

Submerged depositional terraces along the Ionian margin of Puglia

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GEOLOGICAL SETTING

The Ionian margin of Puglia, the eastern sector of the Gulf of Taranto, is located between the Valley of Taranto and Puglia and is characterised by a regular deepening from the coast to seaward. It constitutes part of the foreland of the Southern Apennine Chain. The Apulian foreland is a structurally stable zone affected essentially by vertical movements. Above the crystalline basement (MORELLI *et alii*, 1975; ARISI ROTA & FICHERA, 1985) a sedimentary cover is present mainly made up by a Mesozoic and Cainozoic calcareous succession, whose thickness is more than 6000 m (Apulia Unit; D'ARGENIO *et alii*, 1973; RICCHETTI *et alii*, 1988).

Toward the west the Apulia Unit extends underneath the Pleistocene deposits of the Bradano foredeep till the margin of the chain; it is also recovered underneath the apenninic thrust sheets (CARISSIMO *et alii*, 1963; MOSTARDINI & MERLINI, 1986; PESCATORE, 1988). This unit is affected by several systems of vertical and subvertical faults, the older one, with an apenninic trend, can be attributed to the middle Pliocene, the next, with an anti-apenninic NE-SW and E-W trend, can be dated from the late Pliocene (BALDASSARRE *et alii*, 1978; CIARANFI *et alii*, 1979). During the Quaternary no significant vertical movements were recorded.

In the sea, along the Ionian margin of the Puglia, the Apulia Unit collapses toward the chain and is affected by normal faults that set up a horst and graben structure. The grabens are filled with Plio-Quaternary sediments (AGIP, 1977; TRAMUTOLI *et alii*, 1984; PESCATORE & SENATORE, 1986; SENATORE, 1987).

The structure of the eastern sector of the Gulf of Taranto was included by SENATORE (1988) into the genetic models of the foredeep/foreland systems.

THE CONTINENTAL SHELF

The continental shelf of the eastern sector of the Gulf of Taranto has a width with a range between 1 km and 20 km and a slope between 1° and 2°. Its shelf-break is located at an average depth of 110 m.

Three orders of terraces at depths of 25/30m, 50/60m and 110/120m were located (SENATORE *et alii*, 1980; PENNETTA *et alii*, 1987). On the edge of these terraces, especially the one at -50/60m, coral-line algal banks can be found (PERES & PICARD, 1964; SARÀ, 1967).

The sediments on the shelf are made up of sorted sands ranging from very coarse to very fine (PENNETTA, 1985); generally these sandy grains are made up of bioclastic carbonate fragments which come from the coralline algal banks broken away by the wavy motion (PESCATORE, 1985). The grain size characteristics of such sediments indicate a transport by traction and saltation (PENNETTA, 1985).

The CaCO₃ content is normally higher than 90 % and is due to the bioclastic fraction (BELFIORE *et alii*, 1981). As regards to the Ostracod and Foraminifera assemblages, the shelf is characterised by a normal diversification of species, from the coast seaward. The infralitoral zone is characterised by species belonging to Miliolidae, Discorbidae, Elphidiidae; fragments of bryozoi, molluscs and plates and radioli of Echinoids can also be found (MONCHARMONT *et alii*, 1985; BONADUCE *et alii*, 1985). It can also be pointed out (PESCATORE, 1985) that the shelf and the ionian margin of Puglia are characterised by the presence of species whose geographical distribution is confined to the Levantino Basin; such species are completely absent in the Western sector of the Gulf of Taranto.

Fig. 1 - Location map of the eastern sector of Gulf of Taranto. Bathymetry is in metres. The depositional edge (toothed line) of the terrace at depth of 110/120m and seismic lines shown are reported (lines with letters). The terrace has developed almost in continuity along the most part of the ionian margin of Puglia; where it is present, it also represents the physiographic break of the continental shelf.

Its width is about 1 km whereas its slope is approximately 2°.

