# Global Earth Structure from Seismic Imaging

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The Earth is imaged by a variety of techniques, ranging from free oscillations to short period body waves. The basic long wavelength features are well known and reproducible. The continents have deep (~250 km) keels which are particularly pronounced in the ancient cratonic regions, and have the largest anomalies at approximately 110km depth. The cooling signature in the oceans is clearly mapped, although reconciling the seismic signature with the expected addition of heat as evidenced by seafloor topography poses questions, possibly associated with the contribution of anisotropy. At depths in excess of 250km the magnitude of lateral variations is much smaller, and the signature of subduction emerges as one of the clearest signals, persisting to great depth. The subduction signature persists through the 670 km discontinuity indicating that this boundary is not an impenetrable barrier to subduction At the base of the mantle the amplitude of heterogeneity increase markedly, suggesting a high level of compositional and/or phase heterogeneity.

As data volumes have increased it has been possible also to map anisotropy, although the level of agreement between different groups is much less than is the case for the isotropic shear velocity. The need for anisotropy, however, is clear, and some of the features robust. Among such features is the approximate alignment of the fast directions for Rayleigh wave propagation with the directions of absolute plate motion. The determination of shear attenuation distribution is also difficult but some of the large scale features are reproducible.

Another way to probe the deep mantle is to investigate reflected and scattered body waves. Precursors to SS and PP have provided valuable information on the topography of discontinuities and also on their *complexity*. Both the 520km discontinuity and the 670km discontinuity have been found to consist of more than one discontinuity in some regions, placing constraints on possible composition. The geographical distribution of the Lehmann discontinuity and its depth variations have been mapped and the dependence of its depth on temperature has been inferred by comparison with tomographic models. Scatted shear waves from the lowermost mantle have identified high velocity features consistent with the laterally varying occurrence of post-perovskite. A general feature of these results is that the observations cannot be explained in terms of temperature variations alone; rather, the seismological results indicate a complex superposition of temperature, composition and/or other effects.

Recent results will be summarized and discussed.