Tuhualite $(Na,K)Fe^{2+}Fe^{3+}Si_6O_{15}$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. In well-formed tabular crystals, flattened on {100}, with pyramidal terminations, to 1.5 mm. Also as irregular mosslike aggregates.

Physical Properties: *Cleavage:* Three good, on {100}, {001}, and {010}. *Tenacity:* Very brittle. Hardness = 3–4 D(meas.) = 2.89(2) D(calc.) = 2.86

Optical Properties: Semitransparent. *Color:* Violet.
Optical Class: Biaxial (+). *Pleochroism:* Strong; X = colorless to very pale pink; Y = violet or lavender; Z = intense purplish blue. *Orientation:* $X = a$; $Y = b$; $Z = c$. *Dispersion:* $r < v$, strong. *Absorption:* $Z > Y \gg X$. $\alpha = 1.608(1)$ $\beta = 1.612$ $\gamma = 1.621(3)$ 2V(meas.) = 70°–91°

Cell Data: *Space Group: Cmca.* a = 14.31(3) $b = 17.28(3)$ $c = 10.11(3)$ Z = 1

X-ray Powder Pattern: Mayor Island, New Zealand.
7.16 (100), 2.766 (90), 3.18 (80), 8.62 (70), 5.515 (70), 4.85 (70), 4.35 (70)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO_2	62.93	67.2	66.37	CaO	trace	0.17	
TiO_2	0.42	0.04		Na_2O	7.11	6.3	5.71
ZrO_2		0.03		K_2O	1.74	0.8	
Al_2O_3	0.63	0.22		F		< 0.1	
Fe_2O_3	14.09		14.70	Cl		< 0.05	
FeO	9.58	24.0	13.22	H_2O^+	1.61		
MnO	0.81	0.55		H_2O^-	0.38		
MgO	0.42	trace		Total	99.72	99.3	100.00

(1) Mayor Island, New Zealand. (2) Do.; by electron microprobe. (3) $NaFe^{2+}Fe^{3+}Si_6O_{15}$.

Occurrence: A primary igneous mineral and in vesicles of some silicic lavas, as comendites and pantellerites.

Association: Alkalic feldspar, quartz, aegirine, riebeckite, aenigmatite, arfvedsonite.

Distribution: From Mayor Island, near Opo Bay, New Zealand.

Name: For the type locality, Mayor Island, New Zealand, which is called *Tuhua* by the native Maori.

Type Material: Geological Survey of New Zealand, Lower Hutt, New Zealand, P2077; National Museum of Natural History, Washington, D.C., USA, 96879, 96880, 103053, 136507.

References: (1) Marshall, P. (1932) Notes on some volcanic rocks of the North Island of New Zealand. New Zealand J. Sci. Tech., 13, 202. (2) (1933) Amer. Mineral., 18, 180 (abs. ref. 1). (3) Hutton, C.O. (1956) Re-examination of the mineral tuhualite. Mineral. Mag., 31, 96–106. (4) (1956) Amer. Mineral., 41, 959 (abs. ref. 3). (5) Nicholls, J. and J.S.E. Carmichael (1969) Peralkaline acid liquids: a petrological study. Contr. Mineral. Petrol., 20, 268–294. (6) Merlino, S. (1969) Tuhualite crystal structure. Science, 166, 1399–1401.