

Isotopic ^{238}U - ^{234}U - ^{232}Th - ^{230}Th analysis using LA-ICPMS for direct U/Th dating of millennium stalagmites

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Here we present high sensitivity, *in situ* Th and U isotope ratio determinations in carbonates using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS). Online addition of a well characterized ^{229}Th - ^{233}U - ^{236}U isotopic spike to the laser generated aerosol by means of a desolvating nebulizer enabled to monitor and correct for mass discrimination and elemental fractionation effects of U and Th. The efficacy of inter-element, mass discrimination, and peak tailing baseline corrections were critically evaluated and optimized. Using a “jet” interface ICPMS setup improved the detection efficiency to a yield of 1-2%. Thereby sufficiently high signal intensities have been achieved even for the low abundant isotope ^{230}Th in stalagmites as young as 5,000-year-old with uncertainties ($2\sigma_M$) better than ± 200 years. A flowstone sample in secular equilibrium, collected from Northern Calcareous Alps, was analyzed to verify the approach and activity ratios of 1.011 ± 0.066 ($2\sigma_M$) for $^{230}\text{Th}/^{238}\text{U}$ were obtained. This approach allows for the reconstruction of accurate age profiles for younger carbonates in particular, and could be applied for the better understanding of past millennium climate variabilities.