The present study is focused on features developed during the post-LGM transgression on the narrow, high-gradient shelf off the Crotone area (southern Italy) and on the southern part of the Amendolara palaeo-island (API). In particular, peculiar features such as submerged coastal cliffs and a seabed typified by irregular step-like geometry characterize the present area. We recognized this area as suitable to develop a transgressive model for very high-gradient settings characterized by coastal cliff development and irregular topography. Such a model may be useful in recognizing and understanding the features and style of transgression and variations in its rate, particularly for the post-LGM glacio-eustatic rise. The seabed morphology of the Ionian Calabrian margin reflects the complex interplay between the south-eastward migration of the Calabrian accretionary wedge since mid-Miocene and the rapid uplift of onshore and shallow shelf areas since mid-Pleistocene (MALINVERNO & RYAN, 1986; BONARDI et al., 2001). The uplift, documented by a staircase of marine terraces in the subaerial Crotone Basin, still continues today, and it has been characterized by a rate that, in this area, approximated 1 m/ka (ZECCHIN et al., 2004; ANTONIOLI et al., 2006).

The geophysical data used for this study consist of CHIRP subbottom profiles (SBP) acquired across the Ionian shelf margin (ISM) and the southern side of the API. The information coming from the acoustic character of the SBPs have been combined with the morpho-bathymetric information coming from a high-resolution multibeam dataset. Two seismic units (Unit 1 and Unit 2), separated by
a key stratigraphic marker (Unconformity U) is recognizable in the considered SBPs, both along the ISM and API. Unit 1 is the lower unit, and is truncated above by U. This unit is the almost upper along the ISM, but it may show basinward-inclined to variably folded reflectors along the API. A prograding wedge, typified by basinward-inclined oblique reflectors that downlap on a less inclined reflector, is recognizable between 90 and 130 m water depth at the margin of the API and locally along the ISM. The unconformity U separates the older Unit 1 from the younger Unit 2, and is characterized by both concave- and convex-up profiles in dip direction. It exhibits a variable dip from 0.5° to a maximum of ca. 30° at relict scarps locally exposed. One of these features is recognizable between ca. 75 and 100 m water depth along both the ISM and API. Unit 2 is up to 30 m thick and locally appears as a prograding wedge whose reflectors downlap on the unconformity U. In other cases, it shows onlap relationships with U. The unconformity U, which truncates a unit characterized by variably inclined reflectors (Unit 1), is overlain by a younger unit (Unit 2), and is locally exposed forming scarps, represents a surface of regional significance. In particular, it is interpreted as a wave ravinement surface (WRS), produced by wave erosion on the shelf during the post-LGM transgression, truncating a Plio-Pleistocene unit. The prograding wedge located between 90 and 130 m water depth in Unit 1 is interpreted as the lowstand wedge. The deposition of Unit 2 above U has been related to the post-LGM glacio-eustatic rise. The scarp recognizable between 75 and 100 m water depth along both the ISM and API is interpreted as a partially preserved palaeo-coastal cliff. Moreover, such a depth closely matches with the depth range of melt-water pulse (MWP) 1A, during which the eustatic sea-level rose from 96 to 76 m below present sea-level, between 14.3 and 14.0 ka BP (Liu & Milliman, 2004). This suggests a correlation between the stepped sea-level rise following the LGM and the preservation of coastal cliffs along the continental margins. In particular, it is suggested that the palaeo-coastal cliff recognized between 75 and 100 m water depth generated and started to recede during a phase of slow eustatic rise, and was then overstepped and partially eroded during a subsequent phase characterized by very rapid eustatic rise (i.e. the MWP 1A), otherwise its progressive dismantling would have occurred. This consideration is valid assuming a rough balance between regional uplift and subsidence of glacio-hydro-isostatic origin as shown by Pirazzoli et al. (1997). Younger accelerations and decelerations of sea-level rise, such as MWP-1B (58-45 m below present sea level, 11.5-11.2 ka BP), could be responsible for the formation of some shallower scarps found in our SBPs. A transgressive model for high-gradient shelves during the post-LGM glacio-eustatic rise is proposed. Where the transgressed topography is very steep, coastal cliffs developed and retreated during the initial phase of relatively slow sea-level rise, due to wave erosion acting at the toe of the cliff. During phases of very high rate of sea-level rise, coinciding with melt-water pulses, cliffs tended to be overstepped and not completely eroded by the WRS. This model needs further testing in other contexts characterized by high-gradient shelf topography, but it has the potential to be useful in recognizing variations in the rate of sea-level rise and in general in reconstructing the Late Quaternary evolution of shelf to coastal areas.

REFERENCES


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