

## Post Last Glacial maximum (LGM) shoreline evolution in the Algarve (South Portugal)

D. Moura, L. Albardeiro, C. Veiga-Pires, T. Boski

*Centro de Investigação Marinha e Ambiental (CIMA), Universidade do Algarve, FCMA, Campus de Gambelas, 8000 Faro, Portugal*  
dmoura@ualg.pt, lalbarde@ualg.pt, cvpires@ualg.pt, tboski@ualg.pt

Aeolianites spanning the last 20 ka, are outcropping in a different geomorphological context along the Algarve coast, South Portugal. Here we use the term aeolianite as defined by Fairbridge and Johnson (1978), being a wind-blown sediment originating from the beach with a high carbonate content. The genesis of the aeolianite greatly depends on the sediment availability on the coastal plain, and therefore it is related with sea-level fluctuations. However, other factors like coastal plain slope, marine environment, and coastal morphology, influence the morphogenetic processes. Gentle slopes produce faster shoreline migration than do steeper slopes, but the quantity of sediment involved strongly influences this relationship (Gerds et al., 2003; Bender and Dean, 2004). Moreover, headlands are related with shoaling on the offshore area and therefore wave energy is concentrated on those prominent coastal features where waves are higher than in the more sheltered areas (Komar, 1983). Outcrops of beachrock also occur in the Algarve coast, although less extensive than aeolianite. The beachrock is formed as a sedimentary body in the intertidal zone as a result of beach sand cementation favoured by  $\text{CaCO}_3$ -supersaturated water, salinity, good permeability of the sediment, and microbial activity (Neumeier, 1999; Kneale and Viles, 2000). Constraining the use of the term beachrock only for intertidal cemented beach sand as referred above, this feature can then be used as a shoreline proxy.

Research on Holocene sea level in the Algarve has been focused on estuaries and coastal lagoons based on sedimentological and biological proxies (Boski et al., 2002; Andrade et al., 2004). The main goal of the present work is to contribute to the investigation on post Last Glacial Maximum shoreline evolution and to compare the morphological proxies inferred from the sea-level fluctuations with the sedimentological and biological proxies.

The southernmost coast of Algarve is geomorphologically very diversified: wide and extensive sandy beaches along the eastern part, and rocky coasts along the westernmost region where small pocket beaches occur. The study area includes two sites: a) Sagres Cape on the SW Algarve extreme, a headland on Jurassic limestones plunging landward, well exposed to the SW prevailing waves, and b) Armação de Pera Bay, a zeta bay between headlands on subhorizontal Miocene calcarenites.

Field work in the study area included the mapping of the outcrops, GPR survey in Armação de Pera Bay, structures measurement, description and sampling. The laboratory work consists of sedimentological and mineralogic analyses on rock samples.  $^{14}\text{C}$  dating have been undertaken on the whole sample for the aeolianite and on the shells for the beachrock.

**Sagres Cape.** Two overlapped systems of aeolianite, separated by an erosional surface, accumulated against the coastal cliffs. The aeolianite layers plunge seaward by  $20^\circ$  and  $26^\circ$  in the lower and upper system, respectively. Root traces and joints can be observed in both. The lower aeolianite probably corresponds to the landward shoreline migration as a consequence of the North Atlantic warm phase which occurred at about 19 ka cal BP leading to a rapid sea-level rise of 15 m (Lambeck et al., 2000). According to the sea-level curve of the Algarve (Boski et al., 2002), the uplift rate in this coastal sector is very similar to the rate of sea-level rise.

**Armação de Pera Bay.** A vegetated coastal dune system overlaps an older aeolianite system which age is constrained between 8320 and 6280 yr cal BP, which is the same range of the upper system in Sagres Cape. Ages of the beachrock, outcropping adjacently to the river mouth in the bay, are between 5499 and 437 yr cal BP. In this sheltered coastal sector, the shoreline retreated very fast during the rapid sea-level rise which occurred between 10 and 6 ka (Boski et al., 2002). The sea-level rise was four times higher than at present, and was higher in the Armação de Pera Bay than the present mean sea level. After ca. 2 ka, the sedimentary budget drastically changed, and shoreline migrated seaward.

