

# Amblygonite

# LiAl(PO<sub>4</sub>)(F, OH)

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**Crystal Data:** Triclinic. *Point Group:*  $\bar{1}$ . Crude crystals, typically equant with complex form development, to 1.5 m; massive. *Twinning:* On several laws, with microscopic polysynthetic twinning common.

**Physical Properties:** *Cleavage:* {100}, perfect; {110}, good; {0 $\bar{1}$ 1}, distinct; {001} imperfect [morphological orientation of ref. (1)]. *Fracture:* Uneven to subconchoidal. *Tenacity:* Brittle. Hardness = 5.5–6 D(meas.) = 3.04–3.11 D(calc.) = [3.13]

**Optical Properties:** Transparent to translucent. *Color:* Milk-white, pale yellow, beige, salmon-pink, pale green, pale blue, gray, may be colorless; colorless in transmitted light. *Luster:* Vitreous to greasy, pearly on good cleavages.

*Optical Class:* Biaxial (-). *Orientation:* Euler angles  $\phi = 55.5^\circ$ ;  $\psi = 30.0^\circ$ ;  $\theta = 18.2^\circ$  [for amblygonite 92%]. *Dispersion:*  $r > v$ .  $\alpha = 1.577$ – $1.591$   $\beta = 1.592$ – $1.605$   $\gamma = 1.596$ – $1.613$   $2V(\text{meas.}) = 107^\circ$ – $129.5^\circ$

**Cell Data:** *Space Group:*  $C\bar{1}$ .  $a = 6.644(2)$   $b = 7.744(2)$   $c = 6.910(1)$   $\alpha = 90.35(2)^\circ$   $\beta = 117.33(2)^\circ$   $\gamma = 91.01(2)^\circ$   $Z = 4$

**X-ray Powder Pattern:** Chursdorf, Germany.

3.151 (vvsb), 4.642 (vs), 2.955 (vs), 3.237 (ms), 1.935 (ms), 3.300 (m), 2.384 (m)

Chemistry:	(1)	(2)	(1)	(2)
P <sub>2</sub> O <sub>5</sub>	48.44	48.31	F	13.06
Al <sub>2</sub> O <sub>3</sub>	33.90	34.70	H <sub>2</sub> O	0.00
Li <sub>2</sub> O	10.12	10.17	–O = F <sub>2</sub>	5.50
			Total	100.02
				100.00

(1) [Chursdorf, Germany]; by electron microprobe, corresponds to Li<sub>1.00</sub>Al<sub>0.98</sub>(PO<sub>4</sub>)<sub>1.01</sub>F<sub>1.02</sub>.

(2) LiAl(PO<sub>4</sub>)(F, OH) with F:OH = 1:1.

**Polymorphism & Series:** Forms a series with montebrasite.

**Mineral Group:** Amblygonite group.

**Occurrence:** An uncommon accessory mineral in zoned granite pegmatites; in high-temperature tin veins and greisens.

**Association:** Lacroixite, apatite, lithiophilite, spodumene, lepidolite, petalite, pollucite, tourmaline (pegmatites); cassiterite, topaz, mica (greisens).

**Distribution:** Much less common than montebrasite. The few localities for analyzed material include: from Chursdorf and Arnsdorf, near Penig, Saxony, Germany. On Utö Island, near Stockholm, Sweden. In the USA, at Hebron, Oxford Co., Maine; large crystals in San Domingo Wash, northeast of Wickenburg, Maricopa Co., Arizona. From the Tanco pegmatite, Bernic Lake, Manitoba, Canada. At Coolgardie, Western Australia. From near Karibib, Namibia. In the Muiãne pegmatite, Alto Ligonha district, Mozambique.

**Name:** From the Greek for *blunt* and *angle*, for its  $\sim 90^\circ$  cleavage angle.

**Type Material:** Mining Academy, Freiberg, Germany, 20336.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 823–827. (2) Moss, A.A., E.E. Fejer, and P.G. Embrey (1969) On the X-ray identification of amblygonite and montebrasite. *Mineral. Mag.*, 37, 414–422. (3) Černá, I., P. Černý, and R.B. Ferguson (1973) The fluorine content and some physical properties of the amblygonite-montebrasite minerals. *Amer. Mineral.*, 58, 291–301. (4) Greiner, D.J. and F.D. Bloss (1987) Amblygonite-montebrasite optics: response to (OH)<sup>–</sup> orientation and rapid estimation of F from 2V. *Amer. Mineral.*, 72, 617–624. (5) Groat, L.A., M. Raudsepp, F.C. Hawthorne, T.S. Ercit, B.L. Sherriff, and J.S. Hartman (1990) The amblygonite-montebrasite series: characterization by single-crystal structure refinement, infrared spectroscopy, and multinuclear MAS-NMR spectroscopy. *Amer. Mineral.*, 75, 992–1008.

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