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Research papers

Characteristics of organic matter sources from Guadiana Estuary salt marsh sediments (SW Iberian Peninsula)

Mukesh Kumar [a,b], Tomasz Boski [a], Francisco J. González-Vila [c], Nicasio T. Jiménez-Morillo [c], José A. González-Pérez [c,*]

[a] CIMA, Univ. Do Algarve, 8005-139, Faro, Portugal
[b] FUECA, Univ. Cádiz, Campus de Puerto Real, 11519, Puerto Real, Cádiz, Spain
[c] IRNAS, CSIC, MOSS Group, Avda. Reina Mercedes 10, 41012, Sevilla, Spain

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ABSTRACT

Estuaries are dynamic interfaces between land, rivers and the ocean that play major roles in the global carbon cycle. These coastal wetlands store huge amounts of organic carbon (OC), commonly known as "blue carbon" and excellent places to study C cycling. The Guadiana river estuary is among the most important tidal salt marshes in the South - Iberian coastal margin. Here, a detailed organic geochemical study is described that includes the identification of sedimentary OM composition at a molecular and isotopic level. Total organic carbon content (TOC) of core sediments ranged from 0.39 to 2.23% and stable carbon isotope composition ($\delta^{13}C$) also showed a wide range between −22.4 and −27.0‰. $A^{13}C$ depletion trend observed from the surface to bottom in the core sediments profiles, reflects loss of labile biogenic ^{13}C enriched compounds i.e. polysaccharides and a selective preservation of more depleted compounds with depth i.e. lignin and lipids in the core sediments. Series of *n*-alkanes were found in the range from C_{10} to C_{31}. Carbon preference index ratio (CPI) calculated for long-chain *n*-alkanes (C_{24}–C_{31}) that ranged between 1.17 and 1.94 reflecting diverse OM inputs to the sediments. A study of the lignin-derived phenolic composition pointed to a recalcitrant OM derived from both gymnosperm and angiosperm plants. Moreover, high abundance of vinyl phenol and vinyl guaiacol points to a dominant contribution of lignins from grasses and aquatic macrophytes to the sediments. A well-resolved series of long-chain linear alkyl benzenes (LABs from C_4 to C_{22}) were recorded in all core sediment samples indicating direct discharge of untreated domestic and/or industrial effluents to the estuary. Polycyclic aromatic hydrocarbons (PAHs) with more than 3 rings reflects the pyrogenic origin of a portion of the sedimentary OM. This study highlights the importance of different OM sources to the lower Guadiana estuarine sediments and contributes to a better knowledge about its origin, dynamics and fate.

1. Introduction

Continental margins are critical zones where terrigenous sediment and organic matter mix in a complex and dynamic environment (Aller and Cochran, 2019; Liu et al., 2016; McKee et al., 2004). These areas receive ca. 0.4 Pg yr^{-1} (Pg = 10^{12} kg) of OC, of which approximately half is in particulate form (Hedges and Keil, 1995; Hedges et al., 1997). About 90% of OC transported by rivers is buried on it (Hedges and Keil, 1995) and play a crucial role in the global carbon cycle. Estuaries and the continental shelf are the dynamic interfaces between rivers and the open ocean where the exchange of sediments, organic matter (OM) and nutrients occurs (Raymond and Bauer, 2001). In estuaries, sedimentary OM composition is influenced by several factors such as river discharge, tidal mixing, microbial respiration, photooxidation, flocculation, resuspension and remobilization of OM (Hedges and Keil, 1999; McCallister et al., 2006; Aller and Cochran, 2019). Although the fate of terrestrial OM in estuaries is still ambiguous, mass budgets suggest that extensive remineralisation and removal of terrestrial OM occurs before entering the ocean (Hedges et al., 1997). However, terrigenous OM exhibits a greater burial efficiency because of its more refractory nature compared to its marine counterpart (Hedges et al., 1997; Burdige, 2007).

Estuarine zone is an excellent place to study OC cycling because of its high rate of OM production, processing, high sedimentation rate and an

* Corresponding author.
E-mail address: jag@irnase.csic.es (J.A. González-Pérez).

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