Narsarsukite $Na_2(Ti,Fe^{3+})Si_4(O,F)_{11}$

Crystal Data: Tetragonal. *Point Group:* $4/m$. Crystals, commonly flat tabular to equant, rarely prismatic, striated ‖ [001], to 3 cm. In divergent, radiating groups; as fine-grained segregations, massive.

Physical Properties: *Cleavage:* {100} and {110}, good. *Fracture:* Uneven to subconchoidal. *Tenacity:* Brittle. Hardness = 5.5–7 D(meas.) = 2.64–2.83 D(calc.) = 2.78–2.84

Optical Properties: Transparent to translucent. *Color:* Honey-yellow to lemon-yellow, reddish brown, brownish gray, tan, pink, may be zoned; green from inclusions. *Streak:* White. *Luster:* Vitreous, pearly on {110}.
Optical Class: Uniaxial (+). *Pleochroism:* Weak; O = colorless to yellow; E = colorless to honey-yellow. $\omega = 1.601–1.614$ $\epsilon = 1.632–1.655$

Cell Data: *Space Group:* $I4/m$. $a = 10.61–10.76$ $c = 7.89–7.99$ $Z = 4$

X-ray Powder Pattern: Sweetgrass Hills, Montana, USA.
5.365 (100), 3.394 (80), 3.260 (80), 2.579 (60), 2.524 (60), 3.976 (50), 7.609 (30)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	61.63	63.74	MgO	0.24	
TiO_2	14.00	13.74	Na_2O	16.12	15.48
ZrO_2		0.64	K_2O		0.13
Al_2O_3	0.28	0.53	F	0.71	1.38
Fe_2O_3	6.30	5.55	H_2O	0.29	
MnO	0.47	0.20	$-O = F_2$	0.30	0.58
			Total	99.74	100.81

(1) Narssârssuk, Greenland. (2) Do.; by electron microprobe, total Fe as Fe_2O_3; corresponds to $(Na_{1.92}K_{0.01})_{\Sigma=1.93}(Ti_{0.66}Fe^{3+}_{0.27}Zr_{0.02}Mn_{0.01})_{\Sigma=0.96}(Si_{4.07}Al_{0.04})_{\Sigma=4.11}(O_{10.72}F_{0.28})_{\Sigma=11.00}$.

Occurrence: In pegmatite (Narssârssuk, Greenland); in quartz veins in syenite intruding limestone (Sweetgrass Hills, Montana, USA); in hornfels, igneous breccia, and marble xenoliths in an intrusive alkalic gabbro-syenite complex (Mont Saint-Hilaire, Canada).

Association: Aegirine, microcline, albite, elpidite, epididymite, taeniolite, quartz (Narssârssuk, Greenland); aegirine, pectolite, calcite, feldspar, galena, quartz (Sweetgrass Hills, Montana, USA).

Distribution: From Narssârssuk; on the Island of Igdlutalik, in the Ilímaussaq intrusion; and in the Werner Berge complex, Greenland. On Mt. Flora, Lovozero massif, Kola Peninsula; in the Murun massif, southwest of Olekminsk, Yakutia; and other less-well-defined localities in Russia. In the Oslofjord, Norway. At the Bellerberg volcano, two km north of Mayen, Eifel district, Germany. From near Whitlash, Sweetgrass Hills, Sweetgrass Co., Montana; in the Diamond Jo quarry, Magnet Cove, Hot Spring Co., and from Granite Mountain, near Little Rock, Pulaski Co., Arkansas, USA. At Mont Saint-Hilaire, Quebec, Canada. From Gouré, Damagaram, Niger. In the Sirwa massif, north of Ouarzazate, Morocco.

Name: For the Greenland locality at Narssârssuk (Narsarsuk).

Type Material: University of Copenhagen, Copenhagen, Denmark.

References: (1) Dana, E.S. and W.E. Ford (1909) Dana's system of mineralogy, (6th edition), app. II, 73. (2) Stewart, D.B. (1959) Narsarsukite from Sage Creek, Sweetgrass Hills, Montana. Amer. Mineral., 44, 265–273. (3) Peacor, D.R. and M.J. Buerger (1962) The determination and refinement of the structure of narsarsukite, $Na_2TiOSi_4O_{10}$. Amer. Mineral., 47, 539–556. (4) Mandarino, J.A. and V. Anderson (1989) Monteregian treasures. Cambridge Univ. Press, 149. (5) Wagner, C., G.C. Parodi, M. Semet, J.-L. Robert, M. Berrahma, and D. Velde (1991) Crystal chemistry of narsarsukite. Eur. J. Mineral., 3, 575–585.