Trögerite $(UO_2)_3(AsO_4)_2 \cdot 12H_2O(?)$

Crystal Data: Tetragonal or monoclinic. *Point Group:* $4/m$ $2/m$ $2/m$ or $2/m$. As thin crystals, tabular on {001}, to 1 mm.

Physical Properties: *Cleavage:* On {001}, perfect; on {100}, good; on {011}, probable. Hardness = 2–3 D(meas.) = 3.3 D(calc.) = [5.13] Reversible H_2O content. May fluoresce lemon-yellow under UV. Radioactive.

Optical Properties: Transparent. *Color:* Lemon-yellow. *Luster:* Vitreous, pearly on {001} cleavage.
Optical Class: Uniaxial (–) or biaxial (–), probably anomalous, zoned due to differences in H_2O content. *Pleochroism:* $O = Y = Z$ = lemon-yellow; $E = X$ = nearly colorless. *Orientation:* $X = c$; $Z \wedge a = 12°–14°$. *Dispersion:* $r > v$, moderate. $\omega = 1.624–1.627$ $\epsilon = 1.580–1.582$ $\alpha = 1.584–1.600$ $\beta = 1.620–1.630$ $\gamma = 1.623–1.630$ 2V(meas.) = 0°–40°

Cell Data: *Space Group:* n.d. $a = 6.99$ $c = 8.48$ Z = 8, or *Space Group:* n.d. $a = 7.15$ $b = 6.98$ $c = 11.2$ $\beta = \sim 95°$ Z = 1

X-ray Powder Pattern: Synthetic.
8.59 (10), 3.79 (9), 3.30 (8), 5.50 (7), 4.35 (7), 2.70 (7), 2.19 (7)

Chemistry:

	(1)	(2)	(3)
UO_3	63.76	65.17	65.80
P_2O_5		1.20	
As_2O_5	19.64	22.08	17.62
Bi_2O_3		8.79	
PbO		1.56	
MgO		0.25	
CaO		0.65	
H_2O	14.81		16.58
Total	98.21	99.70	100.00

(1) Weisser Hirsch mine, Germany. (2) Do.; by electron microprobe, after drying at 210 °C; corresponds to $(UO_2)_{2.72}Bi_{0.18}Ca_{0.11}Pb_{0.07}Mg_{0.06}[(AsO_4)_{1.84}(PO_4)_{0.16}]_{\Sigma=2.00}$. (3) $(UO_2)_3(AsO_4)_2 \cdot 12H_2O$.

Mineral Group: Autunite group.

Occurrence: A rare mineral formed in the oxidation zone of some uranium deposits.

Association: Walpurgite, uranospinite, uranospathite, asselbornite, zeunerite, uranosphaerite, erythrite, cobaltian wad (Weisser Hirsch mine, Germany); realgar, orpiment, scorodite, mansfieldite, sodium uranospinite, arseniosiderite, metatorbernite, metazeunerite, uranophane, arsenopyrite, pyrite, galena (Bota-Burum deposit, Kazakhstan).

Distribution: From the Walpurgis vein, in the Weisser Hirsch mine, and at the Daniel mine, Neustädtel-Schneeberg, Saxony, Germany. From Marbruie, near Dalbeattie, Kirkcudbrightshire, Scotland. In the Rabéjac, Riviéral, and Mas-d'Alary uranium deposits, near Lodève, Hérault, France. At the Bota-Burum uranium deposit, 15 km southwest of Alakol Lake, Chu-Ili Mountains, southwestern Balkhash district, Kazakhstan. From the Bald Mountain district, Lawrence Co., South Dakota, USA.

Name: To honor Mining Foreman R. Tröger, Schneeberg, Germany, who found the first specimens.

Type Material: Mining Academy, Freiberg, Germany, 21800; Harvard University, Cambridge, Massachusetts, USA, 106035.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 966–967. (2) Frondel, C. (1958) Systematic mineralogy of uranium and thorium. U.S. Geol. Sur. Bull. 1064, 187–191. (3) Weiss, A., F. Taborszky, K. Hartl, and E. Tröger (1957) Zur Kenntnis des Uranminerals Trögerit. Zeits. Naturforsch., 12b, 356–358.