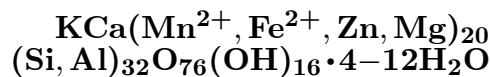


# Bannisterite



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**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . As prismatic bladed crystals and aggregates, to 20 cm; as anhedral plates bounded by cleavage surfaces.

**Physical Properties:** *Cleavage:* Perfect on {001}; a second prismatic cleavage is noted microscopically. *Hardness* = 4 *D*(meas.) = 2.83–2.84 *D*(calc.) = 2.84

**Optical Properties:** Translucent. *Color:* Light to dark brown, black. *Luster:* Resinous. *Optical Class:* Biaxial (–). *Pleochroism:* *X* = nearly colorless; *Y* = *Z* = pale yellow to brown. *Orientation:* *Y* = *b*; *Z*  $\simeq$  *a*. *Dispersion:* *r* < *v*, weak to moderate.  $\alpha = 1.544-1.574$   
 $\beta = 1.586-1.611$   $\gamma = 1.589-1.612$   $2V$ (meas.) = Small to medium.

**Cell Data:** *Space Group:*  $A2/a$ . *a* = 22.20–22.32 *b* = 16.32–16.40 *c* = 24.69–24.70  
 $\beta = 94^\circ 17' - 94^\circ 21'$  *Z* = 4

**X-ray Powder Pattern:** Franklin, New Jersey, USA.  
12.33 (100), 3.436 (20), 4.103 (15b), 2.638 (15), 3.077 (12), 2.606 (11), 4.593 (10)

## Chemistry:

	(1)	(2)
SiO <sub>2</sub>	45.4	46.3
Al <sub>2</sub> O <sub>3</sub>	3.84	4.2
Fe <sub>2</sub> O <sub>3</sub>	2.1	1.44
FeO	16.5	5.67
MnO	19.9	23.4
ZnO	0.0	4.6
MgO	0.47	3.1
CaO	1.55	1.3
Na <sub>2</sub> O	0.51	0.09
K <sub>2</sub> O	0.92	1.04
H <sub>2</sub> O	7.82	9.3
Total	99.0	100.4

(1) Broken Hill, Australia; determinations by a combination of electron microprobe, AA, and flame photometry. (2) Franklin, New Jersey, USA; by electron microprobe; Fe<sup>2+</sup> and Fe<sup>3+</sup> by wet methods, K and Na by flame photometry, H<sub>2</sub>O by DTA-TGA; corresponds to (K<sub>0.82</sub>Na<sub>0.11</sub>)<sub>Σ=0.93</sub>Ca<sub>0.86</sub>(Mn<sub>12.21</sub>Fe<sub>2.92</sub><sup>2+</sup>Mg<sub>2.85</sub>Zn<sub>2.09</sub>Fe<sub>0.66</sub><sup>3+</sup>)<sub>Σ=20.73</sub>(Si<sub>28.53</sub>Al<sub>3.05</sub>)<sub>Σ=31.58</sub>O<sub>76</sub>(OH)<sub>16</sub>•12.2H<sub>2</sub>O.

**Occurrence:** In metamorphosed Mn-Zn orebodies.

**Association:** Manganoan and zincian amphiboles, rhodonite, sphalerite, quartz, calcite, barite (Franklin, New Jersey, USA); rhodonite, sphalerite, fluorite, galena, apophyllite, quartz (Broken Hill, Australia).

**Distribution:** In the Benallt mine, Rhiw, Lleyen Peninsula, Wales. From Franklin, Sussex Co., New Jersey, USA. At Nyberget, Sweden. In the Ananai mine, Kochi Prefecture, Japan. From Broken Hill, New South Wales, Australia.

**Name:** Honoring Dr. Frederick Allen Bannister (1901– ), formerly Keeper of Minerals, British Museum (Natural History), London, England.

**Type Material:** The Natural History Museum, London, England, 1967,321; Harvard University, Cambridge, Massachusetts, 91862, 91863, 108571, 128253; National Museum of Natural History, Washington, D.C., USA, 145728–145730.

**References:** (1) Smith, M.L. and C. Frondel (1968) The related layered minerals ganophyllite, bannisterite, and stilpnomelane. *Mineral. Mag.*, 36, 893–913. (2) (1969) *Amer. Mineral.*, 54, 577 (abs. ref. 1). (3) Plimer, I.R. (1977) Bannisterite from Broken Hill, Australia. *Neues Jahrb. Mineral., Monatsh.*, 504–508. (4) Dunn, P.J., P.B. Leavens, J.A. Norberg, and R.A. Ramik (1981) Bannisterite: new chemical data and empirical formulae. *Amer. Mineral.*, 66, 1063–1067. (5) Heaney, P.J., J.E. Post, and H.T. Evans, Jr. (1992) The crystal structure of bannisterite. *Clays and Clay Minerals*, 40, 129–144.

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