Rhabdoborite-(W) $Mg_{12}W^{6+}_{1.33}O_6(BO_3)_6F_2$

Crystal Data: Hexagonal. *Point Group*: 6. As prismatic to acicular crystals to 7 mm typically in parallel or radial intergrowths, bunches, sheaf- or broom-like clusters to 1 cm.

Physical Properties: *Cleavage*: None. *Tenacity*: Brittle. *Fracture*: Uneven. Hardness = n.d. D(meas.) = n.d. D(calc.) = 3.59

Optical Properties: Transparent. *Color*: Light yellow, beige. *Streak*: White. *Luster*: Vitreous. *Optical Class*: Uniaxial (+). ω = 1.720(5) ε = 1.750(5) *Pleochroism*: Distinct, *E* = yellow with slight greenish tint, *O* = very pale yellow to colorless.

Cell Data: *Space Group*: $P6_3$. a = 10.6366(5) c = 4.5701(3) Z = 1

X-Ray Diffraction Pattern: Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia. 9.18 (100), 3.479 (61), 5.304 (38), 2.228 (35), 2.550 (30), 4.595 (25), 1.703 (25)

Chemistry:

	(1)
MgO	48.89
CaO	0.15
MnO	0.15
Fe_2O_3	0.78
B_2O_3	20.33
P_2O_5	1.80
As_2O_5	1.60
V_2O_5	4.10
MoO_3	2.48
WO_3	18.04
F	3.10
$-O = F_2$	1.31
Total	100.11

(1) Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia; average electron microprobe analysis supplemented by Raman spectroscopy; corresponding to $(Mg_{11.74}Fe^{3+}_{0.09}Ca_{0.03}Mn_{0.02})_{\Sigma=11.88}(W^{6+}_{0.75}V^{5+}_{0.44}Mo^{6+}_{0.13})_{\Sigma=1.32}[(P_{0.25}As^{5+}_{0.13})_{\Sigma=0.38}B_{5.65}]_{\Sigma=6.03}O_{24.42}F_{1.58}$.

Polymorphism & Series; Continuous solid solution with rhabdoborite-(V) and rhabdoborite-(Mo).

Mineral Group: Rhabdoborite group.

Occurrence: A volcanic sublimate or, more probably, formed by the interaction between fumarolic gas and basalt scoria.

Association: Rhabdoborite-(V), rhabdoborite-(Mo), anhydrite, diopside, hematite, schäferite, berzeliite, svabite, calciojohillerite, ludwigite, forsterite, magnesioferrite, baryte, fuorapatite, udinaite, arsenudinaite, powellite.

Distribution: From the Arsenatnaya fumarole, Second scoria cone of the Northern Breakthrough of the Great Tolbachik Fissure Eruption, Tolbachik volcano, Kamchatka, Russia.

Name: Refers to morphological (*rhabdos* is "rod", in Greek) and chemical (*bor*ate) features of the mineral; a suffix indicates the dominant element as the *M* component.

Type Material: A.E. Fersman Mineralogical Museum, RAS, Moscow, Russia (96198).

References: (1) Pekov, I.V., N.V. Zubkova, N.N. Koshlyakova, D.I. Belakovskiy, A.A. Agakhanov, M.F. Vigasina, S.N. Britvin, E.G. Sidorov, and D.Y. Pushcharovsky (2020) Rhabdoborite-(V), rhabdoborite-(Mo) and rhabdoborite-(W): a new group of borate minerals with the general formula $Mg_{12}M_{1⅓}O_6[(BO_3)_{6-x}(PO_4)_xF_{2-x}]$ (M=V^{5+}, Mo^{6+} or W^{6+} and x<1). Phys. Chem. Minerals, 47, 44, 1-17.