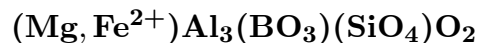


# Grandidierite



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**Crystal Data:** Orthorhombic. *Point Group:*  $2/m\ 2/m\ 2/m$ . As anhedral elongated individuals, to 8 cm, typically strongly corroded.

**Physical Properties:** *Cleavage:*  $\{100\}$ , more perfect, and  $\{010\}$ . *Hardness* = 7.5  
D(meas.) = 2.98–2.99 D(calc.) = [3.00]

**Optical Properties:** Transparent to translucent. *Color:* Bluish green, greenish blue with increasing Fe; in thin section, colorless to blue or green. *Luster:* Vitreous, somewhat pearly on the cleavage.

*Optical Class:* Biaxial (-). *Pleochroism:*  $X$  = deep blue to blue-green;  $Y$  = colorless;  $Z$  = light greenish blue to deep green. *Orientation:*  $X = a$ ;  $Y = c$ ;  $Z = b$ . *Dispersion:*  $r < v$ , very strong. *Absorption:*  $Z > X > Y$ .  $\alpha = 1.590\text{--}1.602$   $\beta = 1.618\text{--}1.636$   $\gamma = 1.623\text{--}1.639$   
 $2V(\text{meas.}) = 27^\circ\text{--}32^\circ$

**Cell Data:** *Space Group:*  $Pbnm$ .  $a = 10.335(2)$   $b = 10.978(2)$   $c = 5.760(2)$   $Z = 4$

**X-ray Powder Pattern:** Sakatelo, Madagascar.

5.17 (vvs), 5.04 (vvs), 5.482 (vs), 2.744 (vs), 2.166 (s), 3.708 (ms), 2.584 (ms)

<b>Chemistry:</b>	(1)	(2)	(3)		(1)	(2)	(3)
SiO <sub>2</sub>	20.39	19.9	19.77	MnO	0.04	0.12	
TiO <sub>2</sub>	0.13	0.02		MgO	12.04	9.2	6.63
B <sub>2</sub> O <sub>3</sub>	11.57	n.d.	11.45	CaO	0.00	0.00	
Al <sub>2</sub> O <sub>3</sub>	52.12	50.35	50.33	Na <sub>2</sub> O	0.04	0.01	
Fe <sub>2</sub> O <sub>3</sub>	0.80			K <sub>2</sub> O	0.09	0.04	
FeO	2.87	7.75	11.82	Total	100.09	87.39	100.00

(1) Sakatelo, Madagascar; corresponds to  $(\text{Mg}_{0.87}\text{Fe}_{0.12}^{2+}\text{Fe}_{0.03}^{3+})_{\Sigma=1.02}\text{Al}_{3.00}(\text{B}_{0.97}\text{O}_3)(\text{Si}_{0.99}\text{O}_4)\text{O}_2$ .

(2) Mt. Amiata, Italy; by electron microprobe, corresponds to  $(\text{Mg}_{0.69}\text{Fe}_{0.32})_{\Sigma=1.01}$

$\text{Al}_{2.98}(\text{BO}_3)(\text{Si}_{1.00}\text{O}_4)\text{O}_2$ . (3)  $(\text{Mg, Fe})\text{Al}_3(\text{BO}_3)(\text{SiO}_4)\text{O}_2$  with Mg:Fe = 1:1.

**Occurrence:** A rare accessory mineral in aluminous boron-rich rocks, thermally and high-grade regionally metamorphosed under low pressure; in pegmatites, aplites, gneisses; in xenoliths.

**Association:** Quartz, potassic feldspar, plagioclase, biotite, garnet, “hypersthene,” spinel, corundum, sillimanite, andalusite, cordierite, tourmaline, kornerupine, sapphirine, serendibite, sinhalite.

**Distribution:** In large crystals from Andrahomana, southwest of Taolaiaro (Fort Dauphin); at Marotrana, Amboasara; from Vohiboly, near Behara; Ampamatoa; and elsewhere on Madagascar. In the Kachebere Hills, Mchinji district, Malawi. From Tizi-Ouchen, Béjaia, Algeria. From near Gananoque, Ontario, Canada. At Johnsbury, Warren Co., New York, USA. On Mt. Amiata and Mt. Cimino, Tuscany, Italy. Around Vestpolltind, and on Almjotheia, 12 km north of Moi, Norway. At Maratakka, Surinam. On Cuvier Island, New Zealand. Known from a number of other minor localities.

**Name:** For Alfred Grandidier (1836–1912), French naturalist and explorer, an authority on Madagascar.

**Type Material:** Harvard University, Cambridge, Massachusetts, USA, 86382.

**References:** (1) Dana, E.S. and W.E. Ford (1909) Dana’s system of mineralogy, (6th edition), app. II, 47. (2) McKie, D. (1965) The magnesium aluminum borosilicates: kornerupine and grandidierite. *Mineral. Mag.*, 34, 346–357. (3) Stephenson, D.A. and P.B. Moore (1968) The crystal structure of grandidierite,  $(\text{Mg, Fe})\text{Al}_3\text{SiBO}_9$ . *Acta Cryst.*, 24, 1518–1522. (4) Van Bergen, M.J. (1980) Grandidierite from aluminous metasedimentary xenoliths within acid volcanics, a first record in Italy. *Mineral. Mag.*, 43, 651–658.

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