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The Moho and the LAB under central Fennoscandia

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P- and S-wave velocity profiles of the crust and upper mantle are obtained from P- and S-wave receiver functions (PRFs and SRFs) for 20 seismograph stations of the POLENET/LAPNET array in Lapland and a few stations in southern Finland. The lithosphere-asthenosphere boundary (LAB) beneath cratons is often described as 'elusive'. Nevertheless, beneath Lapland we detect a clear low S-wave velocity zone with the top (LAB) at a depth of 160 km. This depth corresponds to the wet solidus of peridotite ($\sim$1100 degrees C).The bottom of the LVZ (the Lehmann discontinuity) is at a depth of 240-250 km. Seismic anisotropy within the LVZ is distinctly different from the rest of the upper mantle.

As shown previously by controlled-source experiments, the Moho in southern Finland is anomalously deep (up to $\sim$60 km versus the normal depth of $\sim$40 km), but the depression of $\sim$20 km has practically no effect in the gravity field. Vp in the lower crust is high (7.3 – 7.5 km/s) and can be explained by eclogitization (Kukkonen et al. 2008). In our Vs profiles the crust/mantle boundary in this region is found at a depth of only $\sim$47 km. The strong dependence of the estimated depth on frequency (0.1 Hz for the receiver functions and 10 Hz for controlled-source seismology) suggests that the crust/mantle boundary in this region is a transition zone rather than a sharp interface. Another possible reason for the discrepancy in the Moho depths is the difference in the wave types (P waves in the controlled source experiments and S waves in receiver functions) and the presence of a layer with a low Vp/Vs ratio: P- and S-wave velocities can be in the crust and mantle ranges, respectively. This interpretation is supported by the extremely low Vp/Vs ratio (1.65) in a depth range from 47 to 75 km in our mantle models. This ratio is the likely effect of a large fraction of orthopyroxene (enstatite).