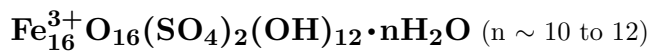


Schwertmannite



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Crystal Data: Tetragonal. *Point Group:* $4/m$ (probable). As fibrous aggregates of poorly-crystalline needles, to 100 μm , in films and thin to thick crusts.

Physical Properties: Hardness = n.d. $D(\text{meas.}) = \text{n.d.}$ $D(\text{calc.}) = 3.77\text{--}3.99$

Optical Properties: Semitransparent. *Color:* Brownish yellow. *Streak:* Ocher-yellow. *Optical Class:* Uniaxial. $\omega = \text{n.d.}$ $\epsilon = \text{n.d.}$

Cell Data: *Space Group:* $P4/m$ (probable). $a = 10.66(4)$ $c = 6.04(1)$ $Z = 1$

X-ray Powder Pattern: Pyhäsalmi mine, Finland; consists of broad bands. 2.55 (100), 3.39 (46), 4.86 (37), 1.51 (24), 2.28 (23), 1.66 (21), 1.46 (18)

| Chemistry: | (1) | (2) | (3) |
|-------------------------|------|---------|--------|
| Fe_2O_3 | 62.6 | 71.0 | 74.01 |
| H_2O^+ | 12.9 | | |
| H_2O^- | 10.2 | | |
| H_2O | | 14.6 | 16.71 |
| CO_2 | 1.5 | | |
| SO_3 | 12.7 | 14.4 | 9.28 |
| Total | 99.9 | [100.0] | 100.00 |

(1) Pyhäsalmi mine, Finland; Fe and S by ICP, CO_2 by gas analyzer, H_2O by TGA. (2) Analysis (1) after deduction of CO_2 and adsorbed H_2O^- , recalculated to 100.0%; corresponds to $\text{Fe}_{16}\text{O}_{16}(\text{OH})_{9.6}(\text{SO}_4)_{3.2}\cdot 10\text{H}_2\text{O}$. (3) $\text{Fe}_{16}\text{O}_{16}(\text{SO}_4)_2(\text{OH})_{12}\cdot 10\text{H}_2\text{O}$.

Occurrence: A secondary mineral precipitated by waters of pH 3–4.5 and high in iron sulfate content from the surface oxidation of metal sulfides.

Association: Goethite, jarosite, natrojarosite, ferrihydrite, sulfides.

Distribution: From the Pyhäsalmi mine, Oulu, Finland. At over 40 unspecified localities in Europe, North America, and Australia.

Name: For Udo Schwertmann (1927–), Professor of Soil Science, Technical University of Munich, Munich, Germany, who has worked on poorly crystalline products of weathering.

Type Material: Museum of Natural History, University of Helsinki, Helsinki, Finland, B8659.

References: (1) Bigham, J.M., L. Carlson, and E. Murad (1994) Schwertmannite, a new iron oxyhydroxysulphate from Pyhäsalmi, Finland, and other localities. *Mineral. Mag.*, 58, 641–648. (2) (1995) *Amer. Mineral.*, 80, 847 (abs. ref. 1).