Orientite $Ca_2Mn^{2+}Mn_2^{3+}Si_3O_{10}(OH)_4$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Crystals exhibit {110}, {001}, and poorly developed to absent {100}; thin to thick tabular on {001}, pseudohexagonal in outline, to 1 mm. In rosettes of crystals, drusy aggregates, framboidal, finely disseminated.

Physical Properties: *Cleavage:* Perfect to imperfect on {001}; may be a parting. *Tenacity:* Brittle. Hardness = 4.5–5 D(meas.) = 3.05–3.33 D(calc.) = 3.48

Optical Properties: Transparent to translucent. *Color:* Light reddish brown, chocolate-brown when enclosing manganese oxides. *Streak:* Brown. *Luster:* Resinous, semimetallic; pitchy to dull when included.
Optical Class: Biaxial (+) or (–). *Dispersion:* $r < v$, very strong. *Pleochroism:* X = red-brown to brownish yellow; Y = yellow to reddish brown; Z = brownish yellow to deep brownish red. *Orientation:* $X = b$; $Y = c$; $Z = a$. *Absorption:* $Z > Y > X$. α = 1.756–1.765 β = 1.777–1.79 γ = 1.794–1.81 2V(meas.) = 67°–83°

Cell Data: *Space Group: Ccmm.* $a = 9.074(4)$ $b = 6.121(2)$ $c = 19.130(7)$ Z = 4

X-ray Powder Pattern: Manganese Lake, Michigan, USA.
9.448 (100), 4.740 (100), 3.026 (45), 4.070 (35), 3.270 (30), 4.509 (25), 4.388 (15)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO_2	32.48	31.21	31.89	MgO		0.46	
Al_2O_3	1.08	0.00		CaO	22.47	20.25	19.84
Fe_2O_3	1.56	0.00		K_2O		0.09	
Mn_2O_3	33.19	33.64	41.90	H_2O	7.93	[7.93]	6.37
V_2O_5		0.96		SO_3		1.00	
CuO		2.09		Total	98.71	[97.63]	100.00

(1) Oriente Province, Cuba; recalculated for total Mn as Mn_2O_3. (2) Manganese Lake, Michigan, USA; average of three analyses, by electron microprobe, total Mn as Mn_2O_3, H_2O from (1). (3) $Ca_2Mn^{2+}Mn_2^{3+}Si_3O_{10}(OH)_4$ with total Mn as Mn_2O_3.

Occurrence: In manganese orebodies in latite and andesite tuffs, agglomerates, and limestones (Oriente Province, Cuba); replacing calcite in fissures and lenses in basalt (Manganese Lake, Michigan, USA).

Association: Todorokite, manganite, pyrolusite, neotocite, barite, quartz, calcite (Oriente Province, Cuba); braunite, manganite, calcite (Manganese Lake, Michigan, USA).

Distribution: In Cuba, in Oriente Province, about 10 km south of Bueycito; and near Banes, north of Antilla. In the USA, from near Manganese Lake, Copper Harbor, Keweenaw Co., Michigan. In the Wessels mine, near Kuruman, Cape Province, South Africa. In the Cerchiara mine, near Faggiona, La Spezia, Liguria, Italy.

Name: For the occurrence in Oriente Province, Cuba.

Type Material: National Museum of Natural History, Washington, D.C., USA, 93819; The Natural History Museum, London, England, 1923,1029.

References: (1) Hewett, D.F. and E.V. Shannon (1921) Orientite, a new hydrous silicate of manganese and calcium from Cuba. Amer. J. Sci., 1, 491–506. (2) Moore, P.B., J. Ito, and I.M. Steele (1979) MacFallite and orientite: calcium manganese (III) silicates from upper Michigan. Mineral. Mag., 43, 325–331. (3) Sclar, C.B. (1961) Optical crystallography of orientite from Oriente Province, Cuba. Amer. Mineral., 46, 226–232. (4) Moore, P.B., J. Shen, and T. Araki (1985) Crystal chemistry of the $^{2}_{\infty}[M_2^{3+}\Phi_2(TO_4)_2]$ sheet: structural principles and crystal structures of ruizite, macfallite and orientite. Amer. Mineral., 70, 171–181.