

Geochemical spatial variability in Carrasqueira marsh (Sado estuary - Portugal)

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Sedimentation in estuarine intertidal environments (tidal-flats, salt-marshes) depends on several variables, such as topography, vegetation, suspended sediment load and tidal range. Those may vary in space, not only between domains but also within the same morphosedimentary domain. Spatial characterization of these areas is frequently made using cross-shore sampling transects, and each transect considered representative of a large area. This methodology has been applied in the Carrasqueira marsh, located in the southern margin of the Sado estuary, where 8 sediment samples for sedimentological and geochemical study (P1 to P8) have been collected along one transect (CAR-S) running through the high-marsh (P8), low-marsh (P5–P7) and tidal-flat (P1–P4). In order to assess the spatial variability within the high marsh, a regular 1m-edge grid was set in one 100m² square located 300m NE of the transect, apparently homogeneous in surface features and sampled at every node. A total of 121 sediment samples (CAR-M) were analysed for sedimentology (texture and composition) and geochemistry (major, minor and trace elements, using EDXRF).

Preliminary data on CAR-M samples show contents in Al (6.56 to 7.83%) and Si (20.35 and 24.49%) typical of fine-grained sediments. This textural homogeneity is also reflected in the narrow concentration range of K (1.39-1.74%), Ca (0.27-0.43%) and Ti (0.38-0.49%), and also in Rb (113-164mg/kg), Sr (84-118mg/kg) and Zr (86-136mg/kg). However, the contents of Mn and Fe vary within wider ranges and are not inter-correlated; the maximum value of Mn (4900mg/kg) exceeds in more than 12x the minimum value (400mg/kg) and the maximum content of Fe (8.9%) doubles its minimum concentration (4.39%). Moreover, the metals usually associated with environmental issues show some spatial variability (Cr:84-152mg/kg; Ni:29-51mg/kg; Cu:56-84mg/kg; Zn:195-311 and Pb:30-60mg/kg). The geochemical proxies of salinity-S, Cl and Br- range between 0.4-0.6%, 0.6-3.0% and 198-357mg/kg, respectively.

The elemental composition of P8 is in general bracketed within the concentration range found in CAR-M with exception of Zn, which occurs in the transect sample in lower content; in fact, the Al-normalized

metal content in P8 is 23×10^{-4} whereas the variation interval of this ratio obtained for CAR-M is $30-40 \times 10^{-4}$.

The elemental variability found within the high marsh is in general similar to the variability found between different morphosedimentary domains, with the exceptions of: Mn (range in CAR-M higher than in CAR-S) and Br and Zn, where the range obtained in CAR-M is lower than in CAR-S.

We conclude that in sediments from the same depositional basin and similar in texture, both the intra- and inter-morphosedimentary variability of some

elements is low, but significant differences in specific elements (major and minor) may exist in a relatively small area. Therefore, the geochemical characterization of large intertidal areas based on a small number of samples/transects should be interpreted with caution.

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