Some geomorphologic evidence of the occurrence of lowstand episodes in the Licosa morpho-structural high, located on the southern Tyrrhenian continental margin off Campania, has been found based on a densely-spaced grid of high resolution seismic reflection profiles (Subbottom Chirp) and is herein presented. This evidence is represented by terraced surfaces located at several water depths, incised in the rocky acoustic basement, widely cropping out in the seaward prolongation of the Licosa morpho-structural high.

The geological structures and the related seismic sequences, unconformably overlying wide outcrops of the acoustic basement, have been studied and interpreted in detail. This has allowed to analyze the stratigraphic architecture of Quaternary marine deposits. These deposits have been detected in the depocentral areas located between the mouth of the Solofrone river and the town of Agropoli. In the Licosa morpho-structural high the rocky outcrops result from the seaward prolongation of the stratigraphic-structural units, widely cropping out onshore in the adjacent emerged sector of the Cilento Promontory (“Flysch del Cilento” Auct.: Ciampo et al., 1984; Bonardi et al., 1988).

The Cilento Promontory represents a morpho-structural high, interposed between the coastal depressions of the Sele Plain-Salerno Gulf and of the Policastro Gulf. Its reliefs are composed of thick successions of turbidite siliciclastic and carbonatic sequences, dipping landwards into the main carbonatic reliefs of the Southern Apennines (“Alburno-Cervati” Unit). The terrains cropping out in the Cilento Promontory are formed by siliciclastic rocks, accumulated into deep basins during a time interval ranging from the Late Mesozoic to the Late Miocene. The oldest one of these formations is the North Calabrian Unit, the highest stratigraphic-structural unit in this sector of the Southern Apenninic chain. In the Cilento area it is represented by a formation ranging in age from the Malm to the Oligocene, composed of dark clays, marls and marly limestones, reaching a thickness of 1300 meters. The North Calabria unit is overlain by Early Miocene synorogenic units, showing a degree of deformation higher with respect to that one of the overlying tectonic units. The Cilento Flysch includes the Pollica, S. Mauro and Monte Sacro Formations, showing an overall thickness of about 1500 m (Bonardi et al., 1988).

In the western sector of the Cilento Promontory several morphological depressions filled by alluvial deposits, whose origin has been attributed to NNE-SSW (Plain of Alento) and NW-SE (Plains of S. Maria di Castellabate and S. Marco) trending structural elements, occur. The formation of these depressions has to be attributed to the Late-Middle Pleistocene (Brancaccio et al., 1995). They include transgressive-regressive cycles referred to the glacio-eustatic oscillations of the isotopic stage 9, 7 and 5 (Shackleton and Opdyke, 1973), downthrown of several tens of meters with respect to their original altitude, between the end of the Middle Pleistocene and the beginning of the Late Pleistocene.

The Cilento Promontory has been involved by a vertical uplift of more than 400 m during the Early Pleistocene and the Middle Pleistocene. Absolute estimates of the entity of the Pleistocene uplift which involved the Cilento Promontory have been obtained through the vertical distribution of the Pleistocene marine terraces along the Cilento coasts. In the Northern Cilento the oldest marine terraces (Middle Pleistocene) are located at a maximum altitude of 350 m a.s.l. (Cinque et al., 1994). At the Bulgheria Mt (southern Cilento), the marine terraces of the Late Pliocene-Early Pleistocene are uplifted to heights of 450 m a.s.l. On the other side, the terraces of the Emilian are uplifted to heights of 350 m a.s.l. (Baggioni et al., 1981; Lippmann-Provansal, 1987; Borrelli et al., 1988).

The morphological elements of the coastal areas relative to palaeo-stands of the sea level
during the Late Pleistocene (isotopic stages 5e and 5c) have evidenced an overall tectonic stability of this tract of the shore from the Tyrrhenian stage to present-day times (Romano, 1992). The lack of relevant vertical movements during the last thousand of years has been evidenced by the height of the Versilian beach deposits. These deposits have been observed in the fluvial and coastal depressions, incised during the previous glacial regression, for more than 2 km in the inner of the shoreline (Cinque et al., 1994).

The present-day coastal cliffs are incised in the arenaceous and silty successions of the Pollica Formation. The geological survey of the Quaternary deposits between the towns of Agropoli and Ogliastro Marina has evidenced the occurrence of five sea level palaeo-stands at altitudes ranging between 25 m and 1.5 m above the sea level. The oldest levels, the Comenale Complex and the S. Antonio – S. Marco sandstones Complex have been tentatively ascribed to the stages 9 and 7 of the isotopic stratigraphy. Next palaeo-stands (+8, +10, +4 m above the sea level) are represented by abrasion terraces and notches, ascribed to the stages 5e and 5c of the isotopic stratigraphy.

