

## High resolution microprofiling, fractionation and speciation at sediment water interfaces

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Within aquatic environments, the exchange between the sediment and the overlaying water is often driven by steep gradients of, e.g., the oxygen concentration, the redox potential or the pH value at the sediment water interface (SWI). Important transport processes at the SWI are sedimentation and resuspension of particulate matter and diffusional fluxes of dissolved substances. To gain a better understanding of the key factors and processes determining the fate of substances at the SWI, methods with a spatial high resolution are required that enable the investigation of several sediment parameters in parallel to different analytes of interest in the sediment pore water. Moreover, beside the total content, questions concerning the speciation and fractionation are of concern in studying the different (transport) processes. Due to the availability of numerous micro-sensors and -electrodes (e.g., O<sub>2</sub>, redox potential, pH value, H<sub>2</sub>S, N<sub>2</sub>O) and the development of methods for pore water sampling [1], the toolbox to study the heterogeneous and often dynamic conditions at the SWI at a sub-millimetre scale were considerably improved. Nevertheless, the methods available for pore water sampling often require the installation of the sampling devices at the sampling site and/or intensive preparation procedures that may influence the conditions at the area studied and/or the characteristics of the samples taken.

By combination of a micro profiling system with a new micro filtration probe head connected to a pump and a fraction collector, a micro profiling and micro sampling system (“missy”) was developed that enables for the first time a direct, automate and low invasive sampling of small volumes (<500  $\mu$ L) at a spatial high resolution of a few millimetres to sub-millimetres [2]. Via the application of different sample preparation procedures followed by inductively plasma-mass spectrometry analyses, it was possible to address not only the total content of metal(loid)s, but also their fractionation (size dependent and micelle mediated) or speciation related distributions along sediment depth profiles in parallel to different sediment parameters (O<sub>2</sub>, redox and pH).

Together with the results of missy-experiments, the results of different experimental approaches will be given and discussed, especially with regard to their potentials and limitations. Based on application examples it will be demonstrated how a variety of parameters can be studied in parallel with the aim to get a more holistic understanding of natural and anthropogenic caused processes that govern the fate of substances at the SWI.

1. Stockdale, A., W. Davison, and H. Zhang, Micro-scale biogeochemical heterogeneity in sediments: A review of available technology and observed evidence. *Earth-Science Reviews*, 2009. 92(1-2): p. 81-97.
2. Fabricius, A.-L., et al., New Microprofiling and Micro Sampling System for Water Saturated Environmental Boundary Layers. *Environmental Science & Technology*, 2014.