Tsaregorodtsevite $N(CH_3)_4[Si_2(Si_{0.5}Al_{0.5})O_6]_2$

Crystal Data: Orthorhombic, pseudocubic. *Point Group:* 222. Pseudocubic crystals, to 1 cm, with dull {100}, {010}, and {001}, additional faces {110}, {011}, {101} lustrous. *Twinning:* Commonly sector twinned, as seen in thin section.

Physical Properties: *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 6 VHN = 796–893, average 835 (120 g load). D(meas.) = 2.04(5) D(calc.) = 2.01 Evolves ammonia and eurotropine above 600 °C, becoming pitch-black.

Optical Properties: Transparent. *Color:* Colorless, white to faintly yellow. *Streak:* White. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Dispersion:* $r < v$, weak. $\alpha = 1.529(2)$ $\beta =$ n.d. $\gamma = 1.531(2)$ 2V(meas.) = 76(5)°

Cell Data: *Space Group:* $I222$. $a = 8.984(3)$ $b = 8.937(2)$ $c = 8.927(2)$ Z = 2

X-ray Powder Pattern: Man'-Khambo Mountains, Russia; very close to ammonian sodalite. 3.66 (100), 4.46 (82), 6.33 (60), 2.586 (15), 4.50 (12b), 3.16 (12), 2.832 (10)

Chemistry:

	(1)	(2)	(3)
SiO_2	66.38	66.7	69.29
Al_2O_3	12.19	12.2	11.76
C			11.08
H			2.79
O			1.85
N	3.2		3.23
Total			100.00

(1) Man'-Khambo Mountains, Russia; by electron microprobe, average of three analyses, given as Si 31.03%, Al 6.45%, N 3.2%, O 45.6%, here converted to oxides; CH_3 shown to be present by gas chromatography, IR spectroscopy, and Raman microanalysis. (2) Do. (3) $N(CH_3)_4[Si_2(Si_{0.5}Al_{0.5})O_6]_2$.

Occurrence: In friable material filling tectonic fractures in muscovite-chlorite schist.

Association: Chlorite, quartz, anatase, brookite, rutile, monazite, phillipsite, albite.

Distribution: On Mt. Yaruta, Man'-Khambo Mountains, Khanty Mansiysk region, Northern Ural Mountains, Russia.

Name: For Sergei Vasil'evich Tsaregorodtsev (1953–1986), Yekaterinberg (Sverdlovsk), Russia, expert collector of Uralian minerals, who found this mineral.

Type Material: Mining Institute, St. Petersburg, 2054/1; Il'menskii Preserve Museum, Miass, 3303, 3374, 5121; Vernadsky Geological Museum, Moscow, 59719, 59859; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 87949; National Museum, Sofia, Bulgaria; National Museum, Prague, Czech Republic.

References: (1) Pautov, L.A., V.Y. Karpenko, E.V. Sokolova, and K.I. Ignatenko (1993) Tsaregorodtsevite $N(CH_3)_4[Si_2(Si_{0.5}Al_{0.5})O_6]_2$ – a new mineral. Zap. Vses. Mineral. Obshch., 122(1), 128–135 (in Russian). (2) (1994) Amer. Mineral., 79, 1013 (abs. ref. 1). (3) (1994) Mineral. Abs., 45, 378 (abs. ref. 1). (4) Sokolova, E.V., V.B. Rybakov, and L.A. Pautov (1991) Crystal structure of a new natural tetramethyammonium aluminosilicate $[N(CH_3)_4][Si_2(Si_{0.5}Al_{0.5})O_6]_2$. Doklady Acad. Nauk SSSR, 317, 884–887 (in Russian). (5) Pautov, L.A. and V.Y. Karpenko (1994) Discovery of czaregorodczevite [tsaregorodtsevite]. World of Stones, 1(4), 28–29.