Rinmanite $Mg_2Fe_4Zn_2Sb_2O_{14}(OH)_2$

Crystal Data: Hexagonal. *Point Group*: 6*mm*. Euhedral, prismatic crystals are elongate along [001] to 0.5 mm; cleavage traces appear as vertical striations on crystals. Penetration twins common.

Physical Properties: *Cleavage*: {100}, good. *Fracture*: Splintery. Hardness = ~6
VHN = 841-907, 880 average (100 g load). D(meas.) = n.d. D(calc.) = 5.13(1)

Optical Properties: Opaque. *Color*: Black, dark red and translucent in thin splinters; gray in reflected light. *Streak*: Brown. *Luster*: Submetallic.
Optical Class: Uniaxial (-). ω(calc.) = 2.10 ε(calc.) = 2.04
Pleochroism: *O* = dark red, *E* = orange-red. Weakly bireflectant; moderately anisotropic.
R_O-R_E: (460) 13.6-12.2, (540) 12.9-11.8, (580) 12.7-11.7, (640) 12.3-11.4

Cell Data: *Space Group*: $P6_3mc$. a = 5.993(1) c = 9.335(2) Z = 1

X-ray Powder Pattern: Garpenberg Norra deposit, Hedemora, south-central Sweden.
2.522 (100), 1.4972 (54), 2.673 (44), 2.994 (43), 3.474 (34), 1.5170 (33), 1.6597 (28)

Chemistry:

	(1)
MgO	8.97
Al_2O_3	0.82
TiO_2	0.01
MnO	2.47
Fe_2O_3	34.33
ZnO	14.24
Sb_2O_5	36.31
H_2O	[1.99]
Total	99.13

(1) Garpenberg Norra deposit, Hedemora, south-central Sweden; average electron microprobe analysis, Fe^{3+} confirmed by Mössbauer spectroscopy, H_2O calculated; corresponds to $Mg_{1.95}[Fe_{3.88}Al_{0.15}]_{\Sigma=4.03}(Zn_{1.58}Mn_{0.31}Mg_{0.06})_{\Sigma=1.95}Sb_{2.03}O_{14.01}(OH)_{1.99}$.

Occurrence: In veinlets and lenses in dolomitic marble and silicate skarn hosting a pyritiferous Zn-Pb-Fe-Cu-Sb-Ag-deposit.

Association: Tremolite, manganocummingtonite, talc, franklinite, baryte, svabite.

Distribution: At the Garpenberg Norra deposit, Hedemora, Dalarna (= Dalecarlia), south-central Sweden.

Name: Honors Sven *Rinman* (1720-1792), a mining scientist considered by some to be the father of the Swedish minerals industry.

Type Material: Swedish Museum of Natural History, Stockholm (#2000160).

References: (1) Holstam, D., K. Gatedal, K. Söderberg, and R. Norrestam (2001) Rinmanite, $Zn_2Sb_2Mg_2Fe_4O_{14}(OH)_2$, a new mineral species with a nolanite-type structure from the Garpenberg Norra mine, Dalarna, Sweden. Can. Mineral., 39, 1675-1683. (2) (2003) Amer. Mineral., 88, 252-253 (abs. ref. 1).