Sapphirine $(Al,Mg)_8(Al,Si)_6O_{20}$

Crystal Data: Monoclinic or triclinic. *Point Group:* $2/m$ or $\bar{1}$. Crystals indistinct, tabular on {010}, to 3 cm. Commonly as disseminated grains or aggregates. *Twinning:* Repeated on {010}; uncommon.

Physical Properties: *Cleavage:* Fair on {010}, poor on {001}, {100}. *Fracture:* Subconchoidal. Hardness = 7.5 D(meas.) = 3.40–3.58 D(calc.) = 3.486

Optical Properties: Transparent to translucent. *Color:* Light to dark blue or green, white, gray, pale red, yellow; in thin section, colorless to blue or pink. *Luster:* Vitreous. *Optical Class:* Biaxial (+) or (–). *Pleochroism:* X = colorless, pale reddish, yellowish green, pale yellow; Y = sky-blue, lavender-blue, bluish green; Z = blue, sapphire-blue, dark blue. *Orientation:* $Y = b$; $Z \wedge c = 6°$–$9°$. *Dispersion:* $r < v$, moderate to very strong. $\alpha = 1.701$–1.726 $\beta = 1.703$–1.728 $\gamma = 1.705$–1.734 2V(meas.) = 47°–114°

Cell Data: *Space Group:* $P2_1/a$ (2M) $a = 11.266(12)$ $b = 14.401(7)$ $c = 9.929(10)$ $\beta = 125.46(5)°$ Z = 4, or *Space Group:* $P\bar{1}$ (1A) $a = 9.97(1)$ $b = 10.34(1)$ $c = 8.62(1)$ $\alpha = 107.4(1)°$ $\beta = 95.2(1)°$ $\gamma = 123.8(1)°$ Z = 4

X-ray Powder Pattern: Fiskenæsset, Greenland; closely resembles surinamite. 2.447 (100), 2.015 (90), 2.990 (65), 1.4353 (65), 1.4192 (65), 2.023 (60), 2.844 (50)

Chemistry:

	(1)
SiO_2	12.83
Al_2O_3	65.29
Fe_2O_3	0.93
FeO	0.65
MgO	19.78
LOI	0.31
Total	99.79

(1) Fiskenæsset, Greenland; corresponds to $(Al_{4.43}Mg_{3.42}Fe^{3+}_{0.08}Fe^{2+}_{0.06})_{\Sigma=7.99}$ $(Al_{4.51}Si_{1.49})_{\Sigma=6.00}O_{20}$.

Polymorphism & Series: 1A, 2A, 2M, 3A, 4M, 5A polytypes.

Occurrence: In high-temperature metamorphic rocks or xenoliths with abundant aluminum and magnesium and low silicon. May occur as a primary magmatic mineral in subsilicic rocks.

Association: Sillimanite, kyanite, cordierite, kornerupine, corundum, surinamite, phlogopite, chrysoberyl, pyroxenes, spinel, garnet, calcite, quartz.

Distribution: Only a few localities are given, which have provided especially large or fine crystals, or rich material. Around Fiskenæsset, Greenland. In the USA, in the Cortland complex, Westchester Co., New York. In Canada, at Wilson Lake, Labrador, Newfoundland. At Sakena, Vorokafotra, Bekily, Anjamiary, and Betroka, Madagascar. Large crystals from Blinkwater, near Messina, Transvaal, South Africa. In Tanzania, at Mautia Hill. From Waldheim, Saxony, Germany. At Naxos, Greece. From Finero, Val Viggezo, Piedmont, Italy. In the Harts Range, Northern Territory, Australia. From the Napier complex, Casey Bay, Enderby Land, Antarctica.

Name: For its typical *sapphire*-blue color.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 724–726. (2) Deer, W.A., R.A. Howie, and J. Zussman (1978) Rock-forming minerals, (2nd edition), v. 2A, single-chain silicates, 614–639. (3) Moore, P.B. (1969) The crystal structure of sapphirine. Amer. Mineral., 54, 31–49. (4) Merlino, S. (1980) Crystal structure of sapphirine-1*Tc*. Zeits. Krist., 151, 91–100. (5) Barbier, J. and B.G. Hyde (1988) Structure of sapphirine: its relation to the spinel, clinopyroxene, and β-gallia structures. Acta Cryst., 44, 373–377. (6) Christy, A.G. and A. Putnis (1988) Planar and line defects in the sapphirine polytypes. Phys. Chem. Minerals, 15, 548–558.