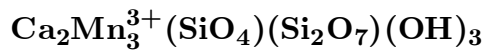


Macfallite



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Crystal Data: Monoclinic. *Point Group:* $2/m$. Rare single crystals, elongated, to 1 cm, invariably twinned; as radial and framboidal aggregates; in fine intergrowths with orientite; massive. *Twinning:* By reflection on $\{100\}$, commonly repeated.

Physical Properties: *Cleavage:* Perfect on $\{001\}$. Hardness = 5–5.5 D(meas.) = 3.43(2) D(calc.) = 3.53

Optical Properties: Transparent to translucent. *Color:* Reddish brown, maroon, dull pink. *Streak:* Brown with a reddish tint. *Luster:* Silky to subadamantine. *Optical Class:* Biaxial (+) or (-). *Pleochroism:* X = colorless to yellow; Y = light brown; Z = dark brown to reddish brown. *Orientation:* Y = b. $\alpha = 1.773\text{--}1.775$ $\beta = 1.795$ $\gamma = 1.810\text{--}1.815$ 2V(meas.) = Very large.

Cell Data: *Space Group:* $P2_1/m$. $a = 10.235(3)$ $b = 6.086(6)$ $c = 8.970(5)$ $\beta = 110.75(3)^\circ$ Z = 2

X-ray Powder Pattern: Manganese Lake, Michigan, USA. 2.70 (100), 4.76 (90), 1.588 (85), 3.904 (80), 3.40 (70), 2.97 (70), 2.18 (70)

Chemistry:	(1)	(2)	(1)	(2)	
SiO ₂	32.04	33.88	MnO	0.69	
TiO ₂	trace		CuO	1.13	
Al ₂ O ₃	3.95	1.03	MgO	0.39	0.73
Fe ₂ O ₃	0.18		CaO	19.75	20.40
Cr ₂ O ₃	0.03		K ₂ O	0.12	
Mn ₂ O ₃	35.96	41.47	Na ₂ O	0.03	
V ₂ O ₅	0.28		H ₂ O	5.39	[2.49]
			Total	99.94	[100.00]

(1) Manganese Lake, Michigan, USA; corresponds to $(\text{Ca}_{1.93}\text{Mn}_{0.05}^{2+})_{\Sigma=1.98}(\text{Mn}_{2.49}^{3+}\text{Al}_{0.42}\text{Cu}_{0.08}\text{Fe}_{0.01}^{3+})_{\Sigma=3.00}(\text{Si}_{2.92}\text{V}_{0.02})_{\Sigma=2.94}\text{O}_{11}[(\text{OH})_{2.66}(\text{H}_2\text{O})_{0.34}]_{\Sigma=3.00}$. (2) Faggiona, Italy; by electron microprobe, average of eight analyses, H₂O by difference.

Occurrence: In abundance, replacing calcite in fissures and in lenses in basalt (Manganese Lake, Michigan, USA); replacing braunite under low-temperature metamorphic conditions (Faggiona, Italy).

Association: Manganite, braunite, orientite, pyrolusite (Manganese Lake, Michigan, USA); braunite, quartz, manganooan richterite, carbonates (Faggiona, Italy).

Distribution: From near Manganese Lake, Copper Harbor, Keweenaw Co., Michigan, USA. In Italy, in the Cerchiara mine, Faggiona, La Spezia, Liguria.

Name: For Russell P. MacFall, American amateur mineralogist.

Type Material: National Museum of Natural History, Washington, D.C., USA, 135923; The Natural History Museum, London, England, 1984,139.

References: (1) 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. (2) (1980) *Amer. Mineral.*, 65, 406 (abs. ref. 1). (3) Moore, P.B., J. Shen, and T. Araki (1985) Crystal chemistry of the $\infty [M_2^{3+}\Phi_2(\text{TO}_4)_2]$ sheet: structural principles and crystal structures of ruizite, macfallite and orientite. *Amer. Mineral.*, 70, 171–181. (4) Basso, R., G. Lucchetti, and A. Palenzona (1989) Orientite and macfallite: new occurrence at the Cerchiara mine (eastern Liguria, Italy). *Neues Jahrb. Mineral., Monatsh.*, 455–460.

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