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Surface wave imaging of the Lithosphere Asthenosphere system beneath 0-80 My seafloor of the equatorial Mid-Atlantic Ridge from the PI-LAB Experiment

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The Passive Imaging of the Lithosphere Asthenosphere Boundary (PILAB) experiment is an ocean bottom seismic experiment designed to image the oceanic crust and upper mantle near the slow spreading equatorial Mid Atlantic Ridge to understand what defines the tectonic plate. Here we present surface wave analysis data from 37 ocean bottom seismometers deployed on 0-80 My old seafloor. We analysed Rayleigh wave and Love wave dispersion using teleseismic events and ambient noise. We find Rayleigh wave average phase velocities that range from ∼1.5 km/s at 5 s period to 4.31 km/s at 143 s, and fundamental mode Love waves with average phase velocities of 4.00 km/s at 5 s to 4.51 at 22 s. We invert these phase velocities for 1-D average radially anisotropic shear velocity structure and find a ∼60 km thick fast lid with velocities of 4.62 km/s, and ξ values up to 1.08 with radial anisotropy in the upper 200 km. Rayleigh wave azimuthal anisotropy is also detected, with 1-2% peak to peak anisotropy observed for the 2θ terms, and no significant 4θ anisotropy. Phase velocity maps from 18-45 s period show low velocities beneath the spreading axes, with increasing velocity on older ages. A 3-D shear velocity inversion reveals that a fast lid is required beneath the spreading axes, ∼30 km thick, with velocities of ∼4.1 km/s in the low velocity zone beneath the ridge. These velocities are slower than predicted by temperature effects and likely require some small melt fraction.