

**Richterite****Na[NaCa](Mg, Fe<sup>2+</sup>)<sub>5</sub>Si<sub>8</sub>O<sub>22</sub>(OH)<sub>2</sub>**

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**Crystal Data:** Monoclinic. *Point Group:* 2/m. Crystals commonly prismatic, flattened along [100], rarely doubly terminated, to 15 cm; acicular or asbestiform. *Twinning:* Simple or multiple twinning || {100}.

**Physical Properties:** *Cleavage:* Perfect on {110}, intersecting at ~56° and ~124°; partings on {100}, {001}. *Fracture:* Uneven. *Tenacity:* Brittle. *Hardness:* 5–6 D(meas.) = 2.97–3.45 D(calc.) = [3.10]

**Optical Properties:** Transparent to translucent. *Color:* Brown, yellow, green, brownish red; colorless to pale yellow in thin section. *Luster:* Vitreous.

*Optical Class:* Biaxial (-). *Pleochroism:* Strong, in pale yellows, orange, and red. *Orientation:* Y = b; Z ∧ c = -54° to -20°. *Dispersion:* r < v, weak. *Absorption:* Y > Z = X. α = 1.605–1.624 β = 1.618–1.64 γ = 1.627–1.641 2V(meas.) = 48°–68°

**Cell Data:** *Space Group:* C2/m. a = 9.783 (ICDD 20-484). b = 17.943 c = 5.287 β = 104.070° Z = 2

**X-ray Powder Pattern:** Imerina, Madagascar. (ICDD 20-484). 8.29 (100), 3.09 (70), 3.33 (20), 2.695 (20), 2.78 (16), 4.47 (14), 8.85 (12)

<b>Chemistry:</b>		(1)	(2)	(1)	(2)	(1)	(2)	
SiO <sub>2</sub>	56.74	58.09	MnO	0.07	0.00	K <sub>2</sub> O	1.80	0.47
TiO <sub>2</sub>	0.28	0.18	NiO	0.23		F	1.30	3.91
Al <sub>2</sub> O <sub>3</sub>	0.71	0.17	MgO	21.95	24.34	Cl		0.03
Fe <sub>2</sub> O <sub>3</sub>	4.71		CaO	6.15	6.73	H <sub>2</sub> O <sup>+</sup>	0.87	
Cr <sub>2</sub> O <sub>3</sub>	0.06	0.06	SrO	0.02		-O = F <sub>2</sub>	0.54	1.61
FeO	0.87	0.01	Na <sub>2</sub> O	5.15	7.21	Total	100.37	99.59

(1) Libby, Lincoln Co., Montana, USA; corresponds to (Na<sub>1.39</sub>Ca<sub>0.92</sub>K<sub>0.32</sub>)<sub>Σ=2.63</sub>(Mg<sub>4.57</sub>Fe<sub>0.50</sub>Fe<sub>0.10</sub>Al<sub>0.04</sub>Ti<sub>0.03</sub>Ni<sub>0.02</sub>Mn<sub>0.01</sub>)<sub>Σ=5.27</sub>(Si<sub>7.92</sub>Al<sub>0.08</sub>)<sub>Σ=8.00</sub>O<sub>22</sub>[(OH)<sub>0.81</sub>F<sub>0.57</sub>]<sub>Σ=1.38</sub>. (2) Mayo Belwa meteorite; by electron microprobe, average of three analyses; corresponds to (Na<sub>1.93</sub>Ca<sub>1.00</sub>K<sub>0.08</sub>)<sub>Σ=3.01</sub>(Mg<sub>5.01</sub>Al<sub>0.03</sub>Ti<sub>0.02</sub>)<sub>Σ=5.06</sub>Si<sub>8.03</sub>O<sub>22</sub>(OH)<sub>2</sub>.

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

**Mineral Group:** Amphibole (sodic-calcic) group: Mg/(Mg + Fe<sup>2+</sup>) ≥ 0.5; (Na + K)<sub>A</sub> ≥ 0.5; 0.67 Na<sub>B</sub> 1.33; (Ca + Na)<sub>B</sub> ≥ 1.34; Si ≥ 7.5.

**Occurrence:** Commonly in contact metamorphosed limestones; in alkalic igneous rocks and carbonatites. Also in meteorites.

**Association:** Leucite, diopside, forsterite, calcite, apatite, natrolite, phlogopite, cristobalite, enstatite, plagioclase.

**Distribution:** A few historic localities or sources for good specimen material include: at Långban and Pajsberg, Värmland, Sweden. In the Praborna mine, near St. Marcel, Val d'Aosta, Italy. At the Kangerdlugssuaq Fjord, Greenland. In the Murun massif, southwest of Olekminsk, Yakutia, Russia. In the USA, at Iron Hill, Gunnison Co., Colorado and the Leucite Hills, Sweetwater Co., Wyoming. In Canada, from Gooderham, Wilberforce; on Tory Hill, Bancroft; and at Essenville, Ontario; from near Gatineau Park, Quebec. At the Jacupiranga mine, São Paulo, Brazil. In the Noda-Tamagawa mine, Iwate Prefecture, and the Taguchi mine, Aichi Prefecture, Japan. At Imerina, Madagascar.

**Name:** For Professor Theodor Richter (1824–1898), German mineralogist.

**Type Material:** Mining Academy, Freiberg, Germany, 28854.

**References:** (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 386, 391. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 2, chain silicates, 352–358. (3) Bevan, A.W.R., J.C. Bevan, and J.G. Francis (1977) Amphibole in the Mayo Belwa meteorite: first occurrence in an enstatite achondrite. Mineral. Mag., 41, 531–534.

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