Calcium isotope fractionation of authigenic carbonates in microbial cultures

KATHRYN H. HALLORAN, HAROLD J. BRADBURY, CHIN YIK LIN, ALEXANDRA V. TURCHYN*

Department of Earth Sciences, Cambridge University, Cambridge, UK CB2 3EQ (*correspondence: avt25@cam.ac.uk)

The metabolic activity of microbial communities in ocean sediments can drive the precipitation of authigenic calcium carbonate minerals. In particular, the activity of sulfate-reducing bacteria can generate alkalinity and raise local pH, driving sedimentary carbonate precipitation. Geochemical signatures of this microbially mediated carbonate precipitation remain relatively unconstrained; in theory if we had a geochemical fingerprint for sedimentary produced carbonate, it would help us identify authigenic carbonate in the geological record. To better understand the links between calcium carbonate precipitation and sulfate reducing bacteria, we examined the calcium isotope fractionation during the precipitation of calcium carbonate in pure cultures of the marine sulfate-reducing bacteria *Desulfovibrio bizertensis*. We show that there is a different calcium isotope fractionation when the unstable precursor monohydrocalcite initially precipitates versus when calcite precipitates directly through microbial induction. Bacterial growth was then modulated with antibiotics, and the evolution of $\delta^{44}Ca$ in solution was monitored under several different growth rates. The resulting calcium isotope fractionation factors can help us understand the link between calcium isotope fractionation and microbial metabolism in authigenically precipitated carbonate minerals.