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Original article

Palaeoecological and sedimentological characteristics of the Lower Tortonian scleractinian reef corals of Gavdos Island, southern Greece[☆]

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ABSTRACT

Early Late Miocene coral assemblages from five outcrops of Gavdos Island, Southern Greece, are investigated with respect to their palaeoecological implications. Small patch reefs with *Porites* assemblage are a common feature of the low-diversity coral occurrences. The determined hermatypic colonies indicate a nearshore palaeoecosystem prevailing in a tropical to subtropical coastal sea at depths ranging from 5 to 50 m with an average temperature of 22–26 °C. Microfacially, the studied Scleractinian patch reefs are represented by Coral Framestones-Floatstones. The reefal facies has been affected by syndepositional processes (boring activities-micritization), as well as by post-depositional diagenesis in the meteoric realm (dissolution, cementation and intense pedogenesis). The palaeoecological and sedimentological analysis indicates a restricted to open-marine inner platform setting of moderate to high energy, possibly of ramp-type (inner-mid ramp). Coral reef growth took place mainly during stages of accommodation (i.e., transgressive episode, cycle 3.1 of Vail curve) and of relatively low siliciclastic input.

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1. Introduction

Tortonian reefs of the Mediterranean region are highly variable in terms of geological setting and organisation. Small patch reefs or biostromes formed in clastic nearshore environments seem to be the norm, whereas reefal carbonate ramps and platforms occurred only locally (Pomar, 2001; Brandano and Corda, 2002; Reuter and Brachert, 2007). Coral reefs with abundant hermatypic coral remains are strong evidences of the existence of a warm Mediterranean sea during this period. These reefs only developed in shallow marine environments, at temperatures ranging from 16 to 36 °C (Glynn, 1984; 18 °C is the most often cited lower limit of reef growth), but most active reef building occurs in the range of 23 to 25 °C (James and Bourque, 1992).

Tortonian coral buildups from Crete have been the subject of a few previous studies documenting their stratigraphic architectures, facies and taxonomy (Moissette et al., 1993; Chaix and Delrieu, 1994; Baron-Szabo, 1995; Tsaparas and Marcopoulou-Diakantoni, 2005; Reuter et al., 2006; Reuter and Brachert, 2007). In this paper, we discuss material collected from early Tortonian outcrops in Gavdos Island. Corals were collected from a total of five outcrops: Bo, Agios Ioannis, Korfé, Karavé and Bardaris (Fig. 1). A first approach of the palaeontological content of these Tortonian

coral buildups was attempted by Tsaparas and Marcopoulou-Diakantoni (2005). However, detailed microfacies and palaeoenvironmental analyses at a small-scale level are still mostly absent. Therefore, the objectives of this paper are:

- to define particular microfacies types;
- to study the relationships between the components;
- to interpret the depositional setting.

2. Geological background and stratigraphy

2.1. Geological setting

The island of Gavdos is located in the Eastern Mediterranean and constitutes the southernmost extension of the Hellenic arc (Fig. 1). Gavdos and Crete are situated between a volcanic arc in the North and a zone of northward subduction (the Hellenic Trench) to the South. The Hellenic Arc and the Hellenic Trench are associated with the northward subduction of the oceanic lithosphere of the African plate under the Aegean continental plate. Subduction probably started in the Late Oligocene/Early Miocene (Meulen-kamp et al., 1988).

The oldest rocks of Gavdos Island are represented by a Maestrichtian-Danian calcareous sequence and Eocene flysch (Vicente, 1970), belonging to the Pindos-Ethia geotectonic zone. Towards the northeastern part of Gavdos Island, a Mesozoic volcano-sedimentary series is exposed, which is thrust above

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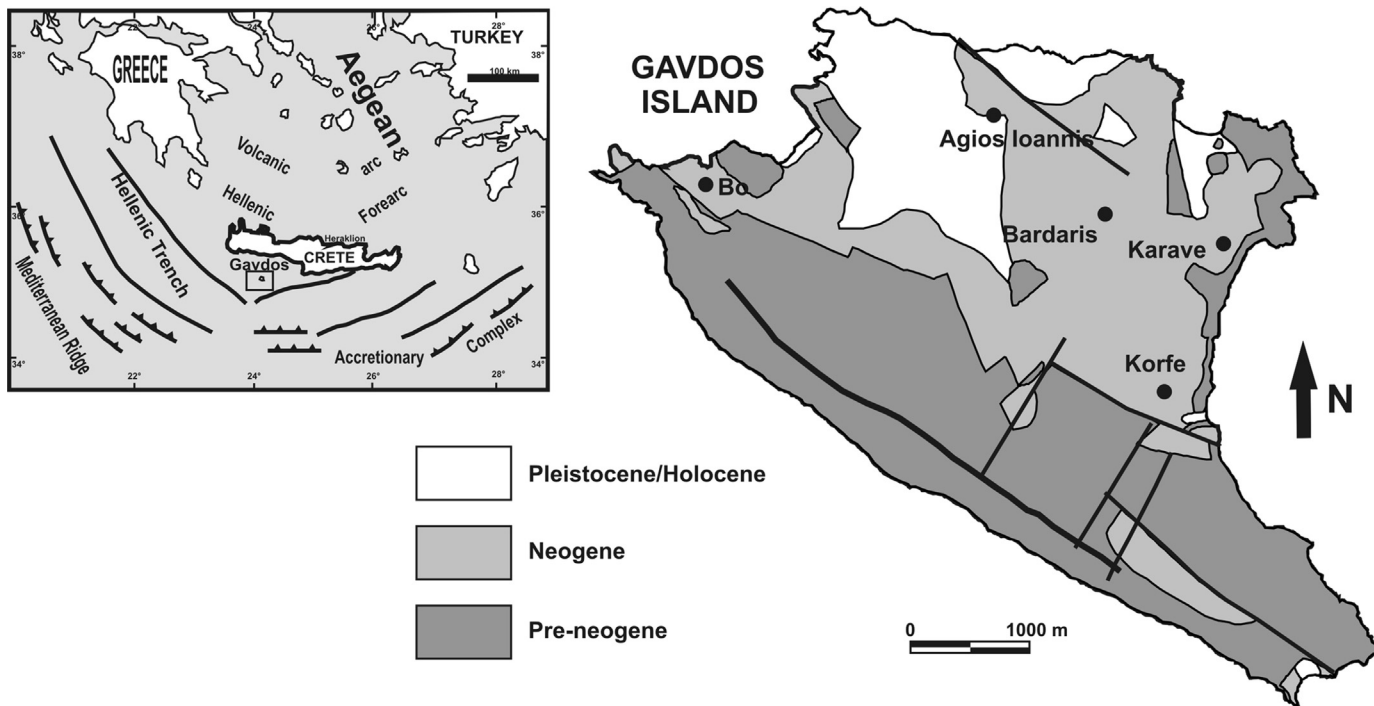


