Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24058

Constraints on the Ba isotope composition of benthic inputs from reduced margin sediments

ETHAN PETROU[1], LUKE BRIDGESTOCK[2], GIDEON M HENDERSON[1], YU-TE ALAN HSIEH[3] AND TZU-HAO WANG[1]

[1]University of Oxford

[2]University of St Andrews

[3]National Taiwan University

Presenting Author: ethan.petrou@univ.ox.ac.uk

Barium (Ba) isotopes are a novel tracer with the potential for new geochemical proxy applications, but to achieve this requires comprehensive constraints on the marine Ba isotope mass balance [1]. Recent studies identify large Ba fluxes (17 Gmol/yr; [2]) from continental margin sediments [3]. However, uncertainty in the mechanism and Ba isotope composition of this flux means its role within the global marine Ba isotope mass balance is still unknown.

This study aims to 1) determine the mechanism controlling the observed Ba fluxes from continental margin settings, 2) constrain their associated Ba isotopic compositions, and 3) investigate what are the wider implications for the marine Ba isotope mass balance. To achieve this, Ba concentration and Ba isotope data are presented for sediments and pore water fraction along with overlying seawater and particulate samples along the Namibian continental shelf and slope.

Sediment and pore water Ba concentration data is observed only to correlate with changes in pore water sulphate concentration ($r^2 = 0.9704$). This suggests that the main mechanism for the remobilisation of sedimentary Ba, is barite solubility.

The Ba concentration of upwelling seawater increases by 15.9% (35.1 to 40.7 nmol/Kg) as it circulates over the Namibian shelf attributed to benthic inputs. The isotopic data for these samples can be feasibly explained by the input of Ba with $\delta^{138/134}$Ba ≈ 0.31 ‰, consistent with measured pore water values from underlying anoxic sediments.

The results of this study imply that large benthic Ba fluxes from continental shelves may constitute a recycling of authigenic Ba phases (barite), rather than an input of ‘new’ Ba. This has implications for how this component of the Ba cycle is considered in marine Ba mass balance and helps to bring the current constraints on the marine input and output fluxes into balance.

[1] Carter, Paytan & Griffith (2020), *Minerals* 10-5, 1-25

[2] Rahman, Shiller, Anderson, Charette, Hayes, Gilbert, Grissom, Lam, Ohnemus, Pavia, Twining & Vivancos (2022), *Global Biogeochemical Cycles* 36, 1-33

[3] Whitmore, Shiller, Horner, Xiang, Auro, Bauch, Dehairs, Lam, Li, Maldonado, Mears, Newton, Pasqualini, Planquette, Rember & Thomas (2022), *Journal of Geophysical Research: Oceans* 127, 1-28