Zircon Provenance of Cretaceous Sandstones in the Perth Basin, Australia: A Cautionary Tale

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Testing a Paradigm

Implicit in numerous provenance studies is the idea that detrital zircon can not only allow identification of the source region, but that the youngest age obtained closely approximates the age of sedimentation. Both tenets become speculative when the rocks involved have undergone deformation and metamorphism, but can also be questioned in rocks that have not been subjected to either of these post-depositional processes.

Sediments whose depositional ages span the opening of the ocean between Western Australia and India in the late Early Cretaceous, were collected from the southern Perth Basin for provenance U-Pb detrital zircon analysis. The basin developed in the lower Permian over high-grade Paleoproterozoic rocks, bounded by the Darling Fault to the east and the Dunsborough Fault to the west. The former separates it from the Archean Yilgarn Craton and the latter from the Meso- to Neoproterozoic Leeuwin Block. Both could potentially have contributed detritus to the Perth Basin, as too could the continental mass that lay to the west before breakup – generally considered to have been Greater India [1].

Findings and Potential Sediment Sources

Six of seven sandstone samples record a range in $^{207}Pb/^{206}Pb$ zircon ages from ~470 Ma to ~3330 Ma, with discrete populations at 1150-1250 Ma and 1600-1750 Ma. Archean zircons are extremely rare (<15%), although the Yilgarn Craton is less than 15 km from the sample sites. Surprisingly, the remaining sample contains 100% Archean grains. Overall, the youngest zircon grains are ~330 to 2100 Myr older than the maximum time of sedimentation and give no clue as to the depositional age of the host rocks. The 1150-1250 Ma zircons are consistent with an origin from the Leeuwin Block [2], and the Archean ones from the Yilgarn Craton. The 1600-1750 zircon population resembles ages recorded in both the Eastern Ghats and Central Indian Tectonic Zone, suggesting these were derived from the continental landmass that lay to the west.

[1] Veevers et al. (1991) *Australian Jour. Earth Sci* **38**, 373-389. [2] Wilde & Nelson (2001) *GSWA Record* **2001/15**.