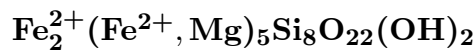


# Grunerite



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**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . Commonly as acicular or fibrous radiating crystals; may be asbestiform. *Twinning:* Simple or multiple twinning common  $\parallel \{100\}$ , producing narrow twin lamellae.

**Physical Properties:** *Cleavage:* Perfect on  $\{110\}$ , with intersections of  $\sim 56^\circ$  and  $\sim 124^\circ$ . *Tenacity:* Brittle. Hardness = 5–6 D(meas.) = 3.40–3.60 D(calc.) = 3.531

**Optical Properties:** Translucent. *Color:* Dark green to brown, gray to greenish gray; colorless to pale green or brown in thin section. *Luster:* Vitreous, silky when fibrous.

*Optical Class:* Biaxial (-). *Pleochroism:* With increasing Fe content, X = pale yellow; Y = pale yellow-brown; Z = pale brown. *Orientation:* Y = b; Z  $\wedge$  c =  $-16^\circ$  to  $-12^\circ$ ; X  $\wedge$  a =  $-3^\circ$  to  $2^\circ$ . *Dispersion:*  $r > v$ , weak.  $\alpha = 1.663\text{--}1.688$   $\beta = 1.677\text{--}1.709$   $\gamma = 1.697\text{--}1.729$  2V(meas.) =  $80^\circ\text{--}90^\circ$

**Cell Data:** *Space Group:*  $C2/m$ .  $a = 9.5642(7)$   $b = 18.393(2)$   $c = 5.3388(3)$   
 $\beta = 101.892(3)^\circ$  Z = 2

**X-ray Powder Pattern:** Wabush Iron Formation, White Lake, Newfoundland, Canada. 8.33 (100), 3.06 (70), 2.756 (70), 2.189 (50), 4.13 (40), 3.26 (40), 2.628 (40)

Chemistry:	(1)	(2)	(1)	(2)	
SiO <sub>2</sub>	49.33	47.54	MgO	6.65	0.04
TiO <sub>2</sub>	0.02		CaO	0.18	0.00
Al <sub>2</sub> O <sub>3</sub>	0.39	0.20	Na <sub>2</sub> O	0.12	0.29
Fe <sub>2</sub> O <sub>3</sub>		0.71	K <sub>2</sub> O	0.20	0.11
FeO	40.94	47.25	F		0.01
MnO	0.54	2.14	H <sub>2</sub> O <sup>+</sup>	1.54	1.55
			Total	99.91	99.84

(1) Wabush Iron Formation, Newfoundland, Canada; corresponds to  $(\text{Fe}_{5.50}^{2+}\text{Mg}_{1.59}\text{Mn}_{0.08}\text{Na}_{0.04}\text{K}_{0.04}\text{Ca}_{0.03})_{\Sigma=7.28}(\text{Si}_{7.92}\text{Al}_{0.08})_{\Sigma=8.00}\text{O}_{22}(\text{OH})_{1.64}$ . (2) Rockport, Essex Co., Massachusetts, USA; corresponds to  $(\text{Fe}_{6.63}^{2+}\text{Mn}_{0.30}\text{Fe}_{0.09}^{3+}\text{Na}_{0.09}\text{K}_{0.02}\text{Mg}_{0.01}\text{Al}_{0.01})_{\Sigma=7.15}(\text{Si}_{7.97}\text{Al}_{0.03})_{\Sigma=8.00}\text{O}_{22}(\text{OH})_{1.74}$ .

**Polymorphism & Series:** Dimorphous with ferro-anthophyllite; forms a series with cummingtonite.

**Mineral Group:** Amphibole (Fe–Mn–Mg) group:  $\text{Mg}/(\text{Mg} + \text{Fe}^{2+}) < 0.3$ ;  $(\text{Ca} + \text{Na})_{\text{B}} < 1.34$ ;  $\text{Li} < 1.0$ ;  $\text{Mn} < 0.5$ .

**Occurrence:** Common in medium- to high-grade metamorphosed iron formations. A product of contact metamorphism, and in some blueschist facies metaquartzites.

**Association:** Magnetite, hematite, hedenbergite, riebeckite, fayalite, garnet, quartz.

**Distribution:** Many localities. From Collobrières, Var, France. At Loch Duich, Ross-shire, and Glen Beag, Glenelg, Inverness-shire, Scotland. From the Botallack mine, St. Just, Cornwall, England. In Portugal, at Vila Real. At Strömshult, near Tunaberg, Sweden. Commercial production from the Penge area, Transvaal, South Africa. From around Michigamme, Marquette Co., Michigan, USA. In Canada, in the Labrador City area, Labrador, Newfoundland. At Gualilan, Argentina.

**Name:** To honor the French chemist, Louis Emmanuel Gruner (1809–1883), who provided the first analysis.

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