Kidwellite $NaFe^{3+}_{9+x}(PO_4)_6(OH)_{11}\cdot 3H_2O$ ($x \approx 0.33$)

Crystal Data: Monoclinic. *Point Group*: 2/*m*. Acicular crystals are elongated along [010] and flattened on {100}, to 50 μm; typically, in mats, tufts, or rosettes of feathery crystals; as spheroidal to botryoidal masses and crusts.

Physical Properties: *Cleavage*: Perfect on {100}. Hardness = 3 D(meas.) = > 3.3 D(calc.) = 3.289

Optical Properties: Transparent to translucent. *Color*: Bright yellow to greenish yellow, pale chartreuse-green, greenish white; colorless in transmitted light. *Streak*: Yellow. *Luster*: Silky. *Optical Class*: Biaxial (–). α = 1.787(5) β = 1.800(5) γ = 1.805(5) 2V(meas.) = Large. *Orientation*: *Y* = *b*.

Cell Data: *Space Group*: $P2_1/c$. a = 20.117(4) b = 5.185(1) c = 13.978(3) β = 107.07(3)° Z = 2

X-ray Powder Pattern: Fodderstack Mountain, Arkansas, USA.
9.41 (100), 3.413 (55), 3.813 (40), 3.193 (40), 4.017 (35), 3.173 (35), 6.43 (30)

Chemistry:

	(1)	(2)
P_2O_5	31.3	31.41
SiO_2	0.27	
Al_2O_3	0.98	
Fe_2O_3	52.3	53.01
MnO	0.02	
MgO	0.01	
Na_2O	1.60	2.29
H_2O^+	13.3	
H_2O^-	0.3	
H_2O		13.29
Total	[100.08]	100.00

(1) Fodderstack Mountain, Arkansas, USA; original total given as 100.07%, corresponds to $Na_{0.71}(Fe^{3+}_{8.91}Al_{0.26})_{\Sigma=9.17}(PO_4)_6(OH)_{10}\cdot 5H_2O$. (2) $NaFe_9(PO_4)_6(OH)_{10}\cdot 5H_2O$.

Occurrence: As a late-stage replacement of earlier phosphate minerals.

Association: Rockbridgeite, beraunite, strengite, dufrénite, chalcosiderite, goethite.

Distribution: In the USA, in Arkansas, from the Coon Creek and York mines, Polk Co; on Fodderstack Mountain, Montgomery Co.; and on Buckeye Mountain, at Three Oak Gap; in Alabama, from Indian Mountain, Cherokee Co.; at Irish Creek, Rockbridge Co., Virginia. In Germany, from the Rotläufchen mine, Waldgirmes, near Giessen, and the Eleonore mine, Hesse; and in the Clara mine, near Oberwolfach, Black Forest. At the Phoenix United mines, Linkinhorne, Cornwall, England. In Australia, from Broken Hill, New South Wales; in the Iron Monarch quarry, Iron Knob, South Australia; and at the Lake Boga granite quarry, near Swan Hill, Victoria. In the Okatjimukuju pegmatite, near Karibib, Namibia.

Name: Honors Albert Laws *Kidwell* (1919-2008), Houston, Texas, USA, for his study of Arkansas phosphate deposits.

Type Material: National Museum of Natural History, Washington, D.C., USA, 137024.

References: (1) Moore, P.B. and J. Ito (1978) Kidwellite, $NaFe^{3+}_9(OH)_{10}(PO_4)_6\cdot 5H_2O$, a new species. Mineral. Mag., 42, 137-140. (2) (1979) Amer. Mineral., 64, 242-243 (abs. ref. 1).
(3) Braithwaite, R.S.W. and H. Corke (1980) Kidwellite from Cornwall. Mineral. Mag., 43, 952-953.
(4) Kolitsch, U. (2004) The crystal structures of kidwellite and "laubmannite," two complex fibrous iron phosphates. Mineral. Mag., 68, 147-165. (5) (2004) Amer. Mineral., 89(12), 1833 (abs. ref. 4).