

**Crystal Data:** Monoclinic. *Point Group:* 2/*m*. As prismatic crystals, to 10 cm. In columnar, radiating, and spherulitic aggregates of fibers and prisms. *Twinning:* Simple and lamellar twinning common on {100}.

**Physical Properties:** *Cleavage:* Good on {110}, (110) ∧ (1 $\bar{1}$ 0) ~87°; partings on {100}, {001}, and {010}. *Fracture:* Uneven to conchoidal. *Tenacity:* Brittle. *Hardness* = 6  
D(meas.) = 3.27–3.54 D(calc.) = [3.52]

**Optical Properties:** Translucent to opaque. *Color:* Clove-brown, gray, colorless, blue, green; colorless in thin section.

*Optical Class:* Biaxial (+). *Orientation:* Y = b; Z ∧ c = -46° to -55°. *Dispersion:* r < v or r > v, weak to moderate. α = 1.699–1.710 β = 1.710–1.719 γ = 1.725–1.738  
2V(meas.) = 58°–72°

**Cell Data:** *Space Group:* C2/c. a = 9.978(9) b = 9.156(9) c = 5.293(5) β = 105°29(2)'  
Z = 4

**X-ray Powder Pattern:** Borieva deposits, Erzebezirk Maden, Bulgaria. (ICDD 18-299).  
3.02 (100), 2.547 (80), 2.600 (60), 2.564 (50), 2.243 (50), 1.633 (50), 6.58 (40)

Chemistry:	(1)	(2)		(1)	(2)
SiO <sub>2</sub>	47.62	48.81	CaO	22.18	21.87
TiO <sub>2</sub>		0.01	Na <sub>2</sub> O		0.07
Al <sub>2</sub> O <sub>3</sub>	0.91	0.74	K <sub>2</sub> O		0.02
Fe <sub>2</sub> O <sub>3</sub>	0.04	0.79	H <sub>2</sub> O <sup>+</sup>	0.40	0.32
FeO	0.70	1.54	H <sub>2</sub> O <sup>-</sup>	0.09	0.35
MnO	27.47	22.58	CO <sub>2</sub>	0.24	
MgO	0.53	2.29	P <sub>2</sub> O <sub>5</sub>		0.01
			Total	100.18	99.40

(1) Tetela de Ocampo, Mexico; corresponds to (Ca<sub>0.97</sub>Mg<sub>0.03</sub>)<sub>Σ=1.00</sub>(Mn<sub>0.96</sub>Fe<sub>0.02</sub>Al<sub>0.02</sub>)<sub>Σ=1.00</sub>(Si<sub>1.97</sub>Al<sub>0.03</sub>)<sub>Σ=2.00</sub>O<sub>6</sub>. (2) Aravaipa district, Arizona, USA; corresponds to (Ca<sub>0.96</sub>Na<sub>0.01</sub>)<sub>Σ=0.97</sub>(Mn<sub>0.78</sub>Mg<sub>0.14</sub>Fe<sub>0.05</sub>Al<sub>0.03</sub>Fe<sub>0.02</sub>)<sub>Σ=1.02</sub>(Si<sub>1.99</sub>Al<sub>0.01</sub>)<sub>Σ=2.00</sub>O<sub>6</sub>.

**Polymorphism & Series:** Forms two series, with diopside, and with hedenbergite.

**Mineral Group:** Pyroxene group.

**Occurrence:** In metasomatized limestones and manganese skarns; in quartz or calcite veins cutting rhyolite.

**Association:** Rhodonite, manganese oxides.

**Distribution:** From Tetela de Ocampo, Puebla, and Pachuca, Hidalgo, Mexico. In the USA, at Franklin, Sussex Co., New Jersey; from the Bohemia district, Lane Co., Oregon; at the Aravaipa district, Graham Co., Arizona; and in the Empire Zinc Co. mine, Hanover, Grant Co., New Mexico. From Schio, Vicenza, and Campiglia, Tuscany, Italy. In the Akatani mine, Niigata Prefecture; the Nakatatsu mine, Fukui Prefecture; the Onagusa mine, Katsuyam, Okayama Prefecture; and elsewhere in Japan. A number of other localities are known.

**Name:** To honor Professor Albert Johannsen (1871–1962), petrologist, University of Chicago, Chicago, Illinois, USA.

**Type Material:** National Museum of Natural History, Washington, D.C., USA, R3118, 97484.

**References:** (1) Schaller, W.T. (1938) Johannsenite, a new manganese pyroxene. *Amer. Mineral.*, 23, 575–582. (2) Deer, W.A., R.A. Howie, and J. Zussman (1978) *Rock-forming minerals*, (2nd edition), v. 2A, single-chain silicates, 415–422. (3) Freed, R.L. and D.R. Peacor (1967) Refinement of the crystal structure of johannsenite. *Amer. Mineral.*, 52, 709–720.

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