Rayleigh wave attenuation in the central Pacific upper mantle from the NoMelt experiment

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Ocean basins record fundamental plate-tectonic processes, most notably the creation and evolution of oceanic lithosphere and its interaction with the underlying asthenosphere. The NoMelt array of ocean-bottom seismometers was deployed on ~70 Ma Pacific seafloor with the aim of characterizing the seismic and electrical structure of normal mature oceanic lithosphere-asthenosphere system. Analyses of surface-wave travel times have revealed that the seismic velocities within the array are strongly anisotropic (Lin et al., 2016; Russell et al., 2016), which complicates attempts to infer the thermal structure of the lithosphere and the volatile and partial-melt content of the asthenosphere from isotropic seismic velocity. We present the first measurements of seismic attenuation determined from the NoMelt data set. Rayleigh wave amplitudes and travel times were measured using the Automated Surface Wave Measuring System (Jin and Gaherty, 2015) in the period range 20-150 s. The amplitude data are corrected for the effects of propagation outside the array and used to solve for a single frequency-dependent attenuation coefficient within the array as well as a frequency-dependent term for each receiver. Preliminary results show that the Rayleigh wave attenuation nearly doubles between periods of 40 s and 50 s. A possible interpretation is that this abrupt change corresponds to the transition from low-absorption lithosphere to strongly attenuating asthenosphere. Inverting these values for depth-dependent shear attenuation allows the transition to be more accurately located in depth and inferences about lithospheric thermal structure and the presence of volatiles and melt in the asthenosphere to be drawn.

Keywords: attenuation, lithosphere, volatiles

