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Coralline algae (Corallinales, Rhodophyta) in western and central Mediterranean Messinian reefs

Juan C. Braga [a,*], Alessandro Vescogni [b], Francesca R. Bosellini [b], Julio Aguirre [a]

[a] Departamento de Estratigrafía y Paleontología, Facultad de Ciencias, Campus Fuentenueva s.n., Universidad de Granada, 18002 Granada, Spain
[b] Dipartimento di Scienze Della Terra, Univesità di Modena e Reggio Emilia, largo S. Eufemia 19, 41100 Modena, Italy

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ABSTRACT

Coralline algae are common components in Messinian reefs in the Sorbas Basin in SE Spain and in the Salento Peninsula (southern Italy). They occur encrusting coral skeletons and other bioclasts, forming rhodoliths, and as fragments in back-reef, reef-framework, and proximal-to-middle slope facies. Corallines also occur in *Halimeda* boundstones associated to coral reefs. In contrast, no coralline algae have been recorded in the fine-grained distal slope deposits in both areas and in lagoonal marly limestones in Salento. The relative abundance of corallines in reefs and their species richness is significantly higher in the Salento platform than in the intermontane Sorbas Basin, which was affected by terrigenous influx. *Neogoniolithon brassica-florida* and *Spongites fruticulosus* dominate the shallow-water assemblages; *Lithophyllum* records peak at the base of reef-core and upper-slope deposits (around 20 m palaeodepth) and *Phymatolithon calcareum* and species of *Lithothamnion* are most abundant in deeper slope facies. The main components of the Messinian Mediterranean reef coralline assemblages are extant species, common in the Mediterranean and along the north Atlantic coast from Morocco (and the Canary Islands) to the British Islands. A few, such as *Spongites fruticulosus* and *Phymatolithon calcareum*, have been living in the Mediterranean region for more than 25 Ma. Four species still live in the Indo-Pacific but disappeared from the Mediterranean during the Messinian Salinity Crisis. The typical components of present-day Indo-Pacific coral reefs do not occur in the Mediterranean Messinian reefs. The 'Mediterranean–Atlantic' character of the Messinian reef corallines reflects the decrease in tropical biotas in the Mediterranean throughout the Miocene, probably related to global cooling and isolation of the Mediterranean from the Indian Ocean since the Middle Miocene.

1. Introduction

Mediterranean Messinian coral reefs are well-known examples of fossil reefs built by a low-diversity coral assemblage. *Porites* is nearly the only zooxanthellate coral together with very minor *Siderastrea* and, locally, *Tarbellastraea* colonies (Chevalier, 1962; Esteban, 1979, 1996). These reefs formed during the closing stages of subtropical reef growth in the Mediterranean, in the final phases of a progressive decrease in species richness of zooxanthellate corals primarily as a consequence of global cooling throughout the Miocene (Chevalier, 1962; Rosen, 1999; Bosellini and Perrin, 2008). Coralline algae are common but secondary components of the reef framework, encrusting *Porites* skeletons together with microbial crusts and foraminifers (Riding et al., 1991; Perrin et al., 1995; Martín et al., 1997; Bosellini et al., 2001, 2002; Bosellini, 2006). Coralline algae also occur forming rhodoliths and as loose bioclasts in different reef subenvironments (Perrin et al., 1995; Pomar et al., 1996; Bosellini et al., 2001; Braga and Aguirre, 2001).

The sedimentology, facies distribution, and stratigraphic architecture of Messinian reefs are best known in examples from Almería in SE Spain (Níjar reef, Dabrio et al., 1981; Warrlich et al., 2005; Cariatiz reef, Riding et al., 1991; Braga and Martín, 1996; Cuevas et al., 2007), Mallorca (Llucmajor platform, Pomar, 1991; Pomar et al., 1996), and the Salento Peninsula in S Italy (Bosellini et al., 2001, 2002; Bosellini, 2006). Other lower Messinian coral reefs have been studied in detail in different sedimentary basins around the Mediterranean Sea in Malta, Sicily and Tuscany (Pedley and Grasso, 1994; Pedley, 1996a,b; Bossio et al., 1996), Morocco (Saint-Martin et al., 1991; Saint-Martin and Cornée, 1996), and Algeria (Cornée et al., 1994; Saint-Martin, 1996).

The composition of coralline algal assemblages at the generic and subfamily level in reef subenvironments has been described in the Níjar and Cariatiz reefs (Martín and Braga, 1989; Braga and Aguirre, 2001) and the Mallorca reef (Perrin et al., 1995). These papers show an algal distribution pattern controlled by palaeobathymetry with shallow-water assemblages dominated by mastophoroids and lithophylloids, and deep-water assemblages in which the proportions of melobesioids progressively increase with depth.

* Corresponding author.
E-mail address: jbraga@ugr.es (J.C. Braga).

