Small scale sedimentary metal variation: a transect investigation

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Sediments are major players in the transport and storage of contaminants. For this reason, they have been growingly used in contaminants source identification, dispersion pathways determination, and localization of sinks in aquatic systems, with particular incidence in trace metals. Furthermore, analytical protocols for metals in sediments are well established and analytical apparatus have become more sensitive, cheaper, and easier to operate. To adequately interpret these results, it is imperative to know the variance associated with the data. Such variance results from a number of 'natural' and human factors that act in temporal and spatial scales, leading to irregularity of contaminant concentrations at the sampling site, a poorly understood parameter virtually never quantified. If small-scale spatial variance is excessive, regional trends may be obscured and award limited value to sediment surveys. Furthermore, knowledge of the spatial variance in the concentration of metals in the aquatic environment also provides a better understanding of the uncertainty associated with contaminant data, assists in interpretation and can better support decision making. In this work, sediment small-scale spatial variance is determined in Mira Channel (a semi-independent estuary integrated in the Ria de Aveiro system, Portugal, usually deemed to be the "least affected by pollution") by performing the analysis of samples collected in transepts. Six metals (Al, Cd, Cu, Cr, Pb and Zn) were determined, together with the amount of organic carbon (OC). No significant differences were determined between the levels of any of the analytes in the samples collected nearer to shore and those closer to the center of the channel. Nevertheless, the transepts returned easily identifiable horizontal gradients of metal concentrations in very small spatial scales, with metal concentrations decreasing from the margin. Aluminum normalization indicated a higher prevalence of "anthropogenic metals" in near shore samples (with the exception of Cr, with similar high correlations with the terriginous tracer in both areas). Reinforcing this trend, correlations among metals in the near shore were low and not significant, the exact opposite of those collected at the center of the canal. The former also possessed, on average, higher enrichment in organic matter, when compared to the latter. Despite being in presence of an uncontaminated dataset (as supported by the comparison with Sediment Quality Guidelines) the small-scale spatial variability registered in this study demonstrates the necessity of implementing a (necessarily limited) number of small-scale spatial studies when performing sampling campaigns in a sedimentary environment, particularly in areas of high hydrodynamism, such as estuaries.

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