Yttrotungstite-(Y) $YW_2O_6(OH)_3$

Crystal Data: Monoclinic, pseudo-orthorhombic. *Point Group:* $2/m$. Lathlike crystals, flattened on {100} and elongated along [001], with {110} and very rare {101}, to 0.2 mm, in druses; typically earthy. *Twinning:* On {100}, probably universal, as contact twins.

Physical Properties: *Cleavage:* {010}, good; on $\{10\overline{1}\}$, probable, very poor. Hardness = n.d. D(meas.) = 5.96 D(calc.) = [5.98]

Optical Properties: Semitransparent. *Color:* Pale yellow.
Optical Class: Biaxial (–). *Pleochroism:* X = pale yellow; $Y = Z$ = dark yellow. *Orientation:* $Z = b$; $X \wedge c = 26°$. $\alpha = 1.89$ $\beta = 1.98$ $\gamma = 2.02$ 2V(meas.) = 68° 2V(calc.) = 65°

Cell Data: *Space Group:* $P2_1/m$. $a = 6.954(6)$ $b = 8.637(9)$ $c = 5.771(6)$ $\beta = 104°56(4)'$ Z = 2

X-ray Powder Pattern: Kramat Pulai mine, Malaysia.
4.69 (vvs), 3.26 (vvs), 2.028 (vs), 6.73 (ms), 3.36 (ms), 2.869 (ms), 2.790 (ms)

Chemistry:

	(1)	(2)	(3)
WO_3	71.45	71.64	76.82
SiO_2	0.37	0.34	
TiO_2	0.01		
Al_2O_3	0.87	0.90	
Y_2O_3	10.29		18.70
RE_2O_3	11.24	20.58	
Fe_2O_3	0.36	0.09	
MgO	0.17	0.37	
CaO	0.32	0.77	
H_2O^+	4.96	4.88	4.48
H_2O^-	0.07	0.20	
Total	100.11	99.77	100.00

(1) Kramat Pulai mine, Malaysia; $Y_2O_3 + RE_2O_3$ normalized from a detailed analysis totaling 18.96% to the 21.53% total determined here, to give: La_2O_3 0.28%, Ce_2O_3 2.06%, Pr_2O_3 0.33%, Nd_2O_3 2.33%, Sm_2O_3 0.76%, Gd_2O_3 1.27%, Tb_2O_3 0.23%, Dy_2O_3 1.38%, Er_2O_3 1.15%, Tm_2O_3 0.14%, Yb_2O_3 1.18%, Lu_2O_3 0.13%; then corresponding to $(Y_{0.55}RE_{0.38}Ca_{0.04}Mg_{0.02})_{\Sigma=0.99}$ $(W_{1.85}Al_{0.10}Si_{0.04}Fe_{0.03})_{\Sigma=2.02}O_6(OH)_3$. (2) Do.; corresponding to $(RE_{0.95}Ca_{0.08}Mg_{0.06})_{\Sigma=1.09}$ $(W_{1.87}Al_{0.10}Fe_{0.03})_{\Sigma=2.00}O_{5.72}(OH)_{3.28}$. (3) $YW_2O_6(OH)_3$.

Occurrence: In eluvial cassiterite mines, probably altered from wolframite or scheelite.

Association: Kaolinite, quartz, muscovite, hydrobiotite, hematite, cassiterite, tourmaline, scheelite, rutile, stolzite, raspite, plagioclase, gypsum.

Distribution: From the Kramat Pulai mine and at Tapah, Kinta district, Perak, Malaysia.

Name: For YTTRium and TUNGSTen in the composition.

Type Material: n.d.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 1097 [thorotungstite = yttrotungstite]. (2) Sahama, T.G., O. von Knorring, and M. Lehtinen (1970) Cerotungstite, a cerian analogue to yttrotungstite, from Uganda. Bull. Geol. Soc. Finland, 42, 223–228. (3) Davis, R.J. and G.W. Smith (1971) Yttrotungstite. Mineral. Mag., 38, 261–285.