Deep pore water geochemistry of tidal flat sediments

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Introduction

In tidal flats a substantial amount of water is incorporated in sediments as pore water. The concentrations of numerous elements in pore water are significantly altered as compared to sea water. Hence, a chemical characterisation of pore waters is an essential prerequisite to establish elemental mass balances for tidal flats.

Fig. 1: Study Area - red cross marks the sampling site.

Sampling

The analysis of pore water is carried out at two locations in the backbarrier tidal flat of Spiekeroog Island in NW Germany (Fig. 1). Pore waters are collected along a permanent transect by pore water lances. These lances extract water samples from 20 different depths of up to 5 m (Fig. 2). The samples are analysed for trace elements, nutrients, and dissolved organic carbon (DOC).

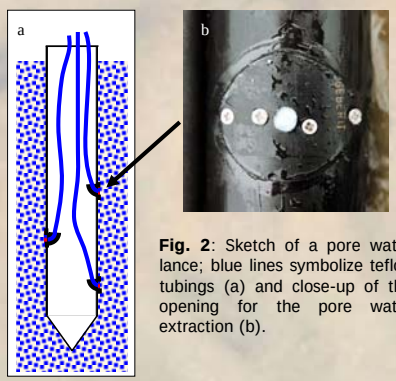

Fig. 2: Sketch of a pore water lance; blue lines symbolize teflon tubings (a) and close-up of the opening for the pore water extraction (b).

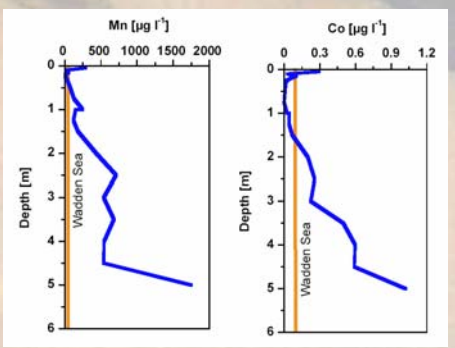

Fig. 3: Concentrations of Mn and Co in deep pore waters. The brown line shows the concentration of the element in sea water of the study area.

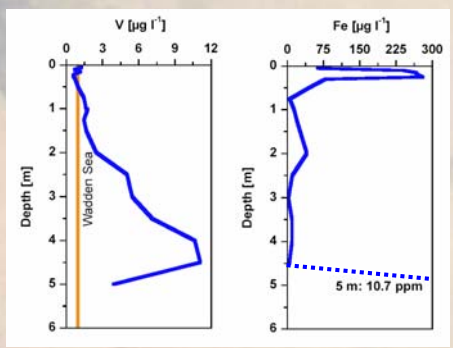

Fig. 4: Concentrations of V and Fe in deep pore waters. The brown line shows the concentration of V in sea water of the study area.

Results

An increase in **Mn** concentration with increasing depth may be related to the reduction of Mn oxides occurring at about 2 m depths. **Co** and **V** are often associated with Mn oxides and therefore show a similar depth profile (Fig. 3, 4).

Fe oxides are supposedly reduced along the whole profile (Fig. 4). In the upper cm H_2S concentrations are low enough for the occurrence of Fe, which is fixed as FeS with increasing depth.

Concentrations of **U** and **Mo** decrease rapidly with depth (Fig. 5) which seems related to a removal from the pore water due to reducing conditions.

The concentration of **DOC**, **NH_4^+**, and **alkalinity** all increase with increasing depth due to organic matter degradation, and the concentration of **SO_4^{2-}** decrease with depth (Fig. 6, 7).

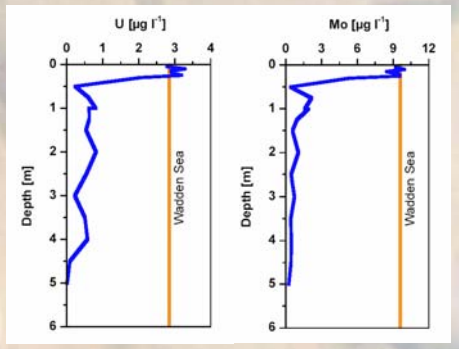

Fig. 5: Concentrations of U and Mo in deep pore waters. The brown line shows the concentration of the element in sea water of the study area.

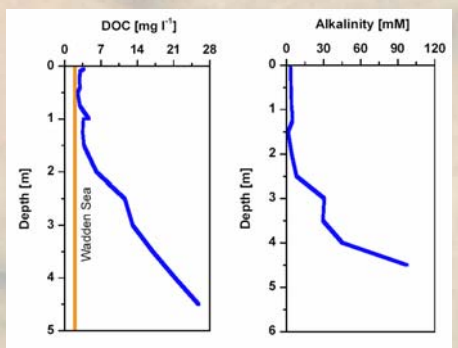

Fig. 6: DOC and alkalinity in deep pore waters. The brown line shows the concentration of the respective parameter in sea water of the study area.

Outlook

Trace metals, nutrients and DOC will be measured over the period of one year to gain a better understanding of processes responsible for the development of the observed depth profiles. Additional lances equipped with sensors measuring temperature, pressure and electrical conductivity will be installed in the sediment to asses advective fluxes within the sediment.

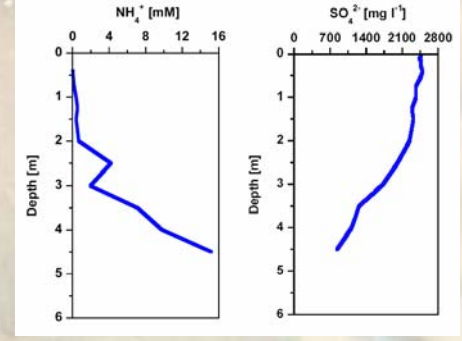

Fig. 7: Concentration of NH_4^+ and SO_4^{2-} in pore waters.

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