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COASTAL AREA: A RECORDER OF ENVIRONMENTAL CHANGES

ABSTRACT: MASTRONUZZI G. & SANSÒ P., *Coastal area: a recorder of environmental changes*. (IT ISSN 1724-4757, 2006).

The morphodynamics of coastal area is the results of the interaction between different processes. Sea level represents their equilibrium surface; as consequence, its local or global changes - due to endogenic or esogenic factors - determines the migration of the coastline inland or seaward. This unsteady equilibrium, expressible in term of Sensivity, generate state of Hazard and Vulnerability which knowledge is at the base of the Risk assessment and of the Coastal Zone Use Capability.

The working group MACRiVaLiMa, branch of the AIGeo - Italian Association of Physical Geography and Geomorphology, was born with the aim to improve the knowledge of the coastal morphodynamics in response to environmental changes.

KEY WORDS: Coastal area, Sea level, Coastal evolution, Coastal dynamics.

RIASSUNTO: MASTRONUZZI G. & SANSÒ P., *L'area costiera: un registratore dei cambiamenti ambientali*. (IT ISSN 1724-4757, 2006).

La fascia costiera rappresenta la zona di equilibrio fra processi atmosferici, litosferici, idrodinamici e biologici. Il livello del mare, per tanto, si può considerare una sorta di livello di base di ognuno di questi processi. Le sue variazioni nel tempo – a lungo, medio, breve e brevissimo termine – e nello spazio – in senso verticale ed orizzontale – controllano la morfodinamica degli ambienti costieri e la posizione della linea di costa che è la materializzazione di un equilibrio instabile. Le variazioni del livello del mare possono essere determinate da fattori locali o globali, endogeni ed esogeni, in un insieme di relazioni complesse difficilmente distinguibili. Il peso di ogni fattore ha un ruolo differente nella determinazione della Suscettività del sistema costiero e di conseguenza nella definizione di parametri quali la Vulnerabilità e la Pericolosità alla base della determinazione del Rischio, la cui stima è a sua volta essenziale nella corretta pianificazione dell'uso della fascia costiera.

Il Gruppo di Lavoro MACRiVaLiMa, nato all'interno dell'AIGeo, l'Associazione Italiana di Geografia Fisica e Geomorfologia, si è posto l'obiettivo di contribuire a migliorare la conoscenza delle complesse interazioni funzionali che avvengono nel sistema costiero conseguenza delle variazioni ambientali, con l'applicazione di tecniche da tempo sperimentate e con metodologie innovative.

TERMINI CHIAVE: Fascia costiera, Livello del mare, Evoluzione della fascia costiera, Dinamica costiera

INTRODUCTION

Coastal area represents the equilibrium zone between atmosphere, lithosphere, hydrosphere and biosphere. Moreover, sea-level represents the base level of main morphodynamic processes; its change, at different timescales, controls large environmental modifications and the landscape evolution of coastal area. Sea-level represents at same time the lower limit of fluvial, erosional and denudational processes in continental area and the upper limit of deposition of continental shelf-produced sediments, carbonates formation and wave action as well (Davis & Fitzgerald, 2004; Fairbridge, 2004). Changes in sea level produced by eustatic, isostatic, tectonic or steric causes, move this important limit inland or seaward producing significant changes in the local relief and the migration of the entire coastal area (i.e.: Carter & Woodroffe, 1994; Morner, 1996; Pirazzoli, 1996). Compared to the effects of some morphodynamic paroxistic processes, sea-level change seems less catastrophic, but this is only partially true. In fact, sea-level change along rocky coasts moves upward the area of wave impact and the spray zone inducing a vertical migration of marine erosion focus. Along the sedimentary and tidal coasts, sea-level changes can produce significant effects in a bi-dimensional system producing environmental changes very far from the former shoreline.

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The growing anthropic pressure on the coastal zone during the last 50 years has dramatically increased the necessity to define its dynamics in response to environmental changes at different timescales. At present the mean rate of sea-level rise is generally estimated between 1 and 2 mm/year (i.e.: Pirazzoli & Tommasin, 1999; Antonioli, 2000; Cecile & *alii*, 2001; Lambeck & *alii*, 2004). The most part of coastal areas in the world are under severe erosion which produced the partial degradation of dune area (i.e.: Brunn, 1988; Bird, 1993; Douglas & *alii*, 2001; Pranzini 2004). The combination of these variations increases the vulnerability of coastal zone to extreme events as, for example, sea storms or tsunamis able to produce more frequent and larger floodings (i.e.: Bryant, 2001; Mastronuzzi & Sansò, 2004; Kelletat & Schellman, 2002). The high variability of coastal environments in a short period induces negative effects on urbanised areas stretching along the coastline.

