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Pavlovskyite $Ca_8(SiO_4)_2(Si_3O_{10})$: A new mineral of altered silicate-carbonate xenoliths from the two Russian type localities, Birkhin massif, Baikal Lake area and Upper Chegem caldera, North Caucasus

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Abstract

The new mineral pavlovskyite $Ca_8(SiO_4)_2(Si_3O_{10})$ forms rims together with dellaite $Ca_6(Si_2O_7)(SiO_4)(OH)_2$ around galuskinite $Ca_7(SiO_4)_3CO_3$ veins cutting calcio-olivine skarns in the Birkhin gabbro massif. In addition, skeletal pavlovskyite occurs in cuspidine zones of altered carbonate xenoliths in the ignimbrites of the Upper Chegem caldera (North Caucasus). The synthetic analog of pavlovskyite has been synthesized before and is known from cement-like materials. Isotypic to pavlovskyite is the synthetic germanate analog $Ca_8(GeO_4)_2(Ge_3O_{10})$. The crystal structure of pavlovskyite, space group *Pbcn*, a = 5.0851(1), b = 11.4165(3), c = 28.6408(8) Å, V = 1662.71(7) Å^3, Z = 4, has been refined from X-ray single-crystal data to $R1$ = 3.87%. The new colorless mineral has a Mohs hardness of 6–6.5, biaxial (–), α = 1.656(2), β = 1.658(2), γ = 1.660(2) (589 nm), $2V$ (meas) = 80(5)°, $2V$ (calc) = 89.9°, medium dispersion: r > v, optical orientation: **X** = **b**, **Y** = **c**, **Z** = **a**.

For comparison with pavlovskyite, the crystal structure of kilchoanite $Ca_6(SiO_4)(Si_3O_{10})$ from the Birkhin massif [space group *I*2*cm*, a = 11.4525(2), b = 5.0867(1), c = 21.996(3) Å, V = 1281.40(4) Å^3, Z = 4] has been refined from single-crystal X-ray data to $R1$ = 2.00%.

Pavlovskyite represents a 1:1 member of a polysomatic series with calcio-olivine γ-Ca_2SiO_4 and kilchoanite $Ca_6(SiO_4)(Si_3O_{10})$ as end-member modules. The structure is characterized by strongly folded trisilicate units (Si_3O_{10}) interwoven with a framework of CaO_6 and CaO_8 polyhedra. Olivine-like slices with orthosilicate groups are interstratified with the characteristic trisilicate module of $Ca_4(Si_3O_{10})$ composition. Although the optical properties of pavlovskyite and kilchoanite are similar, both minerals can be distinguished by chemical analyses (different Ca/Si ratio), X-ray diffraction, and Raman spectroscopy. The new mineral is named after V.E. Pavlovsky (1901–1982), an outstanding geologist in the area of Eastern Siberia, in particular of the Baikal region.

Keywords: Pavlovskyite, kilchoanite, skarn, structure, Raman, Upper Chegem caldera, Birkhin massif, Russia