Geophysical Research Abstracts
Vol. 17, EGU2015-3728, 2015
EGU General Assembly 2015
© Author(s) 2015. CC Attribution 3.0 License.

Density heterogeneity of lithospheric mantle beneath the Siberian craton: testing geophysical models by petrological data

Yulia Cherepanova and Irina Artemieva

University of Copenhagen, Department of Geosciences and Natural Resource Management, Copenhagen, Denmark (yc@ign.ku.dk)

Using free-board modeling, we examine a vertically-averaged mantle density beneath the Archean–Proterozoic Siberian Craton in the layer from the Moho down to base of the chemical boundary layer (CBL). Two models are tested: in Model 1 the base of the CBL coincides with the LAB, whereas in Model 2 the base of the CBL is at a 180 km depth. The uncertainty of density model is < 0.02 t/m3 or < 0.6% with respect to primitive mantle. The results, calculated at in situ and at room temperature (SPT) conditions, indicate a heterogeneous density structure of the Siberian lithospheric mantle with a strong correlation between mantle density variations and the tectonic setting. Three types of cratonic mantle are recognized from mantle density anomalies. 'Pristine' cratonic regions not sampled by kimberlites have the strongest depletion with density deficit of 1.8–3.0% (and SPT density of 3.29–3.33 t/m3 as compared to 3.39 t/m3 of primitive mantle). Cratonic mantle affected by magmatism (including the kimberlite provinces) has a typical density deficit of 1.0–1.5%, indicative of a metasomatic melt-enrichment. Intracratonic sedimentary basins have a high density mantle (3.38–3.40 t/m3 at SPT) which suggests, at least partial, eclogitization. Moderate density anomalies beneath the Tunguska Basin imply that the source of the Siberian LIP lies outside of the Craton. In situ mantle density is used to test the isopycnic condition of the Siberian Craton. Both CBL thickness models indicate significant lateral variations in the isopycnic state, correlated with mantle depletion and best achieved for the Anabar Shield region and other intracratonic domains with a strongly depleted mantle. A comparison of synthetic Mg# for the bulk lithospheric mantle calculated from density with Mg# from petrological studies of peridotite xenoliths from the Siberian kimberlites suggests that melt migration may produce local patches of metasomatic material in the overall depleted mantle.