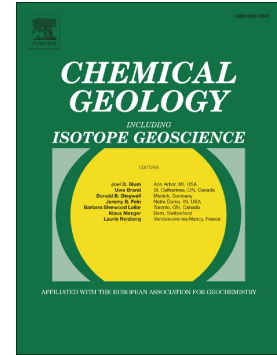


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High precision U-series dating of scleractinian cold-water corals using an automated chromatographic U and Th extraction

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U-series dating, prepFAST-MC, cold-water corals, South Atlantic, Angola, past climate

Abstract

High-precision U-series dating of scleractinian cold-water corals is a key chronological tool for studies of past environmental and climate conditions. Here, we tested and optimized an automated chemical extraction system (ESI prepFAST-MC equipped with an Eichrom TRU-resin chromatographic column) for its ability to purify U and Th isotopes for mass spectrometric U-series dating at the sub-‰ precision level. Chemical yields are constantly high, on average around 90 % for both U and Th. Analytical blanks are comparable to manual purification (< 0.15 pg U, 0.15 pg Th for a typical sample of 50 mg) and memory effects due to the recycling of the column are mostly insignificant as the carry-over fraction is about 10^{-5} for Th and 10^{-3} for U isotopes. However, it was found that the built-in UTh (TRU-resin) column must be pre-conditioned for analysis using $> 1 \mu\text{g g}^{-1}$ Th and U in order to achieve the above mentioned chemical yields. This conditioning has no impact on the Th/U data. The automated chemical preparation protocol described here is compared to conventional ultra-high precision U-series dating with manual sample purification. For the 34 cold-water corals extracted from a sediment core collected from a coral mound off Angola, the differences between $^{230}\text{Th}/^{238}\text{U}$ - and $^{234}\text{U}/^{238}\text{U}$ -ratios and U-series ages measured with the two analytical methods are smaller than the respective analytical uncertainty of less than 3.0 ‰, 0.8 ‰ and 3.0 ‰, respectively. Overall, ages of the studied corals span 34,000 years and perfectly meet quality control constraints, such as initial seawater $\delta^{234}\text{U}_0$. Finally, our record of coral ages indicates vigorous coral growth under warm and cold climate conditions in the temperate south-eastern Atlantic, contrasting climate influenced coral occurrences in the north-eastern Atlantic.

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