Inter-laboratory comparison of a potential reference material for U/Th geochronometry by MC-ICPMS

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The application of U/Th geochronometry in biogenic and chemically precipitated carbonate rocks has grown exponentially owed to the advances in MC-ICPMS over the last two decades. As more academic and commercial laboratories adopt this geochronology tool to investigate earth surface processes during the late Pleistocene, establishing inter-laboratory reference material that cover a wide range of U and Th concentrations has become a crucial step towards standardization of this method.

To that end, this study focuses on a speleothem specimen as a potential reference material using U/Th geochronometry methods developed for MC-ICPMS. The BSS-2 sample, which is the base of a massive flowstone slab from a cave in North Norway, was ground into powder, homogenized, and analyzed using different digestion and ion-resin chromatography separation protocols. Dating of the BSS-2 subsamples were employed by MC-ICP-MS instruments at the University of Miami, University of Mainz, and CENIEH. The yield factor based on the ion chromatography protocol varied between 85 and >95%. U-series analysis on BSS-2 led to uncertainties ranging from approximately 0.2-2% due to the Beta-factor and the chosen U and Th standard bracketing procedures for the BSS-2 aliquots that were measured in different laboratories. The U-Th ages were 122.8 ± 3.3 ka (University of Miami, n=1), 124.5 ± 0.3 ka (University of Mainz, n=3) and 123.9 ± 3.2 ka (CENIEH, n=3) with no correction required ($[^{230}Th/^{232}Th]$ >500 in all cases). Within the limited number of analyses, the good agreement of the preliminary U-Th ages of BSS-2 aliquots obtained by three different laboratories suggest that the BSS-2 is a suitable reference material for U-Series analysis of calcium carbonate.