History of continental growth using detrital feldspars

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The development of *in situ* zircon dating provided a revolution in the understanding of continental growth. Zircons provide robust ages and can be analysed to provide initial Hf isotopic compositions, which reflects the nature of their protolith (e.g. Kemp et al. 2010, Dhuime et al. 2012). Yet the link between continental growth and plate tectonics remains enigmatic, as the isotopic tracers yielded by zircons do not readily distinguish growth at subduction zones from simple magmatic processes (see recent review of issues in Hawkesworth et al. 2020). We have developed a new means to address this long-standing problem. Using novel, collision cell multi-collector plasma mass-spectrometry, we can now date detrital potassium feldspar grains using the Rb-Sr system (Bevan et al. 2019). Not only does this approach allow us to examine the growth of the continents from a major, rather than accessory mineral, but coupled Pb isotope analyses on the same grains can yield the U-Pb evolution of the protolith. U and Pb are very differently fractionated by magmatic and subduction zone processes and therefore we will be able to assess the importance of subduction in the growth in the protoliths of the K-feldspars we date.

Fig. 1 We will collect detrital feldspars in river beds in Western Australia such as this

The studentship will exploit this exciting, new, *in situ* methodology. We will initially examine detrital feldspars transported from the Archaean Pilbara craton (NW Australia) and preserved both in Fortescue group sediments and modern rivers draining the craton (see Fig. 1). The results from this study will shape further locations to be studied. The project will involve training in cutting edge mass-spectrometry, micro-beam techniques for selecting the most suitable grains to analyse and fieldwork in Western Australia.

The project is fully funded for 4 years by an ERC grant. The successful candidate will be one of a cohort of three students due to start on the project in October 2021. The other students will research the mineral physics of isotope fractionation and numerical models of mantle convection as part of a multi-disciplinary endeavour to determine the onset of plate tectonics on Earth. As well as engaging in their own project, the successful candidate will closely interact with the other students, to help introduce them to isotope geochemistry and to learn from their expertise. This will involve regular meetings and extended exchanges between partners at Bristol, Oxford (Andrew Walker) and ETH Zurich (Paul Tackley). We are therefore seeking candidates with specific enthusiasm for sophisticated isotope analysis but with a broad interest in solid Earth Sciences and motivation to gain a multi-faceted training in the field.

References

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