Riebeckite $Na_2[(Fe^{2+},Mg)_3Fe^{3+}_2]Si_8O_{22}(OH)_2$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As prismatic crystals, to 20 cm. Commonly fibrous, asbestiform; earthy, massive. *Twinning:* Simple or multiple twinning ∥ {100}.

Physical Properties: *Cleavage:* Perfect on {110}, intersecting at 56° and 124°; partings on {100}, {010}. *Fracture:* [Conchoidal to uneven.] *Tenacity:* Brittle. Hardness = 6
D(meas.) = 3.28–3.44 D(calc.) = 3.380

Optical Properties: Semitransparent. *Color:* Black, dark blue; dark blue to yellow-green in thin section. *Luster:* Vitreous to silky.
Optical Class: Biaxial (+) or (–). *Pleochroism:* X = blue, indigo; Y = yellowish green, yellow-brown; Z = dark blue. *Orientation:* $Y = b$; $X \wedge c = -8°$ to $-7°$; $Z \wedge c = 6°$–$7°$. *Dispersion:* Strong. $\alpha = 1.656$–1.697 $\beta = 1.670$–1.708 $\gamma = 1.665$–1.740 2V(meas.) = 50°–90°.

Cell Data: *Space Group:* $C2/m$. $a = 9.822$ $b = 18.07$ $c = 5.334$ $\beta = 103.52°$ Z = 2

X-ray Powder Pattern: Doubrutscha [Dobrudja], Romania. (ICDD 19-1061).
8.40 (100), 3.12 (55), 2.726 (40), 2.801 (18), 4.51 (16), 2.176 (16), 3.27 (14)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	52.90	50.45	CaO	0.12	0.08
TiO_2	0.57	0.14	Li_2O		0.54
Al_2O_3	0.12	1.96	Na_2O	6.85	6.80
Fe_2O_3	17.20	17.52	K_2O	0.03	1.48
Cr_2O_3	0.04		F		2.58
FeO	17.95	17.90	H_2O^+		0.87
MnO	0.00	1.40	$-O = F_2$		1.09
MgO	2.96	0.05	Total	98.74	100.68

(1) Dales Gorge Iron Formation, Western Australia; by electron microprobe, corresponds to $(Na_{2.00}Ca_{0.02}K_{0.01})_{\Sigma=2.03}(Fe^{2+}_{2.26}Mg_{0.66}Ti_{0.06})_{\Sigma=2.98}Fe^{3+}_{1.95}(Si_{7.98}Al_{0.02})_{\Sigma=8.00}O_{22}(OH)_2$. (2) Pikes Peak area, Colorado, USA; corresponds to $(Na_{2.02}K_{0.29}Ca_{0.01})_{\Sigma=2.32}(Fe^{2+}_{2.30}Li_{0.33}Mn_{0.18}Al_{0.10}Ti_{0.02}Mg_{0.01})_{\Sigma=2.94}Fe^{3+}_{2.02}(Si_{7.75}Al_{0.25})_{\Sigma=8.00}O_{22}[F_{1.25}(OH)_{0.89}]_{\Sigma=2.14}$.

Polymorphism & Series: Forms a series with magnesioriebeckite.

Mineral Group: Amphibole (alkali) group: $Fe^{2+}/(Fe^{2+} + Mg) \geq 0.5$; $Fe^{3+}/(Fe^{3+} + Al^{vi}) \geq 0.7$; $(Na + K)_A < 0.5$; $Na_B \geq 1.34$.

Occurrence: In alkalic granites and syenites; rarer in felsic volcanics and granite pegmatites; in some schists. In iron formations as asbestiform "crocidolite."

Association: Aegirine, nepheline, albite, arfvedsonite (igneous); tremolite, ferro-actinolite (metamorphic); grunerite, magnetite, hematite, stilpnomelane, ankerite, siderite, calcite, "chalcedony," quartz (iron formations).

Distribution: Numerous localities. On Socotra Island, Indian Ocean. In South Africa, north from Koegas, Cape Province, and east of Pietersburg, Transvaal. Exceptional crystals from Sultan Hamud, Kenya. In the USA, at Quincy, Norfolk Co., Massachusetts; at St. Peters Dome, near Pikes Peak, El Paso Co., Colorado; from Washington Pass, Okanogan Co., Washington. In Canada, at the Red Wine complex, Labrador, Newfoundland; and at Mont Saint-Hilaire, Quebec. Around Chapare, Cochabamba, Bolivia. At Wittenoom and elsewhere in the Hamersley Ranges, Western Australia.

Name: To honor Emil Riebeck (1853–1885), German explorer.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 400. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 2, chain silicates, 333–351. (3) Hawthorne, F.C. (1978) The crystal structure of the amphiboles. VIII. The crystal structure and site chemistry of fluor-riebeckite. Can. Mineral., 16, 187–194. (4) Miyano, T. and C. Klein (1983) Conditions of riebeckite formation in the Iron-formation of the Dales Gorge Member, Hamersley Group, Western Australia. Amer. Mineral., 68, 517–529. (5) Phillips, W.R. and D.T. Griffen (1981) Optical mineralogy, 237–241.