Sadanagaite

$KCa_2[(Fe^{2+}, Mg)_3(Al, Fe^{3+})_2](Si_5Al_3)O_{22}(OH)_2$

Crystal Data: Monoclinic. *Point Group:* m, 2, or $2/m$. Prismatic crystals, to 1 mm; as polycrystalline aggregates.

Physical Properties: *Cleavage:* Perfect on {110}. *Tenacity:* [Brittle.] Hardness = ~6 D(meas.) = n.d. D(calc.) = 3.30

Optical Properties: Semitransparent. *Color:* Dark brown to black; in thin section, paler with greater silicon content. *Streak:* Very light brown. *Luster:* Vitreous.
Optical Class: Biaxial (+) or (–). *Pleochroism:* Strong; X = pale brown, grayish, or greenish yellow; Y = yellowish orange to light olive-brown; Z = greenish brown, light olive-brown to dark yellowish orange. *Orientation:* $Z \wedge c = 28°$. $\alpha = 1.673(2)$ $\beta = 1.684(2)$ $\gamma = 1.697(2)$ 2V(meas.) = 70°–90° 2V(calc.) = 86°

Cell Data: *Space Group:* $C2$, Cm, or $C2/m$. $a = 9.922(10)$ $b = 18.03(2)$ $c = 5.352(9)$ $\beta = 105.30(10)°$ Z = 2

X-ray Powder Pattern: [Myojin Island, Japan; identical to magnesio-sadanagaite.]
3.28 (100), 8.48 (80), 3.15 (70), 2.707 (60), 2.162 (55), 2.951 (50), 2.766 (45)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	29.9	34.4	MgO	6.1	6.11
TiO_2	4.3	3.15	CaO	11.9	11.9
Al_2O_3	22.6	18.4	Na_2O	0.6	0.73
FeO	17.4	18.4	K_2O	3.7	4.21
MnO	0.3	0.24	Total	96.8	97.5

(1) Yuge Island, Japan; by electron microprobe, Fe^{2+}:Fe^{3+} calculated from stoichiometry; corresponds to $(K_{0.74}Na_{0.17})_{\Sigma=0.91}Ca_{1.99}(Fe^{2+}_{1.63}Mg_{1.41}Al_{0.81}Fe^{3+}_{0.63}Ti_{0.50})_{\Sigma=4.98}(Si_{4.66}Al_{3.34})_{\Sigma=8.00}O_{22}(OH)_2$. (2) Nogo-Hakusan area, Japan; by electron microprobe, Fe^{2+}:Fe^{3+} calculated from stoichiometry; corresponds to $(K_{0.84}Na_{0.22})_{\Sigma=1.06}Ca_{1.99}(Fe^{2+}_{2.17}Mg_{1.42}Al_{0.74}Ti_{0.37}Fe^{3+}_{0.23}Mn_{0.03})_{\Sigma=4.96}(Si_{5.36}Al_{2.64})_{\Sigma=8.00}O_{22}(OH)_2$.

Polymorphism & Series: Forms a series with magnesio-sadanagaite.

Mineral Group: Amphibole (calcic) group: $Mg/(Mg + Fe^{2+})$ 0.5; $Fe^{3+}/(Fe^{3+} + Al^{vi})$ 0.50; $(Na + K)_A \geq 0.5$; $Na_B < 0.67$; $(Ca + Na)_B \geq 1.34$; $Si < 5.5$; $Ti < 0.5$.

Occurrence: By contact metamorphism, producing banded skarns, under amphibolite to pyroxene hornfels facies conditions; from eclogites.

Association: Vesuvianite, hercynite, sphene, ilmenite, apatite (Yuge Island, Japan); biotite, orthoclase, subsilicic ferroan pargasite (Nogo-Hakusan area, Japan).

Distribution: On Yuge Island, Ehime Prefecture, and in the Nogo-Hakusan area, Fukui Prefecture, Japan. At the Botallack mine, St. Just, Cornwall, England. In the Oetztal, Austria.

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Type Material: University of Tokyo, Tokyo; National Science Museum, Tokyo, Japan, M23378.

References: (1) Shimazaki, H., M. Bunno, and T. Ozawa (1984) Sadanagaite and magnesio-sadanagaite, new silica-poor members of calcic amphibole from Japan. Amer. Mineral., 69, 465–471. (2) Rock, N.M.S. and B.E. Leake (1984) The International Mineralogical Association amphibole nomenclature scheme: computerization and its consequences. Mineral. Mag., 48, 211–227. (3) Sawaki, T. (1989) Sadanagaite and subsilicic ferroan pargasite from thermally metamorphosed rocks in the Nogo-Hakusan area, central Japan. Mineral. Mag., 53, 99–106. (4) Mogessie, A., F. Purtscheller, and R. Tessadri (1986) High alumina calcic amphiboles (alumino pargasite-magnesio sadanagaite) from metabasites and metacarbonates of Central Oetztal, Eastern Alps (Northern Tyrol, Austria). Neues Jahrb. Mineral., Abh., 154, 21–39.