Chukhrovite-(Y) $Ca_3(Y,Ce)Al_2(SO_4)F_{13}\cdot 10H_2O$

Crystal Data: Cubic. *Point Group:* $2/m\ \overline{3}$. Crystals show varying degrees of dominance of {100} and {111}, to 1 cm.

Physical Properties: *Cleavage:* On {111}, distinct. *Fracture:* Irregular. *Tenacity:* Brittle. Hardness = ∼3 D(meas.) = 2.274–2.398 D(calc.) = [2.16]

Optical Properties: Transparent to opaque. *Color:* Colorless, white, rarely with a lilac tint. *Luster:* Vitreous to pearly, greasy on fracture surfaces.
Optical Class: Isotropic, anomalously birefringent. n = 1.42–1.44

Cell Data: *Space Group:* $Fd3$. a = 16.80(0.5) Z = 8

X-ray Powder Pattern: Kara-Oba deposit, Kazakhstan.
2.193 (10), 1.834 (10), 3.261 (9), 2.572 (9), 2.843 (8), 1.684 (8), 1.512 (8)

Chemistry:

	(1)
SO_3	10.38
Al_2O_3	10.56
RE_2O_3	18.00
MgO	0.40
CaO	21.52
$(Na,K)_2O$	trace
F	28.32
H_2O^+	10.80
H_2O^-	12.00
insol.	trace
$-O = F_2$	11.89
Total	100.09

(1) Kara-Oba deposit, Kazakhstan; $RE_2O_3 = Y_2O_3$ [40.9%], La_2O_3 5%, Ce_2O_3 15%, Pr_2O_3 4%, Nd_2O_3 12%, Sm_2O_3 7.2%, Eu_2O_3 0.2%, Gd_2O_3 6.5%, Tb_2O_3 0.9%, Dy_2O_3 4.1%, Ho_2O_3 0.8%, Er_2O_3 1.7%, Tm_2O_3 0.3%, Yb_2O_3 1.2%, Lu_2O_3 0.2% by X-ray spectroscopy; corresponds to $Ca_{3.03}(Y,Ce)_{0.95}Al_{1.62}(SO_4)_{1.00}[F_{11.46}(OH)_{0.40}]_{\Sigma=11.86}\cdot 9.55H_2O$.

Occurrence: In the oxidation zone of a Mo–W deposit.

Association: Halloysite, gearksutite, fluorite, creedite, anglesite, "limonite".

Distribution: From the Kara-Oba Mo–W deposit, Bet-Pak-Dal Desert, central Kazakhstan.

Name: Honors Fedor Vasil'evich Chukhrov (1908–1988), Russian mineralogist, Director, Institute of Geology of Ore Deposits, Petrology, Mineralogy, and Geochemistry, Moscow, Russia, and *yttrium*, the dominant rare-earth element.

Type Material: Vernadsky State Geological Museum, 46354; Russian Research Institute of Mineral Resources; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 61518, 61519; National Museum of Natural History, Washington, D.C., USA, 144183.

References: (1) Ermilova, L.P., V.A. Moleva, and R.F. Klevtsova (1960) Chukhrovite, a new mineral from central Kazakhstan. Zap. Vses. Mineral. Obshch., 89, 15–25 (in Russian). (2) (1960) Amer. Mineral., 45, 1132 (abs. ref. 1). (3) Mathew, M., S. Takagi, K.R. Waerstad, and A.W. Frazier (1981) The crystal structure of synthetic chukhrovite, $Ca_4AlSi(SO_4)F_{13}\cdot 12H_2O$. Amer. Mineral., 66, 392–397. (4) Pekov, I.V. (1998) Minerals first discovered on the territory of the former Soviet Union. Ocean Pictures, Moscow, 66.