MORPHOLOGIC FEATURES OF THE MARESME CONTINENTAL SHELF (NE BARCELONA) AND THEIR CAUSAL SEDIMENTARY PROCESSES

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Abstract

The seafloor bathymetry, backscatter and upper sediment cover of the Maresme continental shelf (NE Barcelona) were analized by means of multibeam mapping and very high resolution seismic reflection profiling. Two large morphological steps identified as part of relict coastal sand bodies as well as some longitudinal beachrock bars have been linked to successive sea level rise pulses. Numerous bedforms with NNE-SSW orientation are related to present long-term and/or stormy currents. In conclusion, the overall morphology and sediment distribution in the study area results from fluvial sediment input and relative sea level variations during the Late Quaternary.

Keywords: Maresme continental shelf, high-resolution morphology.

Full coverage Simrad EM1002 data and very high-resolution Simrad TOPAS parametric profiles were collected from the Maresme continental middle and outer shelf (NE Barcelona), between the Blanes, Arenys and Mataró canyons, covering an area of around 28×16 km (2°20'-2°50'E, 41°15'-41°40'N). The EM1002 data were used to construct detailed bathymetric and shaded relief maps, backscatter mosaics and combined products of the Maresme continental shelf that, together with the TOPAS profiles, depict the major morphosedimentary elements occurring in the area.

The Maresme coast is mostly wave-dominated and the seafloor is primarily sandy. Prevailing oceanographic currents (mainly the Liguro-Provençal current) and littoral drift flow southwestwards. Typical mesoscale anticyclonic structures migrating from the Gulf of Lions are often present in the study area (1), as well as other ones related to the local submarine physiography (2). Winter storms caused by strong eastern winds create downwelling bottom currents that can transport large volumes of sediment downshelf and offshore (3).

Inspection of the TOPAS profiles shows that the upper sediment cover (most probably Late Quaternary) ranges from 3 to 10 m thick on the westernmost part of the study area to more than 40 m on the easternmost part. The dominant sedimentation pattern is aggradational. Seawards, the sediment cover is more scarce and the terrain more rugged, as can also be observed in the EM1002 data.

The most conspicuous morphological features of the study area are two large steps around 20 m high subparallel to the coastline (Fig. 1). The shallowest one deepens eastward from 40 to 70 m depth evolving to a more subdued relief, while the deepest one ranges from 100 to 120 m depth and shows a gentler slope. These two steps were interpreted as relict sand bodies built up during the Versilian transgression in a shoreface environment (3). Indeed, they seem to be related to different sea level stages showing, at least the deepest one, a progradational internal structure. The relative coarse nature of their sediments appears to be confirmed by a relatively high backscatter compared to surrounding areas (Fig. 1). The upper truncation of these bodies indicates that they have been later reworked.

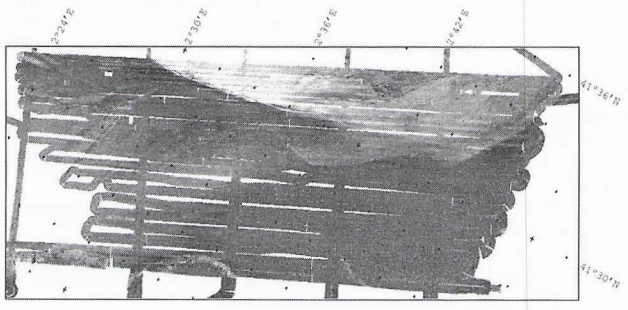

Fig. 1. Backscatter mosaics show a clear difference in reflectivity values above and below the two morphological steps. The largest beachrock bars, showing relative high backscatter (light tones), can be noticed in the upper left part of the picture. Mataró and Arenys canyon heads start at the bottom left corner of the map.

Different groups of longitudinal bedforms (probably dune fields) appear over most of the study area. The structures show different size and textural properties but all them maintain a NNE-SSW orientation. Their origin is probably related to long-term and/or stormy currents which undergo refraction processes and propagate from deeper to shallower areas.

Below the steps, two large crescent shaped bars appear. They become asymptotically parallel to the coast and are probably made up by partially cemented deposits. Their orientation turns from N-S to NE-SW being finally buried by the sediments forming the steps. Their morphology appears similar to that of other minor bodies parallel and closer to the shoreline that have been identified as beachrocks (4). Therefore, these structures can be also linked to successive sea-level rise pulses.

At the northwestern end of the steps, near the Blanes Canyon, the sea-floor becomes very steep, whilst sediment thickness increases suddenly. This appears to be related (a) to a deceleration and consequent lost of competence of the coastal southwestward current previously constrained by the Blanes Canyon head, (b) to the influence of the Tordera River input and/or (c) to a continuous sediment capture towards the aforementioned depressed area and, ultimately, to the Blanes Canyon (2,3).

In conclusion, the Maresme shelf shows a morphological signature that is largely the result of sediment input from the continent and reworking of these sediments during emersion and transgression periods and, more recently, by bottom currents. The shelf morphology and sediment cover show the result of the interplay between these processes during the Late Quaternary.

References

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