

Crystal Data: Orthorhombic. *Point Group:* 222. As bladelike crystals, with prominent {001}, {110}, {102}, elongated along [010], to 100 μm , in radiating to divergent groups and overgrowths on arsenoclasite. *Twinning:* On {001}, contact twins.

Physical Properties: *Cleavage:* On {010}, distinct. *Fracture:* Splintery. Hardness = ~ 4
D(meas.) = n.d. D(calc.) = 3.74

Optical Properties: Transparent. *Color:* Pale brownish orange to yellow or pale yellow.
Streak: Pale yellow. *Luster:* Adamantine.

Optical Class: Biaxial. *Pleochroism:* Distinct; brown to nearly colorless. *Orientation:* Parallel extinction; length-slow. $\alpha = 1.74(1)$ $\beta = \text{n.d.}$ $\gamma = 1.76(1)$ $2V(\text{meas.}) = \text{n.d.}$

Cell Data: *Space Group:* $P2_12_12_1$ (probable). $a = 9.097(2)$ $b = 5.693(2)$ $c = 18.002(10)$
 $Z = 4$

X-ray Powder Pattern: Iron Monarch quarry, Australia.
2.90 (100), 2.702 (80), 2.853 (70), 2.802 (50), 2.022 (15), 1.608 (15), 4.483 (10)

Chemistry:	(1)	(2)	(3)
SO_3		0.10	
P_2O_5	22.18	23.05	26.65
As_2O_5	3.58	3.32	
V_2O_5	0.38		
Al_2O_3	0.10		
FeO	0.19	0.32	
MnO	64.42	63.34	66.59
CuO	0.03	0.04	
ZnO	0.03		
PbO	0.05	0.05	
H_2O	[6.44]	[6.43]	6.76
Total	[97.40]	[96.65]	100.00

(1) Iron Monarch quarry, Australia; by electron microprobe, total Mn as MnO, total Fe as FeO, H_2O calculated for 4(OH); corresponds to $\text{Mn}_{5.09}\text{Fe}_{0.01}\text{Al}_{0.01}[(\text{P}_{0.87}\text{As}_{0.08}\text{V}_{0.01})_{\Sigma=0.96}\text{O}_4]_2(\text{OH})_4$.
(2) Do.; corresponds to $\text{Mn}_{4.74}\text{Al}_{0.03}[(\text{P}_{0.87}\text{As}_{0.08}\text{S}_{0.01})_{\Sigma=0.96}\text{O}_4]_2(\text{OH})_4$. (3) $\text{Mn}_5(\text{PO}_4)_2(\text{OH})_4$.

Occurrence: As a secondary mineral in cavities in a sedimentary Fe–Mn deposit, probably formed by reaction of phosphorus-rich fluids with hausmannite at low temperature.

Association: Arsenoclasite, shigaite, hematite, hausmannite, triplodite, barite, manganooan ferroan calcite.

Distribution: From the Iron Monarch quarry, Iron Knob, South Australia.

Name: Honoring Dr. Bryan Michael Kenneth Cummings Gatehouse (1932–), crystal chemist, Monash University, Melbourne, Australia.

Type Material: South Australian Museum, Adelaide, G17655; Museum Victoria, Melbourne, Australia, M41982, M42467.

References: (1) Pring, A. and W.D. Birch (1993) Gatehouseite, a new manganese hydroxy phosphate from Iron Monarch, South Australia. *Mineral. Mag.*, 57, 309–313. (2) (1994) *Amer. Mineral.*, 79, 185 (abs. ref. 1).