Väyrynenite $Mn^{2+}Be(PO_4)(OH)$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Rare prismatic crystals, elongated and striated along [001], showing {001}, {010}, {110}, a number of additional modifying forms, to 6 cm; typically in fine-grained aggregates.

Physical Properties: *Cleavage:* {010}, perfect; {100}, good; {001}, fair. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 5 D(meas.) = 3.22 D(calc.) = 3.23

Optical Properties: Transparent to translucent. *Color:* Rose-red, salmon-pink, pale pink, brownish pink, pale gray; pink to colorless in transmitted light. *Streak:* White. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Pleochroism:* X = orangish; Y = red; Z = dark red. *Orientation:* $Y = b$; $X \wedge c = -31°$. *Dispersion:* $r > v$, moderate. $\alpha = 1.638$–1.640 $\beta = 1.658$–1.662 $\gamma = 1.664$–1.667 2V(meas.) = 46°–55° 2V(calc.) = 51°–57°

Cell Data: *Space Group:* $P2_1/a$. $a = 5.411(5)$ $b = 14.49(2)$ $c = 4.730(5)$ $\beta = 102°45(5)'$ Z = 4

X-ray Powder Pattern: Viitaniemi pegmatite, Finland.
3.452 (100), 7.251 (85), 2.885 (85), 4.399 (60), 2.662 (42), 2.951 (35), 4.960 (25)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
P_2O_5	39.98	40.5	40.34	Na_2O	0.20	0.03	
Al_2O_3	0.40	0.01		K_2O	0.04	0.01	
FeO	5.92	3.4		H_2O^+	4.93		
MnO	34.01	38.4	40.32	H_2O^-	0.19		
BeO	13.85	12.2	14.22	H_2O		[5.38]	5.12
CaO	0.53	0.07		insol.	0.06		
				Total	100.11	[100.00]	100.00

(1) Viitaniemi pegmatite, Finland; corresponds to $(Mn^{2+}_{0.84}Fe^{2+}_{0.14}Ca_{0.02})_{\Sigma=1.00}Be_{0.98}(PO_4)_{0.99}(OH)_{0.96}$. (2) "Chitral" [Pakistan or Afghanistan]; by AA, H_2O by difference; corresponds to $(Mn^{2+}_{0.92}Fe^{2+}_{0.08})_{\Sigma=1.00}Be_{0.83}(PO_4)_{0.97}(OH)_{1.02}$. (3) $MnBe(PO_4)(OH)$.

Occurrence: An alteration product of beryl and triphylite in complex zoned granite pegmatites.

Association: Eosphorite, moraesite, hurlbutite, beryllonite, amblygonite, apatite, tourmaline, topaz, muscovite, microcline, quartz.

Distribution: In the Viitaniemi pegmatite, near Eräjärvi, Finland. From the Norrö pegmatite, on Rånö Island, and from near Kapelludden, Utö Island, Sweden. In the Bendada pegmatite, near Guarda, Portugal. At the Fregeneda pegmatite, Salamanca Province, Spain. From the Kalba Range, eastern Kazakhstan. Large crystals found in Broghul Pass, Chitral Valley, Pakistan.

Name: To honor Professor Heikki Allan Väyrynen (1888–1956), Technical Institute, Helsinki, Finland.

Type Material: National Museum of Natural History, Washington, D.C., USA, R11807.

References: (1) Volborth, A. (1954) Phosphatminerale aus dem Lithiumpegmatit von Viitaniemi, Eräjärvi, Zentral-Finnland. Ann. Acad. sci. Fennicae, Ser. A, III Geol.-Geogr. 39, 90 pp., esp. 66–73. (2) (1956) Amer. Mineral., 41, 371 (abs. ref. 1). (3) Mrose, M.E. and O. von Knorring (1959) The mineralogy of väyrynenite, $(Mn, Fe)Be(PO_4)(OH)$. Zeits. Krist., 112, 275–288. (4) Mrose, M.E. and D.E. Appleman (1962) The crystal structures of väyrynenite, $(Mn, Fe)Be(PO_4)(OH)$, and euclase, $AlBe(SiO_4)(OH)$. Zeits. Krist., 117, 16–32. (5) Meixner, H. and W. Paar (1976) Ein Vorkommen von Väyrynenit-Kristallen aus "Pakistan". Zeits. Krist., 143, 309–318 (in German with English abs.).