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In situ Rb-Sr dating and REE patterns of Ediacaran glauconites and detrital feldspars from the Centralian Superbasin and the Flinders Ranges, Australia

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In situ Rb-Sr dating of silicate minerals and sedimentary rocks uses a laser ablation (LA)-inductively coupled plasma tandem mass spectrometry with a collision/reaction cell (LA-ICP-MS/MS)[1]to measure the 87Rb and 87Sr isotope abundances. This novel dating method is based on well-established radioactive decay of 87Rb to 87Sr via a negative beta pathway (the emission of an electron), with a half-life of 49.61 ± 0.16 Ga[2].

Here we present results from samples deposited in the Centralian Superbasin, corresponding to glauconite bearing Ediacaran to Cambrian marine sedimentary rocks: Arumbera Sandstone (Amadeus Basin), Dey Dey (Officer Basin). We also analysed the Ediacaran Wonoka Formation (Flinders Ranges from South Australia). Prior to in-situ Rb-Sr dating, the samples were mapped using high-resolution SEM/EDS imaging and mineral mapping3. The analysis of the glauconite from the Arumbera Sandstone returned an age of 441.4 ± 12.6 Ma. For the Dey Dey mudstone, the age of glauconite is 472.32 ± 7.57 Ma, and for glauconite from Wonoka Formation, the age is 491 ± 11.4 Ma. Although the ages are younger than expected stratigraphic ages (i.e., the latter ranging from ca. 580 to 520 Ma) they coincide with possible overprinting related to the Rodingan movement (~440 to 430 Ma)[3] and the Delamerian Orogeny (~500 to 480 Ma)[3].

In situ Rb-Sr dating and Rare Earth Elements (REE) analysis (via LA-ICP MS/MS) was undertaken also in detrital orthoclase grains from the Arumbera Sst. sample. Based upon Eu anomalies, the orthoclase grains with a positive Eu-anomaly are detrital and older (1158±76 Ma), than orthoclase with negative Eu-anomalies which are much younger (556±65 Ma) and thus of likely authigenic origin and age.

Our study shows the potential of the in situ Rb-Sr technique for dating detrital and authigenic K- and Rb-rich mineral components (i.e., glauconite and orthoclase) in marine sedimentary rocks, and for constraining their post-depositional diagenetic overprinting or alteration histories.

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