An update of surface wave study on and off the N. America continent

The rolling of Earthscope/USArray transportable array (TA) and the recent deployment of the Cascadia Initiative (CI) amphibious seismic array allow us to image the crust and uppermost mantle structure beneath Central US as well as the Juan de Fuca plate off the N. America continent. In this abstract, we present the results of the latest seismic modeling efforts in Mid-continental Rift area and Juan de Fuca ridge.

Mid-continental rift (MCR), an over 2000-km-length Proterozoic gravity anomaly located within a plater of Precambrian blocks, is the most prominent geophysical features in Central US. Based on 2 years seismic data recorded by over 100 TA stations covering the MCR and its adjacent area, surface wave ambient noise and teleseismic tomography is performed to produce Rayleigh wave phase velocity maps between 8 and 80 sec periods. Local dispersion information is then inverted to Vs models by jointly interpreting the receiver functions. Figure 1 (a) shows the Rayleigh wave phase velocity map at 28 sec period from ambient noise tomography (ANT), in which a slow anomaly is seen beneath the MCR area. In the resulting 3-D Vs model, a thickened crust is found beneath the MCR and is interpreted as the result of the post-rift compression episode.

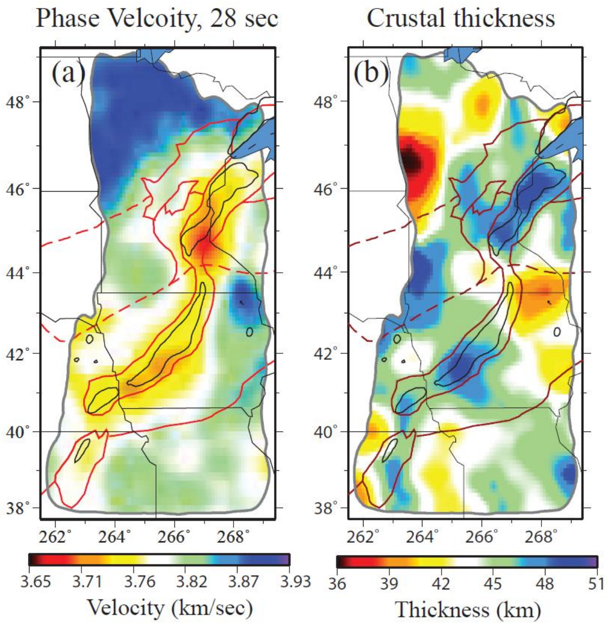

Figure 1 (a) Phase velocity map at 28 sec from ANT. Major geological boundaries/tectonic zones are outlined with red solid/dashed lines. (b) Map of crustal thickness. Thickened crust (>48 km) is found beneath the MCR. Variations of crustal thickness are also seen in the adjacent regions.

Another surface wave modeling result is near Juan de Fuca Ridge. Based on six months of OBS data from the Cascadia Initiative experiment, we obtain Rayleigh wave group and phase speed curves from 6 sec to 20 sec period from ambient noise cross-correlations along all inter-station paths. We fit the dispersion data by a simple age-dependent formula, and invert them for an age-dependent shear wave speed model of the crust and uppermost mantle. The mantle model possesses a low shear velocity zone with a velocity minimum at about 25 km depth at 0.5 Ma. Low velocities at young ages are lower than predicted from a half-space conductively cooling model (HSCM) and the lithosphere thickens with age faster than the HSCM. These results are consistent with the presence of partial melt at very young crustal ages and of non-conductive cooling processes, such as small-scale convection or advection of mantle fluids, at the older crustal ages considered.

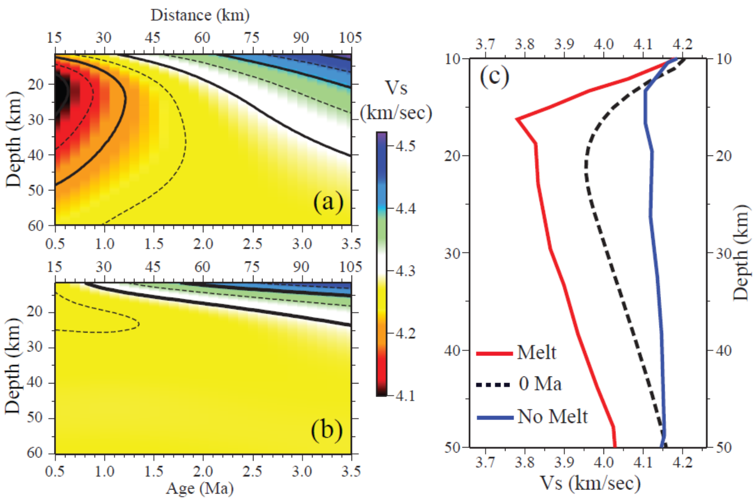

Figure 2. Comparison of (a) the estimated Vsv model and (b) a half-space conductive cooling model (HSCM) as a function of seafloor age.(c) Comparison of our extrapolated 0 Ma model (dashed line) in the mantle compared with two models from Goes et al. (2012): (blue) dry depleted mantle with no melt and (red) dry depleted mantle with 1% retained melt fraction.

Reference:

Ye, T., W. Shen, and M.H. Ritzwoller, Crustal and uppermost mantle shear velocity structure adjacent to the Juan de Fuca Ridge from ambient seismic noise, *Geochem. Geophys. Geosyst*., submitted.

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