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Research paper

Paleoecological and paleobiogeographic implications of a seagrass-indicating foralgal skeletal assemblage: Retracing the Burdigalian Quilon Limestone (Kerala Basin, SW India)

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ABSTRACT

Seagrasses are marine angiosperms documented in shallow-marine, soft bottom settings across the Cenozoic. They proliferated globally after their divergence from other alismatid monocots in the late Cretaceous followed by an adaptation to the marine environment. Detailed evaluation of seagrasses in the geological archives is of utmost importance to understand their responses to climatic and environmental alterations in the deep time perspective. Here we examine the lower Miocene Quilon Limestone from the Kerala Basin (southwest India) that encompasses a *Pseudotaberina-Halimeda* floatstone signalling a robust photozoan foralgal skeletal assemblage. This is characterized by the dominant soritid foraminifer *Pseudotaberina* and the calcareous green alga *Halimeda*, in association with other foraminifera and representatives from various biotic groups that indicate a tropical seagrass paleoenvironment. Abundant soritids together with various bryopsidalean *Halimeda* species indicate light and temperature as the major ecological drivers regulating the Quilon Limestone seagrass paleocommunity during the early Miocene (Burdigalian). The spatio-temporal distribution patterns of *Halimeda* also indicate temperature as the most prominent ecological constraint determining its dispersal and evolution at multiple latitudes. A well illuminated substrate is envisaged to support the development and calcification of the *Halimeda* thalli. Abundance of K-strategist foraminifera with minor occurrence of suspension-feeding bryozoans and some gastropods, bivalves indicate a low-nutrient environment.

1. Introduction

Seagrasses (Kingdom Plantae; Order Alismatales) are a monocotyledonous group of submarine flowering plants dwelling in the photic zone of numerous tropical, temperate, and subarctic carbonate platforms (Short et al., 2007; McKenzie et al., 2020). Including four families and 72 species, seagrass meadows have been widespread habitats in the shallow marine realm since their origin from other alismatid monocots in the late Cretaceous (Brasier, 1975; Ivany et al., 1990; Reich et al., 2015). Seagrass meadows pertinent to the Cenozoic have been recorded from numerous shallow marine settings (Ivany et al., 1990; Domning, 2001; Moissette et al., 2007; Mateu-Vicens et al., 2008; Zamagni et al., 2008; Reuter et al., 2011; Riordan et al., 2012; Sola et al., 2013; Tomás et al., 2016; Tomassetti et al., 2016; Brandano et al., 2019; Aguilera et al., 2022; Mariani et al., 2022a). Anyway, the poor preservation potential of seagrasses makes it difficult to identify well-preserved fossil material from marine sediments and rocks. Thus, to attain reliable paleoenvironmental reconstructions, seagrass-dominated ecosystems in paleo-archives are usually analysed through common indirect paleontological and sedimentological criteria like occurrence of distinct benthic foraminiferal assemblages, specific taxa of echinoderms, particular composition and growth morphology of bryozoans, crustose coralline red algae, ostracods and molluscs, and the presence of unsorted sediments with micritic matrix (Beavington-Penney et al., 2004; James and Bone, 2007; Reuter et al., 2011; Reich et al., 2015; Tomás et al., 2016; Tomassetti et al., 2016; Brandano et al., 2019; Mariani et al., 2022b).

Characterization of the skeletal assemblage is imperative in describing carbonate paleoenvironments. Nomenclature of skeletal assemblages have been subject to numerous criteria for classification and introduction of variable terminologies for the biotic association types (Lees and Buller, 1972; Lees, 1975; Carannante et al., 1988; James,

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