EVOLUTIONARY MODEL OF A MICROTIDAL AND WAVE-DOMINATED COASTAL WETLAND SYSTEM IN SICILY (ITALY)

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Abstract

The Vendicari region is a good example of a coastal wetland system in a microtidal, wave-dominated and bed-rock confined environment, influenced by a dry Mediterranean climate. The study area has attained a near balance of accretion and relative sea-level rise rates, thus it can persist even if coastal wetlands are commonly perceived as sediment sinks destined to a final infilling. The aim of this study is to investigate the Vendicari region from a geological viewpoint, relating the evolution of this natural wetland with the adjacent coastal dune system, thus giving a rationale contribution to integrated coastal wetland management in Mediterranean.

Keywords : Lagoons, geomorphology, coastal models, sea level, shoreline evolution

Introduction

The coast of south-eastern Sicily is mostly terraced with active and abandoned cliffs and shore platforms, incised in Pleistocene carbonate-cemented sandstones and Holocene aeolian sandstones, situated on the eastern sector of the Iblean carbonate Plateaux (1).

Local conditions encourage accumulation forms such as sandy barrier beaches, pocket beaches and coastal wetlands, all ephemeral landforms on a geological time scale (2).

The Vendicari coastal wetland system was declared "Natural Reserve" in 1984 and, at present it is a site of international importance for Ramsar criteria, because it is a particularly good example of a natural Mediterranean wetland.

Material and methods

For the reconstruction of its temporal evolution, the present study advanced with two different methodological approaches: at long-term temporal scale, in the last 125,000 years, the Pleistocene and Holocene littoral deposits of the Vendicari region are described and analysed to investigate processes of wetland formation, and at short-term temporal scale, in the last 50 years, the coastal wetland system is described and monitored to evaluate its future tendency.

In addition, recent morphological changes have been observed in the barrier beach of Vendicari comparing aerial photographs (1943, 1977, 1987 and 1997) with topographic maps (1867, 1968 and 1977) and field data (1998-2000) collected during a seasonal monitoring (3).

Results

From a morphological viewpoint, the study area is characterised by a fine sand barrier beach about 3 km long, wedged between carbonate rocky headlands and a coastal wetland system, locally used as "salina" since Greek-Roman Age.

It is characterised by different wetland types (3):

- *Pantano Piccolo*, a coastal lake, not communicating with the sea, typical habitat of present lacustrine systems, hyperhaline and permanently flooded;
- I, a sabkha, typical habitat of present palustrine systems, hyperhaline and seasonally flooded, excavated and used in ancient times as "salina";
- *Pantani Roveto-Sichilli*, two partially closed lagoons, typical habitat of present estuarine systems, hyperhaline, permanently flooded and seasonally dried, interconnected with the sea through a single channel;
- *Ex-Pantani Balsamo, Chiatale, Scirbia e Cittadella*, all typical examples of ancient palustrine systems, saturated and locally manmade farmed.

The coastal dune system is characterised by sand ridges, partially vegetated and locally stabilised by wooden slats with hollows, incipient blow-outs and overwash fans. The adjacent bay includes at its centre a little carbonate rocky island, that became attached to the mainland some fifties years ago with a *tombolo*. In the Vendicari Bay, fine sandy bottoms prevail on *Posidonia oceanica* meadows and offshore rocky platforms.

Different scenarios have been reconstructed in the Pleistocene and Holocene, applying the transgressive barrier evolutionary model (4) to ancient and recent coastal and marine accumulation forms, at present eroded or with traces situated at different altitude.

The barrier beach and coastal wetland had different models of response at sea-level rise: stationary (overstepping), erosional and translational (rollover). The overstepping was particularly effective in the Vendicari region, because early diagenesis in beachrock and aeolian sandstones prevented mobility of barrier or a portion of it in presence of a warm and dry climate.

Greek-roman sites and individual structures, such as rock-cut features and pool-like depressions, positioned along the coast of Vendicari, provided additional data to confirm a relative sea-level rise in the last 2,500 years. Besides, it has been possible to locate, along the Scirbia stream, traces of the "Naustatmo", the ancient Roman channel-port (about 2,200 years BP) cited by Cicerone (3).

Rates of erosion and deposition were estimated along the beach, and the results confirm that, at a short-term temporal scale, comparing aerial photos between the 1977 and the 1997, accretion dominates in the southern sector and retreat is most significant in the northern sector, where the absence of *Posidonia oceanica* meadows and the bedrock produce an insufficient sediment redistribution mainly in correspondence of the ancient tombolo.

Conclusions

Although coastal wetlands are commonly viewed as sediment sinks, designated to be filled by continental, coastal and marine sediments (5), the Vendicari coastal wetland system has reached an accretionary balance with sediment accumulation rate adjusting to varying rates of relative sea-level rise.

In a microtidal, wave-dominated and bed-rock confined coastal wetland system, such as the study area, coastal variability results strongly influenced by inherited geological factors, which have controlled the evolutionary processes of the Vendicari region, where the sandy barrier beach continues to exert a double action on the adjacent wetlands, mitigating the influence of the sea and delivering fine sands into it.

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