

**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . Crystals are minute, tabular {100}, commonly pseudorhomboidal, {011}, {111}, and many {h0l} forms; striated on {100} giving a triangular pattern; curved, lamellar, radiated, stellated; foliated, micaceous, to several cm; disseminated scaly massive.

**Physical Properties:** *Cleavage:* On {100}, perfect. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 3.5–4 D(meas.) = 3.34–3.41 D(calc.) = 3.426

**Optical Properties:** Transparent to translucent. *Color:* Oil-green to olive-green, light to dark grass-green, yellowish green to brownish green; green in transmitted light. *Streak:* White, nearly. *Luster:* Vitreous, pearly on cleavages.

*Optical Class:* Biaxial (+). *Pleochroism:* X = pale olive-green; Y = paler olive-green; Z = very pale yellowish green. *Orientation:* X = b; Y  $\wedge$  c  $\approx$  15°. *Dispersion:* r > v, moderate to strong.  $\alpha = 1.648\text{--}1.658$   $\beta = 1.655\text{--}1.662$   $\gamma = 1.662\text{--}1.671$  2V(meas.) =  $\leq 90^\circ$

**Cell Data:** *Space Group:*  $A2/a$ . a = 24.940(6) b = 10.131(4) c = 16.722(2)  $\beta = 105.60(2)^\circ$  Z = 4

**X-ray Powder Pattern:** Branchville, Connecticut, USA; close to arrojadite. (ICDD 24-66). 3.04 (100), 2.717 (80), 3.22 (60), 2.85 (45), 5.93 (40), 2.770 (40), 2.554 (35)

Chemistry:	(1)	(2)	(3)	(1)	(2)	(3)
P <sub>2</sub> O <sub>5</sub>	39.57	39.5	39.67	Li <sub>2</sub> O	0.17	[0.17]
Al <sub>2</sub> O <sub>3</sub>		2.0	2.37	Na <sub>2</sub> O	7.46	7.8
FeO	13.25	13.3	23.42	K <sub>2</sub> O	1.52	1.1
MnO	31.58	32.0	23.13	H <sub>2</sub> O	1.65	[1.65]
MgO		0.0		insol.	2.58	
CaO	2.15	2.3	2.61	Total	99.93	[99.82]
						100.00

(1) Branchville, Connecticut, USA. (2) Do.; by electron microprobe, total Fe as FeO, total Mn as MnO, Li<sub>2</sub>O and H<sub>2</sub>O from (1); corresponds to  $\text{K}_{0.49}\text{Li}_{0.24}\text{Na}_{5.33}\text{Ca}_{0.87}(\text{Mn}_{9.55}^{2+}\text{Fe}_{3.92}^{2+})_{\Sigma=13.47}\text{Al}_{0.83}(\text{PO}_4)_{11.78}(\text{OH})_{3.88}$ . (3)  $\text{KNa}_4\text{Ca}(\text{Mn}, \text{Fe})_{14}\text{Al}(\text{PO}_4)_{12}(\text{OH})_2$  with Mn:Fe = 1:1.

**Polymorphism & Series:** Forms a series with arrojadite.

**Occurrence:** A high-temperature ( $\approx 800^\circ\text{C}$ ) primary mineral in granite pegmatites.

**Association:** Eosphorite, triploidite, lithiophilite, rhodochrosite, reddingite, fairfieldite (Branchville, Connecticut, USA).

**Distribution:** In the USA, from Branchville, Fairfield Co., and in the Strickland quarry, Portland, Middlesex Co., Connecticut; in Maine, from Auburn and Poland, Androscoggin Co., and at Hebron, Greenwood, and Newry, Oxford Co.; from the White Picacho district, Maricopa and Yavapai Cos., Arizona; in the Nickel Plate mine, near Keystone, Pennington Co., South Dakota. At the Buranga pegmatite, near Gatumba, Rwanda.

**Name:** In honor of the Reverend John William Dickinson (1835–1899), Redding, Connecticut, USA, an early collector of Branchville minerals.

**Type Material:** Yale University, New Haven, Connecticut, Brush 3090; Harvard University, Cambridge, Massachusetts, 110679, 103812; National Museum of Natural History, Washington, D.C., USA, 80561.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 717–719. (2) Moore, P.B. and J. Ito (1979) Alluaudites, wyllieites, arrojadites: crystal chemistry and nomenclature. Mineral. Mag., 43, 227–235. (3) Moore, P.B., T. Araki, S. Merlino, M. Mellini, and P.F. Zanazzi (1981) The arrojadite-dickinsonite series,  $\text{KNa}_4\text{Ca}(\text{Fe}, \text{Mn})_{14}^{2+}\text{Al}(\text{OH})_2(\text{PO}_4)_{12}$ : crystal structure and crystal chemistry. Amer. Mineral., 66, 1034–1049.