Magnesio-arfvedsonite $NaNa_2[(Mg,Fe^{2+})_4Fe^{3+}]Si_8O_{22}(OH)_2$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Prismatic crystals, to 9 cm; in matted fibrous aggregates. *Twinning:* [Simple or lamellar twinning ∥ {100}.]

Physical Properties: *Cleavage:* [Perfect on {110}, intersecting at ∼56° and ∼124°.] *Fracture:* [Uneven.] *Tenacity:* [Brittle.] Hardness = [6] D(meas.) = ∼3.1–3.3 D(calc.) = [3.25]

Optical Properties: Translucent to opaque. *Color:* Dark bluish green, color zoning common; yellowish, greenish, or bluish in thin section. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Pleochroism:* Strong; X = blue-green; Y = green; Z = pale green. *Orientation:* $Z = b$; $X \wedge c = 20°–40°$. *Dispersion:* $r > v$, strong. *Absorption:* [$X > Y > Z$.] α = ∼1.64–1.67 β = ∼1.65–1.68 γ = ∼1.655–1.69 2V(meas.) = 0°– ∼50°

Cell Data: *Space Group:* $C2/m$. $a = 9.799$ (ICDD 23-495). $b = 17.833$ $c = 5.273$ $\beta = 104.18°$ Z = 2

X-ray Powder Pattern: Norra Kärr complex, Sweden. (ICDD 23-495).
3.11 (100), 8.38 (80), 3.24 (35), 2.694 (35), 4.45 (30), 3.38 (30), 5.03 (12)

Chemistry:	(1)	(2)		(1)	(2)		(1)	(2)
SiO_2	53.70	52.71	MnO	1.05	0.79	F	2.11	1.50
TiO_2	0.29	0.56	MgO	9.50	11.19	H_2O^+	1.02	1.16
ZrO_2	0.05		CaO	0.21	2.22	H_2O^-	0.36	0.01
Al_2O_3	1.85	3.13	Li_2O	0.24	0.02	$-O = F_2$	0.88	[0.63]
Fe_2O_3	15.27	9.50	Na_2O	10.40	8.35	Total	100.07	[99.89]
FeO	3.56	7.41	K_2O	1.34	1.97			

(1) Lovozero massif, Russia; corresponds to $(Na_{2.94}K_{0.25}Ca_{0.03})_{\Sigma=3.22}(Mg_{2.06}Fe^{3+}_{1.67}Fe^{2+}_{0.43}Al_{0.14}Mn_{0.13}Ti_{0.03}Li_{0.14})_{\Sigma=4.60}(Si_{7.82}Al_{0.18})_{\Sigma=8.00}O_{22}[(OH)_{0.99}F_{0.97}]_{\Sigma=1.96}$. (2) Oldonyo Dili, Tanzania; original total given as 99.69%, corresponding to $(Na_{2.37}K_{0.37}Ca_{0.35}Li_{0.01})_{\Sigma=3.10}(Mg_{2.44}Fe^{3+}_{1.05}Fe^{2+}_{0.91}Al_{0.22}Mn_{0.10}Ti_{0.06})_{\Sigma=4.78}(Si_{7.71}Al_{0.29})_{\Sigma=8.00}O_{22}[(OH)_{1.13}F_{0.70}O_{0.17}]_{\Sigma=2.00}$.

Polymorphism & Series: Forms a series with arfvedsonite.

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

Occurrence: As exsolution lamellae in cummingtonite from metamorphosed iron formation; in felsic pegmatites; from sodium metasomatism (fenitization) around some carbonatites; as authigenic or diagenetic overgrowths on detrital igneous "hornblende."

Association: Aegirine, braunite, winchite, cummingtonite, albite, biotite.

Distribution: From the Norra Kärr complex, near Gränna, Sweden. In the Gardiner complex, beyond the head of the Kangerdlugssuaq Fjord, Greenland. From the Khibiny and Lovozero massifs, Kola Peninsula, Russia. In the Green River Formation, head of Avintagnia Canyon, Duchesne Co., Utah, USA. In the Wabush Iron Formation, southwestern Labrador, Newfoundland; near Perkins, and at Mont Saint-Hilaire, Quebec, Canada. From Oldonyo Dili, Tanzania. On Mbolwe Hill, Mkushi River area, Central Province, Zambia. From Ambatoharina, Madagascar. In the Kajlidongri and Tirodi mines, Madhya Pradesh, India. In the Modatamagawa mine, Noda, Iwate Prefecture, Japan. Other localities are known.

Name: For its high *magnesium* content and similarity to *arfvedsonite*.

Type Material: n.d.

References: (1) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 2, chain silicates, 364–374. (2) McKie, D. (1966) Fenitization. In: O.F Tuttle and J. Gittins, Eds., Carbonatites. Interscience, New York, 261–294. (3) Phillips, W.R. and D.T. Griffen (1981) Optical mineralogy, 243–245.