

Motukoreaite

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Crystal Data: Hexagonal. *Point Group:* $\bar{3} 2/m$. As tabular hexagonal crystals, showing rounded {0001} and possible {11 $\bar{2}$ 0}, {10 $\bar{1}$ 1}, {10 $\bar{1}$ 4}, to 0.2 mm, forming rosettes, boxworks, and subparallel aggregates, and as a claylike cement.

Physical Properties: *Cleavage:* Good on {0001}, perhaps a parting. *Tenacity:* Sectile, flexible. Hardness = 1–1.5 D(meas.) = 1.43–1.53 D(calc.) = 1.478 Partial dehydration readily occurs.

Optical Properties: Semitransparent. *Color:* Colorless, white, pale yellow, pale yellow-green. *Luster:* Dull.

Optical Class: Uniaxial (+), nearly isotropic. $n = \sim 1.51$, birefringence ~ 0.012 . $\omega = \text{n.d.}$ $\epsilon = \text{n.d.}$

Cell Data: *Space Group:* $R\bar{3}m$. $a = 9.172(2)$ $c = 33.51(1)$ $Z = 3$

X-ray Powder Pattern: Brown's Island, New Zealand; may exhibit preferred orientation. 11.32 (vvs), 5.58 (s), 4.59 (s), 3.72 (s), 2.578 (s), 2.386 (s), 2.158 (s)

Chemistry:	(1)	(2)	(1)	(2)
SO ₃	10.00	10.65	CaO	0.92
SiO ₂	5.55		Na ₂ O	0.71
CO ₂	9.32	9.52	K ₂ O	0.10
Al ₂ O ₃	17.87	20.35	H ₂ O ⁺	19.62
Fe ₂ O ₃	0.73		H ₂ O ⁻	10.35
MnO	0.70		H ₂ O	32.97
ZnO	0.56		Total	99.41
MgO	22.98	25.48		100.00

(1) Brown's Island, New Zealand; contains estimated quartz 5%, traces of calcite and goethite; after removal of probable impurities, and with (OH)¹⁻ calculated for charge balance, corresponds to (Na_{1.50}K_{0.14})_{Σ=1.64}Mg_{37.36}Al_{22.97}(SO₄)_{8.18}(CO₃)_{13.81}(OH)_{101.29} • 58.36H₂O. (2) Na₂Mg₃₈Al₂₄(SO₄)₈(CO₃)₁₃(OH)₁₀₈ • 56H₂O.

Occurrence: Relatively common in assemblages formed by reaction of basalt volcanoclastics with sea-water; in cavities in a haüyne-nephelinite.

Association: Olivine, pyroxene, calcic feldspar, magnetite, calcite, gypsum, barite, hisingerite, zeolites, "limonite", quartz (Brown's Island, New Zealand); hydrotalcite, nordstrandite, montmorillonite, phillipsite, gismondine, chabazite, calcite, apatite (Stradner Hill, Austria).

Distribution: From Brown's Island (Motukorea), Waitemata Harbour, Auckland, New Zealand. On the Island of Surtsey, and the Great Meteor and Josephine seamounts, North Atlantic, and along the mid-Atlantic Ridge. Northwest of the Emile Baudot Bank, western Mediterranean. Along the Axial Rift, Red Sea. On Stradner Kogel, south of Gleichenberg, Austria.

Name: From Motukorea, *island of cormorants*, the Maori name for Brown's Island, New Zealand.

Type Material: University of Auckland, Auckland, New Zealand; The Natural History Museum, London, England, 1977,422; National Museum of Natural History, Washington, D.C., USA, 142971.

References: (1) Rodgers, K.A., J.E. Chisholm, R.J. Davis, and C.S. Nelson (1977) Motukoreaite, a new hydrated carbonate, sulphate, and hydroxide of Mg and Al from Auckland, New Zealand. *Mineral. Mag.*, 41, 389–390. (2) (1978) *Amer. Mineral.*, 63, 598 (abs. ref. 1). (3) Rius, J. and F. Plana (1986) Contribution to the superstructure resolution of the double layer mineral motukoreaite. *Neues Jahrb. Mineral., Monatsh.*, 263–272. (4) Zamarreño, I., F. Plana, A. Vazquez, and D.A. Clague (1989) Motukoreaite: a common alteration product in submarine basalts. *Amer. Mineral.*, 74, 1054–1058. (5) Bryner, V., K.A. Rodgers, S.F. Courtney, and W. Postl (1991) Motukoreaite from Brown's Island, New Zealand, and Stradner Kogel, Austria: a scanning electron microscope study. *Neues Jahrb. Mineral., Abh.*, 163, 291–304.

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