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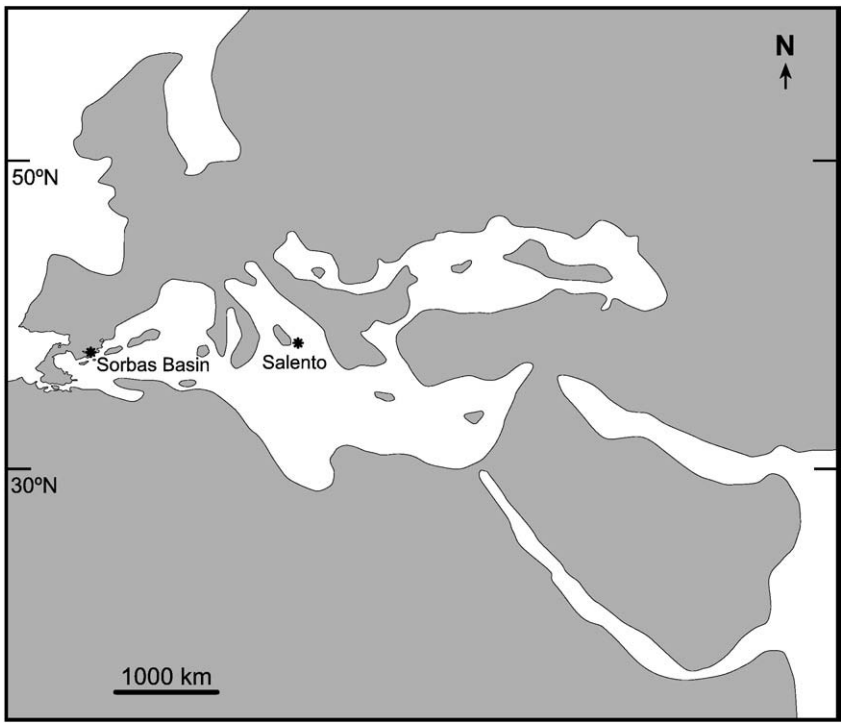

Fig. 1. Location of the Sorbas Basin and the Salento Peninsula Messinian reefs in a paleogeographic map of the Mediterranean region (after Rögl, 1998 and Braga et al., 2003).

In this paper the composition of coralline algal assemblages at the species level in the Sorbas Basin and the Salento Peninsula Messinian reefs is analysed. These examples are well constrained in age, well spaced from each other (in the western and central Mediterranean, respectively) (Fig. 1), and developed in two different environmental settings. While Salento coral reefs formed in a stable carbonate platform, facing the open sea and without any terrigenous influx (Bosellini et al., 2001, 2002; Bosellini, 2006), the Sorbas reefs grew at the margins of a small intermontane basin in a region of uplift and were affected from time to time by terrigenous sediments (Ott d'Estevou and Montenat, 1990; Braga and Martín, 1996).

This study confirms and refines the depth-related pattern of algal distribution throughout the different reef facies. The most noteworthy result, however, concerns the biogeographical character of the coralline algae, which are distinct from the coeval tropical reef algae and show marked affinities to present-day Mediterranean corallines.

2. Methods

Samples of coralline red algae were collected from selected sections of Messinian reefs in Sorbas Basin in southern Spain (Figs. 2, 3) and the

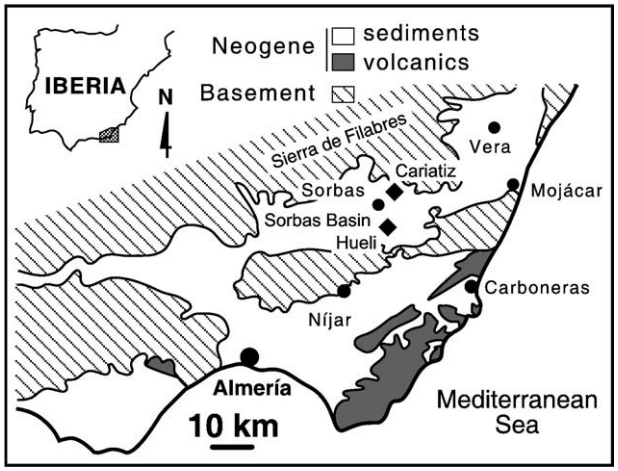

Fig. 2. Study localities (rhombs) in the Sorbas Basin in SE Spain.

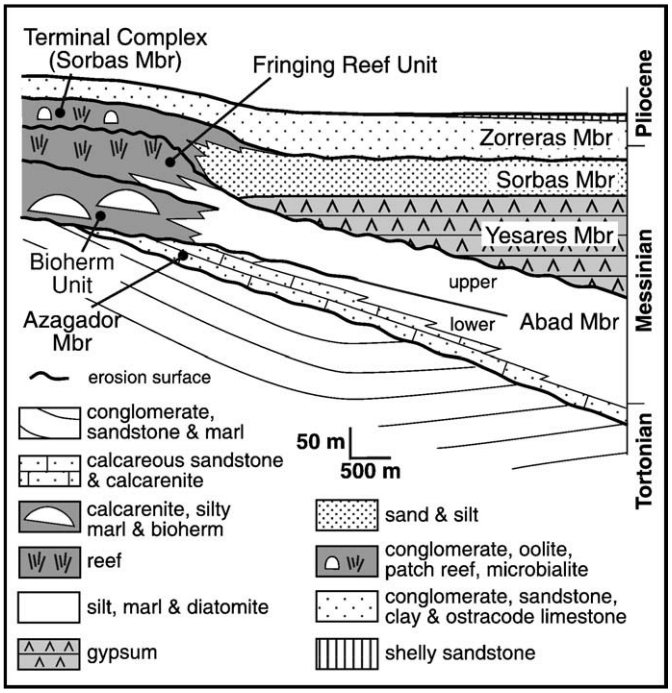

Fig. 3. Messinian stratigraphy of the Sorbas Basin (after Martín and Braga, 1994).