

Crystal Data: Monoclinic. *Point Group:* 2/m. As aggregates of prismatic crystals to 0.3 mm comprised of individual crystals to 0.05 mm.

Physical Properties: *Cleavage:* One perfect. *Tenacity:* Brittle. *Fracture:* Uneven. Hardness = ~2 D(meas.) = n.d. D(calc.) = 3.64

Optical Properties: Translucent. *Color:* Blue. *Streak:* Pale blue. *Luster:* Vitreous. *Optical Class:* Biaxial (+). $\alpha = 1.663(4)$ $\beta = 1.748(4)$ $\gamma = 1.861(4)$ $2V(\text{calc.}) = 86.7^\circ$
Dispersion: Slight, $r > v$. *Pleochroism:* X = colorless, Y = very pale blue, Z = dark sky blue.
Absorption: $Z > Y > X$.

Cell Data: *Space Group:* P2₁/c. $a = 7.2597(15)$ $b = 5.7145(11)$ $c = 5.6624(11)$ $\beta = 104.20(3)^\circ$
 $Z = 2$

X-Ray Diffraction Pattern: Iron Monarch quarry, South Australia, Australia. 3.739 (100), 2.860 (18), 7.070 (16), 2.481 (12), 2.350 (9), 2.373 (8), 2.905 (7)

Chemistry:	(1)	(2)
C ₂ O ₃	[28.91]	28.91
CuO	64.18	63.86
ZnO	0.16	
FeO	0.07	
P ₂ O ₅	0.1	
Cl	0.35	
H ₂ O	[7.23]	7.23
<u>-O = Cl</u>	<u>0.08</u>	<u> </u>
Total	100.92	100.00

(1) Iron Monarch quarry, South Australia, Australia; average electron microprobe analysis supplemented by IR spectroscopy, H₂O and C₂O₃ calculated; corresponding to Cu_{2.00}(C₂O₄)Cl_{0.02}(OH)_{1.98}. (2) Cu₂C₂O₄(OH)₂.

Occurrence: A supergene mineral in a weathered Precambrian manganese sedimentary iron ore deposit. A source of oxalate was probably decaying organic matter. Copper from weathering of Cu sulfides with dissolution of Cu possibly facilitated by oxalic acid.

Association: Atacamite, mottramite.

Distribution: From the upper levels of the Iron Monarch quarry, South Australia, Australia.

Name: For the *Middleback* Range, in which the Iron Monarch quarry is located.

Type Material: South Australian Museum, Adelaide, South Australia, Australia (G34300).

References: (1) Elliott, P. (2019) Middlebackite, a new Cu oxalate mineral from Iron Monarch, South Australia: Description and crystal structure. *Mineral. Mag.*, 83, 427-433.