

EXPERIMENTAL MICROBIAL MEDIATED ANAEROBIC CARBONATE PRECIPITATION: IMPLICATIONS FOR PRECAMBRIAN CARBONATE SEDIMENTATION

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In contrast to Phanerozoic carbonates, which are essentially formed by calcifying Eukarya, such as coral reef builders, the precipitation of Precambrian carbonates was primarily a microbial dominated sedimentation process. In particular, Early Archean microbial mineralization probably occurred under anaerobic conditions. Laboratory simulations of anaerobic natural environments, where biomineralization takes place, provide important information pertaining to microbiological processes that are related to mineral precipitation. Specific microbial dominated environments, such as Lagoa Vermelha, Brazil, can be considered as environmental fossils for the Early Archean Earth. The study of these settings provides valuable insight on the earliest carbonate sedimentation and furnishes information about the mechanisms of microbial mineralization. Microbial growth experiments were performed with pure and mixed cultures under different laboratory conditions in order to simulate the modern natural environments where bacteria mediate precipitation of calcite, Mg-calcite and Ca-dolomite. Sulfate reducing bacteria (SRB's) were cultured in synthetic seawater liquid medium with different SRB-specific substrates. Micro-crystals precipitated on the cell walls were identified by TEM analysis as high-Mg calcite and dolomite. Studies of crystal morphology using SEM with cryogenic fixation showed a relationship between the microbe and biominerals in both the culture and the sediment from which the bacteria was sampled. This cryogenic method allows the visualization of the bacteria and their organic byproducts, as well as the biominerals, providing a more realistic view of the bacteria/sediment associations. This approach, comparing microbial minerals derived from laboratory experiments and modern sediments, can serve as a calibration for widespread Precambrian microbial carbonate precipitation