Submerged shorelines off the Gallinara Island (Ligurian Sea, NW Mediterranean)

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INTRODUCTION

In coastal stable to slowly uplifting/subsiding areas, most of the marine landforms produced during Middle and Late Quaternary are presently submerged. Even though sedimentation can rapidly obliterate coastal landforms in many underwater contexts, along submerged promontories and coastal islands usually the sedimentation is low and landforms inherited by past sea levels can be identified and mapped. In this study we focus on the submerged coastal area of the Gallinara Island, located in the NW Mediterranean Sea (Fig.1) in order to describe its geomorphological features, in particular those inherited by past sea levels.

The Gallinara Island is characterized by rocky cliffs of quartzites interbedded with strata of polygenic conglomerates (Quarziti di Monte Bignone Unit - Createaceous). For its coastlines have not been reported evidences of emerged paleo shorelines, while in the coastal sector facing it (Alassio) OXILIA & VICINO, 1984 report a shoreline attributed to MIS 5.5 located at about 4 meters asl. In general, along the coastline comprised between Savona and Ventimiglia, the paleo-shoreline elevations relative to MIS 5.5 have been reported from 5 to 12 m a.s.l. (FEDERICI & PAPPALARDO, 2006 and reference therein); the Late Quaternary tectonic behavior of this coastal tract is thus considered typical of stable to slowly uplifting areas (AMBROSETTI *et alii*, 1987).

Surveys were carried out using scuba diving techniques in four transects and eight spot diving surveys within the study area (Fig.1). Aerial photos allowed to identify the presence/absence of seagrass meadows in the shallow part of the study area.

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RESULTS AND DISCUSSIONS

Surveys allowed to draw a geomorphological sketch map of the study area (Fig.1). The eastern and southern parts of the island are characterized by plunging cliffs, separated by a large rockfall ending at 27-30 m depth. In this sector, a slope rupture is evident both in the rockfall deposit and in the cliff at 15-20 m depth. Several caves of structural origin (differential erosion of strata) have been identified along these cliffs at -24/-26 m. These caves appear to have been reworked by the sea, as their walls are characterized by abrasion notches decreasing in amplitude towards the closure of the cave. The other sectors of the island show a different morphology: the cliff ends at 5-8 m depth in rockfall deposits. In general, at 25-30m depth, the rockfall deposits are substituted by loose sediments.

The surveys carried out in the study area allowed to identify some evidence which could be related to former shorelines: the slope rupture at 15-20 m depth, and the reworked caves at 27-30 m depth could in fact represent respectively the outer margin of a marine terrace, and the effect of marine abrasion in a shallow or coastal environment. These levels appear to be in bathymetric analogy with those found in several stable to slowly uplifting areas along the Italian coastlines. Nevertheless, this interpretation calls for more reliable data for which concern: i) marine origin of the observed landforms, and more precise depth of the sea level(s) associated to them. It is possible that the two elements represent different aspects of the same shoreline: while the upper marine terrace was forming, the caves were shaped by marine abrasion in shallow (7-10m) water. Nowadays, the caves are no more subjected to marine abrasion. ii) Age of the ancient sea level(s): as no direct chronological constraint is possible, due to the absence of dateable material, hypotheses can be made on the basis of bathymetric cross-correlations. According to the present knowledge, the coastal part of the study area can be considered tectonically stable, and the glacio-hydro isostatic rebound characterizing it after LGM can be constrained within few meters (BARD *et alii*, 2002). Under such conditions, any sea level observed through a geomorphological marker can be in first approximation compared with its eustatic value, without further corrections for tectonic or isostatic effects. According to eustatic curves (e.g. WAELBROECK *et alii*, 2002), different Marine Isotope Stages (5.1, 5.3, 7.1, 7.3 and 7.5) peaked below MIS 5.5 and 1

