

**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.) = 3.42

**Optical Properties:** Transparent. *Color:* Light yellow. *Streak:* White. *Luster:* Vitreous. *Optical Class:* Uniaxial (+).  $\omega = 1.703(4)$   $\varepsilon = 1.750(5)$  *Pleochroism:* Distinct,  $E =$  light yellow,  $O =$  colorless to very pale yellow.

**Cell Data:** *Space Group:*  $P6_3$ .  $a = 10.6304(3)$   $c = 4.56374(16)$   $Z = 1$

**X-Ray Diffraction Pattern:** Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia. 9.20 (100), 3.488 (73), 2.228 (72), 2.769 (70), 1.702 (61), 2.549 (40), 1.475 (37)

Chemistry:	(1)
MgO	51.32
CaO	0.37
MnO	0.52
Fe <sub>2</sub> O <sub>3</sub>	0.48
B <sub>2</sub> O <sub>3</sub>	20.83
P <sub>2</sub> O <sub>5</sub>	2.40
As <sub>2</sub> O <sub>5</sub>	1.69
V <sub>2</sub> O <sub>5</sub>	4.81
MoO <sub>3</sub>	10.16
WO <sub>3</sub>	4.75
F	3.42
-O = F <sub>2</sub>	1.44
Total	99.31

(1) Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia; average electron microprobe analysis supplemented by Raman spectroscopy; corresponding to  $(\text{Mg}_{11.78}\text{Mn}_{0.07}\text{Fe}^{3+}_{0.06}\text{Ca}_{0.06})_{\Sigma=11.97}(\text{Mo}^{6+}_{0.65}\text{V}^{5+}_{0.49}\text{W}^{6+}_{0.19})_{\Sigma=1.33}[(\text{P}_{0.31}\text{As}^{5+}_{0.14})_{\Sigma=0.45}\text{B}_{5.54}]_{\Sigma=5.99}\text{O}_{24.33}\text{F}_{1.67}$ .

**Polymorphism & Series;** Continuous solid solution with rhabdobarite-(V) and rhabdobarite-(W).

**Mineral Group:** Rhabdobarite group.

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

**Association:** Rhabdobarite-(V), rhabdobarite-(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 (5464/1).

**References:** (1) Pekov, I.V., N.V. Zubkova, N.N. Koshlyakova, D.I. Belakovskiy, A.A. Agakhanov, M.F. Vlgasina, S.N. Britvin, E.G. Sidorov, and D.Y. Pushcharovsky (2020) Rhabdobarite-(V), rhabdobarite-(Mo) and rhabdobarite-(W): a new group of borate minerals with the general formula  $\text{Mg}_{12}\text{M}_{1/3}\text{O}_6[(\text{BO}_3)_{6-x}(\text{PO}_4)_x\text{F}_{2-x}]$  ( $\text{M}=\text{V}^{5+}$ ,  $\text{Mo}^{6+}$  or  $\text{W}^{6+}$  and  $x < 1$ ). *Phys. Chem. Minerals*, 47, 44, 1-17.