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The Moho beneath the Precambrian terranes of Western Australia and implications for the formation and evolution of the crust

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The deep crustal structure across Western Australia has been determined using receiver function analysis of broadband records from temporary seismic stations. These stations were deployed in a series of experiments using both widely-spaced station configurations and denser coverage in the form of lines/groups of stations. The improved coverage obtained from the combined deployments allows investigation of seismic structure over the whole craton at a resolution greater than the scale of the main terrane groups. We are thus able to investigate the variations in crustal structure across the West Australian Craton in terms of craton assembly and crustal evolution.

We find remarkable consistency of structure within several of the individual Precambrian terranes. These are underlain by a sharp seismic Moho. We also find significant contrasts in structure between neighbouring terranes, such that several of the major tectonic units have a velocity profile that is a signature of that terrane or terrane group. Some systematic variability in seismic structure exists across more extensive terranes, notably towards the edge of the craton. The structure beneath orogenic belts is more variable and shows a less pronounced seismic Moho. It has been proposed that a very high degree of crustal reworking will produce a felsic lower crust, with a reduced seismic velocity, this would increase the velocity contrast across the Moho and provides a mechanism by which the very sharp discontinuites we observe may be formed. Our findings suggest that the seismic structure of Precambrian crust is fixed early in tectonic history, before craton assembly, and preserved through terrane accretion and the subsequent collision of the elements forming the Western Australia.