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Seismic structure of a late-Archean microcontinent in the middle of the Western Australian Craton

Huaiyu Yuan (1,2,3), Simon Johnson (2), Mike Dentith (3), Ruth Murdie (2), Klaus Gessner (2), Fawna Korhonen (2), and Thomas Bodin (4)

(1) ARC Centre of Excellence for Core to Crust Fluid Systems, Department of Earth and Planetary Sciences, Macquarie University, New South Wales 2109, Australia, (2) Geological Survey of Western Australia, Mineral House, 100 Plain Street, East Perth, Western Australia 6004, Australia, (3) Centre for Exploration Targeting, University of Western Australia, 35 Stirling Highway, Crawley, Perth, Western Australia 6009, Australia, (4) Univ Lyon, Universite Lyon 1, Ens de Lyon, CNRS, UMR 5276 LGL-TPE, F-69622 Villeurbanne, France

The Capricorn Orogen recorded the Paleoproterozoic amalgamation of the Archean Pilbara and Yilgarn cratons to form the Western Australian Craton. Regional surveys involving geological mapping, geochemistry, and geophysics reveal a prolonged tectonic history in craton assembly and subsequent intracratonic reworking, which have significantly re-shaped the orogenic crust. A high-density earthquake seismology deployment targeted the Glenburgh Terrane, an exotic late-Archean to Paleoproterozoic crustal block previously inferred from distinct structural and isotopic characters in the core region of the terrane. Prominent Moho and intracrustal discontinuities are present, replicating the overall trend and depth range found in the previous high-resolution deep crustal reflection image. Significant lateral variations in the seismic signal are found across the terrane boundary, showing a relatively thin crust (<40km) with small Vp/Vs ratios ($\sim$1.70) in the Glenburgh terrane, compared with the thickened (>40km) crust with elevated Vp/Vs ratios (>1.76) in the margin. The small Vp/Vs ratios ($\sim$1.70) are mapped terrane-wide, indicating a felsic bulk crustal composition. Considering the available constraints from isotopic age, magnetotelluric models and absolute shear wave velocities from ambient noise tomography, the Glenburgh Terrane is interpreted as a microcontinent made in the Archean, which however may have been altered during the WAC assembly and cratonization, as well as subsequent intracratonic reworking/magmatic differentiation processes. Our results illustrate that multi-disciplinary datasets bring complementary resolution and therefore may put tighter constraints on the tectonic processes that have affected the crust.