Guanajuatite Bi_2Se_3

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Acicular crystals, to 2 cm, striated lengthwise, forming semicompact masses. Also massive, having granular, foliated, or fibrous texture.

Physical Properties: *Cleavage:* Distinct on {010}, indistinct on {001}. *Tenacity:* Somewhat sectile. Hardness = 2.5–3 VHN = 53–82 (10 g load). D(meas.) = 6.25–6.98 D(calc.) = 7.54

Optical Properties: Opaque. *Color:* Bluish gray; in polished section, white with a yellowish hue. *Streak:* Shiny gray. *Luster:* Metallic. *Pleochroism:* Distinct. *Anisotropism:* Strong. R_1–R_2: (400) 41.2–51.8, (420) 41.8–51.8, (440) 42.3–51.9, (460) 42.8–51.9, (480) 43.3–52.0, (500) 43.3–52.0, (520) 43.3–52.0, (540) 43.1–52.0, (560) 42.9–52.0, (580) 42.7–52.2, (600) 42.4–52.2, (620) 42.2–52.1, (640) 41.9–51.9, (660) 41.5–51.6, (680) 41.2–51.2, (700) 40.8–50.7

Cell Data: *Space Group: Pnma.* $a = 11.37$ $b = 11.55$ $c = 4.054$ $Z = 4$

X-ray Powder Pattern: Guanajuato, Mexico.
3.19 (100), 3.65 (90), 1.989 (70), 2.88 (60), 2.58 (50), 2.31 (50), 5.16 (40)

Chemistry:

	(1)	(2)	(3)
Bi	67.38	68.0	63.83
Se	24.13	24.5	36.17
S	6.60	6.6	
Total	98.11	99.1	100.00

(1) Guanajuato, Mexico; corresponds to $Bi_{1.89}(Se_{1.79}S_{1.21})_{\Sigma=3.00}$. (2) Do.; by electron microprobe, corresponds to $Bi_{1.89}(Se_{1.80}S_{1.20})_{\Sigma=3.00}$. (3) Bi_2Se_3.

Polymorphism & Series: Dimorphous with paraguanajuatite.

Occurrence: In hydrothermal deposits of low to medium temperatures.

Association: Bismuthinite, bismuth, clausthalite, nevskite, galena, pyrite, calcite.

Distribution: In Mexico, from the Santa Catarina [TL], La Industrial [TL], and Nuestra Señora de la Luz mines, Sierra de Santa Rosa, near Guanajuato. In the USA, near Salmon, Lemhi Co., Idaho; and at the Thomas and Essex mines, Darwin, Inyo Co., California. From the Roter Bär mine, St. Andreasberg, Harz Mountains, Germany. At Falun, Kopparberg, Sweden.

Name: For the locality in Guanajuato, Mexico.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 278–279. (2) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. Geol. Soc. Amer. Mem. 85, 85. (3) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 216.