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Sedimentary filters for emerging contaminants and trace metals in two contrasting estuarine systems

JANA-SOPHIE APPELT[1], ANDREW CUNDY[1], JESSICA WHITESIDE[2] AND PAUL SARGENT BRAY[1]

[1]University of Southampton

[2]National Oceanography Centre Southampton, University of Southampton

Presenting Author: j-s.appelt@soton.ac.uk

Sediments can sequester a range of contaminants, moderating the contaminant input from rivers to marine ecosystems and mitigating their effects in aquatic food systems. The interaction between sediments and contaminants is influenced by the physical and chemical properties of both components, including the sediment composition, particle size, and the chemical structure of the contaminant, as well as environmental factors. However, for some contaminants, in particular those of emerging concern (e.g., pharmaceuticals, natural and synthetic hormones, etc.), the circumstances that influence the trapping processes remain unclear. This project examines sedimentary trapping of both emerging and conventional contaminants in two separate but complementary urbanized estuarine systems.

The Southampton Water estuary (U.K) and Pearl River Delta (China) differ, among other aspects, in climate, sediment composition and degree of urbanization. Comparison of analytical results from both sites allows for a better understanding of sediment-contaminant interactions in estuarine systems. XRF analysis of dated sediment cores (Pb-210 and Cs-137 dating) shows spikes in trace metal concentration for e.g., Cu, Zn and Pb, that exceed 3x the local background values and record historical contaminant discharges into Southampton Water. Surface sediments indicate point source inputs of pollutants (e.g., for Hg with concentrations up to 2.4 ppm in Southampton Water) and decreasing contamination away from likely pollution sources. PCA suggests that some trace metals are associated with the TOC and $d^{13}C$ values of the sediment, but there is no general trend. Ongoing work focuses on the occurrence, trapping and degradation of hormones and PAHs in these surface sediments and sediment cores. This way, trapping mechanisms for conventional and emerging contaminants, the historical vs contemporary inputs of these contaminants, their ability to remobilise through and from sediments, and the role of sediment composition in contaminant sequestration and removal can be assessed.