Coral bioconstruction in a Burdigalian mixed siliciclastic-carbonate coastal system (Cala Paraguano, Corsica)

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ABSTRACT - This study presents facies analysis and a depositional model of a middle-lower Burdigalian mixed siliciclastic-carbonate system, characterized by coral bioconstructions, cropping out at Cala Paraguano (southern Corsica). Sedimentary facies, tracing stratigraphic surfaces, stratal and bioconstruction geometries were identified along a sea-cliff exposure. The sedimentary facies described and interpreted are coral rudstone to floatstone, coral domestone and maerl. The coral rudstone to floatstone indicates a highly energetic environment and possibly associated with vegetated areas, whereas the coral domestone was originated by small size patch reefs. These facies grade basinward into the maerl facies, which represents a deeper zone colonized by red algae and subordinate large benthic foraminifers.

The Cala Paraguano deposits document a case were terrigenous input in a mixed siliciclastic-carbonate coastal setting does not prevent the development of coral patch reefs.

KEY WORDS: Burdigalian, corals, siliciclastic-carbonate, Corsica, coastal system, maerl, facies

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INTRODUCTION

It is commonly assumed that corals flourish in oligotrophic and well-lit environments characterized by low siliciclastic input (James and Macintyre, 1985; Hallock and Schlager, 1986). Siliciclastic sediments have several negative effects on coral communities and carbonate producers (Rogers, 1996; Sanders and Baron-Szabo, 2005; Sanders and Baron-Szabo, 2005; Perry and Smithers, 2006; Lokier et al., 2009): i) damage of coral tissue by abrasion and impact of sandy particles; ii) physical covering, causing expenditure of metabolic energy in activating rejection mechanisms, potentially leading to burial and demise of coral communities in case of exceptionally high sediment input; iii) increased turbidity due to high levels of suspended matter in the water column, resulting in a reduction of light penetration and consequently affecting the distribution of the light-dependent biota; iii) changes in water chemistry, which involve reduced salinity, pH variations and an increase in nutrient levels.

Nevertheless, many studies have reported the occurrence of coral reef growth associated with terrigenous input and high turbidity levels, both in present-day settings and fossil examples (Santisteban and Taberner, 1988; Woofe and Larcombe, 1998; Wilson and Lokier, 2002; Perry, 2003; Sanders and Baron-Szabo 2005; Perry and Smithers, 2006; Lokier et al., 2009). These works show coral communities in delta and fan delta environments, on the contrary development of coral bioconstructions in mixed carbonate-siliciclastic in coastal settings are poorly documented.

This paper presents the result of a stratigraphic-sedimentological analysis of coral-rich mixed carbonate-siliciclastic deposits exposed at Cala Paraguano (South Corsica) in the central Mediterranean Sea.

The deposits of Cala Paraguano and their reconstructed depositional setting document an example of coral patch reef development in coastal settings dominated by a mixed siliciclastic-carbonate sedimentation.

GEOLOGICAL SETTING

The island of Corsica (France) is divided in two different domains (Fig. 1): Hercynian Corsica and Alpine Corsica (Durand-Delga, 1978, 1984). The former is represented by Carboniferous-Permian granitoid and acid volcanic rocks, related to calc-alkaline to high K – calc-alkaline granitic magmatism (Ferré and Leake, 2001), Precambrian-middle Paleozoic metamorphic host rocks and scattered outcrops of Paleozoic sedimentary rocks. The latter consist of a complex tectonic stack of thrust sheets, constituted by metamorphosed oceanic- and continental-derived crust nappes, non-metamorphic or low grade and ophiolitic units (Durand-Delga, 1984; Garfagnoli et al., 2009 and references therein).

In the Late Oligocene an important extensional phase affected the Sardinia-Corsica micro-plate with the development of a NE-SW oriented rifting system. This system evolved into a continental drifting related to the opening of the Ligurian-Provençal Basin (Jolivet and Faccenna, 2000), which was located in the back-arc region of the Apennines-Maghrebides Subduction Zone (Gueguen, 1998; Carminati and Doglioni, 2005). Therefore, in the time span between 22 and 15 Ma, Sardinia-Corsica Block rotated counter-clockwise away from southern Europe paleo-margin with an angle of 45° or 60° (Gattacceca et al., 2007; Lustrino et al., 2009; Carminati et al., 2010 and references therein).

During the Burdigalian, southern Corsica was affected by acid volcanism and the deposition of rhyhotitic and dacitic tuff (Ottaviani-Spella et al., 2001). The deposition of marine sediments started also in the Early Miocene (Ferrandini et al., 2003). In Corsica, these sediments crop out in the southern part (Bonifacio), in the northern (Saint Florent and...