Continental lithospheric mantle origin of 2.5 Ga old Monchegorsk layered intrusion from the Fennoscandian Shield

S.G. TESSALINA[1], J.L; BIIRCK[1], C.J. ALLEGRE[1],
E.V. SHARKOV[2] AND B.A. BELYATSKY [3]

[1] Lab. de Geochimie et Cosmochilie, Institute de Physique du Globe de Paris, France; svetes@ipgp.jussieu.fr
[2] Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of RAS, Russia
[3] Institute of Precambrian Geology and Geochronology of RAS, Russia

The Re-Os and Sm-Nd isotope systematics studies were performed at the IPGP for mafic-ultramafic cumulates, sulphide and chromite samples from the Monchegorsk layered complex, which is a part of extensive Early Proterozoic large igneous Province in the Fennoscandian Shield. The Monchegorsk complex consists of two large intrusive bodies: the 2.5 Ga old Monche Pluton mafic-ultramafic layered intrusion, and younger mainly mafic anorthosite-bearing Monche Tundra massif.

The low initial ε_{Nd} of –1.6 for both Monche Pluton and Monche Tundra intrusions is compatible with results from other coeval layered intrusions in the shield. The ultramafic cumulates and associated chromite separates have unradiogenic Os isotope composition with negative initial γ_{Os} of –5.6 ± 1.13.

Until now, the favourite model for Baltic shield layered intrusions formation implies the upper crust assimilation by hot komatiitic plume-derived magma. Although the combination of high-magnesium (13 % < MgO < 17 %) and incompatible elements enriched composition of parental magma with unradiogenic initial Nd, Os and Sr (~0.702) isotopic values and low time-integrated $^{238}U/^{204}Pb$ ratios are indicative for the involvement of Re-poor, but trace-elements enriched portion of the continental lithospheric mantle beneath Fennoscandian Craton. The dehydratational partial melting of metasomatised lithospheric mantle may be induced by upwelling of hot astenosphere or mantle plume-derived magma within extensional rifting zone. The assimilation of lower crustal material by ascending magmas issued from this partial melting event may explain the variations in Sr, Os and Pb isotope compositions for different intrusions.

Layered intrusions and flood basalts with similar geochemical characteristics were found within Precambrian greenstone belts and Phanerozoic flood basalt Provinces over the world. They may be generated in specific extensional regime settings responsible for the thinning and heating up of metasomatised continental lithospheric mantle.