An Updated View of the Australian Lithosphere

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Key to understanding the evolution of the lithosphere in deep time is a full and complete structural view of it. The Australian continent has some of the oldest cratons in the world, juxtaposed with much younger Phanerozoic lithosphere. This makes it an excellent candidate to study how age and past deformational events affect lithospheric structure. Previous studies of the continent have revealed complex structure: shear wave splitting (SWS) results indicate low delay times and variable fast directions (Clitheroe and van der Hilst, 1998; Heintz and Kennett, 2005); receiver function (RF) work has shown stark contrast between Precambrian and Phanerozoic Australia (Ford *et al*., 2010). Despite some more recent regional studies of SWS, there has been no continent-wide study in over 10 years; similarly, a continent-wide receiver function study has not been carried out in nearly 10 years. In this time, more stations have been installed, stations have recorded significant amounts of additional data, and the techniques used have been improved. This study presents new Sp receiver function analysis, which is used to update older results from Ford *et al.* (2010). It also pairs Ps receiver functions and a new catalog of shear-wave splits to more completely characterize seismic anisotropy across the continent.

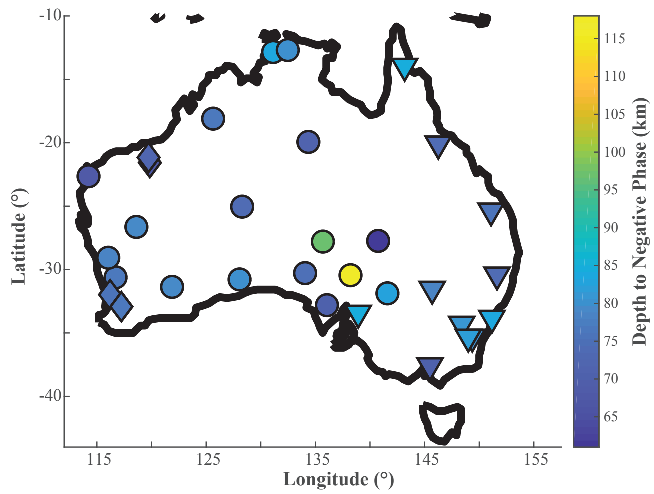

Figure 1: Depth to most prominent Sp receiver function negative phase. Stations plotted as upside down triangles have negative phases determined to be LAB, stations plotted as circles are MLDs, and stations plotted as diamonds were ambiguous or hard to determine.

In most continental regions, SWS fast directions mirror mantle flow and absolute plate motion, likely due to the formation of olivine LPO from shear at the base of the plate. This observation does not hold for Australia, where variable fast directions and delay times are seen. Our study has yielded results similar to those previously published, displaying the same variability from event to event. In addition to SWS, Ps receiver functions were calculated to constrain potential anisotropic structure at depth. Radial component RFs displayed large, broad negative phases beneath the Moho, it is yet unclear whether these phases are mantle structure or the result of crustal reverberations. Transverse component RFs showed generally small amplitudes, but complex signals that may indicate changes in anisotropy at depth.

To constrain the depth of mantle discontinuities, in part to better differentiate multiples from structure in Ps receiver function, Sp receiver functions were updated from Ford *et al.* (2010) for 35 stations spanning continental Australia. Prominent negative phases were observed between depths of 50 and 137 km, averaging 75 km in depth. Our results are overall in agreement with findings from 2010 – the key exception being western Australia, where negative phases are seen within the lithosphere-asthenosphere boundary range as predicted by local tomography models.