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Albany K-feldspar: A new Pb isotope reference material to unravel the evolution of old cratons

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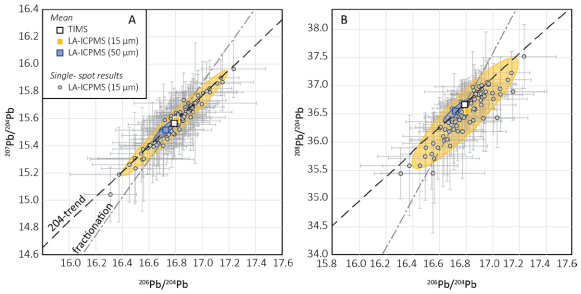

Figure 1. Albany K-feldspar TIMS and LA-MC-ICPMS results. Errors of individual analyses are shown at 2SE level. Error ellipses indicate 95% confidence of the LA-MC-ICPMS means. Dashed lines indicate the effects of the ^{204}Pb-^{204}Hg isobaric interference and mass dependent fractionation on the measured values.

The isotopic signature of initial Pb, i.e. Pb that does not result from in situ radioactive decay but is incorporated into the mineral or rock at the time of formation, provides valuable insights into crustal evolution and structure. Minerals that readily incorporate Pb but reject U and Th from their crystal structure (e.g. K-feldspar) can yield initial Pb isotope compositions owing to negligible radiogenic ingrowth post-crystallization, and are potentially powerful isotope tracking tools. In situ analysis of Pb isotopes via laser ablation multi-collector inductively coupled plasma mass spectrometry (LA-MC-ICPMS) enables rapid data acquisition. However, to validate results of in situ analysis, and to evaluate external reproducibility of Pb isotope data between different laboratories, well characterized, matrix-matched primary and secondary reference materials are vital. Currently, there is only one widely available reference material for Pb isotope analysis of K-feldspar: K-feldspar from the Shap granite, northern England, whose Pb isotopic composition has hitherto only been determined using LA-MC-ICPMS [*1*]. Moreover, high-precision LA-ICP-MS analyses have revealed subtle inter-grain Pb isotope heterogeneity in Shap K-feldspar [*2*].

We use double-spike thermal ionization mass spectrometry (TIMS), which offers the highest currently achievable precision, in conjunction with LA-MC-ICPMS, offering high spatial resolution to further constrain the Pb isotope composition of Shap K-feldspar and evaluate Albany K-felspar as a new Pb isotope reference material. We use these two reference K-feldspars to calibrate and validate the results of LA-MC-ICPMS analysis of Pb isotopes in K-feldspar from Precambrian crustal blocks in central and eastern Australia using a spot size down to 15 µm. Our results thus highlight the feasibility of in situ K-feldspar Pb isotope analysis at high spatial resolution to resolve questions related to source and evolution of ancient crust.

References

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[2] H. Delavault et al. (2018). *J. Anal. At. Spectrom.* **33**, 195–204.