## References

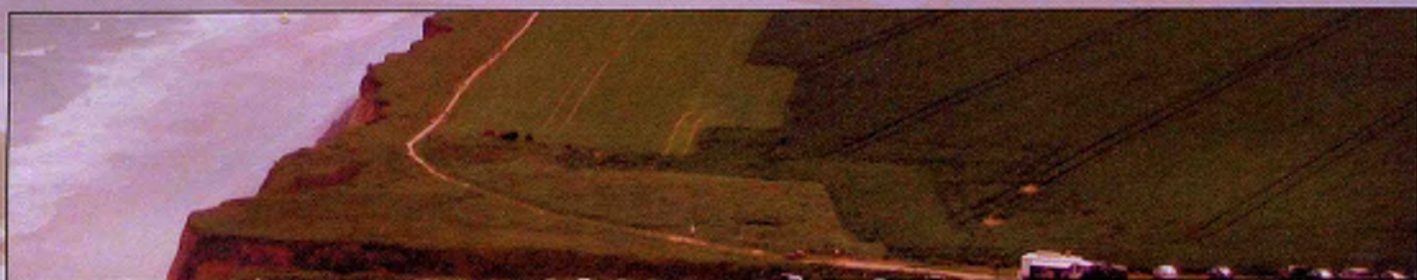
- Andrade, C. Freitas, M. C., Moreno, J., Craveiro, S. C., 2004. Stratigraphical evidence of Late Holocene barrier breaching and extreme storms in lagoonal sediments of Ria Formosa, Algarve, Portugal. *Marine Geology* 210, 339-362.
- Bender, C.J., Dean, R.G., 2004. Potential shoreline changes induced by three-dimensional bathymetric anomalies with gradual transitions in depth. *Coastal Engineering* 51, 1143-1161.
- Boski, T., Moura, D., Veiga-Pires, C., Camacho, S., Duarte, D., Scott, D.B., Fernandes, S.G., 2002. Postglacial sea-level rise and sedimentary response in the Guadiana Estuary, Portugal/Spain border. *Sedimentary Geology* 150, 103-122.
- Fairbridge, R.W., Johnson, D.L., 1978. Eolianite. Fairbridge, R.W., Teicher, C. (Eds), *The encyclopedia of Sedimentology*.
- Gerds, G., Petzelberger, B.E.M., Scholz-Bottcher, B.M., Streif, H., 2003. The role of climatic change in the geological archives of shallow marine, coastal and adjacent lowland areas of Northern Germany. *Quaternary Science Reviews* 22, 101-124.
- Kneale, D., Viles, H.A., 2000. Beach cement: incipient CaCO<sub>3</sub>-cemented beachrock development in the upper intertidal zone, North Uist, Scotland. *Sedimentary Geology* 132, 165-170.
- Komar, P.D., 1983. Wave generation, travel and breaking. *Beach processes and sedimentation*, 75-121.
- Lambeck, K., Yokoyama, Y., Johnston, P., Purcell, A., 2000. Global ice volumes at the Last Glacial Maximum and early Lateglacial. *Earth and Planetary Science Letters* 181, 513-527.
- Neumeier, U., 1999. Experimental modelling of beachrock segmentation under microbial influence. *Sedimentary Geology* 126, 35-46.

This work was supported by FEDER and OE through the Portuguese Foundation for the Science and the Technology (COCHAL, POCTI/34162/CTA/00 Research Project).

# ABSTRACT BOOK



DUNKERQUE 2005  
A Joint INQUA - IGCP 495 Meeting



Edited by Cecile Baeteman  
Belgian Geological Survey  
Royal Belgian Institute of Natural Sciences