Improved multi-ion-counting capabilities for high sensitivity U-Pb LA-MC-ICP-MS zircon geochronology

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The Thermo Scientific NEPTUNE *Plus* with Jet Interface option has been shown to significantly enhance LA-MC-ICP-MS sensitivity for hafnium isotope ratio analyses [1, 2], allowing precise and accurate Hf ratios to be determined from 25 μm diameter laser ablation spots (within 100 ppm 2RSD). The high sensitivity Jet and X-cones have also been used to enhance Hf isotope ratio sensitivity on a NEPTUNE *Plus*, whilst U-Pb ratios were analysed from a split flow to a Thermo Scientific ELEMENT XR [3].

In this poster we present U-Pb data from the NEPTUNE *Plus* with Jet Interface option. The sensitivity enhancement can be used to collect U-Pb ratios on Faraday cups from larger ablation spots, or for small spot sizes using multi-ion-counting. We use an array of new Compact Discrete Dynode (CDD) electron multipliers in combination with classical large-scale Secondary Electron Multipliers (SEM). The new CDDs have the same performance characteristics as the classical SEMs used in the NEPTUNE *Plus* and TRITON *Plus*.

The multi-ion-counting package allows for simultaneous analysis of ^{202}Hg, ^{204}Pb, ^{206}Pb, ^{207}Pb, ^{208}Pb and ^{238}U on the electron multipliers. If desired, also ^{232}Th and ^{235}U can be detected along on additional CDD multipliers. The detector catching ^{206}Pb is a dual detector; ^{206}Pb can be detected in either an SEM or Faraday. This setup gives full flexibility for the analysis of zircons, where ^{206}Pb is the most abundant Pb isotope.

This contribution will present U-Pb data on zircon standards as well as analytical and instrumental challenges relating to the laser ablation process, the plasma interface and the multi-ion-counting detectors will be discussed.

[1] Lloyd *et al.*. (2011) *Min. Mag.* **75**(3), 1351. [2] Hu *et al.*. (2012) *J. Anal. At. Spectrom.* **27**, 1391-1399. [3] Tollstrup *et al.*. (2012) *Geochem. Geophys. Geosyst.*, **13**.

Arsenic release from red mud affected soil-water systems

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Red mud is a highly alkaline waste product from bauxite ore processing. It contains elevated concentrations of several oxyanion forming elements such as Al, As, V and Mo that are mobilised at high pH. The tailings dam breach at Ajka, western Hungary, released ~1 million m^3 of toxic red mud into the Torna and upper Marcal valleys. As part of the initial clean-up, some thinner red mud deposits (< 5 cm) were ploughed into fields to prevent dust formation and some wetland areas were left untreated.

We used anaerobic microcosm experiments to determine the mechanisms of As release from red mud mixed with uncontaminated soils. Soils from unaffected locations in the Torna and upper Marcal valleys were mixed with Ajka red mud at two different ratios (9 % and 33 % red mud), with soil only incubations as controls. XAS spectroscopy and HPLC-ICP-MS was used to determine changes in As oxidation state.

After 180 days the water in soil-only control microcosms contained ~ 200 μg L^{-1} As, of which ~50% had been converted to As(III) as a result of microbial As(V) reduction. However, dissolved As concentrations in red mud effected systems reached only 100 μg L^{-1} after a similar time period, all as As(V), despite microbial Fe(III)-reduction being observed. When red mud is added to soils there is an initial rapid increase in dissolved As concentrations that correlates with microcosm pH. However, concentrations at equilibrium are independent of both microcosm pH and red mud loading and are ultimately controlled by the dissolution of inorganic-arsenate host phases from the red mud.

This study shows that although As in red mud is not bioavailable, the slow leaching of As from red mud / soil mixtures at circum-neutral pH will in time result in an overall increase in the amount of aqueous As(V) present in affected environments. In addition, the use of red mud as a soil amendment should be carried out with caution as even low loadings of red mud may result in As-release at problematic concentrations.

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