

**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . As divergent sprays of bladed crystals to 1.0 mm elongated along [001]. Pseudo-orthorhombic crystals display {100} (dominant), {010}, {011}, and {001}. *Twinning:* Contact twinning on (100).

**Physical Properties:** *Cleavage:* Perfect on (100) and probable on (001). *Fracture:* Splintery to conchoidal. *Tenacity:* Brittle. Hardness = 4 D(meas.) = 3.55(5) D(calc.) = 3.59

**Optical Properties:** Transparent. *Color:* Resinous orange-brown to dark clove-brown. *Streak:* Yellowish brown. *Luster:* Vitreous to pearly on cleavage surfaces. *Optical Class:* Biaxial (-).  $\alpha = 1.730(3)$   $\beta = \sim 1.738$   $\gamma = 1.738(4)$   $2V = \sim 0^\circ$  *Orientation:*  $X = b, Y = a, Z = c$ . *Pleochroism:*  $X =$  pale brown,  $Y =$  brown-yellow,  $Z =$  pale brown. *Absorption:*  $Z = X > Y$ .

**Cell Data:** Space Group:  $P2_1/c$ .  $a = 11.364(2)$   $b = 5.570(1)$   $c = 10.455(2)$   $\beta = 96.61(3)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Iron Monarch mine, Middleback Ranges, Iron Knob, South Australia. 3.621 (100), 4.436 (70), 3.069 (50), 2.941(40), 2.780 (35), 2.890 (20), 2.842 (20)

<b>Chemistry:</b>	(1)
MnO	69.70
ZnO	0.02
P <sub>2</sub> O <sub>5</sub>	17.37
As <sub>2</sub> O <sub>5</sub>	1.09
V <sub>2</sub> O <sub>5</sub>	0.50
<u>H<sub>2</sub>O</u>	<u>[9.49]</u>
Total	98.17

(1) Iron Monarch mine, Middleback Ranges, Iron Knob, South Australia; average of 7 electron microprobe analyses supplemented by Raman spectroscopy, H<sub>2</sub>O calculated from structure analysis; corresponds to  $\text{Mn}_{7.28}[(\text{P}_{1.81}\text{As}_{0.07}\text{V}_{0.04})\text{O}_4]_{1.92}(\text{OH})_{7.81}\text{O}_{0.51}$ .

**Occurrence:** In cavities in the carbonate-rich beds of a Precambrian banded iron formation.

**Association:** Shigaite, gatehouseite, seamanite, rhodochrosite, barite, hausmannite, hematite.

**Distribution:** From the 130-meter level on the eastern side of the Iron Monarch mine, Middleback Ranges, Iron Knob, South Australia.

**Name:** Honors Frederick George Waterhouse (1815-1898), first Director of the South Australian Museum (Adelaide), in recognition of his contribution to the preservation of the natural history of South Australia, and in celebration of the continuing work of the Waterhouse Club in their support of the South Australian Museum.

**Type Material:** The South Australian Museum, Adelaide, Australia (SAM 28408 and 28409).

**References:** (1) Pring, A., U. Kolitsch, and W.D. Birch (2005) Description and unique crystal-structure of waterhouseite, a new hydroxymanganese phosphate species from the Iron Monarch deposit, Middleback Ranges, South Australia. *Can. Mineral.*, 43, 1401-1410. (2) (2006) *Amer. Mineral.*, 91, 714 (abs. ref. 1).