

Crystal Data: Orthorhombic. *Point Group:* 2/m 2/m 2/m. Crystals lamellar to tabular on {100}, rectangular, octagonal or irregular to 0.9 mm; also as divergent aggregates of prismatic to acicular crystals to 0.05 mm, or as dendrite-like aggregates.

Physical Properties: *Cleavage:* None. *Fracture:* Uneven. *Tenacity:* Brittle.
Hardness = ~ 3 D(meas.) = n.d. D(calc.) = 2.641

Optical Properties: Transparent. *Color:* Colorless. *Streak:* White. *Luster:* Vitreous.
Optical Class: Biaxial (-). $\alpha = 1.493(1)$ $\beta = 1.498(1)$ $\gamma = 1.498(1)$ $2V(\text{meas.}) \leq 20^\circ$
 $2V(\text{calc.}) = 0^\circ$

Cell Data: *Space Group:* Pnma. $a = 13.2383(4)$ $b = 10.3023(3)$ $c = 8.9909(4)$ $Z = 4$

X-ray Powder Pattern: Arsenatnaya fumarole, Tolbachik volcano, Kamchatka, Russia.
3.281 (100), 3.144 (84), 3.016 (78), 3.112 (67), 3.963 (62), 2.785 (52), 4.245 (45)

Chemistry:	(1)	(2)
Na ₂ O	7.37	6.34
K ₂ O	19.33	19.28
CaO	21.39	22.96
SO ₃	49.49	49.17
F	3.78	3.89
<u>-O = F₂</u>	<u>1.59</u>	<u>1.64</u>
Total	99.77	100.00

(1) Arsenatnaya fumarole, Tolbachik volcano, Kamchatka, Russia; average of 22 electron microprobe analyses supplemented by IR spectroscopy; corresponding to $K_{2.01}Ca_{1.86}Na_{1.16}S_{3.02}O_{12.03}F_{0.97}$. (2) $K_2(Ca_2Na)(SO_4)_3F$.

Occurrence: As crusts on scoria around a volcanic fumarole, probably through gas-rock interaction with basalt as a source of metals.

Association: Tenorite, hematite, orthoclase, fluorophlogopite, langbeinite, apthitalite, anhydrite, lammerite, johillerite, tilasite.

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

Name: Honors Russian statesman Ivan Ivanovich Shuvalov (1727-1797), an enthusiastic patron of the sciences, arts and literature, and one of the founders of Moscow University in 1755.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (4549/1).

References: (1) Pekov, I.V., N.V. Zubkova, S.N. Britvin, N.V. Chukanov, V.O. Yapaskurt, E.G. Sidorov, and D.Y. Pushcharovsky (2016) Shuvalovite, $K_2(Ca_2Na)(SO_4)_3F$, a new mineral from the Tolbachik volcano, Kamchatka, Russia. *Eur. J. Mineral.*, 28(1), 53-62. (2) (2016) *Amer. Mineral.*, 101, 1923-1924 (abs. ref. 1).