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# A multi-proxy analysis in the assessment of fluvio-marine interactions over the last 5000 years

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The objectives of this work are to assess the evolution of fluvial and marine influences, the responses to climatic events, sea level change and the impact of land use changes in three estuarine environmental conditions over the last 5000 years, which are imprinted in the filling-up of the alluvial plain estuaries (FMI 5000 Project, PTDC/CTE-GIX/104035/2008, financed by Portuguese Science and Technology Foundation). This paper deals with one of the estuaries (Alcabrichel River estuary, Portugal Western coast).
The methodological approach is:
(i) geomorphological characterization at different scales in order to identify sediment sources and slope dynamics with different vegetation cover (ii) sedimentary cores obtained using hand-operated gauge angers and a mechanic geoprobe hammer, taken in different selected sites of the alluvial plain (only one of the core with 7,70m deep is treated in this paper); (iii) treatment of sedimentary samples (each sample correspond to a 1cm slice, exception made to the deeper samples); (iv) sedimentological treatment of 616 samples with Sedigraph; (v) statistical sedimentological parameters calculation; (vi) organic matter content, stable isotopes analysis ($\delta$13C, $\delta$15N) and geochemical procedures (C and N), for 79 samples; (vi) analysis of 23 pollen and npp samples; (vii) archaeological inventory of human settlement in the hydrographic basin; (viii) AMS dating.
Six subsections (sb) with distinctive sedimentary signature were identified in the core: (sb) 6 (770-716cm) sediments are poorly sorted sand and gravel, with a high shell content; (sb) 5 (715-627cm) mud is dominant, sand levels decrease and gravel admixtures are residual; (sb) 4 (626-503cm) shows a fining upward trend, clay and silt higher values alternate with more pronounced clay peaks than in the underlying section; (sb) 3 (502-346 cm) there is an increase in clay content, with a general grain size trend showing a smooth fining upward sequence crossed by two major events of coarser sediment deposition; (sb) 2 (345-293cm), clay content drops dramatically and individual samples are poorly to very poorly sorted and mainly consist of silt with fine sand lenses intercalations; (sb) 1 (280-0cm), consists mainly of mud and slightly sandy mud with alternate layers of more silty and clayey deposits.
The sedimentary data (sb 6, 5, 4 and 3) as well as the $\delta$13C, pollen and npp and AMS dating show that an open marine environment in the estuary prevailed before 5000 yr BP ($\delta$13C less than -25) with salt marsh and several short fresh water events; slopes were cover by forest of oak and pine surrounded by shrubs and heathland. Between sb3 and sb 2 there is a sharp change in environment energy marked by a thick 1.52m terrigenous sedimentary import. However this episode starts before, as shown by very coarse skewed peaks and very leptokurtic sediments, abrupt changes in regional and local pollen assemblages and terrigenous $\delta$13C peak (-26,85). The main conclusion drawn is that the changes are provoked by human activities like animal husbandry and grazing. As time passed forest recovers while the estuary infilled during the following Iberian humid period (Martín-Puertas, 2009).

Keywords: Environmental changes, Fluvio-marine interactions, Portugal.