Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15375

Si and Mg fractionation during reverse weathering: an in vitro experimental approach

ZHE DONG, KATHARINE R. HENDRY, JAMES M. BYRNE AND CASEY BRYCE

University of Bristol

Presenting Author: zane.dong@bristol.ac.uk

Reverse weathering, a geochemical process which converts biogenic silica into authigenic cation-rich clay over a timescale of months to years, has long been recognized as a key sink for Si and an array of other associated elements (e.g., Fe, K, Mg) and as an important control on ocean alkalinity. However, there remain several outstanding scientific questions about the extent and impact of reverse weathering on ocean biogeochemistry. For instance, could reverse weathering occur in highly dynamic estuarine environments (i.e., hyper-tidal estuaries)? And to what extent could this process alter the global isotope budget for various elements? Here, we combine classic in vitro experimental approaches with novel stable isotope geochemistry to investigate reverse weathering in temperate estuarine sediments. We have set up a sediment incubation experiment, designed to last for up to two years, using the fresh sediment sampled from the Severn Estuary, which is the largest hyper-tidal estuary in Europe. Five substrates which simulate the commonly occurring minerals in estuaries, namely kaolinite, quartz, glass beads, iron-coated quartz, and iron-coated glass beads, were inserted into the sediment to examine the occurrence of reverse weathering. In addition, the incubations were conducted either with sterilised or non-sterilised sediment to study the effect of sediment microorganisms on reverse weathering. Scanning electron microscopy will be used to assess the build-up of coatings on the substrates through time under the different conditions. Furthermore, we will measure changes in the major element concentrations and the stable silicon and magnesium isotopic compositions of the sediment before and after the incubation, to quantify the fractionation extent of these two elements during reverse weathering reactions. Our findings will contribute to a better mechanistic understanding of reverse weathering in temperate regions in addition to a more robust quantification of the impact of reverse weathering on biogeochemical cycling more broadly.