

**Kanonaite**

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**Crystal Data:** Orthorhombic. *Point Group:*  $2/m\ 2/m\ 2/m$ . As anhedral nodular porphyroblasts, to 1.2 cm.

**Physical Properties:** *Cleavage:* Poor on {110}. *Hardness* = 6.5 *VHN* = 906–1017 (100 g load). *D*(meas.) = n.d. *D*(calc.) = 3.395

**Optical Properties:** Transparent to translucent. *Color:* Greenish black. *Streak:* Gray-green. *Luster:* Vitreous.

*Optical Class:* Biaxial (+). *Pleochroism:* Strong; *X* = yellow-green; *Y* = bluish green; *Z* = deep golden yellow. *Orientation:* *X* = *a*; *Y* = *b*; *Z* = *c*.  $\alpha = 1.702$   $\beta = 1.730$   $\gamma = 1.823$   $2V$ (meas.) =  $53(3)^\circ$

**Cell Data:** *Space Group:*  $Pn\bar{m}$ . *a* = 7.959(2) *b* = 8.047(2) *c* = 5.616(1) *Z* = 4

**X-ray Powder Pattern:** Kanona, Zambia.

5.669 (100), 2.827 (94), 3.577 (90), 2.517 (90), 2.212 (83), 4.590 (75), 2.299 (69)

**Chemistry:**

	(1)	(2)
SiO <sub>2</sub>	32.2	32.48
TiO <sub>2</sub>	0.01	
Al <sub>2</sub> O <sub>3</sub>	33.9	31.60
Fe <sub>2</sub> O <sub>3</sub>	0.66	2.57
Mn <sub>2</sub> O <sub>3</sub>	32.2	33.48
CuO	0.01	
ZnO	0.13	
PbO	0.01	
MgO	0.04	
CaO	0.01	
BaO	0.04	
Total	99.21	100.13

(1) Kanona, Zambia; by electron microprobe; corresponds to  $(\text{Mn}_{0.76}^{3+}\text{Al}_{0.23}\text{Fe}_{0.02}^{3+})_{\Sigma=1.01}\text{Al}_{1.00}\text{Si}_{0.99}\text{O}_5$ . (2) Salmchâteau, Belgium; by electron microprobe, corresponds to  $(\text{Mn}_{0.79}^{3+}\text{Al}_{0.15}\text{Fe}_{0.06}^{3+})_{\Sigma=1.00}\text{Al}_{1.00}\text{Si}_{1.00}\text{O}_5$ .

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

**Occurrence:** Formed under low-grade metamorphic conditions, in a gahnite schist (Kanona, Zambia); in a schist (Salmchâteau, Belgium).

**Association:** Gahnite, magnesian chlorite, coronadite, braunite (Kanona, Zambia); quartz, muscovite, paragonite, chlorite, hematite, braunite, rutile, apatite (Salmchâteau, Belgium).

**Distribution:** From 13 km north of Kanona, Serenje, Zambia. On the Salm River, one km north of Salmchâteau, near Ottré, Ardennes Mountains, Belgium.

**Name:** For Kanona, near the locality in Zambia.

**Type Material:** Charles University, Prague, Czech Republic, 17352; National Museum of Natural History, Washington, D.C., USA, 144523.

**References:** (1) Vrána, S., M. Rieder, and J. Podlaha (1978) Kanonaite,  $(\text{Mn}_{0.76}^{3+}\text{Al}_{0.23}\text{Fe}_{0.02}^{3+})^{[6]}\text{Al}^{[5]}\text{O}[\text{SiO}_4]$ , a new mineral isotypic with andalusite. *Contr. Mineral. Petrol.*, **66**, 325–332. (2) (1979) *Amer. Mineral.*, **64**, 655 (abs. ref. 1). (3) Kramm, U. (1979) Kanonaite-rich viridines from the Venn-Stavelot massif, Belgian Ardennes. *Contr. Mineral. Petrol.*, **69**, 387–395. (4) Weiss, Z., S.W. Bailey, and M. Rieder (1981) Refinement of the crystal structure of kanonaite,  $(\text{Mn}^{3+}, \text{Al})^{[6]}(\text{Al}, \text{Mn}^{3+})^{[5]}\text{O}[\text{SiO}_4]$ . *Amer. Mineral.*, **66**, 561–567. (5) Gunter, M. and F.D. Bloss (1982) Andalusite-kanonaite series: lattice and optical parameters. *Amer. Mineral.*, **67**, 1218–1228.

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