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Review Article

Modern supratidal microbialites fed by groundwater: functional drivers, value and trajectories

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ABSTRACT

Microbial mats were the dominant habitat type in shallow marine environments between the Palaeoarchean and Phanerozoic. Many of these (termed 'microbialites') calcified as they grew but such lithified mats are rare along modern coasts for reasons such as unsuitable water chemistry, destructive metazoan influences and competition with other reef-builders such as corals or macroalgae. Nonetheless, extant microbialites occur in unique coastal ecosystems such as the Exuma Cays, Bahamas or Lake Clifton and Hamelin Pool, Australia, where limitations such as calcium carbonate availability or destructive bioturbation are diminished. Along the coast of South Africa, extensive distributions of living microbialites (including layered stromatolites) have been discovered and described since the early 2000s. Unlike the Bahamian and Australian ecosystems, the South African microbialites form exclusively in the supratidal coastal zone at the convergence of emergent groundwater seepage. Similar systems were documented subsequently in southwestern Australia, Northern Ireland and the Scottish Hebrides, as recently as 2018, revealing that supratidal microbialites have a global distribution. This review uses the best-studied formations to contextualise formative drivers and processes of these supratidal ecosystems and highlight their geological, ecological and societal relevance. Dynamic interchanges between salinity states both exclude many destructive metazoans and competitors and provides optimal nutrient conditions for benthic microbial and microalgal growth. The outflowing groundwater seeps are alkaline and rich in calcium carbonate, which reflects local catchment geological processes. These habitats support a diverse microbial community dominated by Cyanobacteria as well as some metazoan species previously unknown to science, or unknown for the region. Several taxa (from invertebrates to fish) utilise this environment as refugia. Supratidal microbialites are important coastal features because of the organisms they support and the ecological processes that they facilitate, such as habitat connectivity. Culturally and socially, the value of these habitats is increasingly being appreciated,

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