Cyrilovite $NaFe_3^{3+}(PO_4)_2(OH)_4 \cdot 2H_2O$

Crystal Data: Tetragonal. *Point Group:* 422. Thick tabular euhedral crystals, showing {001}, {012}, {113}, to 0.7 mm, in radiating to botryoidal aggregates and crusts.

Physical Properties: *Tenacity:* Conchoidal. Hardness = n.d. D(meas.) = 3.081–3.096 D(calc.) = 3.114

Optical Properties: Translucent. *Color:* Bright yellow, honey-yellow, orange to brownish yellow, brown. *Streak:* Yellow. *Luster:* Vitreous.
Optical Class: Uniaxial (–). *Absorption:* O = deep yellow to yellow; E = colorless to yellow.
$\omega = 1.802–1.805$ $\epsilon = 1.769–1.775$

Cell Data: *Space Group:* $P4_12_12$ or $P4_32_12$. $a = 7.313(2)$ $c = 19.315(3)$ Z = 4

X-ray Powder Pattern: Cyrilov pegmatite, Czech Republic.
4.85 (10), 3.186 (8), 2.664 (8), 3.101 (5), 3.60 (4), 2.020 (4), 1.553 (4)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
P_2O_5	29.06	31.77	29.29	CaO	0.10	0.80	
Al_2O_3	1.36	0.00		Na_2O	4.70	6.28	6.40
Fe_2O_3	47.87	47.19	49.44	K_2O	0.63	0.00	
FeO	0.00			H_2O	14.45	14.95	14.87
MnO	0.99	0.00		insol.	1.04		
MgO		0.00		Total	100.20	100.99	100.00

(1) Sapucaia mine, Brazil; corresponds to $(Na_{0.74}Mn_{0.07}K_{0.06}Ca_{0.01})_{\Sigma=0.88}(Fe^{3+}_{2.93}Al_{0.13})_{\Sigma=3.06}(PO_4)_2(OH)_{3.84} \cdot 2H_2O$. (2) Near Torre Argentina, Sardinia, Italy; by electron microprobe, H_2O by TGA; corresponds to $(Na_{0.92}Ca_{0.06})_{\Sigma=0.98}Fe^{3+}_{2.98}(PO_4)_{2.03}(OH)_{4.00} \cdot 2.00H_2O$.
(3) $NaFe_3(PO_4)_2(OH)_4 \cdot 2H_2O$.

Occurrence: A rare accessory mineral in some oxidizing phosphate-bearing granite pegmatites and iron deposits.

Association: Dufrénite, frondelite, phosphosiderite, leucophosphite, whitlockite, kingsmountite, triphylite, rockbridgeite, strengite, phosphosiderite, jahnsite, montgomeryite, millisite, wardite, apatite, wavellite.

Distribution: From the Cyrilov pegmatite, Velké Meźiříči, Czech Republic. In the Gunheath china clay pit, St. Austell, Cornwall, England. At Rochefort-en-Terre, Bretagne, France. In Portugal, from the Vermilhas pegmatite, Vouzela; the Mangualde pegmatite, near Mesquitela; and the Bendada pegmatite, near Guarda. At Hagendorf, Bavaria, Germany. Between Torre Argentina and Punta Capuzzo, Bosa region, Sardinia, Italy. In the Kabingo pegmatites, Rwanda. From Kokpatas and Djargantan, central Kyzylkum region, Uzbekistan. At the Sapucaia pegmatite mine, about 50 km east-southeast of Governador Valadares, and in the Énio pegmatite mine, northeast of Galiléia, Minas Gerais, Brazil. In Australia, on Milgun Station, Western Australia; in the Iron Monarch quarry, Iron Knob, at the Moculta phosphate quarry, northeast of Angaston, and in the Fairview quarry, near Robertstown, South Australia; at Wycheproof, and in the Lake Boga granite quarry, near Swan Hill, Victoria. In the USA, from the Palermo #1 mine, near North Groton, Grafton Co., New Hampshire, and in the Tip Top mine, 8.5 km southwest of Custer, Custer Co., South Dakota.

Name: For its occurrence in the Cyrilov pegmatite, Czech Republic.

Type Material: National Museum of Natural History, Washington, D.C., USA, 107425.

References: (1) Novotný, M. and J. Staněk (1953) Nový minerál fosforečnan cyrilovit. Acta Acad. Sci. Nat. Moravo-Silesacae, 25(11), 325–336 (in Czech with English abs.). (2) (1955) Mineral. Abs., 12, 512–513 (abs. ref. 1). (3) Lindberg, M.L. (1957) Relationship of the minerals avelinoite, cyrilovite, and wardite. Amer. Mineral., 42, 204–213. (4) (1957) Amer. Mineral., 42, 586 [avelinoite = cyrilovite]. (5) Cozzupoli, D., O. Grubessi, A. Mottana, and P.F. Zanazzi (1987) Cyrilovite from Italy; structure and crystal chemistry. Mineral. Petrol., 37, 1–14.