Geophysical Research Abstracts
Vol. 19, EGU2017-3099, 2017
EGU General Assembly 2017

Peering into the deep: Illuminating the crustal evolution of the Eucla basement and its relationship to the Albany-Fraser Orogen of southwest Australia.

Michael Hartnady (1,2,3), Chris Kirkland (1,2,3), Chris Clark (1,3), Catherine Spaggiari (4), and Hugh Smithies (4)

(1) Department of Applied Geology, Western Australian School of Mines, Curtin University, WA 6102, Australia, (2) Centre for Exploration Targeting – Curtin Node, Department of Applied Geology, Western Australian School of Mines, Curtin University, WA 6102, Australia, (3) Australian Research Council, Centre for Excellence for Core to Crust Fluid Systems, Australia, (4) Geological Survey of Western Australia, 100 Plain Street, East Perth, WA 6004, Australia

The Albany-Fraser Orogen is a ∼1200 km long east to northeasterly trending Palaeoproterozoic to Mesoproterozoic orogenic belt that defines the southern to southeastern margin of the West Australian Craton (WAC). The belt records a long and complex geological history spanning the break-up of Nuna between 2000 and 1700 Ma and amalgamation of Rodinia between 1300 and 1000 Ma. Recent geochronological, geochemical and isotopic work has shown that the Albany-Fraser Orogen formed through a protracted period of reworking of the margin of the Archean Yilgarn Craton (part of the WAC) with various additions of mantle-derived material.

The Cretaceous Bight and Cenozoic Eucla Basins partially overlie the northeastern part of the Albany-Fraser Orogen and completely cover ∼1000 km of crystalline basement (the Eucla basement) that separates the belt from the South Australian Craton. This basement constitutes the glue between the major building blocks of Proterozoic Australia, yet, its geological history is poorly understood.

New drill cores penetrating the basement have intersected interlayered granitic and gabbroic rocks that yield U-Pb zircon dates that are dissimilar to any magmatic ages from units within the adjoining Albany-Fraser Orogen, with the exception of the youngest, 1190–1125 Ma magmatic suite. In addition, mantle-like hafnium and neodymium isotopic signatures indicate that the rocks of the Eucla basement are dominated by new juvenile addition, and may represent an allochthonous terrane of oceanic heritage.

New εHf contour maps for the Albany-Fraser Orogen and Eucla basement highlight this difference. Time-slicing the isotopic dataset reveals a pattern of Palaeoproterozoic juvenile magmatism sub-perpendicular to the present day structural grain in the belt. If this marks the presence of an older lithospheric structure then it demonstrates the power that time-constrained isotopic mapping provides for illuminating lithospheric architecture through time. This may be particularly useful for unravelling crustal evolution in regions with complex tectonic histories.