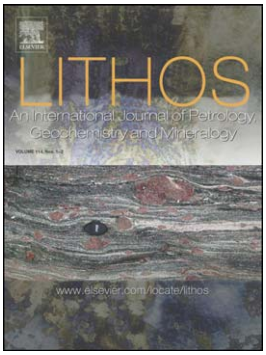

Proterozoic crustal evolution of the Eucla basement, Australia: Implications for destruction of oceanic crust during emergence of Nuna

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Proterozoic crustal evolution of the Eucla basement, Australia: Implications for destruction of oceanic crust during emergence of Nuna

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Abstract

The crystalline basement beneath the Cretaceous to Cenozoic Blight and Eucla Basins, in Western Australia has received comparatively little attention even though it lies on the eastern margin of one of the most mineral resource endowed regions on the planet. This basement is characterized by a complex geological evolution spanning c. 2 billion years, but paucity of outcrop and younger basin cover present a daunting challenge to understand the basement geology. In this work the composition of the unexposed Proterozoic crystalline basement to the Bight and Eucla Basins is investigated through zircon Hf isotopes and whole rock geochemistry from new drillcore samples. This region includes two geophysically defined basement entities: The Madura Province, containing: 1) **c. 1478 Ma Sleeper Camp Formation**, which has variable isotopic signatures including evolved values interpreted to reflect reworking of rare slivers of hyperextended Archean crust, 2) **1415–1389 Ma Haig Cave Supersuite**, with mantle-like isotope values interpreted as melting of subduction-modified N-MORB source, and 3) **1181–1125 Ma Moodini Supersuite**, with juvenile isotopic signatures interpreted to reflect mixed mafic lower-crustal and asthenospheric melts produced at the base of thinned crust. The Coompana Province, to the east of the Madura Province, has three major magmatic components: 1) **c. 1610 Ma Toolgana Supersuite**, with chemical and isotopic characteristics of primitive arc rock, 2) **c. 1490 Ma Undawidgi Supersuite**, with juvenile isotope values consistent with extensional processes involving asthenospheric input and 3) **1192–1140 Ma Moodini Supersuite**, with strong isotopic similarity to Moodini Supersuite rocks in the Madura Province.

This new isotopic and geochemical data shows that the Madura and Coompana regions together represent a huge tract of predominantly juvenile material. Magma sources recognised, include; 1) depleted mantle, producing MORB-like crust at c. 1950 Ma, but also contributing to younger magmatism; 2) recycled c. 1950 Ma crust reworked in primitive arcs and in intra-plate settings and; 3) minor evolved material representing fragments of