

## U-Pb dating of detrital zircons by laser ablation inductively coupled quadrupole mass spectrometry

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The use of LA-ICPMS has become increasingly popular for U-Pb dating of zircons and offers several advantages over TIMS and SIMS methods: decreased sample prep and data acquisition time and increased cost effectiveness [1]. Although many labs utilize magnetic sector instruments for enhanced sensitivity and higher mass resolution, next-generation quadrupole-based ICPMS instruments have the potential to yield comparable U-Pb age data of zircon. To demonstrate this, we are using a Varian 810 Quadrupole coupled with a Cetac 213 nm wavelength laser. The Varian ion optics include a 90° off-axis ion mirror that focuses the ion stream into the mass analyzer allowing more than 80% of the ions to be transported through the ion optics resulting in high sensitivity. The detector consists of an all digital, extended-range, scaling pulse detector developed by ETP Electron Multipliers [2]. The detector design consists of an ion-to-electron conversion section (conversion dynode) followed by a controllable electron attenuation section. A 9-decade dynamic range and linear response of the detector is the result of the controllable electron attenuation section which can vary the ion detection efficiency from 90% down to .001%. Tests with variable concentration natural U solutions where the  $^{238}\text{U}$  intensity would vary across all of the detector attenuation thresholds but the  $^{235}\text{U}$  intensity would always be unattenuated indicate that there is no measureable bias in the measured  $^{235}\text{U}/^{238}\text{U}$  ratio due to signal attenuation. This test ensures suitability for isotope ratio measurements that require a substantial dynamic range (e.g., U/Pb and  $^{206}\text{Pb}/^{204}\text{Pb}$  ratios in zircon).

The results of our tests with various-aged zircon standards: temora-2, peixe, stettin-1, FC5z (Duluth Complex), indicate that we can perform *in situ* U-Th/Pb age measurements with external reproducibility of <1% (2SD) for pooled ages, using a 25 to 50 $\mu\text{m}$  spot size. Errors of individual ages (single spot analyses) are generally between 1-7% (2SD), making this technique ideal for sediment provenance studies as well as dating zircon-bearing igneous rocks.

[1] Gehrels *et al.* (2006) *Paleo. Soc. Pap.* (11) [2] Stresau and Hunter (2001) *SGE Tech.* article TA-0103-A.

## Subduction-related B and H isotope fractionations across the Mariana arc: Consequences for recycling

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We present new B and H isotope data, along with volatile, trace and major elements for olivine-hosted melt inclusions from a suite of cross chain volcanoes extending across the Mariana arc from Guguan volcano to the Mariana Trough. H and B isotopes, H<sub>2</sub>O, CO<sub>2</sub>, S, F and Cl abundances, as well as trace elements, have been determined by SIMS. Our results show that enrichments in fluid-mobile elements generally associated with the subducting slab (e.g., Ba, B) decrease systematically across the arc into the back-arc. However, water contents in cross-chain samples, 230 km above the subducting slab, show similar values to the arc-front samples, implying that water release is a continuous process across the arc and that trace element proxies for slab fluids are decoupled from actual water contents. The isotopic composition of water changes during progressive dehydration, as expected [1];  $\delta\text{D}$  values are highest at the arc front,  $\sim -10\text{‰}$ , and decrease to values as low as  $-80\text{‰}$  in the back-arc. Likewise, B isotopes decrease systematically from  $\delta^{11}\text{B}$  values as high as 5.9-8.5‰ at the arc front, consistent with values previously reported for Guguan arc front lavas ( $\delta^{11}\text{B} = 5.0\text{-}6.2\text{‰}$  [2]), down to values as low as  $-14\text{‰}$  in back-arc melt inclusions, extending beyond the range inferred for MORB ( $-5$  to  $-9\text{‰}$  [3]) and to values observed in OIBs (down to  $-15\text{‰}$  [4]).

Our observations demonstrate that fluid release behind the main volcanic front can be substantial and that the dehydration process has fractionated H and B isotope compositions. Our findings suggest that B and H isotopes of OIBs containing recycled slab components would be low.

[1] Shaw *et al.* (2008) *EPSL* 275, 138-145, [2] Ishikawa and Tera (1999) *Geology* 27, 83-86 [3] leRoux *et al.* (2003) *Abstr. Fall AGU #V51A-03* [4] Chaussidon and Marty (1995) *Science* 269, 383-386