COLLECTION AND ANALYSIS OF DATA

From 1978 the Department of Earth Sciences of Naples, in collaboration with Italian and foreign researchers, have carried out joint researches in the Gulf of Taranto within the "Progetto Oceanografia e Fondi Marini" with the aim of studying the dynamics of the waters and the sedimentary and structural phenomena that control the development of the gulf. Detailed studies were carried out on the structure, the morphology and the sedimentary processes of the continental shelf, for the potential use of these areas.

From 1978 to 1982 five oceanographic cruises with C.N.R. ships Marsili and Bannock were carried out. Sparker profiles at 6000 J, high resolution profiles (Uniboom 1000 J and EDO 3.5kHz) and Side Scan Sonar were collected. Gravity cores, dredges (cylindrical and triangular) and grab Shipek were used to collect samples.

The location of the seismic profiles and the samples was settled with the Loran C Decca and Satellite Decca positional systems.

In 1987 a new oceanographic cruise with the Bannock ship, was carried out with the aim of fulfilling the data already collected and of studying the sedimentary processes that occur in the Valley of Taranto. During this latter oceanographic cruise Sparker profiles 1kj, EDO 3.5 kHz and Side Scan Sonar were carried out, mostly in the Apulian sector of the gulf.

To make in plan the obtained data a base map at the scale 1: 100,000 and 1: 250,000 was used with a bathymetric contour made by DIPLOMATICO *et alii* (1985). Although the Apulian continental shelf is characterised by three orders of terraces in all its width, only the terrace at a depth of 110/120 m presents morphological and depositional characteristics to be mapped. The depositional edge of the terrace was reported in all the areas where it was recognised; in the showed cases even the parameters of the lower and upper margin of this terrace were reported in plan. The lateral variability was controlled by comparing the depths, the seismic facies and the reflections geometry. All the terraces are characterised by progradational seaward reflections that have been connected to at least two regressions and lowstand of the sea level which probably occurred from middle Pleistocene.

Fig. 2 - Line drawing across the Apulian continental shelf. Three orders of terraces are observed. The border of the deepest terrace represents the shelf -break. The sediments present at the bottom are made up of calcareous bio-

clastic sand ranging from fine to coarse (PESCATORE, 1985); such sediments, on profile with 3.5 kHz frequencies, created insufficient or almost no penetration of the seismic waves. At the edge of the terraces of -50/60 m and -25/30 m coralline algal banks are present (BC).

Fig. 3 - (a) 3.5 kHz profile located to the south of Taranto. The deposits that make up the terrace are characterised by an echo with an indistinct bottom and discontinuous reflections in the subbottom, which indicates the presence of sandy sediments that are of bioclastic origin (PESCATORE, 1985). The reflections on the profile show a seaward dip of about 4°.

A sub-horizontal reflection (R) can be observed. It divides the terrace in two depositional bodies (1.a - 1.b); the terrace therefore results linked to at least two cyclic events of a width most likely similar.

On the right of the figure a morphological step, without the development of a terraced surface is visible.

On the right (b) the principal depositional parameters of the terrace have been reported.

Fig. 4 - 3.5 kHz profile located to the north of Torre dell'Ovo (B in Fig.1). The profile shows the upper depositional body (1.a), characterised by progradational reflections in downlap on the R reflection and with a seaward slope of about 2°. The lower depositional body (1.b), underneath R, is made up by clinoforms seaward prograding.

On the right (b) the depositional parameters of the terraces have been reported.

Fig. 5 - 3.5 kHz profile located seaward of Gallipoli (C in Fig. 1). The terrace is again made up of two superimposed depositional bodies.

The more superficial (1.a) characterised by lack of penetration of the seismic waves because of the presence of sand, is characterised by a morphological relief that confers to the surface of the terrace, usually smooth, a rough topography. Analogously with similar structures recovered seaward of Cilento by COPPA et alii (1996), such a body could be interpreted as part of a submerged beach emplaced during the lowstand of the isotopic stage 2. The deeper depositional body (1.b) is constituted by clinoforms with a seaward dip of about 5°.

At the margin of the terrace, the reflections indicate that there are frequent slumping phenomena.

On the right (b) the depositional parameters of the terrace are reported.