Manjiroite $Na(Mn^{4+}_7Mn^{3+})O_{16}$

Crystal Data: Tetragonal. *Point Group*: 4/*m*. Compact, massive, to 10 cm.

Physical Properties: *Fracture*: Conchoidal. Hardness = n.d. VHN = 181 average.
D(meas.) = 4.29 D(calc.) = [4.45]

Optical Properties: Opaque. *Color*: Dark brownish gray; yellowish gray-white in reflected light. *Streak*: Brownish black. *Luster*: Dull.
Optical Class: Uniaxial. *Anisotropism*: Distinct; yellowish gray, gray, grayish black.
Bireflectance: Very weak.
R_1-R_2: n.d.

Cell Data: *Space Group*: *I*4/*m*. $a = 9.916$ $c = 2.864$ $Z = 1$

X-ray Powder Pattern: Kohare mine, Japan.
2.406 (100), 7.017 (98), 3.136 (92), 4.941 (77), 2.160 (69), 1.839 (46), 1.548 (46)

Chemistry:

	(1)		(1)
SiO_2	0.12	MgO	0.18
MnO_2	85.79	CaO	0.22
Al_2O_3	0.62	BaO	0.16
Fe_2O_3	0.40	Na_2O	2.99
MnO	3.18	K_2O	1.39
CoO	0.00	H_2O^+	3.92
CuO	0.03	H_2O^-	0.68
ZnO	0.03	Total	99.71

(1) Kohare mine, Japan; wet chemical analysis; corresponds to $(Na_{0.73}K_{0.22}Ca_{0.03}Ba_{0.01})_{\Sigma=0.99}(Mn^{4+}_{7.46}Mn^{2+}_{0.34}Al_{0.09}Fe_{0.04}Mg_{0.03})_{\Sigma=7.96}O_{16}\cdot 1.64H_2O$. (2) Do., average electron microprobe and FTIR spectroscopic analyses, Mn oxidation states by X-ray photoelectron spectroscopy; corresponds to $(K_{0.19}Na_{0.17}Ca_{0.03}Ba_{0.01})(Mn^{4+}_{5.02}Mn^{3+}_{2.82}Al_{0.14}Fe_{0.02})(O,OH)_{16}\cdot nH_2O$.

Mineral Group: Hollandite group.

Occurrence: In the oxidation zone of metamorphosed bedded manganese deposits.

Association: Pyrolusite, nsutite, birnessite, cryptomelane, goethite (Kohare mine, Japan); cryptomelane, pyrolusite, nsutite, roman`echite (Pilbara, Australia).

Distribution: In the Kohare, Tachikawa, Kotamagawa, Kawai, and Takinosawa mines, Iwate Prefecture, Japan. At Bollier, Mary Valley, Queensland, and the Pilbara manganese belt, Western Australia. From the Prompter mine, Tombstone, Cochise Co., Arizona, USA. Found in the Capillitas mine, Veta Balaza, Catamarca, Argentina. From the Adams mine, near Kuruman, Cape Province, South Africa.

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Type Material: National Science Museum, Tokyo, Japan, M15748.

References: (1) Nambu, M. and K. Tanida (1967) Manjiroite, a new manganese dioxide mineral, from Kohare Mine, Iwate Prefecture, Japan. J. Japan. Assoc. Mineral. Petrol. Econ. Geol., 58, 39-54 (in Japanese with English abs.). (2) (1968) Amer. Mineral., 53, 2103 (abs. ref. 1). (3) Nambu, M., Ed. (1970) Introduction to Japanese minerals, Geol. Surv. Japan, 22, 82-83. (4) Post, J.E., P.J. Heaney, T.B. Fischer, and E.S. Ilton (2022) Manjiroite or hydrous hollandite? Amer. Mineral., 107, 564-571.