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Artemieva, Irina; Herceg, Matija; Cherepanova, Yulia

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Compositional heterogeneity of the upper mantle beneath the Siberian craton: reconciling thermal, seismic and gravity data

Irina Artemieva[1], Matija Herceg[1], Yulia Cherepanova[1], Hans Thybo[1]

[1] IGN, Univ. Copenhagen, Denmark, irina@geo.ku.dk

We present a new regional model for the upper mantle structure below the Siberian craton. The model includes (i) thermal model of the lithosphere structure constrained by surface heat flow data, (ii) seismic velocity heterogeneity constrained by global tomography models corrected for temperature variations in the upper mantle, (iii) and a new regional model for the density structure based on the GOCE satellite gravity data. We also present a new regional seismic crustal model SibCrust, which is used to calculate crustal correction to gravity field. Thermal model and seismic tomography models are used as independent constraints on lithosphere thickness, required to convert mantle residual density anomalies to density heterogeneity. New regional upper mantle model is compared with regional and world-wide petrological data on upper mantle velocities and densities constrained by mantle-derived xenoliths. The results indicate a significant compositional heterogeneity of the lithospheric mantle of the region. Seismic velocity and density anomalies cannot be explained by variations in mg# alone. Compared to the adjacent orogenic belts and the West Siberian basin, density structure of the cratonic mantle is in a close agreement with isopicnic condition, although significant regional variations are well correlated with basement topography.