

## EVOLUTION OF THE TRÓIA PENINSULA: THE FOREDUNES RECORD (TALK)

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The Tróia Peninsula is located on the west Portuguese coast, 50 km south of Lisbon, near Setúbal, at the southwest end of the Sado estuary (Fig. 1). The peninsula consists of a sand spit approximately 14 km long by 1.5 km wide, covered by sand dunes.

Since Roman times to recent days, written and geographical testimonies (aerial photography, historical and recent maps) show that the northern part of the peninsula has been very active. Roman settlement ruins (dated 1<sup>st</sup> to 5<sup>th</sup> century AD) are strong evidence of local coastal change, since, today, some of their facilities are underwater while some others are deeply covered by aeolian sand. Furthermore, the Roman settlement has been described as sitting on an island, named Acála (Étienne *et al.*, 1994) that no longer exists.

The main purpose of this work is to contribute to the understanding of the coastline evolution of the Tróia Peninsula and to relate these changes with the enclosure of the Sado estuary in the Holocene, based on foredune analysis.

Mapping of the Tróia dune crests (Fig. 1) relied upon detailed study of morphological features and their spatial distribution, in USAF 1958 aerial photographs. These photographs were particularly relevant, since human occupation was incipient in 1958, and therefore different dune types and generations could be traced. Recent evolution was studied using 1995 orthofotomaps and published studies on the area (Gomes *et al.*, 2002).

Foredunes are indicators of shoreline position since they grow and evolve on the upper part of the beach. Foredunes accreting in a growing beach are different from foredunes accreting in an eroding beach (Psuty, 1992). Thus, analysis of dune morphology and of dune crests makes it possible, not only to establish past positions of the coastline but also to find out whether the dunes were built during periods of coastal progradation or retreat.

The study of the Tróia peninsula evolution, in terms of dune morphology analysis, has been previously addressed (Psuty, 1992; Gomes 1992; Quevauviller, 1984). However, the larger scale used in this work allowed a different interpretation of both the evolution of the peninsula's morphology and associated aeolian processes. Although various types of dunes were found, this paper will focus only on foredunes.

Detailed morphological analysis of dunes in the northern part of the peninsula showed that foredune ridges are very well preserved (Fig. 1). Seventeen sedimentary episodes, corresponding to beach accretion or erosion, were recognized, according to dune morphology and spatial relation criteria. Other aeolian features, typical of blowouts and larger-scale transgressive events, were also found. Fore-dune interpretation shows that the recent evolution of the peninsula changed several times from accretion to erosion. Accretion episodes usually comprise several sub-parallel dune crests, forming a "sedimentary package". Although absolute dating has not yet been attempted, spatial relations between crests and "sedimentary packages" are good evidences of how the coastline and the peninsula morphology have evolved.

Three major evolution events can be recognized, regarding foredune crests orientation and geographical position (Fig. 1): Unit 1 – Dunes probably contemporaneous with the enclosure of the estuary, trending NNW-SSE; Unit 2 – Dunes built during a major event of offshore shift of the shoreline with an orientation close to NW-SE; Unit 3 – Dunes contemporaneous with the northern part of the peninsula growth episode. This unit is responsible for the formation of the Caldeira.

The interpretation of the Tróia Peninsula foredunes indicates that the spit has shifted seawards while it was growing northwards. The Tróia Caldeira was probably formed during the development of the northern part of the peninsula, by means of a detached sand spit that joined the farthest northern part of the peninsula. Fore-dunes interpretation also allows to determine paleo-coastlines, probably since Acála times to recent days, i.e. from approximately the 1<sup>st</sup> century AD to Present.

