Detrital K-Feldspar geochronology by collision cell MC-ICPMS/MS

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Detrital alkali feldspars offer huge potential to investigate the evolution of the continental crust. Representing a major component of the crust that records an integrated prior history in readily measured initial Pb isotopic composition [e.g. 1], detrital K-feldspar offers valuable, complementary perspective to well-established zircon approaches. The impediment to realising this promise is being able to date single crystals with the efficiency of modern zircon geochronology. Our development of *in situ* Rb-Sr dating by collision cell MC-ICPMS/MS removes this obstacle [2].

We use SF_6 as a reaction gas to ensure chemical resolution of Rb and Sr during analysis [3]. The *in situ* analysis requires the use of a mass filter, prior to the collision cell, to significantly reduce the vareity and abundance of unwanted isobaric interferences.

Our use of collision cell MC-ICPMS/MS technology enables the dating of single K-feldspar grains *in situ,* with age resolutions as low as 1%. We demonstrate using a K-feldspar, from the Shap Granite, the ability to produce internal isochrons from single grains that are within uncertainty of the Rb-Sr age and $^{87}Sr/^{86}Sr_i$ determined for the intrusion. This *in situ* Rb-Sr dating of single K-feldspar can be achieved, despite a relatively low intra-grain range in Rb/Sr, due to the high precision measurement of $^{87}Sr/^{86}Sr$ achievable with MC-ICPMS. Here we also exhibit the first application of this approach on detrital K-feldspars from the ~1Ga arkosic sandstone from the Applecross Formation. The K-feldspar grains within the sandstone reveal a broad age spectrum with multiple age peaks. These peaks range from 1.1Ga, associated with Grenvillian magmatism, to 2.3Ga, which are interpreted as being derived from the underlying Lewisian Gneiss. This proof of concept for single grain *in situ* Rb-Sr dating of K-feldspar provides a powerful new tool for detrital geochronology.

[1] Tyrrell et al. (2006) *Journal of Sedimentary Research*, *76*, 324-345
[2] Bevan et al. (2019) *AGU Fall Meeting 2019*. AGU.
[3]Cheng *et al*. (2008) *Analytica chimica acta*, 627 148-153