Paper Number: 3422

Chemical zonation in stratiform chromitites of the Imandra Layered Intrusion, Kola Peninsula, Russia

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The Imandra Layered Intrusion is located in the central part of the Kola Peninsula, Russia, about 125 km north of the Arctic Circle. The intrusion was emplaced at about 2.40 Ga into Proterozoic volcanic rocks in the north and between these rocks and granite gneisses of the Archean basement in the south. A generalized stratigraphic section of the Imandra Layered Intrusion can be subdivided into a marginal zone and a Layered Series. The Layered Series has a thickness of over 3.5 km and consists, from bottom to top, of orthopyroxenites passing up through norites, gabbronorites, pigeonite- and magnetite-pigeonite gabbros and magnetite-apatite-pigeonite diorites to the uppermost granophyres. This study has focused on the detailed examination of chemistry of three massive chromitite layers, which are interlayered with orthopyroxenites in basal part of a Layered Series. The thickness of chromitite layers are 78, 42 and 14 cm, respectively. They are fine-grained and consist, on average, of 40-50 vol. % of cumulus chromite and 50-60 vol. % of interstitial silicate minerals (plagioclase and pyroxenes). All chromitite layers show pronounced compositional trends in terms of major and trace elements. From bottom to top, whole-rock Cr_2O_3, Al_2O_3, FeO and V decrease whereas SiO_2, Zr and La increase indicating that the amount of chromite systematically decreases up the section. In addition, electron microprobe composition of chromite also reveals a unidirectional upward decrease in Mg-number (Mg/(Mg+Fe2+)) from 0.22 to 0.12 and an increase in Cr-number (Cr/(Cr+Al) from 0.68 to 0.78. We tentatively attribute the discovered whole-rock and mineral compositional trends in chromitite layers of the Imandra Layered Intrusions to variations in the amount of trapped liquid and a postcumulus reaction of chromite with interstitial melt and silicate minerals (Barnes, 1998; Barnes & Roeder, 2001).

References:

[1] Barnes SJ (1998) Journal of Petrology 39(10): 1689-1720

[2] Barnes S J and Roeder P L (2001) Journal of Petrology 42(12): 2279-2302