Françoisite-(Nd) $(Nd, Y, Sm, Ce)(UO_2)_3O(PO_4)_2(OH)\cdot 6H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals are platy {010}, elongated along [001], to 0.3 mm, in aggregates. *Twinning:* By reflection across {100}.

Physical Properties: *Cleavage:* On {010}, good. *Fracture:* Uneven. Hardness = 3
D(meas.) = > 4.06 D(calc.) = 4.63 Radioactive.

Optical Properties: Translucent to opaque. *Color:* Yellow. *Streak:* White.
Luster: Vitreous.
Optical Class: Biaxial (–). *Orientation:* $X = b$; $Y \wedge c = 14.5°$; $Z \wedge a = 8.3°$. $\alpha = [1.65]$
$\beta = 1.74(1)$ $\gamma = 1.75(1)$ 2V(meas.) = 35°

Cell Data: *Space Group:* $P2_1/c$. $a = 9.298(2)$ $b = 15.605(4)$ $c = 13.668(2)$
$\beta = 112.77(1)°$ Z = 4

X-ray Powder Pattern: Kamoto-East mine, Congo.
7.79 (100), 5.76 (50), 3.88 (50B), 3.13 (50), 4.44 (40), 4.33 (40), 2.874 (40)

Chemistry:

	(1)	(2)
UO_3	69.29	68.96
P_2O_5	10.45	10.54
Al_2O_3		0.21
Y_2O_3	1.57	n.d.
La_2O_3	0.73	0.99
Ce_2O_3	1.03	3.52
Pr_2O_3	0.95	1.04
Nd_2O_3	4.74	3.61
Sm_2O_3	1.65	0.72
Dy_2O_3	0.81	
PbO		2.55
H_2O	8.78	[7.86]
Total	[100.00]	[100.00]

(1) Kamoto-East mine, Congo; by electron microprobe, H_2O by gas chromatography; average of ten analyses, recalculated to 100% from original total of 97.13%; corresponds to $(Nd_{0.18}Y_{0.09}Sm_{0.06}Ce_{0.04}Pr_{0.04}La_{0.03}Dy_{0.03})_{\Sigma=0.47}(UO_2)_{3.15}O(PO_4)_{1.92}(OH)\cdot 6.34H_2O$. (2) Bangombé, Gabon; by electron microprobe, H_2O by difference; corresponds to $(Nd_{0.28}Ce_{0.28}Pb_{0.15}Pr_{0.08}La_{0.08}Sm_{0.05}Al_{0.05}Dy_{0.03})_{\Sigma=1.00}(UO_2)_{3.11}O(PO_4)_{1.92}(OH)\cdot 6H_2O$.

Occurrence: A rare alteration product of uraninite in a sedimentary Cu–Co deposit (Kamoto-East mine, Congo).

Association: Uraninite, schoepite, uranophane, curite, schuilingite-(Nd), kamotoite-(Y), astrocyanite-(Ce), masuyite (Kamoto-East mine, Congo).

Distribution: From the Kamoto-East Cu–Co mine, five km east of Kolwezi, Katanga Province, Congo (Shaba Province, Zaire). At the Bangombé natural fission reactor, Gabon.

Name: To honor Dr. Armand François (1922–), former Director of Geology for Gécamine (the national mining company), and for its dominant *neodymium* content.

Type Material: Royal Institute of Natural Sciences, Brussels, Belgium, RC3512.

References: (1) Piret, P., M. Deliens, and J. Piret-Meunier (1988) La françoisite-(Nd), nouveau phosphate d'uranyle et de terres rares; propriétés et structure cristalline. Bull. Minéral., 111, 443–449 (in French with English abs.). (2) (1990) Amer. Mineral., 75, 241 (abs. ref. 1). (3) Janeczek, J. and R. Ewing (1996) Phosphatian coffinite with rare earth elements and Ce-rich françoisite-(Nd) from sandstone beneath a natural fission reactor at Bangombé, Gabon. Mineral. Mag., 60, 665–669.