

The Structure of the Lowermost Mantle

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Teleseismic observations suggest that the lowermost mantle (lowest 200-300 km, D" region) is highly inhomogeneous on many length scales. The size of these inhomogeneities ranges from tens to thousands of kilometres. Studying these structures can help to understand mantle processes (e.g., mantle plumes, convection, slab penetration into the lower mantle) and interaction between the core and the mantle. The large-scale structure of the core-mantle boundary region can be studied with reflections from the top of the discontinuity above the D" region which has been found in several regions of the Earth. On the other hand we have investigated the small-scale structure using scattered waves, which arrive as precursors to seismic core

phases. We also find evidence for seismic anisotropy using pre-diffracted S waves. Combining these studies with tomographic models we find two distinct regions in the lowermost mantle beneath Northern Europe and Siberia. One region showing larger scale structure and anisotropy which can likely be associated with the palaeo-subduction of the Izanagi plate well into the mantle. The other region has a lower overall velocity and shows evidence of scatterers and small-scale ultra low velocity zones perhaps suggesting the presence of partial melt. These results suggest dramatic lateral variations in the nature of the lowermost mantle beneath northern Asia over a length scale of roughly 30 degrees.