



Continental mantle root deep analysis: a 620-km-long cross section of the Archean Karelian craton (Fennoscandian shield)

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A 620-km-long cross section of the continental mantle underlying the Archean Karelian craton has been compiled by utilising mantle xenolith and xenocryst data from seven kimberlite localities, and seismic and magnetotelluric data. Seismic data demonstrate that the lithospheric mantle beneath the transect is extremely cold and thick. This generally agrees with magnetotelluric data, which show highly resistive mantle lithosphere, implying that it is dry, underlain by a conducting layer (the lithosphere-asthenosphere boundary) at a depth of 230-260 km in the southern part of the craton. Towards the north, approaching the Belomorian graben, this boundary shallows to 170 km. The Karelian crust and underlying lithospheric mantle exhibits considerable variation in structure and composition from the margins of the craton towards the core. In its southwestern margin the crust is more than 60 km thick and the mantle lithosphere, according to geological and seismic data, exhibits a clear 3-layer structure where upper and lower layers represent Paleoproterozoic (~ 3.3 Ga) mantle reworked during Proterozoic (~ 1.9 Ga) continent-continent collision. Towards the core of the craton, east of the Kuhmo Greenstone Belt and in the Kuusamo area, the crust is about 40 km thick, the layered structure is absent, and the entire mantle column represents unusually refractory residue of an Archean melting event. At the northeastern margin of the craton the layered structure reappears within the Belomorian graben area between the Karelian craton and Kola Peninsula. The pressure-temperature "window" where diamond is stable is up to 110 km thick (from 140 to 250 km) in the core of the

craton, but has been reduced to c. 40 km thick (from 140 to 180 km) at both margins of the craton due to melt metasomatism of the base of the lithosphere.