

# A GEOSTATISTICAL ANALYSIS OF PRODELTAIC UNDULATIONS OFF THE GUADALFEO RIVER IN THE NORTHERN MARGIN OF THE ALBORAN SEA, WESTERN MEDITERRANEAN BASIN

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## Abstract

A geostatistical analysis of multibeam bathymetric data in two fields of prodeltaic undulations located off the Guadalfeo River, northern margin of the Alboran Sea, was conducted in order to obtain useful insights into genetic mechanisms. The geostatistical analysis was based on the determination of characteristic parameters and derived relationships. Our results support the contention that prodeltaic undulations off the Guadalfeo River should be regarded as sediment waves, mainly generated by strong normal-to-contour sediment flows with a riverine origin.

**Keywords:** *Deltas, Continental Shelf, Geomorphology, Swath Mapping, Alboran Sea*

A detailed study of the along- and across-shelf variability of geostatistical parameters such as rms (H), strike azimuth with respect to north ( $\Theta_s$ ), characteristic width ( $L_n$ ) and characteristic length ( $L_s$ ) defining the von Kármán covariance function, as well as the wave or vertical form index ( $L_n/H$ ) and aspect ratio ( $L_s/L_n$ ), provides valuable information about the genetic interpretation of submarine undulations found in highly dynamic prodeltaic systems. Those systems have been particularly documented in several settings of the Mediterranean Sea [1, 2, 3], a region characterized by seasonal climatic patterns and strong physiographic control on drainage basins. Our analysis provides evidence to support the hypothesis that the prodeltaic undulations can be considered as a type of sediment waves, resulting as the final products of energetic sediment flows emanating from river outlets.

Overall, geomorphological statistics indicate that the undulations under consideration bear high similarity with prodeltaic undulations developed in deltaic systems where a primary control of hyperpycnal flows has been proposed. The parameter values in the Guadalfeo River prodelta (Fig. 1) suggest the imprint of very intense sediment flows, with increased proportions of bedload sediment transport in relation with other undulation areas. This may be a consequence of the extreme seasonality and torrentiality dominant in the drainage basin of the feeding system.

Most of the geostatistical parameters are disposed in basically consistent distribution patterns, especially in the along-shelf direction. Amongst them, the  $L_n/H$  ratio observes the most clearly discerned geomorphological patterns, by defining two identifiable depositional axes, whose location seems to be controlled at large by changing river mouth position. The most recent, western undulation field is highly symmetrical, with higher H and lower  $L_n/H$  and  $L_s$  values, suggesting the action of very intense and focused flows, with relatively high amounts of bedload sediment with decrease rapidly both laterally and downslope. In contrast, the eastern field shows lower H and higher  $L_n/H$  and  $L_s$  values, indicating the influence of less energetic flows with increased proportion of suspended sediment. In the end, those differences are also indicating a temporal change, as the western field undulations appear to be active, relatively in equilibrium with recent/present flow regime, whereas the more subdued profile of the eastern field undulations would indicate a higher quiescence.

Changes of  $\Theta$  and  $L_s$  also support a main genetic mechanism through normal-to-contour flows, as the undulations are disposed around two adjacent lobes and show relatively low lateral continuity when compared to other Mediterranean undulations. Those parameters fit with the depositional model, described by two main point sources that irradiate sediments concentrically. In contrast to the previous parameters,  $L_n$  does not show a predictable pattern, as no significant systematic change is detected in the study area.

## Acknowledgements

Multibeam data were collected within the framework of the ESPACE project. Additionally, this work represents a contribution to the research projects MOSAICO and CTM2005-04960/MAR. This contribution was elaborated during a research stage of the first author funded by the "José Castillejo" program (JC2008-00210) at the Institute for Geophysics, Jackson School of Geosciences, University of Texas at Austin, during May to August 2009.

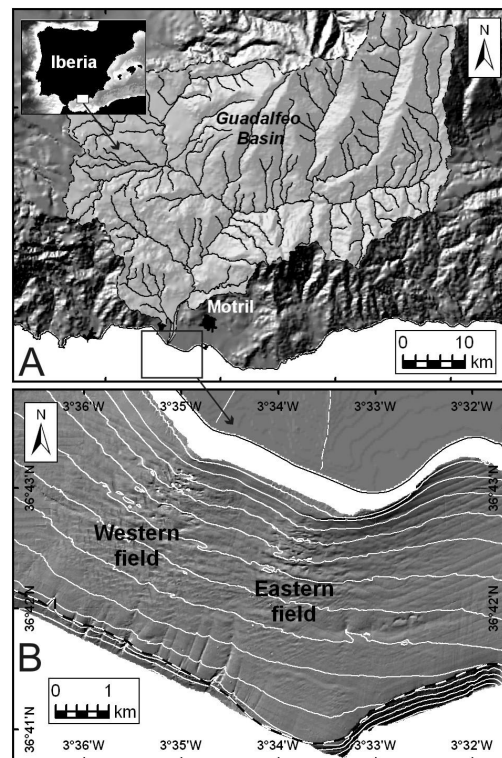


Fig. 1. Prodeltaic undulations off the Guadalfeo River: A) Geographical setting of the study area, located in the northern margin of the Alboran Sea, western Mediterranean Basin. B) Shaded relief of the study area, showing two main undulation fields (western and eastern).

## References

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