Mahlmoodite $Fe^{2+}Zr(PO_4)_2 \cdot 4H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. In spheroidal aggregates of radiating fibrous to lathlike crystals, to 0.15 mm.

Physical Properties: Hardness = ∼3 D(meas.) = n.d. D(calc.) = 2.877

Optical Properties: Translucent. *Color:* Cream-white.
Optical Class: Biaxial (–), sensibly uniaxial (–). *Orientation:* Positive elongation; parallel extinction. $\alpha = < 1.646$ $\beta = 1.652(2)$ $\gamma = 1.652(2)$ 2V(meas.) = n.d.

Cell Data: *Space Group:* $P2_1/c$. $a = 9.112(6)$ $b = 5.412(7)$ $c = 19.19(1)$ $\beta = 94.81(6)^\circ$ Z = 4

X-ray Powder Pattern: Wilson Springs mine, Arkansas, USA.
3.160 (100), 4.382 (80), 9.58 (75), 2.640 (70), 4.572 (65), 4.092 (60), 3.978 (40)

Chemistry:

	(1)	(2)
P_2O_5	36.2	34.70
SiO_2	0.3	
TiO_2	0.7	
ZrO_2	28.7	30.12
Al_2O_3	0.3	
FeO	16.1	17.56
MnO	0.8	
MgO	0.26	
CaO	1.3	
Na_2O	0.11	
F	0.5	
H_2O	[14.7]	17.62
Total	[100.0]	100.00

(1) Wilson Springs mine, Arkansas, USA; by electron microprobe, average of 25 analyses, total Fe as FeO, total Mn as MnO, H_2O by difference, probably reduced by loss under vacuum; excluding SiO_2 and F, corresponds to $(Fe_{0.88}Ca_{0.09}Mn_{0.04}Mg_{0.03}Na_{0.03})_{\Sigma=1.07}(Zr_{0.91}Ti_{0.03}Al_{0.02})_{\Sigma=0.96}(PO_4)_{2.01} \cdot 4H_2O$. (2) $FeZr(PO_4)_2 \cdot 4H_2O$.

Occurrence: A rare secondary mineral in vugs in alkaline igneous rock (Wilson Springs mine, Arkansas, USA); in a mineralized fissure vein (Kerriack Cove, Cornwall, England).

Association: Kolbeckite, sodic pyroxene (Wilson Springs mine, Arkansas, USA); sphalerite, pyrite, anatase (Kerriack Cove, Cornwall, England).

Distribution: In the USA, in the Wilson Springs (Potash Sulphur Springs) mine, Garland Co., Arkansas. At Kerriack Cove, near Redruth, Cornwall, England.

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Type Material: National Museum of Natural History, Washington, D.C., USA, 170394.

References: (1) Milton, C., J.J. McGee, and H.T. Evans, Jr. (1993) Mahlmoodite, $FeZr(PO_4)_2 \cdot 4H_2O$, a new iron zirconium phosphate mineral from Wilson Springs, Arkansas. Amer. Mineral., 78, 437–440. (2) Elton, N.J. and J.J. Hooper (1995) A second occurrence of mahlmoodite, from Cornwall, England. Mineral. Mag., 59, 166–168.