Leaching deep sea sediments for the reliable extraction of seawater-derived neodymium

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The reconstruction of the ocean's circulation in the past is crucial for an understanding of its interaction with the climate system as a whole. The analysis of seawater-derived neodymium isotopes ($^{143}Nd/^{144}Nd$, expressed as ε_{Nd}) in marine sediments provides a unique proxy for deep water provenance studies in particular in the Atlantic [1]. Obtaining past local bottom-water ε_{Nd} from authigenic phases associated with foraminiferal tests has lately become the most reliable method available [2]. Attempts have also been made to extract the Nd-rich authigenic metal fraction by reductive leaching from bulk sediment, thereby using this proxy with less effort, in the highest possible resolution and in sediments where foraminifera are not sufficiently present [1]. However, at several sites other sedimentary components were also leached in the process and contaminated the extracted Nd [3] [4].

In this project one conventional leaching method was graduated into small sub-steps and applied to a range of different Atlantic sediments in order to investigate the laboratory leaching behaviour in detail. Our results show that a foraminiferal Nd signature can be extracted from bulk sediment by a very simple short and gentle weak leach without prior removal of carbonates. Contamination from leachable volcanogenic phases occurred in several sediments later in the process after all carbonates had been removed, but could be traced with elevated Al/Nd ratios. Contamination by non-biogenic carbonates, on the other hand, could clearly be identified by low Sr/Ca ratios. Rare earth element (REE) patterns, however, were not indicative of non-authigenic contamination. On this basis, a simplified, revised leaching procedure is proposed, which can extract seawater-derived Nd from a wide range of different deep sea sediments.

[1] Böhm *et al*. (2014), *Nature* **517**(7532), 73–76 [2] Roberts *et al*. (2012), *GCA* **94**, 57–71 [3] Elmore *et al*. (2011), *G³* Vol. **12/9** [4] Wilson *et al*. (2013), *GCA* **109**, 197-221