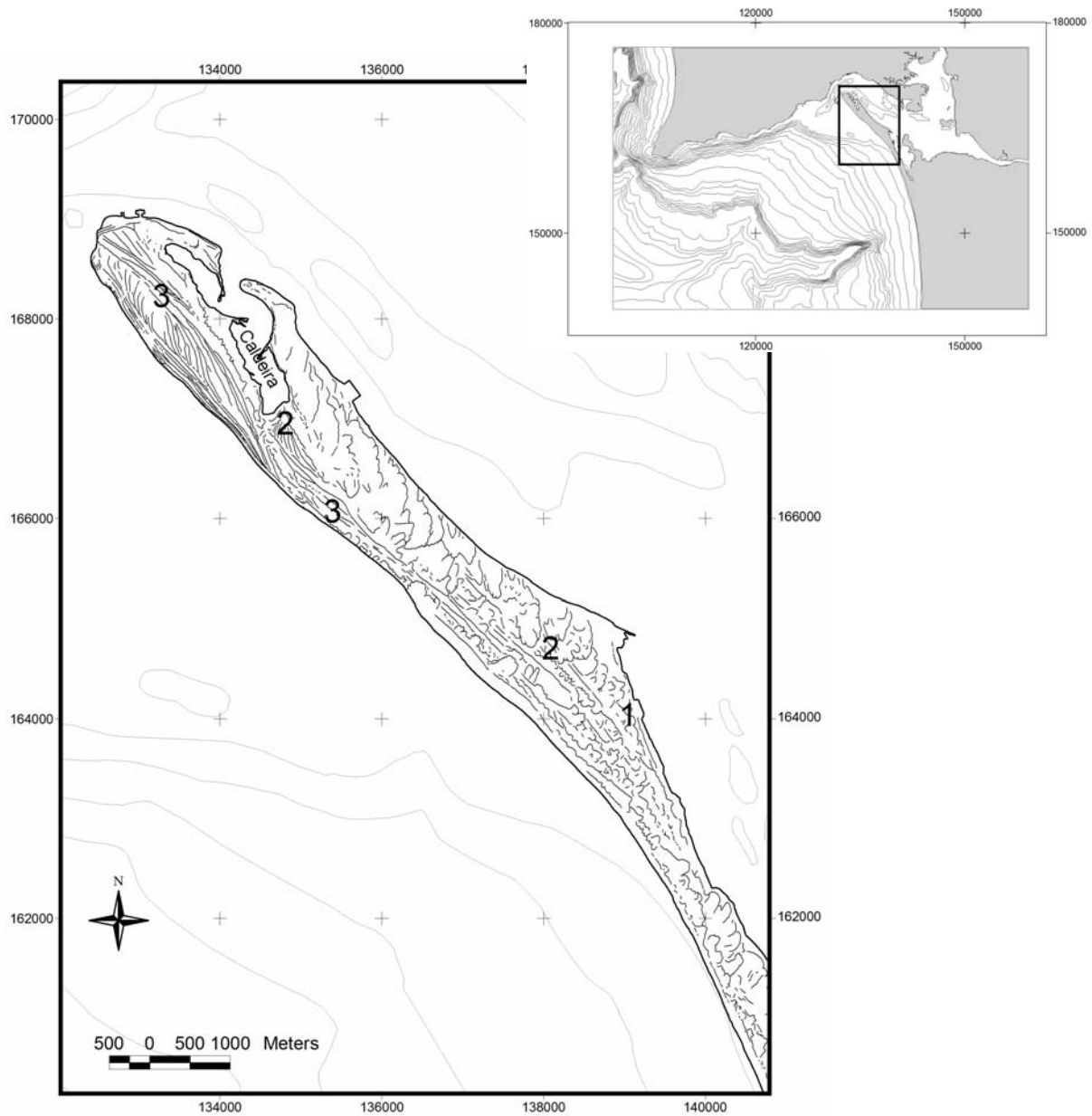


Figure 1 – Northern part of Tróia Peninsula. Dune crests representation obtained from 1958 USAF aerial photos and complemented by 1995 orthorectified aerial photo. Inset showing Tróia peninsula location. Coordinates Hayford-Gauss, Datum Lisboa, in meters and underwater morphology represented by 10m interval contours. 1,2 and 3: Major evolutionary events.

#### References

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