# MICROBIALLY-INDUCED CALCIFICATION: PATTERNS, PROCESSES, AND IMPLICATIONS FOR INORGANIC CARBON CYCLING

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Microbially-induced calcification has been identified as a significant source of carbonate sediment production in modern marine and lacustrine environments around the globe, and has been implicated in the production of large, micritic carbonate deposits throughout the geologic record. Recent research has advanced our understanding of the microbial calcification mechanism as a photosynthetically driven process. However, little is known of the effects of this process on inorganic carbon cycling or of the effects of changing atmospheric $CO_2$ concentrations on microbial calcification mechanisms. Direct measurements of air:sea $CO_2$ gas fluxes and carbonate sediment production rates were measured in blooms of actively calcifying marine microbes located on the Great Bahama Bank and in laboratory cultures of calcifying cyanobacteria and unicellular green algae. In situ gas flux measurements showed a reduction in atmospheric $CO_2$ relative to adjacent waters outside of blooms. Similar results were also observed in laboratory cultures. Calcification rates in blooms and laboratory cultures ranged from approximately 0.06 to 34.5 g $CaCO_3$ $m^{-3}$ $h^{-1}$. These results suggest that production of microbial carbonates may serve as a sink for inorganic carbon. Laboratory cultures of calcifying microbes were subjected to biological buffers to examine the role of photosynthetic uptake of inorganic carbon species in calcification. Results from these experiments indicate that microbial calcification mechanisms depend upon the species of inorganic carbon available to cells for photosynthesis and, thus, atmospheric $CO_2$ concentrations. These results suggest fluctuations in Phanerozoic dominance trends for calcareous cyanobacteria and algae may be linked to fluctuations in atmospheric $CO_2$.