 11.54 | 11.18 |
| $(NH_4)_2O$ | 10.86 | 14.44 |
| $Na_2O$ | 0.60 | |
| $K_2O$ | 0.22 | |
| $H_2O$ | 31.48 | 29.98 |
| Total | 98.31 | 100.00 |

(1) South Mountain, California, USA. (2) $(NH_4)_2Mg(SO_4)_2 \cdot 6H_2O$.

**Mineral Group:** Picromerite group.

**Occurrence:** A rare sublimate formed under fumarolic conditions.

**Association:** n.d.

**Distribution:** From Travale, Val di Cecina, and Larderello, Tuscany, Italy. At the Schoeller mine, Libušin, near Kladno, Czech Republic. In the USA, in California, from South Mountain, near Santa Paula, Ventura Co.; in substantial quantity in Geyser Creek Canyon, The Geysers, Sonoma Co.; and at Coso Hot Springs, Inyo Co. From Gcwihaba Cave, 280 km west of Maun, northwestern Botswana.

**Name:** Honoring Professor Jean-Baptiste Joseph Dieudonné Boussingault (1802–1887), French chemist, Lyon University, Lyon, France.

**Type Material:** Natural History Museum, Paris, 99.494; National School of Mines, Paris, France, 17853.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 455–456. (2) Larsen, E.S. and E.V. Shannon (1920) Boussingaultite from South Mountain, near Santa Paula, California. Amer. Mineral., 5, 127–128. (3) Margulis, T.N. and D.H. Templeton (1962) Crystal structure and hydrogen bonding of magnesium ammonium sulfate hexahydrate. Zeits. Krist., 117, 344–357. (4) Montgomery, H. (1964) The crystal structure of Tutton's salts. II. Magnesium ammonium sulfate hexahydrate and nickel ammonium sulfate hexahydrate. Acta Cryst., 17, 1478–1479.