In-Situ U-Th Dating of Speleothems and Corals using Laser Ablation MC-ICPMS

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The determination of U-Th ages has become increasingly important to constrain the timing of secondary carbonate formation, with recent advances on age screening and U series open system verification on the micro-scale. Hence, in-situ laser ablation studies can provide high resolution trace element profiles but also constrains on carbonate ages. Here we report on first results on the quality of U and Th isotope measurements and trace elements obtained using a 193 nm laser ablation system (New Wave Research - NWR193^{UC}) equipped with a two-volume cell coupled to a MC-ICPMS (Thermo Fisher Neptune Plus).

Important features of the laser ablation system and the mass spectrometer are systematically evaluated, such as its ion transmission, element and mass fractionation, sensitivity and oxide rates. The sensitivities achieved so far range between 0.5 cps/ppm and 2.0 cps/ppm. The resulting uncertainty on the $^{230}Th/^{238}U$ ratio needed for age determination is below 5 % for stalagmites and coral samples (>30 ka) with a uranium concentration above 2.5 µg/g. Other samples containing far less U yield uncertainty within 5 - 20 % depending on the ^{230}Th content. $^{234}U/^{238}U$ ratios can be determined within 30 ‰ of the values obtained by conventional methods. This allows us to quantify U and Th elemental variations on scale of ~ 100 µm with % precision and yields ages and age uncertainties in agreement with conventional MC-ICPMS measurements of 3.3±0.7ka to 132±2.5 ka. We further explore the possibilities using novel 10^{13} Ohm resistors for simultaneous data collection on Faraday Cups.