

Crystal Data: Triclinic. *Point Group:* 1. As hexagonal platy crystals (0.05 mm wide and 0.01 mm thick) or as stalactitic aggregates, to 2 cm.

Physical Properties: *Cleavage:* Perfect, {001}. *Fracture:* Uneven. *Tenacity:* Flexible. Hardness = 1 VHN = 20.3 D(meas.) = n.d. D(calc.) = 2.75 Dissolves readily in dilute hydrochloric acid.

Optical Properties: Transparent. *Color:* White or pale blue to colorless. *Streak:* White to pale blue. *Luster:* Pearly. *Optical Class:* Biaxial (-). $\alpha = 1.532(2)$ $\beta = 1.565(2)$ $\gamma = 1.567(2)$ $2V(\text{calc.}) = 27.2^\circ$ Positive elongation.

Cell Data: *Space Group:* P1 [by analogy to the synthetic phase]. $a = 8.358(5)$ $b = 8.337(4)$ $c = 11.027(2)$ $\alpha = 94.79(2)^\circ$ $\beta = 83.16(2)^\circ$ $\gamma = 119.61(4)^\circ$ $Z = 2$

X-ray Powder Pattern: Hirao Mine, Osaka Prefecture, Japan. 10.96 (100), 2.717 (21), 1.574 (18), 3.642 (17), 5.47 (16)

Chemistry:	(1)
ZnO	55.30
CuO	3.44
SO ₃	14.66
H ₂ O	26.01

(1) Hirao Mine, Osaka Prefecture, Japan; ICP-AES and thermogravimetric analyses, OH⁻, H₂O and SO₄ confirmed by infrared spectroscopy, corresponding to $(\text{Zn}_{3.75}\text{Cu}_{0.24})_{\Sigma=3.99}(\text{SO}_4)_{1.01}(\text{OH})_{5.96} \cdot 4.99\text{H}_2\text{O}$.

Occurrence: A secondary mineral on mine walls and fractures produced by reaction of oxygenated groundwater with a polymetallic sulfide deposit.

Association: Hydrozincite, smithsonite, "chlorite," and "limonite".

Distribution: At the Hirao Mine, Osaka Prefecture, Japan.

Name: For the region (Osaka) in Japan containing the mine that produced the first specimens.

Type Material: National Science Museum, Tokyo, Japan (NSM-M28983).

References: (1) Ohnishi, M., I. Kusachi, and S. Kobayashi (2007) Osakaite, $\text{Zn}_4\text{SO}_4(\text{OH})_6 \cdot 5\text{H}_2\text{O}$, a new mineral species from the Hirao Mine, Osaka, Japan. *Can. Mineral.*, 45, 1511-1517. (2) (2008) *Amer. Mineral.*, 93, 1688-1689 (abs. ref. 1).