Effects of microbial activity on the stability of aragonitic bivalve shells: Implications for early carbonate diagenesis

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Marine biogenic carbonates undergo post-mortem burial in sediments where heterotrophic bacteria shape the geochemistry of their environment through a manifold of metabolic redox processes. Given the importance of biogenic carbonate archives for paleo-environmental reconstructions, it is of vital importance to gain insight into these, yet poorly constrained, processes regarding their potential for carbonate alteration. We conducted a three-month in-vitro experiment incubating aragonitic valve parts of the ocean quahog *Arctica islandica* in oxic and anoxic seawater media containing marine sediment slurries or bacterial cultures. Analyses of the bulk liquid from incubations with the anaerobic bacterium *Shewanella sediminis* and anoxic sediment indicated calcium carbonate dissolution in the supersaturated media, with a strong increase in Ca and Sr concentration, Total Alkalinity, DIC, and $\Omega_{Aragonite}$. Stereomicroscopic examination displayed pronounced post-incubation alteration of valve-surface structures. Further, SEM examination revealed surface dissolution features on incubated valve samples. Electron Microprobe element mapping showed declined Ca concentrations in valve areas exposed to *S. sediminis* cells and anoxic sediment. Our results depict the potential of microbial metabolic activity to substantially alter biogenic carbonates during early diagenesis.