Whiteite-(MnMnMg) $Mn^{2+}Mn^{2+}Mg_2Al_2(PO_4)_4(OH)_2 \cdot 8H_2O$

Crystal Data: Monoclinic. *Point Group*: 2/*m.* As a single unterminated 1.2 mm crystal, prismatic along [100].

Physical Properties: *Cleavage*: Good on {001}. Tenacity: Brittle. *Fracture*: Splintery. Hardness = ~4 D(meas.) = 2.61(4) D(calc.) = 2.632

Optical Properties: Translucent. *Color*: Reddish orange. *Streak*: Pale orange. *Luster*: Vitreous. *Optical Class*: Biaxial (-). $\alpha = 1.582(2)$ $\beta = 1.586(2)$ $\gamma = 1.613(2)$ 2V(calc.) = 74.5° *Pleochroism*: Distinct, X = pale gray, Y = orange-pink, Z = beige. *Absorption*: $X < Z < Y$.

Cell Data: *Space Group*: $P2/a$. $a = 15.0357(18)$ $b = 6.9408(5)$ $c = 9.9431(9)$ $\beta = 110.827(8)°$ $Z = 2$

X-ray Powder Pattern: Iron Monarch quarry, Iron Knob, South Australia, Australia. 9.244 (100), 5.619 (32), 2.759 (30), 3.501 (22), 4.839 (20), 2.566 (17), 4.111 (16)

Chemistry:

	(1)
Na_2O	0.11
K_2O	0.04
CaO	3.03
MgO	10.97
MnO	[14.11]
Mn_2O_3	[1.81]
Al_2O_3	12.10
P_2O_5	37.13
H_2O	21.15
Total	100.45

(1) Iron Monarch quarry, Iron Knob, South Australia, Australia; average electron microprobe analysis, H_2O from structure analysis, total manganese apportioned so that M(1) sites are occupied by Mn, the M(2) site by Mg and Mn, and the M(3) sites by Al and Mn^{3+}; corresponds to $(Mn^{2+}_{0.60}Ca_{0.41}Na_{0.03}K_{0.01})_{\Sigma=1.05}(Mn^{2+}_{0.92}Mg_{0.08})_{\Sigma=1.00}Mg_{2.00}(Al_{1.82}Mn^{3+}_{0.18})_{\Sigma=2.00}(PO_4)_{4.00}(OH)_{2.06} \cdot 7.95H_2O$.

Mineral Group: Jahnsite group, whiteite subgroup; $Al > Fe^{3+}$ in the M(3) structural site.

Occurrence: From a Mn-rich, carbonate-rich zone, in a deeply weathered, Precambrian sedimentary iron ore deposit (Monarch quarry), likely as a late-stage, low-temperature hydrothermal phase.

Association: Hematite, hausmannite, baryte, Mn-rich calcite, rhodochrosite.

Distribution: At the Iron Monarch quarry, Iron Knob, South Australia, Australia. From the Jocão pegmatite, and the Sapucaia mine, Minas Gerais, Brazil.

Name: Root name, *whiteite*, indicates a member of the group with $M(3) = Al^{3+}$; the suffix indicates sequentially the dominant atom in the X, M(1), and M(2) structural positions.

Type Material: South Australian Museum, Adelaide, South Australia, Australia (G32398).

References: (1) Elliott, P. and A.C. Willis (2019) Whiteite-(MnMnMg), a new jahnsite-group mineral from Iron Monarch, South Australia: description and crystal structure. Can. Mineral., 57(2), 215-223. (2) (2021) Amer. Mineral., 106, 1364 (abs. ref. 1). (3) Moore, P.B. and J. Ito (1978) I. Whiteite, a new species, and a proposed nomenclature for the jahnsite-whiteite complex series. II. New data on xanthoxenite. III. Salmonsite discredited. Mineral. Mag., 42, 309-323. (4) (1979) Amer. Mineral., 64, 465–466 (abs. ref. 3).