

Montgomeryite

Ca₄MgAl₄(PO₄)₆(OH)₄•12H₂O

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Crystal Data: Monoclinic. *Point Group:* 2. As laths, flattened on {010} and elongated and striated along [001], terminated by pyramids, to 5 mm; {010} dominant, with many {hk0} forms.

Physical Properties: *Cleavage:* {010}, perfect; {100}, poor. Hardness = 4
D(meas.) = 2.53(5) D(calc.) = 2.523

Optical Properties: Translucent. *Color:* Dark green to pale green, colorless, red, yellow, may be zoned. *Luster:* Vitreous.

Optical Class: Biaxial (-). *Pleochroism:* X = colorless to pale green; Y = Z = colorless. May be X = light orange brown; Y = pale magenta-pink; Z = light orange-brown. *Orientation:* Z = b; X ∧ c = 60°. *Dispersion:* r < v, perceptible. α = 1.572(2) β = 1.578(2) γ = 1.582(2) 2V(meas.) = 75(10)°

Cell Data: *Space Group:* C2. a = 10.004–10.023 b = 24.083–24.121 c = 6.235–6.243
β = 91.55–91.60° Z = 2

X-ray Powder Pattern: Tip Top mine, South Dakota, USA. (ICDD 35-624).
12.0 (100), 5.11 (65), 2.895 (45), 2.580 (30), 2.874 (25), 2.615 (25), 6.03 (20)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
P ₂ O ₅	37.70	36.6	37.14	MgO		3.5	3.52
Al ₂ O ₃	21.32	17.1	17.78	CaO	19.07	19.1	19.56
MnO		0.5		H ₂ O	21.65	[23.2]	22.00
				Total	99.74	[100.0]	100.00

(1) Fairfield, Utah, USA. (2) Tip Top mine, South Dakota, USA; by electron microprobe, total Mn as MnO, H₂O by difference; corresponding to (Ca_{3.97}Mn_{0.08})_{Σ=4.05}Mg_{1.01}Al_{3.89}(PO₄)₆(OH)_{4.06}•12.94H₂O. (3) Ca₄MgAl₄(PO₄)₆(OH)₄•12H₂O.

Mineral Group: Montgomeryite group.

Occurrence: In sedimentary phosphatic nodules (Fairfield, Utah, USA); a late mineral in highly oxidized phosphate nodules in granite pegmatite (South Dakota, USA).

Association: Variscite, englishite, wardite, gordonite, crandallite (Fairfield, Utah, USA); mitridatite, triphylite, rockbridgeite–frondelite, whitlockite, carbonate-apatite, robertsite, fairfieldite, englishite (South Dakota, USA).

Distribution: In the USA, from the Little Green Monster mine, Clay Canyon, about nine km west of Fairfield, Utah Co., Utah; in South Dakota, in the Etta mine, near Keystone, Pennington Co., and at the Tip Top mine, 8.5 km southwest of Custer, Custer Co., South Dakota; in the Redhouse Barite mine, Golconda district, Humboldt Co., Nevada. From the Lavra da Ilha pegmatite, in the Jequitinhonha River, three km north of Taquaral, Minas Gerais, Brazil. About 15 km northwest of Milgun Station, Western Australia; in the Iron Monarch quarry, Iron Knob, and the Moculta phosphate quarry, northeast of Angaston, South Australia. At the Mangualde pegmatite, near Mesquitela, and the Bendada pegmatite, near Guarda, Portugal. In Spain, from Montcada and Bruguers, Barcelona Province. At the Sandamap pegmatite, west of Usakos, Namibia.

Name: To honor Dr. Arthur Montgomery (1909–1999), American mineralogist, Professor of Geology, Lafayette College, Easton, Pennsylvania, USA, who collected the first specimens.

Type Material: Harvard University, Cambridge, Massachusetts, USA, 95481.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 978–979. (2) Moore, P.B. and T. Araki (1974) Montgomeryite, Ca₄Mg(H₂O)₁₂[Al₄(OH)₄(PO₄)₆]: its crystal structure and relation to vauxite, Fe₂²⁺(H₂O)₄[Al₄(OH)₄(H₂O)₄(PO₄)₄]•4H₂O. Amer. Mineral., 59, 843–850. (3) Fanfani, L., A. Nunzi, P.F. Zanazzi, and A.R. Zanzari (1976) Additional data on the crystal structure of montgomeryite. Amer. Mineral., 61, 12–14. (4) Dunn, P.J., W.L. Roberts, T.J. Campbell, and P.B. Leavens (1983) Red montgomeryite and associated minerals from the Tip Top pegmatite with notes on kingsmountite and calcoferite. Mineral. Record, 14, 195–197.

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