Schwertmannite $\mathbf{Fe^{3+}_{16}O_{16}(SO_4)_2(OH)_{12}\cdot nH_2O}$ (n ~ 10 to 12)

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(meas.) = n.d. D(calc.) = 3.77–3.99

Optical Properties: Semitransparent. *Color:* Brownish yellow. *Streak:* Ocher-yellow. *Optical Class:* Uniaxial. ω = n.d. ϵ = 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 $Fe_{16}O_{16}(OH)_{9.6}(SO_4)_{3.2}\cdot 10H_2O$. (3) $Fe_{16}O_{16}(SO_4)_2(OH)_{12}\cdot 10H_2O$.

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).