Multiple Collector Inductively Coupled Plasma Mass Spectrometry (MC-ICPMS): Accurate, Precise and Rapid Measurement of Pb and Th Isotope Ratios

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Advances in MC-ICPMS analytical techniques using Micromass Isoprobe® with hexapole collision cell yield a ~1 ev ion beam and flat-topped peaks across a broad multi-FC array. Sensitivity >$1x10^{10}$ cps Pb^+ per ppm of Pb gives an efficiency of 1 ion:130 atoms. With LA, Isoprobe® has potential to revolutionize *in situ* U-Pb geochronology. However, prior to application of LA, capacity to generate accurate and precise isotopic ratios must be demonstrated.

50 ppb solutions of NBS 981 and 982, spiked with 5 ppb Tl, were analyzed by Isoprobe® at UQ. Taking baselines at ±0.5 amu, Pb isotope ratios are identical to other MC-ICPMS data but not with TIMS data. When on-peak zeros (to correct for Hg in the Ar and Pb memory from the sample introduction system) and ±0.5 amu baselines are combined, standards yield results within error of double and triple spiked TIMS data. More importantly for *in situ* LA zircon applications, Isoprobe® analyses of 12 ppb NBS 983 solutions yield a mean $^{206}Pb/^{204}Pb = 2700.4\pm19.5$ (1σ) using < 0.4 ng during data acquisition, representing 0.5% external precision and 0.18% accuracy. Accurate and precise Pb isotope ratios can thus be obtained by Isoprobe®, correcting for fractionation using IUPAC Tl isotope composition, providing correct methodologies are applied for blank subtraction.

Isoprobe® is also applicable to U-series geochronology, yielding enhanced Th sensitivity: >$3.7x10^9$ cps/ppm (1 ion:345 atoms) cf. (1 ion:2000 atoms TIMS). UCSC Th-α analyzed by WARP filter-ion counting Daly Isoprobe® yielded comparable results in 5 min. to that achieved by TIMS in 5 hours; consuming <3 ng Th, cf. 250 ng Th viz. $^{232}Th/^{230}Th=170,539\pm1478(2\sigma)$ [Isoprobe]®cf.$^{232}Th/^{230}Th=170,545\pm1345(2\sigma)$ [TIMS].