Laser ablation acquisition protocols and non-matrix matched standardisation of U-Pb data

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Interest in accessory mineral geochronology using laser ablation ICP-MS techniques has increased greatly in recent years. Standardisaton of these analyses generally requires matrix matched material to characterise the Pb-U fractionation processes occurring at both the ablation site and within the plasma of the mass spectrometer. Currently only a few zircon ablation standards are internationally accepted and even homogeneous in-house standards of other accessory minerals such as monazite, titanite and allanite which could be used in tandem, are difficult to verify.

We show data which indicate that use of a dynamic ablation protocol as opposed to the static spot approach, can allow non-matrix matched standardisation of U-Pb data. A 193nm solid state (UP193SS, New Wave Research) laser ablation system coupled to an Axiom MC-ICP-MS (VG Elemental) was used to cross calibrate several zircon standards and in-house accessory minerals whose ages were previously determined by ID-TIMS. Laser ablation U-Pb data reproduced to 3% (2SD) during each analytical session. Results from rasters through to single-spot ablations over a spatial resolution of 35-100um demonstrate that zircons can be used to standardise monazite and xenotime data using a dynamic ablation protocol, whilst static ablations require matrix matched standards.

Whilst high-spatial resolution is the ideal in most laser ablation geochronology studies, some applications can tolerate a reduced spatial resolution and/or require analysis of minerals without the availability of well characterised matrix matched standard materials. In these circumstances, use of another well known, well characterised material may be appropriate combined with a dynamic ablation and other protocol constraints to determine the U-Pb ratio of the material. A thorough understanding of the processes which control the nature of this ablation may allow this approach to be used in standardising other applications and other inter-element isotope systems.