

REFINING THE LINKS AND STRATIGRAPHIC CORRELATIONS BETWEEN THE SOUTH NICHOLSON AND MCARTHUR BASINS: INSIGHTS FROM NOVEL METAL ISOTOPE CHEMOSTRATIGRAPHY AND IN-SITU Rb/Sr DATING OF GLAUCONITES

MINEX CRC PROGRAM 3

National Drilling Initiative

PHD PROJECT

University of Adelaide

PREREQUISITES AND INTERESTS

Geochemistry, geochronology, sedimentology and earth system evolution.

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RESEARCH PROJECT

The Proterozoic sedimentary sequences in the South Nicholson Basin and the underlying Isa Superbasin have potentially significant hydrocarbon and base metal reserves, which could be linked to similarly aged and better-explored resources hosted in the McArthur Basin. However, palaeo-depositional conditions (i.e., basin restriction/connection, salinity, palaeo-redox) and absolute ages of these inter-connected Proterozoic depositional systems remain relatively poorly constrained.

This project thus aims to apply (i) novel metal isotope proxies (stable Sr, Ca and Cr isotopes) in carbonates/shales, and (ii) in-situ RbSr dating of glauconites to further constrain the palaeo-depositional environment, redox-structure and stratigraphy/geochronology of the Proterozoic sedimentary sequences in the South Nicholson (Isa) and the McArthur Basins. Specifically, stable Cr isotopes in shales and carbonates will be used as sensitive palaeo-redox indicator; and stable/radiogenic Sr and Ca isotopes in carbonates will be applied to infer the relative restriction vs. connectivity of these depositional systems/basins with respect to each other, but also relative to the coeval Palaeo-Mesoproterozoic global ocean. The in-situ RbSr dating of sedimentary glauconites originating from (i) existing legacy material/cores from the McArthur Basin, and also (ii) new NDI materials recovered from the South Nicholson (Isa) Basin, will in turn refine the chronostratigraphy of these Proterozoic depositional systems.

The proposed PhD project will employ state-of-the-art mass spectrometry techniques such as TIMS and double-spike approach to analyse stable Sr, Ca and Cr isotopes in carbonates and shales, using the MIG (Metal Isotope Group) facilities at the University of Adelaide. The new in-situ RbSr dating of glauconites will be performed using LA system coupled with a new collision cell ICP MS/MS, hosted at Adelaide Microscopy Centre at the University of Adelaide.