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Submerged depositional terraces in the Gulf of Policastro (Southern Tyrrhenian sea, Italy)

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GEOLOGICAL FRAMEWORK

During two oceanographic cruises in the Gulf of Policastro (S. Tyrrhenian Sea, Italy) in 1989 and 1990 on the vessel 'Bannock' of the Italian National Council for Research (Fig. 1), bathymetric and seismo-acoustic profiles were acquired, for a total distance of 894 nautical miles.

The Gulf of Policastro lies between the western flank of the Calabro-Lucanian segment of the Appennine chain and, to an even greater extent, a stretch of the Tyrrhenian basin (KASTENS *et alii*, 1988; PATACCA *et alii*, 1990). The very recent tectonic events which occurred in this area are revealed by the considerable complexity of the platform-scarp system of this margin (PENNETTA, 1996a).

Strong subsidence, together with distension of the Tyrrhenian basin and considerable uplift of emerged areas, modelled this stretch of margin, characterized by slope ridges (SELLI, 1970), peri-Tyrrhenian basins (SELLI, 1970; FABBRI *et alii*, 1981), canyons, and generally complex depositional patterns (ARGNANI *et alii*, 1989; SARTORI, 1989; DE PIPPO *et alii*, 1996). This development is also the result of large-scale tectonic disjointings, both parallel and at right angles to the margin, more clearcut in the chain areas (PENNETTA, 1996b; DE PIPPO & PENNETTA, 1999).

Study of seismic profiles identified submerged sedimentary bodies near the edge of the continental platform, with external terraces and an internal structure prograding seawards. These bodies formed during the phases of sea level lowering and lowstand during the Last Glacial, and are called here submerged depositional terraces (SDT). They develop along one stretch of the prograding platform between Punta Cirella and Capo Tirone and along another eroding stretch off the mouth of the river Bussento (Fig. 2).

Fig. 1 - *Location of the study area and of profiles.*

Fig. 2 - *Morphological map of Gulf of Policastro, with indication of SDT*

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MORPHOLOGY

The northern portion contains the Sapri slope basin, it is subtended by a generally narrow continental platform about 1 km wide, which sometimes reaches 7.5 km. The platform has high gradients and clearly shows the effects of erosion and structural control, with a well-defined edge between -90 m and -120 m. An SDT running for at least 3.5 km lies off the river Bussento. The continental platform then passes to a scarp affected by gravitational processes and deeply cut by channels, the heads of which tend to increase the generalized retreat of the edge of the platform, due to regressive erosion. The resulting slump deposits thus collect in the Sapri basin, defined to the south and west by submerged slope ridges, which act as sediment collectors (PENNETTA, 1996a).

The southern portion of the study area, from Capo Scalea to Capo Tirone, is characterized by morphostructural highs subtending a quite wide (5-8 km) platform, with small gradients and a gradual edge at a depth of 130-140 m. This portion evolves gradually to the upper scarp, which is generally regular and has a low gradient. The effects of past progradation of the platform are evident in this area. There is an SDT running parallel to the coast for 2.5 km off the stretch between Punta Cirella and Capo Tirone.

In the sub-bottom of the entire stretch of platform, interpretation of acoustic profiles identified a very irregular disconformity surface, probably created by subaerial erosion (Fig. 3). Its maximum depth varies between -90 and -100 m in the eroding stretches and up to -130 m in those with a deeper edge, sometimes prograding. This surface thus probably formed during the Last Glacial (18,000 years B.P.), when the sea level reached its current isobath of -110/120 m (MARANI *et alii*, 1988). This event caused the almost complete emergence of the platform and displaced the old coastline almost to the present-day edge. The marine depositional sequence was thus laid down near the edge of the platform and on the scarp (Figs. 3, 4), with gradually coarser deposits prograding seawards, while pre-existing deposits on the more internal portion were subjected to erosion by exogenic agents. Erosion by watercourses which cut the present-day platform during that period is shown by frequent depressions in the disconformity surface (Fig. 3), interpreted as paleo-riverbeds, with preserved paralic deposits, in their turn buried under thick layers of marine transgressive and highstand sediments (PENNETTA, 1996a). The diachronous erosional surface separating the deposits of the two environments is due to the progressive retreat of the coastline caused by the rise in sea level after the Last Glacial.

