Fourmarierite $Pb(UO_2)_4O_3(OH)_4 \cdot 4H_2O$

Crystal Data: Orthorhombic, pseudohexagonal. *Point Group: mm*2. Crystals, flattened on {001}, elongated along [010], striated on {001} ∥ [010], showing prominent {001}, {101}, {111}, to 2 mm; in crusts, dense aggregates, and compact masses.

Physical Properties: *Cleavage:* {001}, perfect; {100}, imperfect. Hardness = 3–4 D(meas.) = 6.05, 5.74 D(calc.) = 5.98 Radioactive.

Optical Properties: Transparent to translucent. *Color:* Red-orange to golden red, carmine red, reddish brown to brown; yellow to reddish yellow in transmitted light. *Luster:* Adamantine to subadamantine.
Optical Class: Biaxial (–). *Pleochroism:* X = colorless; Y = pale amber-yellow; Z = amber-yellow. *Orientation:* $X = c$; $Y = a$; $Z = b$. *Dispersion:* $r > v$, strong. *Absorption:* Moderate; $Z > Y > X$. $\alpha = 1.85–1.865$ $\beta = 1.885–1.92$ $\gamma = 1.890–1.97$ 2V(meas.) = 50°–55°

Cell Data: *Space Group: Bb*2_1m. $a = 13.986(4)$ $b = 16.400(5)$ $c = 14.293(9)$ Z = 8

X-ray Powder Pattern: Shinkolobwe, Congo.
3.562 (100), 3.169 (100), 7.12 (80), 3.523 (50), 2.512 (50), 1.975 (50), 2.739 (20)

Chemistry:

	(1)	(2)
UO_3	77.92	77.54
PbO	15.86	15.13
H_2O	6.22	7.33
Total	[100.00]	100.00

(1) Shinkolobwe, Congo; recalculated to 100% after deduction of SiO_2 2.07%.
(2) $Pb(UO_2)_4O_3(OH)_4 \cdot 4H_2O$.

Occurrence: A rare secondary mineral formed as an alteration product of uraninite in the oxide zone of uranium deposits; a common component of "gummite" replacing uraninite; may replace fossil wood.

Association: Uraninite, ianthinite, schoepite, becquerelite, billietite, dewindtite, phosphuranylite, vandendriesscheite, rutherfordine, torbernite, kasolite, curite, goethite.

Distribution: Relatively abundant from Shinkolobwe, Katanga Province, Congo (Shaba Province, Zaire). At Morogoro, Uluguru Mountains, Tanzania. From Wölsendorf and Hagendorf, Bavaria, Germany. At Tvedestrand and Krøderen, Norway. From Great Bear Lake, Northwest Territories, and in the Lac Indicateur area, Quebec, Canada. In the USA, from the Palermo mine, near North Groton, Grafton Co., New Hampshire; at Newry, Oxford Co., Maine; in Liepers quarry, Swarthmore, Delaware Co., Pennsylvania; from Spruce Pine, Mitchell Co., North Carolina. In the Monument No. 2 mine, Monument Valley, Apache Co., Arizona; at the Lucky Strike No. 2 mine, San Rafael Swell, Emery Co., Utah; and at Mica Lake, Hahns Peak, Routt Co., and elsewhere in Colorado.

Name: Honors Paul Fourmarier (1877–1970), Belgian geologist, Professor of Geology, University of Liège, Liège, Belgium.

Type Material: University of Liège, Liège, Belgium, 16871 and 16872; Natural History Museum, Paris, France, 124-181.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 628–629. (2) Frondel, C. (1958) Systematic mineralogy of uranium and thorium. U.S. Geol. Sur. Bull. 1064, 87–91. (3) Christ, C.L. and J.R. Clark (1960) Crystal chemical studies of some uranyl oxide hydrates. Amer. Mineral., 45, 1026–1061. (4) Deliens, M. (1977) Review of the hydrated oxides of U and Pb, with new X-ray powder data. Mineral. Mag., 41, 51–57. (5) Piret, P. (1985) Structure cristalline de la fourmariérite, $Pb(UO_2)_4O_3(OH)_4 \cdot 4H_2O$. Bull. Minéral., 108, 659–665 (in French with English abs.).