Thorutite $(Th, U, Ca)Ti_2(O, OH)_6$

Crystal Data: Monoclinic; always metamict. *Point Group*: 2, *m*, or 2/*m*. As short prismatic crystals, to 2 cm.

Physical Properties: *Fracture*: Conchoidal. Hardness = 5-6 D(meas.) = 5.82; 6.0(5) (synthetic $ThTi_2O_6$). D(calc.) = [5.65]; 6.08 (synthetic $ThTi_2O_6$).

Optical Properties: Translucent. *Color*: Black; brown on thin edges. *Streak*: Pale brown.
Luster: Resinous.
Optical Class: Isotropic. n = > 2.1

Cell Data: *Space Group*: *C*2, *Cm*, or *C*2/*m* (synthetic $ThTi_2O_6$). a = 9.822(5) b = 3.824(2) c = 7.036(5) β = 118.84(5)° Z = 2

X-ray Powder Pattern: Kutyur-Tyube deposit, Russia; after heating at 1000 °C.
3.17 (7), 1.728 (6), 1.695 (6), 1.632 (3), 2.72 (2), 1.226 (2), 4.35 (1.5)

Chemistry:

	(1)
UO_3	0.14
Nb_2O_5	1.12
Ta_2O_5	0.08
SiO_2	0.44
TiO_2	36.1
ThO_2	54.10
UO_2	1.43
Al_2O_3	1.50
Fe_2O_3	1.10
CaO	1.07
H_2O	0.94
LOI	1.72
Total	99.74

(1) Kutyur-Tyube deposit, Russia; corresponds to $(Th_{0.87}Ca_{0.08}Fe^{2+}_{0.06}U^{4+}_{0.02})_{\Sigma=1.03}(Ti_{1.92}Al_{0.09}Nb_{0.03})_{\Sigma=2.04}(O, OH)_6$.

Polymorphism & Series: Forms a series with brannerite and a limited series with loparite.

Occurrence: In veins of microcline and sericitized nepheline, in a syenite massif.

Association: Thorite, zircon, calcite, barite, galena.

Distribution: Kutyur-Tyube thorium deposit, near Urusai Peak, Sokh River basin, Alai Range, Kyrgyzstan.

Name: For the composition, THORium, Uranium, and TItanium.

Type Material: All-Union Research Institute of Mineral Resources, Moscow, Russia.

References: (1) Gotman, Y.D. and I.A. Khapaev (1958) Thorutite - a new mineral of the group of titanites of thorium. Zap. Vses. Mineral. Obshch., 87, 201-202 (in Russian). (2) (1958) Amer. Mineral., 43, 1007 (abs. ref. 1). (3) Povilaitis, M.M. (1963) On the new minerals lodochnikite, absite, and thorutite. Zap. Vses. Mineral. Obshch., 92, 113-123 (in Russian). (4) Ruh, R. and A.D. Wadsley (1966) The crystal structure of $ThTi_2O_6$ (brannerite) [= thorutite]. Acta Cryst., 21, 974-978. (5) Mitchell, R.H. and A.R. Chakhmouradian (1999) Solid solubility in the system $NaLREETi_2O_6$ - $ThTi_2O_6$ (LREE, light rare-earth elements): experimental and analytical data. Phys. Chem. Minerals, 26, 396-405.