Leningradite $PbCu_3(VO_4)_2Cl_2$

Crystal Data: Orthorhombic. *Point Group*: 2/*m* 2/*m* 2/*m*. Rough crystals and flakes, rhomboidal, flattened on {010}, to 0.3 mm; in radial spherical aggregates.

Physical Properties: *Cleavage*: On {010}, perfect. *Tenacity:* Brittle. Hardness = 4.25 VHN = 180-345, 247 average (10 g load). D(meas.) = 4.81 (thought low due to admixtures). D(calc.) = 4.97

Optical Properties: Opaque, transparent in very thin grains. *Color*: Bright red, golden red in transmitted light. *Streak*: Red-orange. *Luster*: Vitreous.
Optical Class: Biaxial (–). *Orientation*: $X = b$, $Y = a$, $Z = c$. α = n.d. β = 2.29(1) γ = 2.35(1) 2V(meas.) = Large.

Cell Data: *Space Group*: *Ibam*. a = 9.005(7) b = 11.046(9) c = 9.349(7) Z = 4

X-ray Powder Pattern: Tolbachik volcano, Russia.
3.418 (100), 2.763 (95), 2.358 (73), 2.548 (66), 3.242 (62), 5.545 (49), 1.847 (49)

Chemistry:

	(1)	(2)
As_2O_5	0.49	
V_2O_5	26.22	26.03
CuO	32.84	34.16
ZnO	0.32	
PbO	32.13	31.95
Cl	9.60	10.15
$-O = Cl_2$	2.17	2.29
Total	99.43	100.00

(1) Tolbachik volcano, Russia; by electron microprobe, average of ten analyses on five grains; corresponds to $Pb_{1.01}(Cu_{2.89}Zn_{0.05})_{\Sigma=2.94}[(V_{1.01}As_{0.01})_{\Sigma=1.02}O_4]_2(Cl_{1.90}O_{0.10})_{\Sigma=2.00}$. (2) $PbCu_3(VO_4)_2Cl_2$.

Occurrence: In volcanic fumaroles, deposited at about 140◦ C.

Association: Tolbachite, lammerite, anglesite, hematite.

Distribution: At the Tolbachik fissure volcano, Kamchatka Peninsula, Russia.

Name: For the city of *Leningrad* (once and again St. Petersburg), in the Universities of which this and related minerals have been studied.

Type Material: Mining Institute, St. Petersburg, Russia, 2003/1.

References: (1) Vergasova, L.P., S.K. Filatov, T.F. Semenova, and V.V. Anan'ev (1990) Leningradite $PbCu_3(VO_4)_2Cl_2$, a new mineral from volcanic exhalations. Doklady Acad. Nauk SSSR, 310, 1434-1437 (in Russian). (2) (1991) Amer. Mineral., 76, 1434-1435 (abs. ref. 1). (3) Sidra, O.I., S.V. Krivovichev, T. Armbruster, S.K. Filatov, and I.V. Pekov (2007) The crystal structure of leningradite, $PbCu_3(VO_4)_2Cl_2$. Can. Mineral, 45, 445-449.