

## Littoral morphology and sediment distribution in the Ebro Delta (NW Mediterranean)

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The Ebro Delta is a fluvial wave dominated delta, with a surface of 325 km<sup>2</sup>. Its 50 km long sandy shoreline is characterized by the presence of two spits which individualize lagoons to the North and South of the delta plain (MALDONADO, 1975). The microtidal nearshore depicts several bar and trough systems as the main morphological features. Coastal sediment erosion has been analyzed for a five years period (1988-1992), with financial support from the Autonomous Government of Catalunya. Each 4 months, bathymetric surveys and sediment sampling were performed in the littoral zone (0-15 m water depth).

Littoral morphology is controlled by the location of river mouths and the wave climate. Four major delta lobes were developed during the last centuries (MALDONADO, 1972; 1986). These lobes are located in the southern, northern, central and, the most recent, northeastern sectors of the delta plain (Fig. 1). The bathymetry shows that littoral slopes are gentle offshore abandoned lobes and steep in front of the presently active lobe and at both spit ends. A submerged platform is observed off abandoned delta lobes, which is deeper proportionally to the age of the lobe. Three types of littoral profiles have been recognized: (1) progradational profiles, located offshore the present river mouth and in the spit ends, where depositional processes are dominant; (2) erosional profiles, situated in the recently abandoned delta lobes, that are in an erosion-dominated evolution, and (3) equilibrium profiles, located in the more ancient abandoned delta lobes, where the processes of reworking and deposition are in equilibrium (Fig. 2). These littoral profiles allow also to differentiate two areas in the coastal zone separated by a sharp change in slope: (1) the nearshore area, with steep slopes is characterized by the bar and trough systems, which extend from the shoreline to 4-6 m water depth, and (2) the transitional area between the nearshore area and the inner shelf, which is smooth and gently sloped.

Littoral sediment distribution is closely related to delta morphology, sediment input and wave climate. The grain size of the nearshore deposits is medium sand (250 µm) (Fig. 2). The sand-mud transition normally starts in the sea-side of the more distal sand bar and the sediment becomes progressively fining toward the inner shelf. In progradational profiles, the sand-mud transition is sharp and is located close to the shoreline (4-7 m) (Fig. 2A). Erosional profiles are characterized by the presence of mud outcrops corresponding to ancient delta lobes and relict sand bars located offshore of the influence of the mean wave climate (Fig. 2B). In equilibrium profiles, the sand-mud transition is more widely spread and complex. In these profiles grain-size decrease between the distal sand bar and about 10 m water depth, without mud in this zone. Between 10 and 15 m water depth, mixed medium and very fine sand is present, probably as result of reworking of ancient nearshore and delta lobe deposits. From this zone toward the inner shelf, the sediment is progressively finer and mud is usually observed at about 20 m water depth (Fig. 2C). The wave climate is the main factor controlling the long-shore sediment transport from delta erosion and river input. It cause changes in the littoral slope and the across-shore sediment distribution patterns.

During this Century, sediment supplied by the Ebro River has been drastically reduced by dam construction, modifying the coastal evolution of the Ebro Delta (MALDONADO, 1986; PALANQUES *et al.*, 1990). Littoral profiles have a tendency towards the erosion-dominated type and a landward migration of the shoreline, while sandy deposits are eroded and transported both offshore to deeper areas and landward infilling the coastal lagoons. During periods of low fluvial sediment input, as the 1988-1991 period, coastal erosion increase and littoral sediment becomes progressively coarser, because the finer-grained fractions are transported offshore.

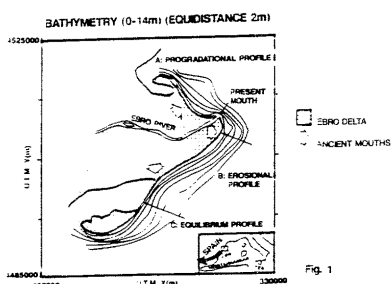


Fig. 1

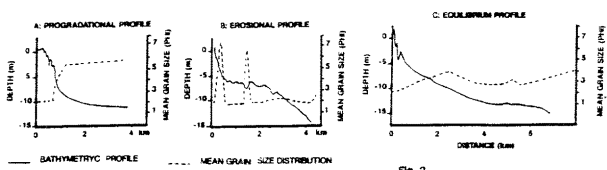


Fig. 2

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