

Mallardite

Mn²⁺SO₄·7H₂O

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Crystal Data: Monoclinic. *Point Group:* 2/m. As masses of fibers, to 12 mm, efflorescences, and crusts.

Physical Properties: *Cleavage:* On {001}, good; on {110}, probable. Hardness = ~2
D(meas.) = 1.846 (synthetic). D(calc.) = 1.838 Soluble in H₂O; quickly dehydrates at room temperature.

Optical Properties: Transparent to translucent. *Color:* White to pale rose; colorless in transmitted light. *Streak:* White. *Luster:* Vitreous.
Optical Class: Biaxial (-), may be (+). *Orientation:* Y = b; Z ∩ c = 43°–44°. α = 1.462–1.513
β = 1.465–1.533 γ = 1.474–1.540 2V(meas.) = Moderate to large.

Cell Data: *Space Group:* [P2₁/c] (by analogy to melanterite and bieberite). a = 14.15
b = 6.50 c = 11.06 β = 105°36' Z = 4

X-ray Powder Pattern: Jokoku mine, Japan.
4.92 (100), 5.49 (72), 4.88 (54), 3.79 (42), 2.758 (38), 3.26 (36), 3.13 (31)

Chemistry:	(1)	(2)	(3)
SO ₃	29.0	29.08	28.89
MnO	23.6	23.36	25.60
MgO	0.6	1.59	
CaO	0.7		
H ₂ O	44.5	44.89	45.51
insol.	1.6	1.39	
Total	100.0	100.31	100.00

- (1) Lucky Boy mine, Utah, USA; corresponds to (Mn_{0.92}Mg_{0.04}Ca_{0.04})_{Σ=1.00}SO₄·6.83H₂O.
(2) Jokoku mine, Japan; corresponds to (Mn_{0.90}Mg_{0.11})_{Σ=1.01}SO₄·6.83H₂O. (3) MnSO₄·7H₂O.

Mineral Group: Melanterite group.

Occurrence: A rare mineral formed by oxidation of Fe–Mn sulfides and carbonates under conditions of saturated relative humidity; typically post-mine, when it may be seasonal.

Association: Manganoan melanterite (Lucky Boy mine, Utah, USA); jokokuite, ilesite, rhodochrosite, manganoan calcite, kutnohorite (Jokoku mine, Japan); alabandite (Broken Hill, Australia); melanterite, chvaleticeite, epsomite, jokokuite, rozenite, ilesite, copiapite, gypsum (Chvaletice, Czech Republic).

Distribution: In the USA, from the Lucky Boy mine, Butterfield Canyon, Bingham district, Salt Lake Co., Utah; in New Mexico, in the Bayard area, Central (Bayard) district, Grant Co., and in the Lake Valley district, Sierra Co.; at the Moon Anchor mine, Cripple Creek district, Teller Co., Colorado. In the Jokoku mine, about 60 km southwest of Hakodate, Hokkaido, Japan. From Broken Hill, New South Wales, Australia. At Chvaletice, Czech Republic.

Name: To honor François Ernest Mallard (1833–1894), French crystallographer, National School of Mines, Paris, France.

Type Material: Natural History Museum, Paris, France, 96132.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 507–508. (2) Nambu, M., K. Tanida, and T. Kitamura (1979) Mallardite from the Jôkoku mine, Hokkaido, Japan. J. Japan. Assoc. Mineral. Petrol. Econ. Geol., 74, 406–412.