

Academia-Industry-Government Collaborative Projects to Explore the Proterozoic Basins in Australia and their Sediment-Hosted Resources

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The Proterozoic depositional systems in Australia not only provide unique sedimentary archives of the Earth system and environmental/biological evolution on our planet in deep time, but these systems or basins also host vast and still relatively underexplored sedimentary-hosted mineral and energy resources. This contribution will present key outcomes and research highlights from the recently completed and/or ongoing collaborative ARC Linkage projects between academia, industry and government, focused on novel analytical techniques (e.g. in-situ geochronology, metal-isotope chemostratigraphy, etc) applied to problems relevant to improved basin exploration, including sediment-hosted resources in the greater McArthur Basin (NT) and the Centralian Superbasin (NT, WA and QLD).

Specifically, we will introduce and discuss the recently developed and relatively rapid and high-throughput laser-based geochronology techniques, which were applied to the above basins for direct dating of the Precambrian sedimentary rocks and their depositional and diagenetic histories (via in-situ Rb-Sr dating of shales/illite, glauconite, detrital feldspar, etc). These novel dating techniques are thus highly complementary to more established and popular geochronology tools, such as U-Pb zircon and carbonate dating, used for basin exploration. In addition, we will also illustrate the application of novel metal-isotope chemostratigraphy (e.g. Ca, Cr, Cd isotopes) in marine carbonates and organic-rich shales, along with more routine chemostratigraphy tools (e.g. C and Sr isotopes, elemental ratios), and how these various tracers and isotope proxies might get reset via fluid-rock interactions related to the formation of sediment-hosted ore deposits in the studied basins. Overall, this contribution will provide latest updates on the application of novel geochemical/isotope and geochronology tools to de-risk resource exploration in the Proterozoic Basins in Australia, while illustrating the benefits of highly collaborative research developed via ARC Linkage projects between the Universities, Geological Surveys, CSIRO, resource exploration companies, and manufacturers of analytical instruments.