Xenotime-(Y) YPO_4

Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. Short to long [001] prismatic crystals, with {010}, {110}, may be pyramidal {011}, equant, several other minor forms noted, to 5 cm. In radial or rosettelike aggregates of coarse crystals. *Twinning:* On {111}, rare.

Physical Properties: *Cleavage:* On {100}, good. *Fracture:* Uneven to splintery. *Tenacity:* Brittle. Hardness = 4–5 D(meas.) = 4.4–5.1 D(calc.) = 4.25 Paramagnetic; may exhibit yellow cathodoluminescence.

Optical Properties: Translucent to opaque. *Color:* Yellowish brown, reddish brown, flesh-red, grayish white, wine-yellow, pale yellow, greenish; in transmitted light, colorless to very pale yellowish green, yellow, or yellowish brown. *Luster:* Vitreous to resinous. *Optical Class:* Uniaxial (+). *Pleochroism:* Weak; O = pink, yellow, or yellowish brown; E = brownish yellow, grayish brown, greenish. $\omega = 1.720–1.721$ $\epsilon = 1.816–1.827$

Cell Data: *Space Group:* $I4_1/amd$. a = 6.884–6.902 $c = 6.021–6.038$ Z = 4

X-ray Powder Pattern: Synthetic.
3.443 (100), 2.558 (60), 1.762 (45), 4.54 (25), 2.145 (25), 1.820 (18), 1.721 (18)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
P_2O_5	34.37	33.89	38.60	Y_2O_3	44.03	46.49	61.40
SiO_2	0.31	0.10		RE_2O_3	20.18	17.22	
UO_2		0.96		CaO		0.07	
ThO_2		0.38		Total	98.89	99.11	100.00

(1) Gloserheia pegmatite, Froland, Norway; by electron microprobe, average of 8 analyses; RE_2O_3 = Nd_2O_3 0.17%, Sm_2O_3 0.49%, Eu_2O_3 0.07%, Gd_2O_3 2.69%, Tb_2O_3 0.58%, Dy_2O_3 4.93%, Ho_2O_3 1.27%, Er_2O_3 4.05%, Tm_2O_3 0.70%, Yb_2O_3 4.36%, Lu_2O_3 0.87%. (2) Switzerland; by electron microprobe, average of 82 analyses on 11 samples; RE_2O_3 = Eu_2O_3 0.04%, Gd_2O_3 1.89%, Tb_2O_3 0.60%, Dy_2O_3 5.15%, Ho_2O_3 1.06%, Er_2O_3 3.86%, Yb_2O_3 4.10%, Lu_2O_3 0.52. (3) YPO_4.

Mineral Group: Forms a series with chernovite-(Y).

Occurrence: An accessory mineral in alkalic to granitic rocks, well-developed in associated pegmatites; in gneiss and Alpine veins; a common detrital mineral in placers.

Association: Zircon, monazite, rutile, anatase, brookite, hematite, ilmenite, gadolinite, allanite, apatite, yttrotantalite, thorite.

Distribution: Numerous localities but fine crystals are unusual. In Norway, from Lindesnes; on Hidra (Hitterö) Island; around Tvedestrand and Arendal; at Raade, near Moss; and elsewhere. From Ytterby, on Resarö Island, near Vaxholm, Sweden. In Switzerland, from the Binntal, Valais; in the Maderanertal, Uri; in the Tavetsch, Graubünden; and many other places. Large crystals from the Yazgulem Ridge, western Pamir Mountains, Tajikistan. At Sahamandrevo, near Ampangabe, Madagascar. In the Ishikawa district, Fukushima Prefecture, Japan. In Brazil, from Ataleia and Ibitiara, Minas Gerais; at Brumado and Novo Horizonte, Bahia. In the USA, in North Carolina, from placers in Polk, McDowell, and Burke Cos.; on Cheyenne Mountain, El Paso Co., and elsewhere in Colorado. In the Gunter quarry, near McKenzie Lake, Ontario, Canada.

Name: From the Greek for *vain* and *honor*, as the contained *yttrium* had been mistaken for a new element.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 688–691. (2) Åmli, R. (1975) Mineralogy and rare earth geochemistry of apatite and xenotime from the Gloserheia granite pegmatite, Froland, Southern Norway. Amer. Mineral., 60, 607–620. (3) Demartin, F., T. Pilati, V. Diella, S. Donzelli, P. Gentile, and C.M. Gramaccioli (1991) The chemical composition of xenotime from fissures and pegmatites in the Alps. Can. Mineral., 29, 69–75. (4) Y. Ni, J.M. Hughes, and A.N. Mariano (1995) Crystal chemistry of the monazite and xenotime structures. Amer. Mineral., 80, 21–26. (5) (1958) NBS Cir. 539, 8.