Detection of environmental changes in the Minho River Estuary (NW Iberian Peninsula): A multi proxy approach

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Biogeochemical processes and environmental conditions that lead to the preservation of organic matter (OM) in coastal and marine sediments has been the subject of a wealth of studies in the last decades (Hedges et al., 1999). It is estimated that more than 80% of the total organic carbon preserved in marine sediments is buried in deposits along the continental margins in “terrigenous-deltaic” regions near river mouths. In such semi-enclosed scenarios, significant environmental changes, such as climatic warming, flooding caused by an increase in the riverine water discharge or alteration of the sea level may be reflected in the characteristics of organic carbon supplied to and buried in their sediments.

In this sense, the study of the biomarker assemblages, which are specific and sensitive to trace compounds biogenic sources (Goñi et al., 1998), has become a valid tool to interpret the changes that occurred within those ecosystems and to explore the possibility of short-term environmental changes and geochemical processes.

This communication presents geochemical data of a tidal marsh sediment core (1 m depth) taken at the Minho estuary (NW Iberian Peninsula). Five replicates were collected with a Van der Horst manual sampler, to be used in the different analyses. The core chosen for the biomarker approach was stored in glass cylinders, sliced into samples of 2 cm of thickness and kept frozen (-20°C) to avoid OM degradation. Free lipids were soxhlet-extracted with a solution containing dichloromethane-methanol (3:1) for 16 h and total extracts were saponified with 0.5 mol L⁻¹ KOH in methanol for 8 h under reflux. In order to remove elemental sulphur, copper curls were added. The analysis of lipid biomarkers was carried out by gas chromatography-mass spectrometry (GC-MS) according to Gonzalez-Vila et al., (2003). Sample resolution was 1 cm for ²¹⁰Pb and ¹³⁷Cs analysis, which are used to determine the accumulation rates. In addition sediments were characterized by elemental analysis (C, TOC, H, N, S), whereas isotopic analysis (δ¹³C, δ¹⁵N) is being developed.

Preliminary results can be summarized as follows:
The Minho estuary presented very low sedimentation rates, recording the last 100 years in the top 4-6 cm, the limiting factor was the sampling resolution (1 cm samples). Geochronological data estimated by ²¹⁰Pb and ¹³⁷Cs suggested a sedimentation rate of about 0.6 mm yr⁻¹.

Concerning the chromatographic data, several downcore fluctuations were observed in the patterns of the most abundant alkyl series (n-alkanes and n-fatty acids), as well as in several biomarker ratios such as C₃₃/C₁₇ or C₃₇/C₁₈. In general, our findings are indicative of the existence of a complex input of organic matter (OM) to the estuarine area studied, mainly of terrestrial origin. In addition, significant changes were observed in the elemental analysis (TOC decreased from 14% (10-12cm) to 2% (92 cm); C/N ratio ranged from 17 (10 cm) to 10 (92 cm). Temporal variations could be attributed to terrigenous contributions from Minho River sediment load, although different degradation rate of individual biomarkers as well as that of OM from different origins should not be neglected when interpreting biomarker assemblages in these geodynamically active environments. Prior confirm those findings further data such as the stable isotopic analysis and radiocarbon dating are being carried out.

References:

Keywords: biomarkers patterns, sedimentary organic matter; Minho tidal marsh