Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03278, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03278
EGU General Assembly 2008


# Structure and Dynamics of Ultra-Low Velocity Zones at the Core-Mantle Boundary

S. Rost (1), E.J. Garnero (2) and A. McNamara (2)

(1) Institute of Geophysics and Tectonics, School of Earth and Environment, University of Leeds, Leeds, UK, (2) School of Earth and Space Exploration, Arizona State University, Tempe, AZ, USA (s.rost@leeds.ac.uk)

Ultra-Low Velocity Zones (ULVZ) are enigmatic features at the core-mantle boundary (CMB) that can be resolved using Seismology. They are characterized as thin layers ($<$40 km) with strong reductions in seismic velocities (up to 40%). Several seismic probes for ULVZ structure have been exploited, revealing strong evidence for ULVZ in only a few isolated regions, indicating that ULVZ are a localized phenomenon of CMB dynamics. Only about half of the area of the CMB has been seismically probed yet and many areas do not show any evidence for the presence of ULVZ. Lack of evidence for ULVZ structure either indicates that it is too small/thin (or mild in properties) to be detected with current seismic probes or that it is absent.

High resolution seismic array studies reveal small ULVZ patches with scale lengths of a few hundred km's or less. They also show a rapid lateral transition from non-ULVZ mantle to ULVZ material. The seismic properties of ULVZ appear most consistent with partially molten material. Recent high resolution waveform studies also find evidence that the ULVZ material is denser than the surrounding mantle. Geodynamical calculations suggest that the ULVZ material can remain in distinct pockets even with large density increases that can exceed 10%. However, ULVZ viscosity plays an important role: if the ULVZ viscosity is significantly lower than the surrounding mantle, other mechanisms may be needed to keep ULVZ material in isolated pockets, and preventing it from flattening out on the CMB.

Using a multidisciplinary approach, we study the existence, structure, and stability

of ULVZs. We will present recent seismological evidence for ULVZ with seismic properties in agreement with the existence of dense partially molten material at the CMB. Higher resolution studies allow resolution of ULVZ layering down to about 2 km thickness and enables us to resolve internal structure within these thin layers. Using this method, we will present evidence for previously undetected ULVZ structure east of Australia. High resolution geodynamical modeling shows that dense thermo-chemical piles (such as found beneath the central Pacific and southern Africa) might play an important role in ULVZ dynamics, including stabilizing ULVZ into lenses or ridges towards the perimeter edges of the piles. Seismological, mineral-physical and geodynamical evidence indicate ULVZ being the collection of the, perhaps partially molten, dregs of mantle convection at the bottom of the mantle.