NOVEL ISOTOPE TECHNIQUES FOR ONSHORE BASIN EXPLORATION: **REFINING CHRONOSTRATIGRAPHY OF THE CENTRALIAN SUPERBASIN**

MINEX CRC PROGRAM 3

National Drilling Initiative

PHD PROJECT

University of Adelaide

PREREQUISITES AND INTERESTS

Knowledge and skills in geochemistry, geochronology, sedimentology, and/or basin exploration techniques would be desirable, as well as interest in earth system science

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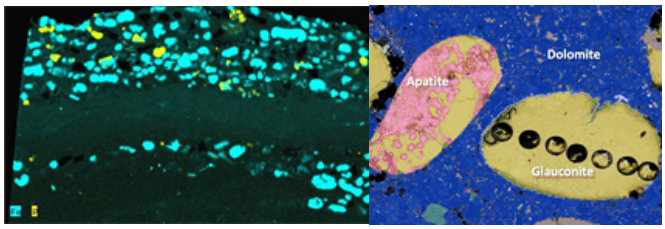
Figure: (left) Map of Fe-rich glauconite grains (blue) and P-rich apatite (yellow) hosted in a carbonate rock. (right) A close up view (BSE, Nanomin map) showing the association of glauconite (with laser-spots after in-situ RbSr dating) and apatite hosted in Precambrian dolomite.



RESEARCH PROJECT

The depositional history, paleogeography and hydrological connectivity of a large intra-cratonic 'Centralian Superbasin' (CS) which occupies central, southern and western Australia is complex and still relatively poorly understood. In addition, a general lack of macrofossils in Precambrian sedimentary records of the CS prevents robust and reliable intra-basin correlation based on biostratigraphy, which thus calls for the development of novel and alternative dating techniques and chemostratigraphy tools. Here we propose to apply new laser-based geochronometers, specifically in-situ Rb-Sr and K-Ca dating of glauconite (K- and Fe-rich marine green clays) which will be coupled with in-situ U-Pb and Lu-Hf dating of associated phosphorites/phosphates (biogenic apatite). Existing data show that such glauconite/apatite mineral association is quite common (see image below), especially in Precambrian and Ediacaran/Cambrian marine carbonates and sandstones; and could be thus used for such coupled dating, with pilot data showing consistent Rb-Sr and U-Pb ages. In addition, stable isotope composition of metals in glauconites (Fe, Mg, K) and phosphates (Ca, Sr) will be used as a new chemostratigraphy tool to test (i) hydrological connectivity of the CB depositional system (e.g., Amadeus, Officer, Georgina, Ngalia basins), and also to constrain (ii) processes leading to local and regional phosphogenesis as well as later postdepositional alteration and diagenetic resetting. Samples for this project will be collected from new MinEx NDI cores such as Cararra-1, but also from existing legacy cores archived at Geological Surveys, and possibly new field sampling campaigns. Existing and future HyLogger spectral data from NDI and legacy cores will be used to identify glauconite and phosphate-rich horizons to streamline the sampling process and select most suitable material for in-situ dating and further metal isotope analysis.