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Effect of composition on the seismic structure of the Siberian lithospere

F. Cammarano, I.M. Artemieva, and H. Thybo
Department of Geography and Geology, University of Copenhagen, Denmark (fc@geo.ku.dk)

Understanding the seismic and compositional structure of the Siberian lithosphere has remained elusive due to poor seismic coverage and weak compositional signature of the seismic structure. Petrologic data from mantle-derived xenoliths, that are restricted to kimberlite fields within the Siberian craton and to volcanic provinces at its southern margins, indicate significant compositional heterogeneity of the lithospheric mantle. Borehole heat flow measurements, also largely restricted to the kimberlite provinces and to the peripheral parts of the craton, but abundant within the West Siberian Basin, also indicate strong variations in thermal regime of the mantle both within the craton and within the basin. In this study we use a new tomography inversion for the Siberian craton and the West Siberian Basin to examine the role of thermal and compositional variations on seismic velocity anomalies.

A re-evaluation of available long period surface waveforms allows us to infer lateral and vertical shear-velocity gradients that indicate, univocally, the role of compositional heterogeneity in determining the observed seismic features. Independent constraints from petrology, gravity (satellite data from GOCE), and mineral physics are used to improve our thermo-chemical interpretations. Installing new broadband stations is necessary to improve further seismic models of the upper mantle structure, including anisotropy.