

# Non-seagrass meadow sedimentary facies of the Pontinian Islands, Tyrrhenian Sea: A modern example of mixed carbonate–siliciclastic sedimentation

Marco Brandano\*, Giacomo Civitelli

*Dipartimento di Scienze della Terra Universita' degli Studi di Roma "La Sapienza" P.le Aldo Moro 5, I-00185 Roma, Italy*

Received 12 December 2006; received in revised form 7 May 2007; accepted 17 May 2007

## Abstract

The soft bottom of the Mediterranean continental shelf is characterized by a heterozoan skeletal assemblage (*sensu* [James, N.P., 1997. The cool-water carbonate depositional realm. In: James, N.P., Clarke, J. (Eds), Cool-water Carbonates. Spec. Publ. Soc. Sediment. Geol., vol. 56, pp.1–20.]). Although the contemporary presence of terrigenous and skeletal carbonate sediments has been well established [Tortora, P., 1996. Depositional and erosional coastal processes during the last postglacial sea-level rise: an example from the Central Tyrrhenian continental shelf (Italy). *J. Sed. Res.* 66, 391–405.; Fornós, J.J., Ahr, W.M., 1997. Temperate carbonates on a modern, low-energy, isolated ramp: the Balearic Platform, Spain. *Journal of Sedimentary Research*, 67, 364–373.; Fornós, J.J., Ahr, W.M., 2006. Present-day temperate carbonate sedimentation on the Balearic Platform, western Mediterranean: compositional and textural variation along a low-energy isolated ramp. In: Pedley, H.M., Carannante, G. (Eds.) 2006, Cool-water Carbonates: Depositional Systems and Palaeoenvironmental Controls. Geological Society, London, Special Publications, 255, pp. 121–135], the interactions between carbonate and terrigenous–siliciclastic sedimentation has not been documented well enough. A total of 33 surface sediment samples from the Pontinian shelf (Tyrrhenian Sea, central Mediterranean) have been analysed. Sampling stations range from 15 to 250 mwd (meter water depth) and are located along five transects (PonzaW, PonzaNW, Ponza NE, Ponza E, Zannone), plus four samples collected around Palmarola Island. Sectors colonized by seagrass meadows have not been sampled. A total of 6 sedimentary facies (F) and 10 microfacies (mf) have been recognized by using component analyses, grain size percentage, sorting, carbonate content and authigenic mineralization rate. These facies and microfacies represent the Pontian Islands shelf sedimentation, in the interval between the upper infralittoral and the epibathyal zones that represent shelf-break and upper slope sedimentation. The Maerl facies (F4a,b; mf4a,b) and the skeletal sands (F2a,b; mf2a1, mf2a2, mf2b) fall within the circalittoral zone. The circalittoral zone in the water depth interval between 82 m and 112 m display relict facies (F6, mf6). Finally facies F5 (Siliciclastic sands) includes subfacies F5b (mf5b), located in the circalittoral zone at depths of 49 to 101 mwd and restricted to the western and eastern sectors of Ponza, and subfacies F5a in the upper infralittoral zone (15 mwd/25 mwd) where erosional processes prevail.

Carbonate content analyses indicate that maximum carbonate production on the Pontinian shelf took place in the 60–80 mwd interval. Facies F4 (Maerl) represents the environment characterized by the highest carbonate production rates.

In the Pontian area siliciclastic–carbonate mixing took place in the infralittoral zone and in the lower circalittoral zone. In the infralittoral zone erosional processes on the rocky shoreline produced lithoclasts and vulcanoclastic deposits that were reworked by wave-induced near-shore currents. In the lower circalittoral zone the prolific production by photic biota (red algae) ends, while skeletal remains of the aphotic environment mixes with planktonic sediments characterized by low carbonate values.

\* Corresponding author. Tel.: +39 06 49694240; fax: +39 06 4454729.

E-mail address: [marco.brandano@uniroma1.it](mailto:marco.brandano@uniroma1.it) (M. Brandano).

Sand (63  $\mu\text{m}$ –2 mm) is the dominant grain size class, however gravel-dominated facies (F4 Maerl) are present in water depths (50 to 112 mwd) which are significantly below the storm wave base. Glauconite mineralization appears on the Pontinian shelf from 50 mwd and increases in abundance along the deeper bathymetries. The compositional characteristics of relict facies F6 shows the concurrence of biota assemblages of the infralittoral and circalittoral zones, likely representing the record of the last Holocene transgressive event (18 ky) and expressed by the overlapping of components of different environments.