Coastal environments are the results of processes occurring at different timescale and for this reason they can retain the records of past tectonic and climatic changes. In some coastal areas the continuous human presence represents an inestimable source of chronological data helpful to define the sequence of past environmental changes. From this point of view, coastal area is very useful in the reconstruction of past global change aiming to predict the future coastal evolution and to assess its environmental sensivity, vulnerability, hazard and risk (i.e.: Gornitz, 1991; Silenzi, 2000; Brunsden, 2001; Panizza, 2005). In fact, the increasing risk generated by the growing anthropization of coastal areas rises the demand for an integrated geomorphological research which must take into account information coming from the geochemistry, biology, archaeology, physics and mathematics. In this way, it is possible to constitute the base for an improved management of coastal zone.

THE WORKING GROUP MACRIVALIMA

The working group MACRiVaLiMa - *Modificazioni dell'Ambiente Costiero in Risposta alle Variazioni del Livello del Mare nel Tardo Quaternario* (Environmental modifications of coastal zone in response to sea level changes in the Late Quaternary) was constituted in the 2002 as a branch of the AIGeo (Italian Association of Physical Geography and Geomorphology) with the main goal to improve the geomorphological knowledge of the coastal landscape. It comprised a group of Italian and foreign researchers that shared experience and data.

The objectives of this working group were:

– to compare the morphological evolution of different coastal landscape during relative sea-level stands;
– to reconstruct relative sea-level changes during the Late Quaternary;
– to develop new methods for coastal landforms dating and correlation.

This issue of Geografia Fisica e Dinamica Quaternaria collects a number of papers resulting from the research activities of Italian and foreign researchers along the Italian coasts.

A number of papers deal with Last Interglacial period landforms. Dumas & Raffy (2005) stress the relationships occurring between the marine terraces of Southern Calabria and the climatic changes occurred during MIS 5 - MIS 4 period. They reconstruct a relative sea-level curve for this coastal area from the interpretation of geomorphological and geological data. Zander & *alii* (2005) make an attempt to obtain a definitive chronological attribution of the marine terraced deposits occurring in the area of Metaponto (Taranto Gulf). However, notwithstanding the numerous OSL analyses performed on the marine terrace deposits, not final results have been obtained due to the limit of the method.

Pagliarulo (2005) defines the tectonic evolution of the coastal area of Sibari (Calabria) during the last sea level rise using archaeological and geotechnical data aiming to individuate the causes of the disappearance of Sibari archaeological site.

The two following papers are devoted to the study of rocky coasts. Cucchi & *alii* (2005) discuss the effects of present sea level on the limestone rocky coast of Gulf of Trieste. In particular, the shaping of intertidal platform is investigated by using experimental data in correlation with data referred to karstic processes active in the near karst area. Arozarena Llopis (2005) paper focuses on the evolution of rocky coasts; in particular she suggests a polygenetic origin for the wave cut platforms placed at different altitude along the coastal tract stretching from Lerici to Tellaro in eastern Liguria.

The two final papers are devoted to the definition of the effects of extreme waves on the coastal area. Mastronuzzi & Sansò (2005) report the first assessment of the vulnerability of the Apulian coast related to tsunami events. This coast is in fact prone to tsunami hazard since it has been struck by large tsunami several times during historical times.

Pignatelli & *alii* (2005) show the result of a study carried out on two case-sites along the coast of the Apulia, aiming to evaluate the environmental vulnerability of these two areas due to extreme marine events such as extreme sea-storms or tsunamis.

The papers collected in this issue of Geografia Fisica e Dinamica Quaternaria, produced by researchers involved in MACRiVaLiMa working group activity, is only a small part of a larger number of papers produced during the course of the working group activities. These contributions will surely represent a valid contribution to the knowledge of the coastal processes, morphodynamics and evolution.

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