## Yuanfuliite $Mg(Fe^{3+}, Al)O(BO_3)$



**Crystal Data:** Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Poorly formed crystals, elongated along [001], to 2 mm, commonly anhedral granular, massive.

**Physical Properties:** *Cleavage:* Perfect on {100}. *Tenacity:* Brittle. Hardness = 5–6 VHN = 843 (50 g load). D(meas.) = n.d. D(calc.) = [3.40–3.43]

**Optical Properties:** Nearly opaque. *Color:* Black; brown in thin section; pale gray in reflected light, with dark red internal reflections. *Streak:* Black. *Luster:* Submetallic to adamantine. *Optical Class:* Biaxial. *Pleochroism:* Brown to very dark brown or dark brownish red. *Anisotropism:* Weak.
R: (400) — , (420) 1.2, (440) 7.70, (460) 9.77, (480) 10.11, (500) 10.12, (520) 10.03, (540) 9.66, (560) 9.40, (580) 9.38, (600) 9.27, (620) 9.22, (640) 8.98, (660) 8.79, (680) 5.33, (700) 1.33

**Cell Data:** *Space Group: Pnam.* $a = 9.198$–$9.258$ $b = 9.351$–$9.355$ $c = 3.081$–$3.091$ $Z = 4$

**X-ray Powder Pattern:** Zhuanmiao deposit, China.
2.570 (100), 4.176 (38), 2.957 (30), 6.563 (23), 2.088 (20), 1.550 (19), 1.591 (18)

**Chemistry:**

| | (1) | (2) | | (1) | (2) |
|---|---|---|---|---|---|
| $P_2O_5$ | 0.15 | | FeO | | 6.06 |
| $B_2O_3$ | 20.44 | 23.37 | MnO | | 0.28 |
| $SiO_2$ | 0.07 | | CoO | 0.04 | |
| $TiO_2$ | 5.76 | 3.80 | MgO | 27.71 | 25.99 |
| $MnO_2$ | 0.02 | | CaO | 0.04 | |
| $Al_2O_3$ | 6.02 | 7.80 | $Na_2O$ | 0.70 | |
| $Fe_2O_3 + FeO$ | 36.87 | | $K_2O$ | 0.03 | |
| $Fe_2O_3$ | | 31.76 | Total | 97.89 | 100.00 |
| $Cr_2O_3$ | 0.04 | 0.94 | | | |

(1) Zhuanmiao deposit, China; by electron microprobe, average of four analyses, $B_2O_3$ by wet methods, $Fe_2O_3$:FeO determined by Mössbauer spectroscopy; corresponds to $(Mg_{0.91}Fe^{2+}_{0.09})_{\Sigma=1.00}(Fe^{3+}_{0.56}Al_{0.19}Mg_{0.17}Ti_{0.11}Fe^{2+}_{0.10})_{\Sigma=1.13}O(B_{0.92}O_{3.00})$. (2) Inglefield Land, Greenland; by electron microprobe, $B_2O_3$ by ion microprobe; corresponds to $(Mg_{0.59}Al_{0.23}Fe^{2+}_{0.12}Fe^{3+}_{0.06}Mn_{0.01})_{\Sigma=1.01}(Fe^{3+}_{0.53}Mg_{0.38}Ti_{0.07}Cr_{0.02})_{\Sigma=1.00}O(B_{1.00}O_3)$.

**Occurrence:** In metamorphosed magnesian marble in a boron deposit (Zhuanmiao deposit, China); in ultramafic rocks (Inglefield Land, Greenland).

**Association:** Suanite, anhydrite, apatite (Zhuanmiao deposit, China); sinhalite, forsterite, calcite (Huayuangou deposit, China); forsterite, pleonaste, phlogopite, magnetite, apatite, tourmaline (Inglefield Land, Greenland).

**Distribution:** From the Zhuanmiao boron deposit, Kuandian Co., and the Huayuangou boron deposit, both in Liaoning Province, China. Found in central Inglefield Land, northwest Greenland.

**Name:** In honor of Professor Yuan Fuli (1893–1987), Chinese geologist, China University of Geosciences, Wuhan, China.

**Type Material:** Geological Museum of China, Beijing, China.

**References:** (1) Huang Zouliang and Wang Pu (1994) Yuanfuliite – a new borate mineral. Acta Petrologica Mineralogica, 13(4), 328–334 (in Chinese with English abs.). (2) (1996) Amer. Mineral., 81, 252–253 (abs. ref. 1). (3) Appel, P.W.U., S. Biga, and M.F. Brigatti (1999) Crystal structure and chemistry of yuanfuliite and its relationships with warwickite. Eur. J. Mineral., 11, 483–491.