

## **In situ Rb–Sr dating and trace element analysis of glauconite-rich strata from the Arumbera Sandstone, Amadeus Basin**

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We present results of the novel in-situ (laser-based) rubidium-strontium dating of glauconite and apatite in glauconite-rich strata of the Arumbera Sandstone from the northeast part of the Amadeus Basin in central Australia. This study employs a new in situ rubidium-strontium geochronology technique, coupled with simultaneous collection of trace-element concentration data by laser ablation tandem mass spectrometry (LA-ICP-MS/MS)<sup>1</sup>. Prior to analysis, the micro-scale mineralogy and petrography of the samples were characterized by backscatter electron (BSE) images and mineral maps (SEM/EDS) (Figure 1).

Analysis of the authigenic phases returned an age of  $437.2 \pm 4.92$  Ma (Figure 2). Although the age is younger than expected ( $\sim 550$  to  $\sim 520$  Ma)<sup>2</sup>, it coincides with the early stages of the Alice Springs orogeny (450–300 Ma)<sup>2</sup>.

In addition, the Rare Earth Elements patterns revealed two different groupings. The apatite and mix (apatite-glauconite) mineral phases show an enrichment in middle REE (MREE in Figure 3), while the 'pure' glauconite shows a depletion in light REE (LREE), similar to documented REE patterns from marine pore waters reported by Smrzka et al. (2019)<sup>3</sup> characteristic for an iron redox zone in marine settings. Thus, we argue that the observed REE patterns are 'primary' and record the palaeo-redox conditions during the deposition of the Arumbera Sandstones and associated formation of early diagenetic glauconites and apatites within a sediment-water interface in a late Ediacaran/early Cambrian.

<sup>1</sup> REDAA, A., FARKAÅ, J., GILBERT, S., COLLINS, A. S., WADE, B., LÖHR, S., ZACK, T. & GARBE-SCHÖNBERG, D. 2021. Assessment of elemental fractionation and matrix effects

during in situ Rb–Sr dating of phlogopite by LA-ICP-MS/MS: implications for the accuracy and precision of mineral ages. *Journal of Analytical Atomic Spectrometry*, 36, 322-344.

<sup>2</sup> EDGOOSE 2013. Chapter 23: Amadeus Basin. In: M, A. & TJ, M. (eds.) *Geology and mineral resources of the Northern Territory*. Northern Territory Geological Survey.

<sup>3</sup> SMRZKA, D., ZWICKER, J., BACH, W., FENG, D., HIMMLER, T., CHEN, D. & PECKMANN, J. 2019. The behavior of trace element in seawater, sedimentary pore water, and their incorporation into carbonate minerals: a review.