© 2007 Elsevier B.V. All rights reserved.

*Keywords:* Mediterranean; Tyrrhenian; Mixed carbonate–siliciclastic; Heterozoan; Facies

## 1. Introduction

Depositional processes that occur on the western Mediterranean continental shelf have been widely documented (Marani et al., 1986; Hernández-Molina et al., 1994; Bellotti et al., 1995; Vinals and Fumana, 1995; Tortora, 1996; Fornós and Ahr, 1997, 2006). Shallow marine environments in the Mediterranean and, in particular in the Tyrrhenian Sea, are generally characterized by terrigenous (siliciclastic) sediments supplied by fluvial systems and coastal erosional processes (Bellotti et al., 1995; Tortora, 1996; Tortora et al., 2001). Modern carbonate depositional environments have been described by many authors in the Mediterranean Sea (Péres and Picard, 1964; Caranante et al., 1988; Canals and Ballesteros, 1997; Betzler et al., 1997a; Fornós and Ahr, 1997; Basso, 1998; Toscano and Sorgente, 2002; Fornós and Ahr, 2006; Tropeano and Spalluto, 2006). The soft bottom of the continental shelf is characterized by heterozoan skeletal assemblages (*sensu* James, 1997), as reported by Péres and Picard (1964) and Caranante et al. (1988). Although the contemporary presence of terrigenous and skeletal carbonate sediments has been well established (Tortora, 1996; Fornós and Ahr, 1997) the interactions between these two sedimentation regimes has not been documented well enough on the Mediterranean continental shelf.

Most publications dealing with recent mixed systems are concerned with the interaction of carbonates and siliciclastics in photozoan carbonate depositional systems (Piller and Mansour, 1994; Testa and Bosence, 1998; Ferro et al., 1999; Dunbar et al., 2000), thereby neglecting the heterozoan carbonate depositional systems. Exceptions to this are studies conducted on cool-water carbonate settings in New Zealand and southern Australia (Nelson et al., 1988; James et al., 1992; Gillespie and Nelson, 1997). These examples are characterized by high hydrodynamic regimes, with year-round high-energy levels influencing cool-water carbonate siliciclastic interactions to at least mid-shelf

depth (James, 1997). Recently Halfar et al. (2004) studied an example of shallow-water facies and sediment mixing in a modern combined heterozoan and photozoan regime, transitional between tropical and cool-waters in the Southern Gulf of California.

This paper presents the first documentation of sedimentary facies and sediment mixing of heterozoan and siliciclastic sediments in temperate waters on the continental shelf of the Pontian Archipelago (Fig. 1a).

## 2. Geological setting

The Pontinian Archipelago is a Plio-Pleistocene volcanic structure located on the external margin of the continental shelf in the central Tyrrhenian Sea (Fig. 1a). The archipelago is formed by five islands, subdivided into western (Palmarola, Ponza and Zannone islands) and eastern (Ventotene and Santo Stefano islands) groups based on structural and volcanic differences (Chiocci and Orlando, 1996).

The western group represents the emerged portion of a structural high separating two Plio-Quaternary intra-slope sedimentary basins: the Palmarola and Ventotene Basins. (Zitellini et al., 1984; De Rita et al., 1986). This group consists mainly of acid volcanic domes and subordinate effusive thachytic magmas emplaced along the main NW-SE trending tectonic system and successive NW-SE and E-W trending alignments. Palmarola and Ponza are divided by a 7 km wide channel that is oriented N-S and reaches a maximum depth of 70 m. In contrast the eastern group represents the subaerial portion of a submerged stratovolcano emplaced at the center of the Ventotene basin. This structure is characterized by pyroclastic and effusive products having a basaltic-thachytic composition. The volcanic activity of the archipelago started 4 My ago and lasted until 33 Ky ago (Savelli, 1987; Bellucci et al., 1999).

The shelf-break is well defined and is situated at a depth of 105–160 m. In the south-western sector the

Download English Version:

<https://daneshyari.com/en/article/4690758>

Download Persian Version:

<https://daneshyari.com/article/4690758>

[Daneshyari.com](https://daneshyari.com)