

**Rhabdoborite-(V)**

**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.) = 3.39

**Optical Properties:** Transparent. *Color:* Light to bright yellow. *Streak:* White. *Luster:* Vitreous. *Optical Class:* Uniaxial (+).  $\omega = 1.696(3)$   $\varepsilon = 1.740(4)$  Nonpleochroic.

**Cell Data:** *Space Group:*  $P6_3$ .  $a = 10.6314(4)$   $c = 4.5661(2)$   $Z = 1$

**X-Ray Diffraction Pattern:** Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia. 9.17 (100), 2.226 (79), 3.472 (76), 2.763 (64), 1.701 (63), 2.547 (61), 5.301 (44)

Chemistry:	(1)
MgO	52.25
CaO	0.15
MnO	0.44
Fe <sub>2</sub> O <sub>3</sub>	0.97
B <sub>2</sub> O <sub>3</sub>	20.97
P <sub>2</sub> O <sub>5</sub>	2.75
As <sub>2</sub> O <sub>5</sub>	1.98
V <sub>2</sub> O <sub>5</sub>	6.99
MoO <sub>3</sub>	5.73
TeO <sub>3</sub>	0.28
WO <sub>3</sub>	5.43
SO <sub>3</sub>	0.03
F	3.44
-O = F <sub>2</sub>	1.45
Total	99.96

(1) Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia; average electron microprobe analysis supplemented by Raman spectroscopy; corresponding to  $(\text{Mg}_{11.85}\text{Fe}^{3+}_{0.11}\text{Mn}_{0.06}\text{Ca}_{0.02})_{\Sigma=12.04}(\text{V}^{5+}_{0.70}\text{Mo}^{6+}_{0.36}\text{W}^{6+}_{0.21}\text{Te}^{6+}_{0.01})_{\Sigma=1.28}[(\text{P}_{0.35}\text{As}^{5+}_{0.16})_{\Sigma=0.51}\text{B}_{5.50}]_{\Sigma=6.01}\text{O}_{24.35}\text{F}_{1.65}$ .

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

**Mineral Group:** Rhabdoborite group.

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

**Association:** Rhabdoborite-(Mo), rhabdoborite-(W), anhydrite, diopside, hematite, schäferite, berzeliite, svabite, calciojohillerite, ludwigite, forsterite, magnesioferrite, baryte, fluorapatite, 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 (*borate*) features of the mineral; a suffix indicates the dominant element as the *M* component.

**Type Material:** A.E. Fersman Mineralogical Museum, RAS, Moscow, Russia (96197).

**References:** (1) Pekov, I.V., N.V. Zubkova, N.N. Koshlyakova, D.I. Belakovskiy, A.A. Agakhanov, M.F. Viganina, 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  $\text{Mg}_{12}\text{M}_{1/2}\text{O}_6([\text{BO}_3]_{6-x}(\text{PO}_4)_x\text{F}_{2-x}]$  ( $\text{M}=\text{V}^{5+}$ ,  $\text{Mo}^{6+}$  or  $\text{W}^{6+}$  and  $x < 1$ ). Phys. Chem. Minerals, 47, 44, 1-17.