Tranquillityite $Fe_8^{2+}(Zr,Y)_2Ti_3Si_3O_{24}$

Crystal Data: Hexagonal. *Point Group:* n.d. As thin laths, to 65 μm, and as sheaves of laths.

Physical Properties: Hardness = n.d. D(meas.) = n.d. D(calc.) = 4.7(1)

Optical Properties: Opaque to semitransparent. *Color:* Gray; foxy-red [deep reddish brown] in strong transmitted light.
Optical Class: Isotropic to weakly anisotropic. $n = 2.11–2.13$

Cell Data: *Space Group:* n.d. $a = 11.69(5)$ $c = 22.25(10)$ $Z = 3$

X-ray Powder Pattern: Sea of Tranquillity, Moon.
3.23 (100), 1.781 (70), 2.155 (60), 4.04 (50), 3.34 (40), 3.18 (40), 3.13 (40)

Chemistry:

	(1)
SiO_2	14.00
TiO_2	19.45
ZrO_2	17.15
HfO_2	0.17
Al_2O_3	1.12
Cr_2O_3	0.11
Nb_2O_3	0.33
Y_2O_3	2.76
Nd_2O_3	0.24
FeO	42.48
MnO	0.29
CaO	1.26
Total	[99.36]

(1) Sea of Tranquillity, Moon; by electron microprobe, average of 12 analyses, original total given as 99.32%; corresponds to $(Fe_{7.36}Ca_{0.28}Ti_{0.25}Mn_{0.05})_{\Sigma=7.94}(Zr_{1.73}Y_{0.30}Nd_{0.02}Hf_{0.01})_{\Sigma=2.06}(Ti_{2.78}Al_{0.17}Nb_{0.03}Cr_{0.02})_{\Sigma=3.00}(Si_{2.90}Al_{0.10})_{\Sigma=3.00}O_{24}$.

Occurrence: A late-stage crystallization product of lunar basaltic magma.

Association: Troilite, pyroxferroite, tridymite, cristobalite, alkalic feldspar, felsic glass.

Distribution: On the Moon, at the Apollo 11, 12, 14, 16, and 17 collection sites.

Name: For the Sea of Tranquillity, Moon, from which the mineral was first collected.

Type Material: Lunar Science Institute, Houston, Texas, USA.

References: (1) Lovering, J.F., D.A. Wark, A.F. Reid, N.G. Ware, K. Keil, M. Prinz, T.E. Bunch, A. El Goresy, P. Ramdohr, G.M. Brown, A. Peckett, R. Phillips, E.N. Cameron, J.A.V. Douglas, and A.G. Plant (1971) Tranquillityite: a new silicate mineral from Apollo 11 and Apollo 12 basaltic rocks. Proc. Second Lunar Sci. Conf., 1, Geochim. Cosmochim. Acta, 35, suppl., 39–45. (2) (1973) Amer. Mineral., 58, 140–141 (abs. ref. 1).