The stratigraphic units individuated in the adjacent offshore through the seismo-stratigraphic analysis belong to the Late Quaternary depositional sequence. In this sequence, the space and time evolution and the lateral and vertical migration of the marine coastal, continental shelf and slope depositional environments pertaining to the Late Pleistocene to Holocene glacio-eustatic cycle have been recognized. The stratigraphic succession records the variations of the accommodation space of the Late Quaternary deposits during the last 4th order glacio-eustatic cycle, ranging between 128 ky B.P. (Tyrrhenian stage) and present-day times (isotopic stage 5e). Several local unconformities overlie coarse-grained deposits, filling intra-basinal depressions or palaeo-channels located at the top of the acoustic basement.
The used approach has allowed to obtain comparable information for all the margins of the Italian Peninsula without a strong influence of local and particular aspects (Aiello and Budillon, 2004). The last Late Quaternary sea level rise, having an excursion of 120 m and a maximum rate in the order of 10 m/1000 y has left an imprint on the morphologic and stratigraphic setting of many continental margins of the earth. The deposits related to this process are strongly different in several areas as a function of variable sedimentary supply, morphologic setting and oceanographic regimes. Through this approach the facies, the internal geometries and the thickness of the Quaternary deposits may be studied. These factors record the process of eustatic sea level rise in differential ways on several continental margins.

The geologic interpretation of the seismic sections has been carried out according to the criteria of seismic stratigraphy. This has allowed to distinguish the main seismo-stratigraphic units occurring in the subsurface, separated by main reflectors, corresponding with main surfaces of conformity or unconformity. The interpretation of seismic sections has allowed to carry out a distinction between the acoustic basement, cropping out in wide sectors of the nearshore area, for an extension at the sea bottom resulting higher with respect to that one singled out by previous studies (Coppa et al., 1988; Ferraro et al., 1997) and the zones of accumulation of sediments.

The geologic interpretation of Chirp profiles located in the Licosa morpho-structural high has evidenced the occurrence of the acoustic basement on Chirp lines (unit S), cropping out at the sea bottom nearshore and dipping seawards under the Quaternary deposits, forming the recent sedimentary cover. Unit S correlates with the Cilento Flysch Formation, widely cropping out in adjacent emerged sectors of the Cilento Promontory. The remnants of terraced surfaces located at different water depths, detected on seismic lines have evidenced the complex morpho-evolution of the acoustic basement during the Late Quaternary.

The seismic data analysis has suggested that the acoustic basement was involved in several phases of erosion/emersion, development of terraces and successive transgression, as a consequence of both the Late Quaternary glacio-eustatic sea level fluctuations and of the Pleistocene tectonic uplift.

The outcrops of the acoustic basement, related with the “Flysch del Cilento” Auct., widely cropping out in the surrounding emerged sectors, are widely diffused in the bathymetric belt ranging between the –10 m and the –50 m of water depths (then in the inner shelf) and form terraced surfaces having a low gradient occurring in the inner shelf between the Solofrone river mouth and the Licosa Cape.

Four orders of terraced surfaces have been recognized based on geologic interpretation of Chirp lines. The oldest ones are located at water depths ranging between 50 m and 43 m. They are genetically related with the terraced surfaces disposed at several water depths, ranging between 46 m and 44 m in the Palinuro Cape area (Antonioli et al., 1997). The second order of terraced surfaces has been identified at water depths ranging between –18 m and –24 m in the Palinuro Cape area (Antonioli et al., 1997). The third order of terraced surfaces has been recognized at water depths ranging between –10 m and –14 m and is related with similar surfaces disposed at water depths ranging between –12 m and –14 m in the Palinuro Cape area (Antonioli et al., 1997). Finally, the terrace rims occurring at –8 m are coeval, if not older, than the last interglacial and are related with the last part of the isotopic stage 3. On the basis of high resolution reflection seismics it has not been possible to recognize the Eutyrrhenian palaeo-sea level mark or related deposits.

The analysis of the seismic signal and the correlation with Sidescan Sonar sonograms recorded on the same navigation lines of Subbottom Chirp lines have evidenced the occurrence of widespread grasses of Posidonia oceanica and Cymodocea nodosa, particularly occurring in shallow sea bottoms up to –50 m of water depth. Proceeding seawards, the acoustic basement is downthrown by normal faults below the recent sedimentary cover, which is organized in three main seismo-stratigraphic units separated by unconformities.
References