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Seismic-Scale Architecture and Properties of Phanerozoic Microbial Carbonates

Marine carbonate precipitation proceeds in three modes - abiotic, biotically induced (largely microbial) and biotically controlled (skeletal). Abiotic and microbial precipitation dominated the Precambrian, biotically controlled, skeletal precipitation the Phanerozoic. Despite the prominence of skeletal carbonate in Phanerozoic rocks, a production system combining abiotic and microbial pathways - here termed mud-mound factory - contributed significantly to the total carbonate accumulation. Best evidence for microbially-induced precipitation is found in organic compounds preserved in the rocks. However, there is more wide-spread indirect evidence in the form of rock fabrics that indicate micrite precipitation in situ (''automicrite''). This micrite forms as cavernous, chalky material that gradually loses its porosity during subsequent diagenesis. The Phanerozoic mud-mound factory functioned best in nutrient-rich waters of the oceanic thermocline or at methane seeps. However, quantitative estimates of the proportions of abiotic, microbial and skeletal carbonate in stratigraphic formations indicate that even in the Phanerozoic the mud-mound factory intermittently dominated the shallow, photic environments, particularly when the skeletal factories were weakened by extinctions. The characteristic architecture of the mud-mound factory are groups of convex mounds but it formed rimmed platforms where it could build into the wave-swept, shoalwater environments. For instance, the famous Triassic atolls of the Alps have been shown to be mud-mounds by composition. The growth potential of the mud-mound factory is only slightly lower than that of the tropical skeletal factory and about three times higher than that of the skeletal cool-water factory.

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