

Manganaxinite



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Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Crystals typically flattened, axe-head-shaped, to 10 cm; granular, massive.

Physical Properties: *Cleavage:* {100}, good; {001}, {110}, and {011}, poor.
Fracture: Uneven to conchoidal. *Tenacity:* Brittle. Hardness = 6.5–7 D(meas.) = 3.314
D(calc.) = [3.31]

Optical Properties: Transparent to translucent. *Color:* Honey-yellow, clove-brown, brown, blue; colorless to pale brown or blue in thin section. *Luster:* Vitreous.
Optical Class: Biaxial (-). $\alpha = 1.678(3)$ $\beta = 1.687(3)$ $\gamma = 1.692(3)$ $2V(\text{meas.}) = 75(5)^\circ$

Cell Data: *Space Group:* $P\bar{1}$. $a = 7.161(2)$ $b = 9.190(3)$ $c = 8.978(3)$ $\alpha = 88.26(3)^\circ$
 $\beta = 81.80(3)^\circ$ $\gamma = 77.26(2)^\circ$ $Z = 2$

X-ray Powder Pattern: Babbitt, Minnesota, USA. (ICDD 27-84).
3.16 (100), 3.47 (70), 2.810 (50), 6.31 (20), 2.891 (18), 2.189 (16), 3.44 (15)

Chemistry:	(1)	(2)	(1)	(2)	
SiO ₂	41.66	42.23	MgO	0.25	
TiO ₂	0.01		CaO	18.08	19.70
B ₂ O ₃	5.96	6.12	Na ₂ O	0.15	
Al ₂ O ₃	18.00	17.91	K ₂ O	0.02	
Fe ₂ O ₃	0.10		H ₂ O ⁺	1.26	1.58
FeO	3.27		H ₂ O ⁻	0.04	
MnO	11.66	12.46	Total	100.46	100.00

(1) Babbitt, Minnesota, USA; corresponds to $(\text{Ca}_{1.85}\text{Mn}_{0.94}^{2+}\text{Fe}_{0.26}^{2+}\text{Mg}_{0.04})_{\Sigma=3.09}(\text{Al}_{2.03}\text{Fe}_{0.01}^{3+})_{\Sigma=2.04}\text{B}_{0.99}\text{Si}_{3.98}\text{O}_{16}\text{H}_{0.83}$. (2) $\text{Ca}_2\text{MnAl}_2\text{BSi}_4\text{O}_{15}(\text{OH})$.

Polymorphism & Series: Forms two series, with ferroaxinite, and with tizenite.

Mineral Group: Axinite group; Ca > 1.5 per formula unit, Mn > Fe.

Occurrence: Typically a mineral formed by contact metamorphism and boron metasomatism; from a pegmatite vein cutting metamorphosed iron formation at a contact with gabbro (Minnesota, USA).

Association: Chlorite, quartz, potassic feldspar.

Distribution: A few verified localities include: in Germany, from St. Andreasberg, Harz Mountains. In Ireland, at Calliagh, eight km southwest of Monaghan, Co. Monaghan. On Monte Pu, Liguria, Italy. In the USA, from the Huachuca Mountains, Cochise Co., and at the Iron Cap Pb-Zn mine, near Aravaipa, Graham Co., Arizona; at the Consumnes Copper mine, Amador Co., and the Greystone claim, Genesee Valley, Plumas Co., California; from the Mesabi Range, St. Louis Co., Minnesota; in the McKinney mine, Mitchell Co., North Carolina. At Avondale, Delaware Co., and Cornog, Chester Co., Pennsylvania, and from Franklin, Sussex Co., New Jersey. In Canada, from Marmora Township, Ontario. At the Anawai mine, Kochi Prefecture, and the Obira mine, Bungo, Oita Prefecture, Japan.

Name: For dominant manganese in a mineral of the axinite group, named from the Greek for axe after their sharp crystal forms.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 527–529. (2) Deer, W.A., R.A. Howie, and J. Zussman (1986) Rock-forming minerals, (2nd edition), v. 1B, disilicates and ring silicates, 603–623. (3) Sanero, E. and G. Gottardi (1968) Nomenclature and crystal-chemistry of axinites. Amer. Mineral., 53, 1407–1411. (4) French, B.M. and J.J. Fahey (1972) Manganaxinite from the Mesabi Range, Minnesota. Amer. Mineral., 57, 989–992. (5) Lumpkin, G.R. and P.H. Ribbe (1979) Chemistry and physical properties of axinites. Amer. Mineral., 64, 635–645.

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