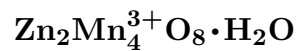


# Hydrohetaerolite



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**Crystal Data:** Tetragonal. *Point Group:*  $4/m\ 2/m\ 2/m$ . Crystals are fibrous, elongated || [110]; radiating, in botryoidal crusts, finely granular, massive.

**Physical Properties:** *Cleavage:* Parallel fiber elongation. Hardness = 5–6 D(meas.) = 4.64 D(calc.) = [5.57]

**Optical Properties:** Opaque, transparent on thin edges. *Color:* Dark brown to brownish black; dark brown in transmitted light; creamy gray in reflected light. *Streak:* Dark brown. *Luster:* Submetallic.

*Optical Class:* Uniaxial (-).  $\omega = 2.26(2)$   $\epsilon = 2.10(2)$

**Cell Data:** *Space Group:*  $I4_1/amd$ .  $a = 5.735(1)$   $c = 9.005(1)$   $Z = 2$

**X-ray Powder Pattern:** Wolfstone mine, Colorado, USA.  
2.47 (10), 2.66 (8), 3.02 (7), 1.508 (7), 1.570 (5), 2.87 (4), 1.434 (4)

Chemistry:	(1)	(2)	(3)
SiO <sub>2</sub>	2.69	1.71	
Fe <sub>2</sub> O <sub>3</sub>		0.77	
Mn <sub>2</sub> O <sub>3</sub>	56.00	60.44	63.59
ZnO	37.56	33.43	32.78
H <sub>2</sub> O <sup>+</sup>		1.42	3.63
H <sub>2</sub> O <sup>-</sup>		2.47	
H <sub>2</sub> O	4.36		
Total	100.61	100.24	100.00

(1) Wolfstone mine, Colorado, USA; average of two analyses; corresponding to  $\text{Zn}_{2.26}(\text{Mn}_{3.50}^{3+}\text{Si}_{0.22})_{\Sigma=3.77}\text{O}_{7.94} \cdot 1.20\text{H}_2\text{O}$ . (2) Franklin, New Jersey, USA; corresponding to  $\text{Zn}_{2.02}(\text{Mn}_{3.77}^{3+}\text{Si}_{0.14}\text{Fe}_{0.04}^{3+})_{\Sigma=3.97}\text{O}_{8.03} \cdot 1.06\text{H}_2\text{O}$ . (3)  $\text{Zn}_2\text{Mn}_4\text{O}_8 \cdot \text{H}_2\text{O}$ .

**Occurrence:** In oxidized manganese-bearing zinc deposits.

**Association:** Chalcophanite, hemimorphite, smithsonite (Leadville, Colorado, USA); chalcophanite (Franklin, New Jersey, USA).

**Distribution:** In the USA, from the Wolfstone mine, Leadville, Lake Co., Colorado; at Sterling Hill, Ogdensburg, Sussex Co., New Jersey; in the Mohawk mine, San Bernardino Co., California; in Arizona, from the Campbell mine, Bisbee, and the Emerald mine, Tombstone, Cochise Co. In England, from the Copperthwaite vein, Swaledale, North Yorkshire. At Silvermines, Co. Tipperary, Ireland. On Mont Chemin, Valais, Switzerland. In the Orzel Bialy mine, Upper Silesia, Poland. In Japan, from the Maruyama mine, Aomori Prefecture.

**Name:** For a HYDROus mineral, and its relation to *hetaerolite*.

**Type Material:** Harvard University, Cambridge, Massachusetts, USA, 112011.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 717–718. (2) Frondel, C. (1942) New data on hetaerolite, hydrohetaerolite, coronadite, and hollandite. *Amer. Mineral.*, 27, 48–56. (3) Wadsley, A.D. (1955) Hydrohausmannite [feitknechtite + hausmannite] and hydrohetaerolite. *Amer. Mineral.*, 40, 349–353. (4) McAndrew, J. (1956) Observations on hydrohetaerolite. *Amer. Mineral.*, 41, 268–275.