Eleonorite $Fe^{3+}_6(PO_4)_4O(OH)_4 \cdot 6H_2O$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As prismatic crystals displaying {30$\bar{1}$}, {100}, and {301}, flattened on {100}, or with a rhombic cross section, to 3.5 mm; typically in random or radial aggregates to 5 mm.

Physical Properties: *Cleavage*: Perfect on {100}. *Tenacity*: Brittle. *Fracture*: n.d. Hardness = 3 D(meas.) = 2.92(1) D(calc.) = 2.931 Dissolves slowly in dilute HCl.

Optical Properties: Translucent. *Color*: Red-brown. *Streak*: Light red-brown. *Luster*: Vitreous. *Optical Class*: Biaxial (+). α =1.765(4) β = 1.780(5) γ = 1.812(6) 2V(meas.) = 75(10)° 2V(calc.) = 70° *Pleochroism*: Strong; *X* = brownish yellow, *Z* = brown-red. *Orientation*: *X* = *b*, *Z* and *Y* parallel (100). *Absorption*: $Z >> Y \geq X$. *Dispersion*: Very strong, $r > v$.

Cell Data: Space Group: *C*2/*c*. a = 20.679(10) b = 5.148(2) c = 19.223(9) β = 93.574(9)° Z = 4

X-ray Powder Pattern: Rotläufchen mine, Waldgirmes, Wetzlar, Hesse, Germany. 10.41 (100), 9.67 (38), 3.071 (34), 4.816 (31), 7.30 (29), 3.432 (18), 3.197 (18)

Chemistry:	(1)	(2)
Al_2O_3	1.03	
Mn_2O_3	0.82	
Fe_2O_3	51.34	52.82
P_2O_5	31.06	31.29
H_2O	16.4	15.89
Total	99.58	100.00

(1) Rotläufchen mine, Waldgirmes, Wetzlar, Hesse, Germany; average of 5 electron microprobe analyses supplemented by IR spectroscopy, H_2O by chromatography of ignition products, Fe_2O_3 by Mössbauer spectroscopy; corresponds to $(Fe^{3+}_{5.76}Al_{0.18}Mn^{3+}_{0.09})_{\Sigma=6.03}(PO_4)_{3.92}O(OH)_{4.34} \cdot 5.98H_2O$.
(2) $Fe^{3+}_6(PO_4)_4O(OH)_4 \cdot 6H_2O$.

Occurrence: A supergene mineral formed by solid-state oxidation of beraunite.

Association: Goethite, quartz, calcite, lepidocrocite, manganese oxides, cacoxenite (Eleonore mine); goethite, rockbridgeite, dufrénite, kidwellite, variscite, matulaite, planerite, cacoxenite, strengite, wavellite (Rotläufchen mine); goethite, quartz, cacoxenite, rockbridgeite (Gutglück mine).

Distribution: From the Eleonore Iron mine, Dünsberg, near Giessen, the Rotläufchen mine, Waldgirmes, and the Gutglück mine, Braunfels, Wetzlar, Hesse, Germany.

Name: For the mine that produced the first specimens.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (4684/1 and 4684/2).

References: (1) Chukanov, N.V., S.M. Aksenov, R.K. Rastsvetaeva, C. Schäfer, I.V. Pekov, D.I. Belakovskiy, R. Scholz, L.C.A. De Oliveira, and S.N. Britvin (2017) Eleonorite, $Fe^{3+}_6(PO_4)_4O(OH)_4 \cdot 6H_2O$: validation as a mineral species and new data. Mineral. Mag., 81(1), 61-76. (2) (2017) Amer. Mineral., 102, 1144-1145 (abs. ref. 1).