

## **Braking the scale of *in situ* Pb isotope microanalysis down to 10 µm spot size: A comparison of SIMS and LA-MC-ICP-MS**

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Lead isotopes have been used in the Earth Sciences for decades, e.g., to trace magmatic processes, to unravel the genesis of ore deposits, or to constrain the secular evolution of the Earth's crust and mantle. Lead isotope ratios (i.e.  $^{206}\text{Pb}/^{204}\text{Pb}$ ,  $^{207}\text{Pb}/^{204}\text{Pb}$  and  $^{208}\text{Pb}/^{204}\text{Pb}$ ) can be measured *in situ* by SIMS, or by laser ablation coupled with a MC-ICP-MS. For both techniques, the precision and the accuracy of the measurements crucially depend on the sensitivity/stability of the instrument, the concentration of Pb in the sample, and the amount of material that can be analysed *in situ*.

The geochemical information that is preserved within zircon inclusions allows deciphering the evolution of the continental crust through time using unexplored ways. Delavault et al. (1) analysed Pb isotope ratios in K-feldspar inclusions within zircon by SIMS. Using this technique they were able to measure inclusions with a 40 µm spot size. Analyses with 2-sigma errors of ~2 % for both the internal precision and the external reproducibility of the measurements were achieved for K-feldspar with typical Pb concentrations of 40–100 µg/g. Unfortunately, most K-feldspar inclusions in zircon are smaller than 20–30 µm and could not be analysed by SIMS.

We present a new routine procedure to analyse Pb isotopes in K-feldspar by LA-MC-ICP-MS, with a spot size down to 10 µm diameter. Natural K-feldspar grains from the Shap granite (north England) were selected for their homogenous Pb isotope composition (1, 2). The Faraday cups (FC) of the ThermoFinnigan Neptune+ MC-ICP-MS were used to collect the beams for spot sizes of 150 µm and 40 µm. The average  $^{206}\text{Pb}/^{204}\text{Pb}$  ratios are  $18.260 \pm 0.29\%$  and  $18.23 \pm 1.5\%$ , respectively (2 s.d.). Ion counters (IC) give an average  $^{206}\text{Pb}/^{204}\text{Pb}$  ratio of  $18.28 \pm 1.6\%$ , for a spot size of only 10 µm. The precision and the accuracy of the Pb isotope ratios measured at 40 µm (FC) or 10 µm (IC) are similar to those obtained by SIMS. Finally K-feldspar inclusions within zircon were analysed by both SIMS and LA-MC-ICP-MS, and the Pb isotope ratios obtained via both methods are similar within error.

(1) Delavault H et al. *Geology*, 2016, 44, 819-22. (2) Tyrrell S et al., *Journal of Sedimentary Research*, 2006, 76, 324-345.