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Origin of the Sopcheozero Deposit and host Dunite Lens, Monchegorsk Pluton, Kola Peninsula, Russia

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Origin of chromitites in layered intrusions is controversial problem. It was recently proposed that the formation of peridotite-hosted chromitites could be related to the influx of a more primitive Cr-rich melt. Thus formed chromitites resemble lower crustal-transitional ophiolitic chromitites (Yudovskaya et al., 2015). This problem is discussed by the example of the Sopcheozero chromite deposit from 2.5.-Ga Monchegorsk pluton, Kola Peninsula. The deposit is hosted in the Dunite lens confined to the western part of the Peridotite zone of the pluton.

The Dunite lens consists of dunites and Opx dunites and hosts 3-10 m thick chromitite horizon. The top part of the lens has LREE-enriched gabbroic composition with 86 Ol and presumably represents a residual melt. Mg# in olivine from the top part of the chromitite is 93-94, which then increases to 97-98 Mg#, and again decreases to 94. In the underlying dunite, olivine is from 92 to 91 Mg#. NiO content in olivine reaches 1.00 % and shows no positive correlation with Mg#, as typical of the magmatic olivine. Olivine from the Dunite lens and chromitites, unlike other rocks of the Monchegorsk pluton, reveals a weak reverse zoning with outward increase of MgO and $Cr2O_3$.

This pattern is supplemented by complementary variations in chromite composition: a gradual increase of $Cr2O_3$ up to 61.22% and MgO up to 15.01% accompanied by a decrease of $Al2O_3$, TiO_2, $V2O_3$, and almost complete disappearance of MnO and Zn, and then downward insignificant decrease of $Cr2O_3$ (55.16%) and MgO (11.41%) with increase of $Al2O_3$, slight decrease of TiO and NiO. In addition, chromite shows a clear zoning, with outward decrease of MgO and $Cr2O_3$, which is presumably related to the diffusion of these components in olivine.

Practically all chromites from the layered series define a horizontal trend of Mg# variation at practically unchangeable Cr#, while chromite from the chromitites shows a decrease in Cr# with decrease of Mg#, which is indicative of fractionation of olivine and orthopyroxene.

The clear trend of magmatic fractionation accompanied by the upward increase of Mg# and Cr# in chromite can be related to the multiple influxes of fresh magma. We suggest that the formation of the Dunite lens was related to the multiple injections of a high-Mg and high-Cr melt. High Mg# in olivine is consistent with a komatiitic composition of the parental melt. This assumption agrees with the development of coeval komatiitic rocks in this region (Vrevsky, 2011).

Extremely high Mg# (up to 98) in olivine from chromite deposit in combination with reverse zoning and the absence of positive NiO-MgO correlation suggests its formation through subsolidus re-equilibration.

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