

**Crystal Data:** Hexagonal. *Point Group:*  $\bar{3} 2/m$ . Intimately intergrown with guanajuatite.

**Physical Properties:** *Cleavage:* Perfect on {0001}. *Hardness* = 2 VHN = 27–50 (10 g load). *D*(meas.) = 6.2–7.0 *D*(calc.) = [7.704]

**Optical Properties:** Opaque. *Color:* Pale yellow, commonly tarnished lead-gray. *Luster:* Metallic. *Pleochroism:* Distinct in air. *Anisotropism:* Distinct.

*R*<sub>1</sub>–*R*<sub>2</sub>: (400) 46.9–56.2, (420) 47.5–56.6, (440) 48.0–56.8, (460) 48.6–57.2, (480) 49.3–57.7, (500) 49.9–58.0, (520) 50.2–58.1, (540) 50.3–58.2, (560) 50.2–58.1, (580) 50.0–58.0, (600) 49.7–57.8, (620) 49.2–57.4, (640) 48.6–56.8, (660) 48.1–56.2, (680) 47.4–55.5, (700) 46.9–55.0

**Cell Data:** *Space Group:*  $R\bar{3}m$  (synthetic Bi<sub>2</sub>Se<sub>3</sub>). *a* = 4.133 *c* = 28.62 *Z* = 3

**X-ray Powder Pattern:** Synthetic Bi<sub>2</sub>Se<sub>3</sub>. 3.03 (100), 2.23 (60), 1.404 (40), 4.80 (30), 2.07 (30), 1.907 (30), 1.320 (30)

<b>Chemistry:</b>	(1)	(2)
Bi	62.8	63.64
Se	36.4	30.08
Te		5.13
S	0.8	1.48
Total	100.0	100.33

(1) Mexico; by electron microprobe, corresponds to Bi<sub>1.86</sub>(Se<sub>2.85</sub>S<sub>0.15</sub>)<sub>Σ=3.00</sub>. (2) Kawazu mine, Japan; by electron microprobe, corresponds to Bi<sub>1.97</sub>(Se<sub>2.47</sub>Te<sub>0.26</sub>S<sub>0.30</sub>)<sub>Σ=3.03</sub>.

**Polymorphism & Series:** Dimorphous with guanajuatite.

**Mineral Group:** Tetradyomite group.

**Occurrence:** Intergrown with guanajuatite in contact metamorphic as well as in hydrothermal veins (Santa Catarina mine, Mexico).

**Association:** Guanajuatite, bismuthinite, ferroselite (Santa Catarina mine, Mexico).

**Distribution:** From Mexico, in Guanajuato, in the Santa Catarina [TL] and Leon mines. From Falun, Kopparberg, Sweden. At the Kawazu mine, Shizuoka Prefecture, Japan.

**Name:** From the supposed relation to guanajuatite.

**Type Material:** n.d.

**References:** (1) Ramdohr, P. (1948) Los especes mineralogicas guanajuatite y paraguanajuatite. *Comite Direct. Invest. Recursos Minerales Mexico*, Bol. 20, 1–15 (in Spanish). (2) (1949) *Amer. Mineral.*, 34, 619 (abs. ref. 1). (3) Godovikov, A.A. and V.A. Klyakhin (1966) Guanajuatite and paraguanajuatite. *Akad. Nauk SSSR, Sibirsk. Otdel., Geol. Geofiz.*, 7, 67–76 (in Russian). (4) (1967) *Amer. Mineral.*, 52, 1588 (abs. ref. 3). (5) Shmizu, M., A. Kato, and S. Matsubara (1988) Hemusite and paraguanajuatite from the Lawazu mine, Shizuoka Prefecture, Japan. *Mineral. J. (Japan)*, 14, 92–100. (6) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. *Geol. Soc. Amer. Mem.* 85, 28. (7) Sindeeva, N.D. (1964) Mineralogy and types of deposits of selenium and tellurium, 71–74. (8) Ramdohr, P. (1969) *The ore minerals and their intergrowths*, (3rd edition), 702–703. (9) Criddle, A.J. and C.J. Stanley, Eds. (1993) *Quantitative data file for ore minerals*, 3rd ed. Chapman & Hall, London, 413.