Near the edge of the platform, under the angular disconformity surface, are relict deposits prograding seawards, laid down both during the Wurmian regression and during preceding eustatic cycles (Figs. 3, 4). They are overlain by paralic and marine deposits, thickening landwards, as identified by groups of aggrading acoustic reflections (Fig. 4).

SUBMERGED DEPOSITIONAL TERRACES

Both off the river Bussento and between Punta Cirella and Capo Tirone are clino-stratified SDTs, prograding seawards and running parallel to the margin.

Fig. 3 - *Sub-bottom profile, 3.5 KHz, GPL'89-Z3.*

Off the river Bussento (see Fig. 3) is a platform about 2 km wide with a gradient of about 2°. The sub-bottom has an angular disconformity surface at about -90 m, filled with paralic and marine sediments which were laid down during the rise in sea level after the Wurmian Pleniglacial.

There is a relict depositional body near the edge with internal structure prograding seawards, and an external terrace interpreted as an SDT. This body is located at the foot of what is possibly a surface of marine abrasion, at about -85 m, and lower than it by at least 10 m. The SDT is at least 3.5 km long, 20-25 m thick, and is located at a distance of about 150 m from the coastline. Its internal part contains a structure characterized by close-set clinoforms with a gradient of about 4°, interpreted as coarse-grained deposits on the basis of the type of reflection. These clinoforms are truncated upwards by an erosional surface on which lie thin transgressive and highstand deposits.

Fig. 4 - *Sub-bottom profile, 3.5 KHz, GPL'90-E15.*

Off the stretch between Punta Cirella and Capo Tirone (see Fig. 4), at the margin of a platform wider than the preceding one (about 8 km wide) and with a gradient of less than 1°, there is a depositional body extending seawards for about 500 m, at least 2.5 km long, and about 40 m thick. Its internal structure clearly shows clinoforms, with frequency and gradient gradually increasing seawards, attributable to the deposits of the progradational body which were laid down during the fall and lowstand of the sea level during the Wurmian Pleniglacial. This structure may indicate an increase in the sandy fraction of sediments, corresponding to a coarsening-upward trend. The clinoforms are eroded in their upper endings by the marine erosional surface (PENNETTA, 1996a), and the maximum depth of 145 m near the margin correlates it with the rise in sea level after the Last Glacial. This surface separates prograding units at the base, related to sediments deposited during the lowstand, from two aggrading units on the upper surface, related to transgressive and highstand deposits. The prograding deposits of the SDT are bounded at the base by an older erosion surface, identical in structure to the preceding one and interpreted as a surface cutting deposits laid down during eustatic cycles preceding the last one.

CONCLUSIONS

Ongoing morphological and sedimentary processes in the northern and southern portions of the Gulf of Policastro are differentiated thanks to the structural arrangement of the Gulf, which is not indicative of a 'typical passive margin', since the platform-scarp system bordering the Sapri basin (north) is characterized by marked structural control and has been undergoing evident erosion ever since its emplacement. Instead, structural control is less evident in the southern portion, which shows the effects of both progradation and aggradation, facilitated by significant clastic supplies from watercourses (e.g., seasonal rivers) cutting the margin of northern Calabria. In spite of this, and although the present-day morphostructural contexts and probably those of 18,000 years B.P. in the northern and southern portions of the Gulf of Policastro are different, the submerged sedimentary bodies, with their terraced external geometry, show practically the same characteristics, and therefore probably had the same genesis.

Their origin is probably due to sedimentation which occurred during the lowstand of the Last Glacial, during which the sea retreated to the current isobath of -110/120 m on the Eastern Tyrrhenian Margin, displacing the old coastline to depths lower than the present-day edge of the platform and thus favouring the creation of prograding regressive beach deposits.

The absence of sedimentary supplies favoured the laying down of 'forced' regressive prograding deposits, composed of coastal sediments, gradually more recent seawards and generally well preserved on the continental margin which, in the study area, shows features similar to those identified along other such margins (FIELD & TRINCARDI, 1991; TRINCARDI & FIELD, 1991; CORREGGIARI *et alii*, 1992; POSAMENTIER *et alii*, 1992).