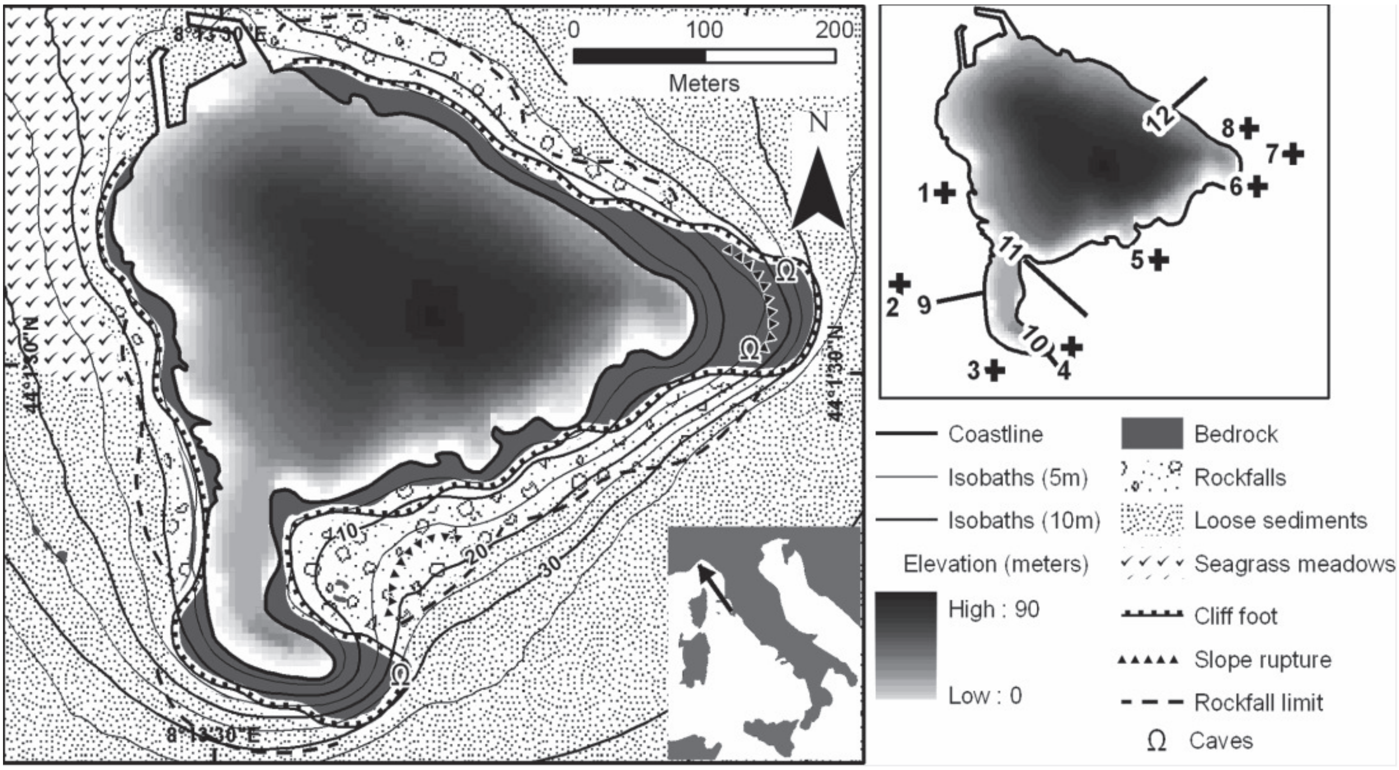

Fig. 2 –Geomorphological sketch map of the underwater part of Gallinara Island and location of transects and spot diving surveys.

sea levels and near the levels described in this study. Therefore, the shorelines identified in this study can have been shaped by one or more sea level highstands lower than the present one. In the case of their MIS 7 age, further studies would be needed to identify the causes of their preservation during two entire glacial cycles (MIS 6 and MIS 2).

REFERENCES

OXILIA M. & VICINO G. (1984) - *Scoperta di un livello marino fossilifero del quaternario ad alassio (Savona)*. Riv. Ing.e Int. **3-4**, 85-86.

FEDERICI P. & PAPPALARDO M. (2006) - *Evidence of MIS 5.5 highstand in Liguria (Italy) and its tectonic significance*. Quat. Int. **145-146**, 68-77.

AMBROSETTI P., BOSI C., CARRARO F., CIARANFI N., PANIZZA M., PAPANI G., VEZZANI L.& ZANFERRARI A. (1987) - Neotectonic Map of Italy, Scale 1:500 000. CNR, Rome.

BARD E., ANTONIOLI F. & SILENZI S. (2002) - *Sea-level during the penultimate interglacial period based on submerged stalagmite from Argentarola cave (Italy).* Earth and Plan. Sc. Lett. **196** (3-4), 135-146.

WAELBROEK C., LABEYRIE L., MICHEL E., DUPLESSY J.C., MCMANUS J.F., LAMBECK K., BALBON E.& LABRACHERIE M. (2002) - *Sea-level and deep water temperature changes derived from benthic foraminifera isotopic records*. Quat. Sc. Rev. **21**, 295-305.