Tusionite $Mn^{2+}Sn^{4+}(BO_3)_2$

Crystal Data: Hexagonal. *Point Group:* $\overline{3}$. Thin platy crystals, to 1.5 cm, in rosettelike aggregates.

Physical Properties: *Cleavage:* Perfect on {0001}. Hardness = n.d. VHN = 400–500 ∥ {0001}, 700–750 ⊥ {0001} (40 g load). D(meas.) = 4.73 D(calc.) = 4.85

Optical Properties: Transparent to translucent. *Color:* Honey-yellow, yellowish brown; nearly colorless in transmitted light. *Luster:* Vitreous.
Optical Class: Uniaxial (–). $\omega = 1.854(2)$ $\epsilon = 1.757(2)$

Cell Data: *Space Group:* $R\overline{3}$. $a = 4.781(1)$ $c = 15.381(7)$ Z = 3

X-ray Powder Pattern: Along the upper Tusion River, Tajikistan.
2.818 (10), 3.65 (9), 1.744 (8), 2.393 (6), 1.999 (6), 5.12 (4), 4.02 (4)

Chemistry:

	(1)	(2)	(3)
B_2O_3	23.51	[23.72]	23.90
WO_3		0.45	
SnO_2	52.45	51.62	51.74
ZrO_2		0.10	
Sc_2O_3		0.06	
FeO	3.57	2.31	
MnO	20.46	18.72	24.36
MgO		0.00	
CaO	0.39	1.71	
H_2O	0.00		
Total	[100.38]	98.69	100.00

(1) Along the upper Tusion River, Tadjikistan; by electron microprobe, total Fe as FeO, total Mn as MnO, original total given as 100.38%; corresponds to $(Mn_{0.84}Fe_{0.15}Ca_{0.02})_{\Sigma=1.01}Sn_{1.02}(B_{0.98}O_3)_2$. (2) Belo Horizonte No. 1 pegmatite, California, USA; by electron microprobe, total Fe as FeO, total Mn as MnO; B_2O_3 calculated for stoichiometry; corresponds to $(Mn_{0.78}Fe_{0.09}Ca_{0.09})_{\Sigma=0.96}Sn_{1.00}(BO_3)_2$. (3) $MnSn(BO_3)_2$.

Occurrence: Of late-stage hydrothermal origin, rare in granite pegmatites, typically in miarolitic cavities.

Association: Tetrawickmanite, hambergite, danburite, tourmaline, orthoclase, albite, quartz (along the upper Tusion River, Tajikistan); tourmaline, hambergite, danburite, hellandite, boromuscovite, cassiterite (Řečice, Czech Republic; Thomas Mountain, California, USA).

Distribution: From along the upper Tusion River, Shakhdara Range, southwestern Pamir Mountains, Tadjikistan. At Řečice, Czech Republic. In the Belo Horizonte No. 1 and New Columbia No. 1 pegmatites, Thomas Mountain, Riverside Co., California, USA.

Name: For its first-noted occurrence along the upper Tusion River, Tadjikistan.

Type Material: Mineralogical Museum, St. Petersburg University, St. Petersburg, 17096; Mining Institute, St. Petersburg, 1661/1; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 82546.

References: (1) Konovalenko, S.I., A.V. Voloshin, Y.A. Pakhomovskii, S.S. Anen'yev, G.A. Perlina, D.L. Rogachev, and V.Y. Kuznetsov (1983) Tusionite, $MnSn(BO_3)_2$, a new borate from granite pegmatite of southwestern Pamir. Doklady Acad. Nauk SSSR, 272, 1449–1553 (in Russian). (2) (1984) Amer. Mineral., 69, 1193 (abs. ref. 1). (3) Cooper, M., F.C. Hawthorne, M. Novák, and M.C. Taylor (1994) The crystal structure of tusionite, $Mn^{2+}Sn^{4+}(BO_3)_2$, a dolomite-structure borate. Can. Mineral., 32, 903–907.