Paper Number: 4693

Resolving the evolution of long-lived orogens through laser-split stream ICP-MS of detrital accessory minerals preserved in successor basins

Armandola S., Reddy S. M, Taylor R., Clark C.

Department of Applied Geology, Curtin University, ,GPO Box U1987, Perth, WA 6845, Western Australia
(Email: sonia.armandola@curtin.postgrad.edu.au

The Mesoproterozoic Edmund Basin (1620-1456 Ma) lies between the Pilbara and Yilgarn cratons and comprises a sequence of sedimentary rocks that formed in the later stages of the evolution of the Capricorn Orogen during the amalgamation of the Western Australian Craton [1], [2].

Accessory detrital phases, hosted by a variety of sediments, can be used as tracers to address the sediment provenance, and find links between sediment deposition, crustal exhumation and erosion. In a complex regional study under the SIEF Distal Footprint Project, we present a new approach to sedimentary provenance analysis, through use of the Laser Ablation Split Stream-ICPMS (LASS-ICPMS) technique, that integrates age information and trace element geochemistry [3].

Initial stages of the study involved detailed core logging to assess facies relationships, depositional environment and interpret depositional processes. Samples for geochemical analysis were selected from the core and detrital zircon and titanite were extracted using SELFRAG electro-pulse disaggregation, NaPT heavy liquids and magnetic separation techniques. Mineral grains were characterised using the scanning electron microscope by atomic number contrast imaging and cathodoluminescence (CL). These data were used to inform the selection of specific sites for LASS-ICPMS.

The U-Pb ages and trace element data were obtained by LASS-ICPMS at the University of Santa Barbara, and link the sediments with many sources. The trace element compositions indicate that the host rocks of the detrital phases include granite, dolerite and some syenite. These units were probably exhumed and eroded during multiple tectonic reactivations and were then reworked and transported until deposition within the sequence. The most significant age populations suggest a younger depositional age for these sediments and correspond to the latest tectonic events in the region: the Mangaroon Orogeny of 1680-1620 Ma, the 1280-1250 Ma Mutherbukin Tectonic Event and the 1030-955 Ma Edmundian Orogeny [2].

References:

[1] Martin & Thorne (2004) Precambrian Research 128: 385–409.

[2] Dentith et al. (2014) GSWA 135 Report.

[3] Kylander-Clark (2013) Chemical Geology 345: 99-112