Factors controlling development of microbialites in past and modern environments

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The study of modern sedimentary microbial carbonate systems contributes to our knowledge of environmental conditions required for (i) the formation of microbial mats and microbialites and (ii) the development of their particular morphologies. Understanding the formation of specific morphologies of extant modern microbial mats and microbialites may facilitate interpretation of past microbial-dominated systems. Relationships between environmental conditions and modern microbial mats were investigated in a hypersaline lagoon in Cuban and compared to Triassic microbial reefs.

Our study site in south of Cayo Coco Island (Cuba) comprises a tropical, highly evaporative, marine-fed lagoonal network. Mineralization is driven here by changes in hydrological budget changes related to water-level fluctuations and evaporation/rainfalls. A detailed field mapping shows a wide range of macrofabrics influenced by inherited substrates (eolianites), hydrodynamic parameters (wind-driven waves, storms…), subsurface degasing mediated by mangrove roots and desiccation. These findings provide keys to the understanding of fossil microbialite morphologies in lagoonal settings. The Early Triassic Mineral Mountains area (Utah, USA) preserves diversified Smithian and Spathian microbial reefs and bioaccumulations that contain fenestral-microbialites and various benthic and pelagic organisms. New data acquired in this area facilitate deciphering of the relationships between depositional environments and the growth and distribution of microbial structures. Microbial constructions developed in peritidal to deep subtidal environments and are controlled by hydrodynamic changes, grain supply, accommodation and local ecosystem destabilizations. Comparison between fossil and modern systems questions the representativeness of major macrofabric diversity in microbial mats and microbialites throughout the geological record and provides a base from which to discuss the processes involved in preservation of microbial mat fabrics.