Celestine $SrSO_4$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Well-formed crystals are common; typically thin to thick tabular on {001} with large {210}; tabular on {001} or {100}, lathlike or with equant cross-sections; also elongated along [010] or [001], to 45 cm; may be equant with equal {001}, {011}, {101} or pyramidal with {122}, {011}, {102}. Also fibrous, lamellar, earthy, massive granular.

Physical Properties: *Cleavage:* On {001}, perfect; on {210}, good; on {010}, poor. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 3–3.5 D(meas.) = 3.97(1) D(calc.) = 3.98

Optical Properties: Transparent to translucent. *Color:* Colorless, white, pale blue, pink, pale green, pale brown, black; colorless or faintly tinted in transmitted light. *Luster:* Vitreous, pearly on cleavages.
Optical Class: Biaxial (+). *Pleochroism:* Weak; if blue, indigo-blue, lavender-blue, violet. *Orientation:* $X = c$; $Y = b$; $Z = a$. *Dispersion:* $r < v$, moderate. *Absorption:* $Z > Y > X$. $\alpha = 1.619$–1.622 $\beta = 1.622$–1.624 $\gamma = 1.630$–1.632 2V(meas.) = 50°

Cell Data: *Space Group: Pnma.* $a = 8.359$ $b = 5.352$ $c = 6.866$ Z = 4

X-ray Powder Pattern: Synthetic.
2.972 (100), 3.295 (98), 2.731 (63), 3.177 (59), 2.041 (57), 2.045 (55), 2.674 (49)

Chemistry:

	(1)	(2)
SO_3	43.40	43.59
CaO	0.40	
SrO	56.20	56.41
Total	100.00	100.00

(1) Djebel Kebbouch, Tunisia. (2) $SrSO_4$.

Polymorphism & Series: Forms a series with barite.

Mineral Group: Barite group.

Occurrence: Of primary sedimentary origin, diagenetic, or typically as fissure and cavity fillings (including caves) precipitated by migrating strontium-bearing ground water or basinal brines in carbonate rocks, concretions and nodules; in hydrothermal veins and mafic volcanic rocks.

Association: Gypsum, anhydrite, sulfur (bedded evaporites); strontianite, calcite, dolomite, anhydrite, gypsum, fluorite (cavities in carbonate rocks); analcime, natrolite, hydroxyapophyllite, celadonite (mafic volcanoclastics).

Distribution: The most common strontium mineral; only a few localities for fine and large crystals are listed; in the USA, from near Bellwood, Blair Co., Pennsylvania; in Crystal Cave, Put-in-Bay, South Bass Island, and at Clay Center, Ottawa Co., Ohio; from Cave-in-Rock, Hardin Co., Illinois; at the Scofield quarry, Maybee, Monroe Co., Michigan; from Adamsville, Lampasas Co., Texas. At Dundas, Ontario, Canada. In Mexico, from near Matehuela, San Luis Potosi, and at Musquiz and Ramos Arizpe, Coahuila. From Girgenti, Caltanissetta, and elsewhere in Sicily, Italy. In the Konrad mine, near Salzgitter, Lower Saxony, Germany. At Yate, near Bristol, England. From Bamle, Norway. At Jebel Mokattem, near Cairo, Egypt. From Sakoany, near Mahajanga (Majunga), Madagascar.

Name: From the Latin for *celestial*, in allusion to the typical bluish color.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 415–420. (2) Chang, L.L.Y., R.A. Howie, and J. Zussman (1996) Rock-forming minerals, (2nd edition), v. 5B, non-silicates, 30–39. (3) Miyake, M., I. Minato, H. Morikawa, and S. Iwai (1978) Crystal structures and sulphate force constants of barite, celestite, and anglesite. Amer. Mineral., 63, 506–510. (4) Jacobsen, S.D., J.R. Smyth, R.J. Swope, and R.T. Downs (1998) Rigid-body character of the SO_4 groups in celestine, anglesite, and barite. Can. Mineral., 36, 1053–1060. (5) (1953) NBS Circ. 539, II, 61.