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Insights into lithospheric structure from shear wavespeed variations in the Australasian upper mantle

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Contrasting lithospheric structure is expected beneath old Precambrian shields, younger Phanerozoic terranes and the oceans. Surface wave tomography offers a means of investigating a particular aspect, e.g., shear wavespeed, of the uppermost mantle, which may then be related to the lithospheric structure.

The Australasian region is a natural platform for investigating the variations in lithospheric structure, comprising old Archaean and Proterozoic terranes in central and western Australia, Phanerozoic terranes in the east and surrounded by oceans. Using new surface wave data from recent temporary deployments of broadband seismometers, a shear wavespeed model of the region has been constructed. Variations in wavespeed are seen within the cratonic region. At 225km depth there appears to be a relationship between the gradients in wavespeed pertubations and the location of diamondiferous deposits, suggesting a link to lithospheric structure of the cratons. At shallower depths, a strong gradient in shear wavespeeds near the eastern margin of Australia may relate to the depth extent of the lithosphere, and gives a possible explanation for the bends in the hotspot tracks of the East Australian Plume System.

When interpreting tomographic models it must always be clear that the images represent models of the wavespeed variations; we cannot make direct assumptions about the horizontal and vertical extent of the lithosphere. However, in combination with other work, and in correlations with known geological features, there remains the strong link between higher seismic wavespeeds and the lithosphere.