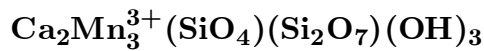


# Macfallite



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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 <sub>2</sub>               | 32.04 | 33.88 | MnO               | 0.69  |          |
| TiO <sub>2</sub>               | trace |       | CuO               | 1.13  |          |
| Al <sub>2</sub> O <sub>3</sub> | 3.95  | 1.03  | MgO               | 0.39  | 0.73     |
| Fe <sub>2</sub> O <sub>3</sub> | 0.18  |       | CaO               | 19.75 | 20.40    |
| Cr <sub>2</sub> O <sub>3</sub> | 0.03  |       | K <sub>2</sub> O  | 0.12  |          |
| Mn <sub>2</sub> O <sub>3</sub> | 35.96 | 41.47 | Na <sub>2</sub> O | 0.03  |          |
| V <sub>2</sub> O <sub>5</sub>  | 0.28  |       | H <sub>2</sub> 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, H<sub>2</sub>O 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  $\infty^2[\text{M}_2^{3+}\Phi_2(\text{TO}_4)_2]$  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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