Hetaerolite ZnMn$^{2+}$O$_4$

Crystal Data: Tetragonal. Point Group: 4/m2/m2/m. As pyramidal crystals, to 1 cm; also as botryoidal to stalactitic aggregates, and fibrous. As exsolution lamellae in franklinite. Twinning: On \{112\}, producing fivelings, very rare.

Physical Properties: Cleavage: \{001\}, indistinct; two additional, probably on \{112\} and \{011\}. Fracture: Uneven. Tenacity: Brittle. Hardness = 6 VHN = 528–707 (100 g load). D(meas.) = 5.18 D(calc.) = [5.21].


X-ray Powder Pattern: Franklin, New Jersey, USA. 2.462 (100), 2.707 (90), 3.040 (80), 1.5209 (70), 2.855 (50), 1.5634 (50), 2.019 (40).

Chemistry: (1) (2) (3) (1) (2) (3) (1) (2) (3)

- SiO$_2$ 0.18 ZnO 32.46 32.6 34.02
- Mn$_2$O$_3$ 64.21 67.2 65.98 MgO 0.49
- Fe$_2$O$_3$ 0.24 0.17 H$_2$O 0.19
- MnO 1.86 Total 99.63 99.97 100.00

(1) Sterling Hill, New Jersey, USA; corresponds to (Zn$_{0.94}$Mn$_{0.06}$)$_{\Sigma=1.00}$Mn$_{3+}$O$_4$, Si$_{0.01}$O$_{3.92}$H$_2$O. (2) Kennack Sands, England; by electron microprobe, total Mn as Mn$_2$O$_3$, total Fe as Fe$_2$O$_3$; corresponds to Zn$_{0.95}$Mn$_{0.05}$O$_4$. (3) ZnMn$_2^{2+}$O$_4$.

Occurrence: A secondary mineral associated with other manganese minerals, primarily in hydrothermal ore deposits.

Association: Franklinite, chalcophanite, hodgkinsonite, willemite, hemimorphite, manganite, romanechite, calcite.

Distribution: In the USA, from Sterling Hill, Ogdensburg, and Franklin, Sussex Co., New Jersey; in Arizona, in Cochise Co., at the Lucky Cuss mine, Tombstone, and the Campbell and Junction mines, Bisbee; the 79 mine, Banner district, Gila Co.; and the Domeroy property, Pioneer district, Pinal Co. From the Contact mine, Grant Co., New Mexico; in the Mohawk mine, San Bernardino Co., California; and the Wolfton mine, Leadville, Lake Co., Colorado. In Romania, at Rodna. At Moresnet, Belgium. On Mont Chemin, Valais, Switzerland. From Kennack Sands, Cornwall, England. In the Maruyama and Oe mines, Aomori Prefecture, Japan. From the EZ mine, near Beltana, South Australia. Other occurrences are known.

Name: From the Greek for companion, for its occasional association with chalcophanite.

Type Material: Harvard University, Cambridge, Massachusetts, USA, 134145.