A new fully automated sample preparation system for the isotopic analysis of Sr, Pb and Nd via MC ICP-MS and its application to sediment digests

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Sr, Pb and Nd are three elements with isotopic compositions that are intensively used in geochemistry. Furthermore, they are also of specific interest in the field of marine geochemistry, as they allow the tracing of the geological origin of sediments (Sr, Nd, Pb) as well as the tracing of anthropogenic emissions (Pb).

Especially sediment and rock digests contain various matrix elements at high concentrations (e.g. Si, Al, Fe or Ca). These have to be separated from the analytes of interest, since measurements of isotopic ratios via MC ICP-MS suffer from isobaric polyatomic as well as matrix-related interferences. Established separation protocols are often time-consuming and cost-intensive.

This issue is adressed by the prepFAST-MC® sample preparation system (Elemental Scientific, Omaha, Nebraska, USA) which is a fully automated, column based chromatographic separation system. Within this work, an optimized sample preparation protocol for the separation of Sr, Pb and Nd in sediment digests, based on the DGA resin (TrisKem International, Bruz, France) using the prepFAST-MC®, is presented.

The new, optimized method allows to separate three isotopic systems within a single analytical run, which helps to save time and effort compared to manual separation techniques. The separation scheme was applied to sediment digests with high recovery rates (Sr >95%, Pb >90%, Nd >95%) and low separation blanks. The optimized sample preparation protocol was applied to selected sediment samples from the German river Elbe and subsequent establishment of isoscapes as basis to trace the origin and fate of sediments in the German North Sea catchment.