The role of biological processes in geochemical heterogeneity in cultured planktic foraminifera: Calcite crusts and pH-dependent respiration

C. V. DAVIS[12*], E. RIVEST[1], A. D. RUSSELL[2], J. S. FEHRENBACHER[2], B. GAYLORD[1], H. J. SPERO[2], J. JAHNCKE[3] AND T. M. HILL[12]

[1]Bodega Marine Laboratory, UC Davis, Bodega Bay, CA, USA ([*]correspondance: cvdavis@ucdavis.edu)

[2]Department of Earth and Planetary Sciences, UC Davis, Davis, CA, USA

[3]Point Blue Conservation Science, Petaluma, CA, USA

We present two case studies from cultured California Current cold-water foraminifera highlighting heterogeneity in the geochemistry, calcification, and respiration of widely used proxy species *Neogloboquadrina incompta* and *Globigerina bulloides*. Crusting has been identified in several species of planktic foraminifera, distinguished in part by lower Mg/Ca compared to ontogenetic calcite. Sediment trap and fossil material has been unable to resolve whether the characteristic geochemistry of crusted calcite arises from calcification at lower temperatures. Results of constant-temperature laboratory experiments using *N. incompta*, show that differences in Mg/Ca values between crust and ontogenetic calcite need not derive from calcification at different temperatures as in these individuals, the Mg/Ca ratio in the crusted portion of the shells was 40-60% lower than in the inner ontogenetic calcite. These findings have important implications for Mg/Ca paleothermometry in crusted versus non-crusted foraminifera.

A second culture experiment quantified effects of seawater pH on oxygen consumption and net calcification of *G. bulloides*. We documented pH-dependent rates of respiration and calcification across a pH range of ~7.4-8.3. Both oxygen consumption and calcification increased with pH, peaking at ~pH 8.0, before declining at higher pH levels. This latter experiment highlights the importance of metabolism as a potential link between seawater pH and metabolism or calcification rate-dependant shell chemistry.