Shakhovite $Hg_4^{1+}Sb^{5+}O_3(OH)_3$

Crystal Data: Monoclinic. *Point Group:* m. Platy crystals, to about 2 mm, slightly elongated.

Physical Properties: *Cleavage:* In two directions, parallel elongation. *Tenacity:* Brittle. Hardness = 3–3.5 VHN = 285–362, 317 average (20 g load). D(meas.) = 8.34–8.51, 8.38 average. D(calc.) = 8.60

Optical Properties: Semitransparent. *Color:* Bright lettuce-green, olive-green, yellowish green, darkening on exposure; grayish white in reflected light. *Streak:* Yellowish white. *Luster:* Adamantine.
Optical Class: Biaxial; high birefringence. *Pleochroism:* Weak; olive-green to colorless.
$\alpha = > 2.03$ $\beta = > 2.03$ $\gamma = > 2.03$ 2V(meas.) = n.d.
R_1–R_2: (434) 24.5–19.0, (460) 22.5–17.6, (486) 21.5–16.4, (500) 21.5–16.2, (546) 20.2–15.8, (590) 20.3–15.6, (656) 18.2–13.4

Cell Data: *Space Group:* Im. $a = 4.871(1)$ $b = 15.098(3)$ $c = 5.433(1)$ $\beta = 98.86(2)^\circ$
$Z = 2$

X-ray Powder Pattern: Kelyana mine, Russia.
3.88 (10), 3.33 (8), 2.69 (6), 2.63 (5), 2.552 (5), 1.931 (3.5), 3.47 (3b)

Chemistry:

	(1)	(2)	(3)	(4)
Hg	77.25	77.57	77.3	78.42
Sb	11.53	11.93	12.1	11.90
O	9.88	9.67		9.38
H				0.30
Total	98.66	99.17		100.00

(1) Kelyana mine, Russia; by electron microprobe, Hg average of 24 analyses, Sb average of 13 analyses, O average of five analyses; Cu, As, Cl, S absent; corresponding to $Hg_{4.03}Sb_{1.00}O_{6.47}$. (2) Khaydarkan, Kyrgyzstan; by electron microprobe, Hg average of 15 analyses, Sb average of 10 analyses, O average of seven analyses; corresponding to $Hg_{4.09}Sb_{1.04}O_{6.38}$. (3) Landsberg, Germany; by electron microprobe, presence of $(OH)^{1-}$ confirmed by IR. (4) $Hg_4SbO_3(OH)_3$.

Occurrence: A late-stage secondary mineral in the oxidation zone of cinnabar-stibnite ore (Kelyana mine, Russia); in the oxidation zone of cinnabar-livingstonite ore (Khaydarkan, Kyrgyzstan); in oxidized Hg–Sb-bearing tetrahedrite ore (Landsberg, Germany).

Association: Calomel, eglestonite, mercury, montroydite, terlinguaite, corderoite, kelyanite, kuznetsovite, antimony oxides (Kelyana mine, Russia); calomel, cinnabar, mercury, malachite, goethite (Landsberg, Germany).

Distribution: In the Kelyana Sb–Hg mine, North Muya Mountains, Buryatia, Transbaikal, Siberia, Russia. From the Khaydarkan deposit, Fergana Valley, Alai Range, south Kyrgyzstan. At Landsberg, near Obermoschel, and Stahlberg, Rhineland-Palatinate, Germany.

Name: To honor Feliks Nikolaevich Shakhov (1894–1971), Head of the Division of Geochemistry of the Russian Academy of Sciences, Novosibirsk, Russia.

Type Material: Central Siberian Geological Museum, Siberian Division, Academy of Sciences, Novosibirsk, BII-30/1; Mining Institute, St. Petersburg, 1212/1–2; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 81603.

References: (1) Vasil'ev, V.I., Y.G. Lavrent'ev, and N.A. Pal'chik (1980) Shakhovite – $Hg_8Sb_2O_{13}$ – a new supergene mineral. Geol. i Geofiz., 128–132 (in Russian with English abs.). (2) (1981) Amer. Mineral., 66, 1101 (abs. ref. 1). (3) Tillmanns, E., R. Krupp, and K. Abraham (1982) New data on the mercury antimony mineral shakhovite: chemical composition, unit cell and crystal structure. Tschermaks Mineral. Petrog. Mitt., 30, 227–235. (4) Baur, W.H. and E. Tillmanns (1986) How to avoid unnecessarily low symmetry in crystal structure determinations. Acta Cryst., 42, 95–111.