Preobrazhenskite $Mg_3B_{11}O_{15}(OH)_9$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. As crystals, to 4 cm; in nodules and granular massive.

Physical Properties: Hardness = 4.5–5 D(meas.) = n.d. D(calc.) = 2.45

Optical Properties: Semitransparent. *Color:* Colorless, lemon-yellow, dark gray. *Optical Class:* Biaxial (+), nearly uniaxial (+). $\alpha = 1.570$ $\beta = 1.570$ $\gamma = 1.595$ 2V(meas.) = n.d.

Cell Data: *Space Group: Pbcm.* $a = 16.291(4)$ $b = 9.181(2)$ $c = 10.571(2)$ $Z = 4$

X-ray Powder Pattern: Inder deposit, Kazakhstan.
5.28 (10), 3.79 (10), 3.230 (9), 3.187 (9), 2.821 (9), 2.769 (9), 2.641 (9)

Chemistry:

	(1)	(2)
SiO_2	0.30	
B_2O_3	65.90	65.47
R_2O_3	0.17	
MgO	20.65	20.67
CaO	0.00	
H_2O^+	13.39	13.86
H_2O^-	0.16	
Total	100.57	100.00

(1) Inder deposit, Kazakhstan; after washing to remove soluble halides. (2) $Mg_3B_{11}O_{15}(OH)_9$.

Occurrence: In fine-grained halite–polyhalite rock.

Association: Inyoite, halite, polyhalite, kieserite, anhydrite, aksaite, boracite, ginorite, halurgite, strontioborite, metaborite, kaliborite.

Distribution: In Kazakhstan, in and under the Inder borate deposit, and from the Chalkar salt dome, Ak-saĭ Valley, Uralsk district.

Name: To honor Pavel Ivanovich Preobrazhenskii (1874–1944), investigator of Russian salt deposits, Institute of Halurgy, St. Petersburg, and Institute of Mining and Chemical Stock, Moscow, Russia, a discoverer of the Inder deposit, Kazakhstan.

Type Material: Mining Institute, St. Petersburg, 1497/1–2,5; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 57015.

References: (1) Yarzhemskii, Y.Y. (1956) Preobrazhenskite, a new borate from the salt strata of the Inder uplift. Doklady Acad. Nauk SSSR, 111, 1087–1090 (in Russian). (2) (1957) Amer. Mineral., 42, 704 (abs. ref. 1). (3) Ostrovskaya, I.V. and I.B. Nikitina (1969) The formula of preobrazhenskite. Tr. Mineral. Muz. Akad. Nauk SSSR, 19, 206–209 (in Russian). (4) (1970) Amer. Mineral., 55, 1071–1072 (abs. ref. 3). (5) Burns, P.C. and F.C. Hawthorne (1994) Structure and hydrogen bonding in preobrazhenskite, a complex heteropolyhedral borate. Can. Mineral., 32, 387–396. (6) Kondrat'eva, V. (1969) X-ray determination of borates, 153. (7) Pekov, I.V. (1998) Minerals first discovered on the territory of the former Soviet Union. Ocean Pictures, Moscow, 170.