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Coastal Environmental Change
During Sea-Level Highstands:
A Global Synthesis with implications
for management of future coastal change

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Quaternary coastal morphology and sea level changes

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Quaternary Sea Level Highstands in the Algarve (South Portugal)

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Introduction

Algarve is the Portuguese southernmost region in which we can distinguish three main domains in the coastal zone. In the west coast, abrupt cliffs are cutting mainly Paleozoic schists and graywackes, prevailing small enclosed beaches with the largest sandy beaches being developed adjacently to the river mouths. In the windward side (west) of the south coast, cliffs were formed essentially into the Mesozoic and Miocene limestones. To the east side (leeward) extensive sandy beaches overspread till the Guadiana River inlet at the Portugal-Spain border. Miocene limestones and sandy limestones are the major lithotypes of the Lagos-Portimão Formation (Antunes & Pais, 1992), and they include abundant and well preserved warm fauna of mollusc species. At least after Lower Miocene, Algarve Basin underwent a structural control faulting in a half-grabben pattern. As a consequence, the eastern sector of Quarteira fault subsided allowing the sedimentation of up to 40 m of mainly sandy sediments during the Pliocene and Pleistocene times. The western sector of the fault has uplifted with the sandy sediments being confined to the karstic holes (Moura & Boski, 1999). Lower Pleistocene deposits are fluvial in origin, showing well hierarchised network changing to a braided system during the Upper Pleistocene arid climatic phase. Geographically extensive raised beaches were reported in all the Algarve coast as the last deposits of the Pleistocene, covering Pliocene and the oldest Pleistocene sediments. Windward coast of Algarve shows well developed abrasion platforms into the Miocene rocks rising from 2 to 13 meters above present mean sea level. The main goals of these work are to prevail and to date the referred platforms testifying sea level highstands during the Quaternary in the Algarve Coast.

Results and discussion

Sea shore cliffs have been developed in the carbonate rocks of the Lagos-Portimão Formation (Miocene), ranging from 2-3 m high at the Galé Beach up to over 20 m in the Coelha beach. Those carbonate rocks underwent strong weathering during the Upper Miocene while valleys and karstic depressions were filled by reddish sands during Pliocene and Pleistocene.

Upper flatness keep morphological continuity between carbonate and sand formations.

Twelve marine abrasion platforms have been recorded in the study area, all shaped in the Miocene sedimentary sequence, ranging from the present high spring tide level to over 20 m above de actual mean sea level. Platforms are developed within units, and the whole sequence is a west dipping monocline structure. This means also that all platforms can be followed at continuously higher elevations to the east, and the elevation criteria must be used with precaution. One strike slip fault cuts the monoclinal structure with a vertical displacement of 5 m.

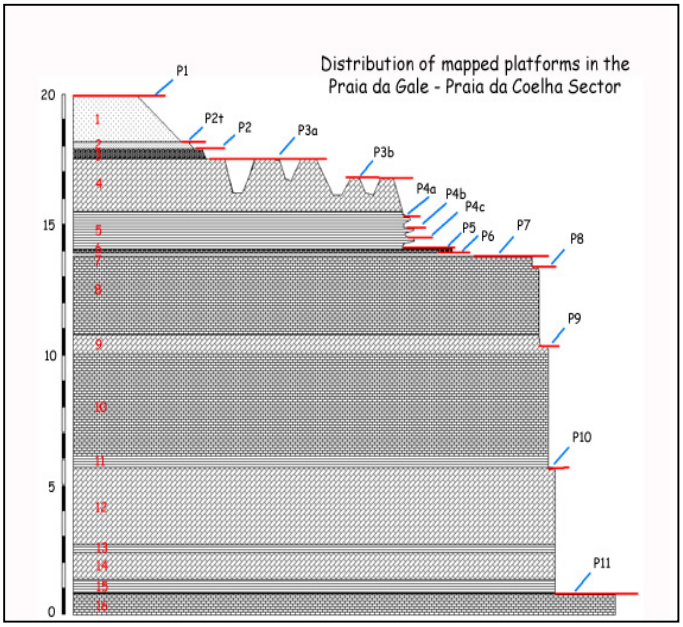

Figure 1. Schematic representation of mapped platforms in south coastal zone of Algarve.

From those, the P3 and P5-7 are the prominent platforms (Figure 1). T3 is a strongly eroded and carsified surface defined by continuous hill tops at 2-4 m at the Galé beach (over 500 m extension by 30 m wide) and by a flatter horizon on the top of the cliffs at the Coelha beach area. P5 to P7 are less that half a meter apart in elevation, and mark the widest surfaces with 50-60 wide platforms gently

dipping to the south. Some notchs can be observed in the inner part of some of those platforms. The surface of this platforms usually shows strong bio-erosion by echinoderms as well as *Balanus* as individual or grouped (up to 8 shells) individuals. Furthermore, some platforms are recovered by a thin calcite layer. Both *Balanus* and calcite were dated, at various levels, giving ages in the range 38 to 13 Ka BP, at elevations of 3-4 m and 2-3 m respectively, but, in different platforms. Further dating analysis must be taken to refine interpretation. If we remove the tectonic tilting of the sedimentary sequence, apparently occurred after major sea level stands, we have platforms within 15 to 18 m apart in elevation, from 2-3 m high to about 20 m high above present mean sea level at the more elevated and apparently stable sector. Comparing with Mediterranean coasts, OIS 11 is at +20 m at Calábria (Zazo, 1999) and in the Bermudas-Bahamas stable plateau it shows 3 terraces at +2, +7 and +20 m (Hearty & Kindler, 2000). In Almeria area OIS 5e is defined from +7 to +14 m in 3 different terraces and at +2 e +3 m in the Baleares Islands (Zazo, 1999); comparing again with the other side of Atlantic, OIS 5e is at +4 and +8 m at Bermudas-Bahamas (Zazo, 1999). Again in Almeria, OIS 5c and 5a are defined at +8 m and +1 m high respectively (Zazo, 1999). Finally OIS 3, at Tyrrhenian area is +7 m above actual sea level (Mauz, 1999). These comparisons shows that paleo-geographic reconstruction of the Algarve coast is still an open discussion and further work at dating proceedings level and tectonic uplift estimation must continue.

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