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Exploring the potential of authigenic clay minerals in Atlantic sediments as a novel source of rare earth elements

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Rare earth elements (REEs) are a vital component of modern technology that have been instrumental in driving technological advancements over the past century. However, the growing demand for REEs in production, coupled with a lack of efficient substitutes and an unstable global supply chain, poses significant threats to both economic and national security. To address the vulnerability associated with the global supply chain for REEs, we are faced with the need to explore and develop new sources of REEs for commercial production. Deep-sea sediments have demonstrated considerable potential as an alternative source for REEs, with past studies recording ΣREY values as high as 22,000 ppm in the Pacific Ocean[1] and a benthic flux of REEs at the sediment-water interface driven by clay authigenesis and dissolution[2]. Despite numerous studies investigating the REE potential of marine sediments in the Pacific and Indian oceans, our knowledge regarding the REE content of sediments in the Atlantic Ocean remains limited. Here, we aim to characterize the REE signature of glauconitic sediments from the Atlantic continental shelf and slope and assess their potential as a novel source of REEs. Elemental analysis revealed REE signatures consistent with previously established REE patterns for glauconite[3,4] while XRD analysis confirmed an average composition of 55% authigenic material among the samples, suggesting that clay authigenesis was the primary factor influencing REE signature and further supporting the proposed role of clay authigenesis and dissolution as a significant benthic flux of REEs. However, with an average REE concentration of 271 ppm, these samples are unlikely to represent a promising REE resource. Despite the controlling influence authigenic clay minerals exert on REE cycling at the sediment-seawater interface, their limited capacity to incorporate REEs makes them an unsuitable host phase. Further investigations constraining the primary host phase for REEs in marine sediments will bolster their potential as an alternative source of REEs.

1 Takaya, Y. *et al. Sci. Rep.* 8, (2018)

2 Abbott, A. N. *et al. Front. Mar. Sci.* 6, (2019)

3 Kechiched, R. *et al. J. African Earth Sci.* 145, 190–200 (2018)

4 Tóth, E. *et al. Chem. Geol.* 269, 312–328 (2010)