

Ophirite**Ca₂Mg₄[Zn₂Mn³⁺₂(H₂O)₂(Fe³⁺W₉O₃₄)₂]**·46H₂O****

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Crystals are tabular, to 1 mm, displaying {100} and {110}.

Physical Properties: *Cleavage:* None. *Fracture:* Irregular. *Tenacity:* Brittle. *Hardness* = ~ 2
D(meas.) = n.d. D(calc.) = 4.060

Optical Properties: Transparent. *Color:* Orange-brown. *Streak:* Pale orange. *Luster:* Vitreous.
Optical Class: Biaxial (+). $\alpha = 1.730(3)$ $\beta = 1.735(3)$ $\gamma = 1.770(3)$ $2V(\text{meas.}) = 43(2)^\circ$
 $2V(\text{calc.}) = 42.1^\circ$ *Orientation:* $Y \wedge b \approx 9^\circ$, one optic axis $\sim \perp \{001\}$. *Dispersion:* $r > v$, strong.
Absorption: $X < Y \ll Z$. *Pleochroism:* $X =$ light orange-brown, $Y =$ light orange-brown,
 $Z =$ orange-brown.

Cell Data: *Space Group:* $P\bar{1}$. $a = 11.9860(2)$ $b = 13.2073(2)$ $c = 17.689(1)$
 $\alpha = 69.690(5)^\circ$ $\beta = 85.364(6)^\circ$ $\gamma = 64.875(5)^\circ$ $Z = 1$

X-ray Powder Pattern: Ophir Hill Consolidated mine, Ophir district, Tooele County, Utah, USA.
10.169 (100), 11.33 (91), 2.992 (75), 8.27 (55), 2.760 (55), 16.72 (38), 5.44 (33)

Chemistry:	(1)	(2)
CaO	1.68	1.94
MgO	2.79	2.78
ZnO	2.86	2.81
Mn ₂ O ₃	2.50	2.73
Fe ₂ O ₃	3.25	2.76
Sb ₂ O ₅	0.61	
WO ₃	71.94	72.06
H ₂ O	[15.24]	14.92
Total	100.87	100.00

(1) Ophir Hill Consolidated mine, Ophir district, Oquirrh Mountains, Tooele County, Utah, USA; average of 14 electron microprobe analyses supplemented by Raman spectroscopy, H₂O calculated from structure; corresponds to (Ca_{1.46}Mg_{0.50}Zn_{0.04}) $\Sigma=2.00$ (Mg_{3.96}Mn³⁺_{0.04}) $\Sigma=4.00$ [(Zn_{1.16}Fe³⁺_{0.68}Ca_{0.14}Sb⁵⁺_{0.02}) $\Sigma=2.00$ (Mn³⁺_{1.42}Sb⁵⁺_{0.32}Fe³⁺_{0.24}W_{0.02}) $\Sigma=2.00$]{(H₂O)₂[(Fe³⁺_{0.80}Sb⁵⁺_{0.11}Ca_{0.07}Mg_{0.02}) $\Sigma=1.00$ (W_{8.71}Mn³⁺_{0.29}) $\Sigma=1.00$]₂}]**·46H₂O**. (2) Ca₂Mg₄[Zn₂Mn³⁺₂(H₂O)₂(Fe³⁺W₉O₃₄)₂]**·46H₂O**.

Occurrence: Produced by late acidic and oxidizing hydrothermal solutions reacting with dolomite and scheelite, in the presence of pyrite and calcium-rich hornfels.

Association: Scheelite, pyrite, dolomite, sericite, apatite, bournonite, galena, sphalerite, fluorite, sulfur.

Distribution: From the Ophir Hill Consolidated mine, Ophir district, Oquirrh Mountains, Tooele County, Utah, USA.

Name: For the mine that produced the first specimens.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA (64029 and 64030).

References: (1) Kampf, A.R., J.M. Hughes, B.P. Nash, S.E. Wright, G.R. Rossman, and J. Marty (2014) Ophirite, Ca₂Mg₄[Zn₂Mn³⁺₂(H₂O)₂(Fe³⁺W₉O₃₄)₂]**·46H₂O**, a new mineral with a heteropolytungstate tri-lacunary Keggin anion. *Amer. Mineral.*, 99, 1045-1051.