

Botryogen

MgFe³⁺(SO₄)₂(OH)·7H₂O

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Crystal Data: Monoclinic. *Point Group:* 2/m. Crystals are short to long prismatic, elongated and striated || [001], complex with { $\bar{1}01$ }, {010}, {110}, {120}, { $\bar{1}11$ }, many other forms, to several mm. Commonly in stalactitic, reniform, botryoidal or globular aggregates with internal radiating structure.

Physical Properties: *Cleavage:* {010}, perfect; {110}, good. *Fracture:* Conchoidal, irregular. *Tenacity:* Brittle. Hardness = 2–2.5 D(meas.) = 2.14 D(calc.) = 2.23 Decomposed by hot H₂O.

Optical Properties: Transparent to translucent. *Color:* Pale to dark orange. *Streak:* Ocher-yellow. *Luster:* Vitreous.

Optical Class: Biaxial (+). *Pleochroism:* X = colorless to pale brown; Y = cinnamon-brown; Z = golden yellow. *Orientation:* X = b; Z \wedge c = 12°. *Dispersion:* r > v, strong. $\alpha = 1.523$ $\beta = 1.530$ $\gamma = 1.582$ 2V(meas.) = 42°

Cell Data: *Space Group:* P2₁/n. a = 10.47–10.51 b = 17.83–17.85 c = 7.11–7.14 $\beta = 100^{\circ}00' - 100^{\circ}20'$ Z = 4

X-ray Powder Pattern: Quetena, Chile.

8.86 (FFF), 2.998 (F), 6.29 (mF), 5.11 (mF), 5.47 (f), 3.86 (f), 3.41 (f)

Chemistry:

	(1)	(2)
SO ₃	38.37	38.55
Fe ₂ O ₃	19.51	19.28
MgO	9.35	9.64
H ₂ O	32.28	32.53
Total	99.51	100.00

(1) Redington mine, California, USA. (2) MgFe(SO₄)₂(OH)·7H₂O.

Occurrence: A secondary mineral, which may be in great abundance, altered from pyrite, especially in arid climates.

Association: Copiapite, amarantite, hohmannite, coquimbite, voltaite, pickeringite, epsomite, gypsum, chalcantite.

Distribution: From Falun, Sweden. At the Rammelsberg mine, near Goslar, Harz Mountains, Germany. In Chile, in Antofagasta, at Chuquicamata, Quetena, west of Calama, and Alcaparrosa, near Cerritos Bayos, southwest of Calama. From the Santa Elena mine, Quebrada de La Alcaparrosa, San Juan Province, Argentina. In the USA, from the Redington mine, Knoxville, and at the Palisades mine, near Calistoga, Napa Co., California; abundant as a post-mining product at Bisbee, Cochise Co., Arizona; from Cornwall, Lebanon Co., Pennsylvania. At Libiola, Liguria, and Rio Marina, Elba, Italy.

Name: From the Greek for *bunch of grapes* and *to bear*, in allusion to the globular forms exhibited by the original material.

Type Material: Natural History Museum, Vienna, Austria, A.a.185; The Natural History Museum, London, England, 1956,315.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 617–618. (2) Cesbron, F. (1964) Contribution à la minéralogie des sulfates de fer hydratés. Bull. Soc. fr. Minéral., 87, 125–143 (in French). (3) Süsser, P. (1968) Die Kristallstruktur des Botryogens. Acta Cryst., 24, 760–767 (in German with English abs.).