

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Crystals are tabular on {001} or short prismatic along [100], to 22 cm; prominently striated on {001} || [100]. *Twinning:* Common on {130}, producing either flattened heart-shaped or pseudohexagonal multiple contact and penetration twins.

Physical Properties: *Cleavage:* Distinct on {110}, imperfect on {010}, poor on {001}. *Fracture:* Uneven to conchoidal. *Tenacity:* Brittle. Hardness = 8.5 D(meas.) = 3.75(1) D(calc.) = 3.69

Optical Properties: Transparent to translucent, may be opaque and chatoyant with oriented inclusions. *Color:* Various shades of green, yellow, brownish to greenish black, may be raspberry-red under incandescent light when chromian; colorless, pale shades of yellow, green, or red in transmitted light. *Streak:* White. *Luster:* Vitreous. *Optical Class:* Biaxial (+). *Pleochroism:* X = red; Y = yellow-orange; Z = emerald-green. *Orientation:* X = c; Y = b; Z = a. *Dispersion:* $r > v$. $\alpha = 1.746$ $\beta = 1.748$ $\gamma = 1.756$ $2V(\text{meas.}) = 70^\circ$

Cell Data: *Space Group:* $Pbnm$. $a = 4.428(1)$ $b = 9.415(3)$ $c = 5.481(2)$ $Z = 4$

X-ray Powder Pattern: Near Golden, Colorado, USA. (ICDD 11-448). 3.24 (100), 2.091 (90), 1.619 (80), 4.01 (50), 2.563 (50), 2.265 (45), 2.081 (45)

Chemistry:	(1)	(2)
TiO ₂	0.55	
Al ₂ O ₃	76.34	80.30
FeO	3.60	
BeO	19.15	19.70
LOI	0.30	
Total	99.94	100.00

(1) Near Golden, Colorado, USA. (2) BeAl₂O₄.

Occurrence: Characteristic of some granite pegmatites associated with high-grade mica schists or reaction zones in ultramafic rocks; also detrital in placers.

Association: Quartz, muscovite, albite, beryl, columbite, tourmaline, topaz, kyanite, staurolite (granite pegmatites); phenakite, apatite, tourmaline, fluorite (reaction zone pegmatites).

Distribution: Widespread, however fine crystals are uncommon. Notable localities include: from many places in Brazil, with exceptional crystals from Tancredo, Itaguaçu, and Colatina, Espirito Santo; from Faria Lemos, Santa Luzia de Carangola, and Americana, Teófilo Otoni, Minas Gerais; at Campo Formoso, Teixeira de Freitas, and Cachoeira, Bahia. From Maršíkov, Czech Republic. At the Izumrudnye mines, Tokovaya River, near Yekaterinburg (Sverdlovsk), and Mursinka, Ural Mountains, Russia. From Miakanjovato, near Lake Alaotra, northeast of Ambatosoratra, Madagascar. Near Masvingo (Ft. Victoria), Zimbabwe. Abundant in gem gravel placers in the Ratnapura district, Sri Lanka. In the USA, from near Golden, Jefferson Co., Colorado; in Maine, at Topsham, Sagadahoc Co., from Paris, Norway, and Hartford, Oxford Co., and elsewhere.

Name: From the Greek for *golden*, in allusion to the mineral's color, and *beryl*.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 718–722. (2) Vlasov, K.A., Ed. (1966) Mineralogy of rare elements, v. II, 73–77. (3) Farrell, E.F., J.H. Fang, and R.E. Newnham (1963) Refinement of the chrysoberyl structure. *Amer. Mineral.*, 48, 804–810. (4) Hazen, R.M. (1987) High-pressure crystal chemistry of chrysoberyl, Al₂BeO₄: insights on the origin of olivine elastic anisotropy. *Phys. Chem. Minerals*, 14, 13–20. (5) Pilati, T., F. Demartin, F. Cariati, S. Bruni, and C.M. Gramaccioli (1993) Atomic thermal parameters and thermodynamic functions for chrysoberyl (BeAl₂O₄) from vibrational spectra and transfer of empirical force fields. *Acta Cryst.*, 49, 216–222.

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