Fig. 1. Simplified geological map of Gavdos Island (after Tsaparos, 2005, modified).

the Pindos-Ethia sequence (Vicente, 1970; Seidel and Okrusch, 1978). Neogene sediments have a maximum thickness of 150 m and cover most of the surface area of the island, unconformably overlying its Mesozoic substrate. The Neogene deposits of Gavdos Island have been divided by Anastasakis et al. (1995) into two formations: Potamos and Metochia. A thorough description and interpretation of these formations is given by Anastasakis et al. (1995), Drinia et al. (2004) and Tsaparos (2005). Antonarakou (2001) and Antonarakou et al. (2007) consider that they are late Middle and Late Miocene in age, respectively, basing their conclusions on the planktonic foraminifer faunas.

2.2. Palaeogeography

Based on lithostratigraphical, biostratigraphical, palaeontological and palaeoecological data from the Neogene deposits of Gavdos Island, a palaeogeographical reconstruction of the Neogene evolution of the island was attempted by Tsaparos and Dermitzakis (2005). According to these authors, at the end of the Serravallian, the island was probably affected by drastic subsidence, which resulted in the transformation of the central-west part of the island into a shelf characterized by hemipelagic sedimentation (Fig. 2(a)). During the earliest Tortonian, differentiated fault activity broke up

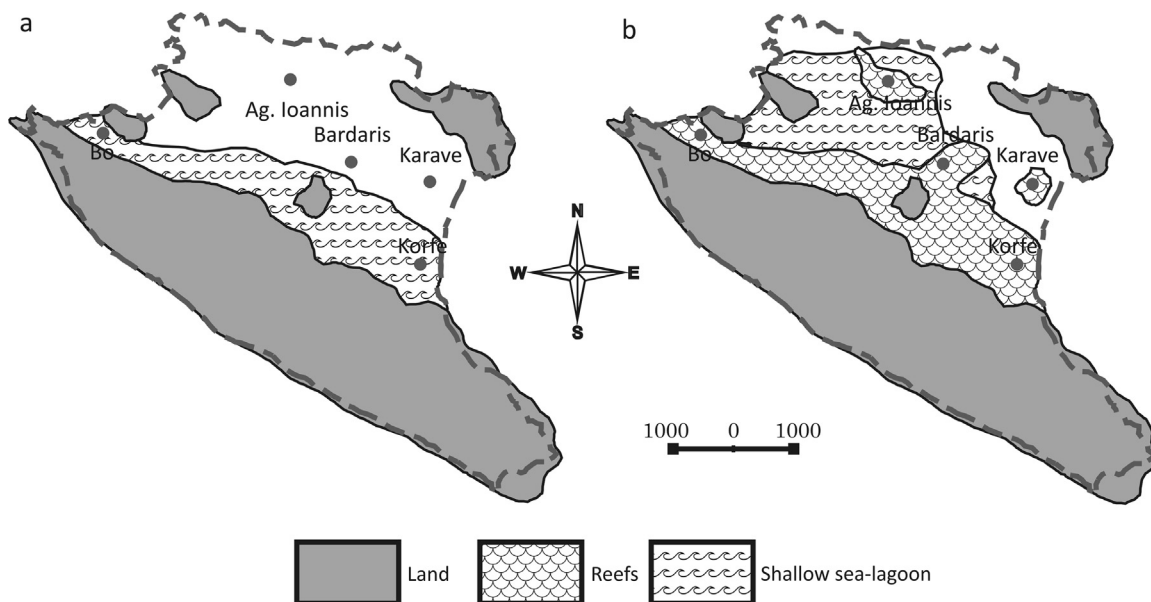


Fig. 2. Palaeogeographical reconstruction of Gavdos Island. a: during earliest part of Early Tortonian; b: during Early Tortonian. (after Tsaparos, 2005 and Tsaparos and Dermitzakis, 2005).

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