

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

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**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 eurotopine 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.  $\alpha = 1.529(2)$   $\beta = \text{n.d.}$   $\gamma = 1.531(2)$   $2V(\text{meas.}) = 76(5)^\circ$

**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 <sub>2</sub>               | 66.38 | 66.7 | 69.29  |
| Al <sub>2</sub> O <sub>3</sub> | 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<sub>3</sub> 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) Tsaregorodtsevitse  $N(CH_3)_4[Si_2(Si_{0.5}Al_{0.5})O_6]_2$  – 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 czaregorodtsevitse [tsaregorodtsevitse]. *World of Stones*, 1(4), 28–29.

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