

Water column signatures of the NW German backbarrier tidal flats: Sources and processes

Kölsch S¹, Dellwig O¹, Reuter R², Terjung F² and Brumsack H-J¹

¹Institut für Chemie und Biologie des Meeres (ICBM),
Carl von Ossietzky Universität Oldenburg, D-26111 Oldenburg
(e-mail: s.koelsch@icbm.de)

²AG Meeresphysik, Carl von Ossietzky Universität Oldenburg
D-26111 Oldenburg

At the ICBM, a Research Group has been established to study the fundamental biogeochemical processes and hydrodynamic conditions of the NW German Wadden Sea. Tidal and seasonal variations are not only seen in physical parameters, like salinity and temperature, but also in the elemental composition of the particulate and dissolved fractions of the water column. For example, concentrations of dissolved Mn increase during ebb tide. In summer, Mn and Fe are extremely enriched in particles due to increased activity of Mn and Fe oxidizing bacteria.

Several sources for dissolved and particulate elements have to be considered: (i) pore water, (ii) subterranean estuary, (iii) fresh water.

The pore water draining from the flats at low tide is influenced by microbial activity in the sediment, as reflected by elevated alkalinity and enrichments in redox-sensitive elements like Mn reaching up to 6 mg l⁻¹. The effect of a presumed subterranean estuary system formed by early Holocene tidal channels is still relatively unknown. Nevertheless, measurements of short-lived Ra isotopes provide a first hint for the existence of such an aquifer [1].

The fresh water of small NW German coastal tributaries is extremely rich in dissolved organic matter (DOC) as well as particulate and dissolved metals. The concentrations of dissolved Fe and Mn are 20 to 40 times higher than average global river water. During ebb tide the fresh water is discharged into the Wadden Sea through a sluice, drifts with the ebb current into the backbarrier area and mixes with seawater. This fresh water contribution, although of small volume, cannot be neglected when performing elemental mass-balance calculations on the Wadden Sea environment.

Reference:

[1] Schnetger, B., Hinrichs, J., Dellwig, O., Shaw, T., Brumsack, H.-J. (2000): The significance of radionuclides and trace elements in a backbarrier tidal area: Results from the German Wadden. In: Distribution and Speciation of radionuclides in the environment. Inaba, J. et al. (Ed.), Proc. of the Int. Workshop on Distribution and Speciation of radionuclides in the environment, Japan, pp. 99-106