

## ABSTRACT

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Marine sediments are central in the cycling of organic matter in coastal environments. Through a range of primarily microbially mediated redox reaction pathways, organic matter is mineralized creating a succession of redox zones. The integrated activity of all biological, chemical and physical processes in the sediment gives rise to benthic fluxes of chemical species across the sediment-water interface. In this thesis, benthic fluxes on different spatial, temporal and complexity scales were used as response variables to evaluate the relative importance of quality and quantity of additions of organic matter. Information about the underlying mechanisms was collected through small-scale incubations of sieved sediment, where fluxes mainly are attributed to microbial activity. Another setup allowed for ecological relevant experiments with intact sediment communities. A multivariate approach enabled simultaneous variation of both quality and quantity as mixes of the green alga *Ulva lactuca* and lignin. For additions that did not exceed the microbial community's capacity for carbon assimilation (for the presented conditions equal to  $2.5\text{g C}\cdot\text{m}^{-2}$ ), the sediment acted as a sink for nitrogen with an increasing efficiency with increasing nitrogen content. For larger additions, the sediment instead acted as a source with increased ammonium effluxes with increased amount of organic matter, independent of the quality. In the light of eutrophication, these insights are essential to improve the knowledge of the mechanisms behind, as well as natural thresholds for, organic matter degradation. In order to find out what action to take and where to emphasize in order to overcome the eutrophication problems we must identify the normal behavior of our coastal systems.

Another step in this direction is the use of redox sensitive elements (RSE) as proxies in sediment archives. Some redox sensitive elements as molybdenum, rhenium and uranium, undergo a phase shift from dissolved to solid in anoxic events. The presence of RSE can therefore be used to map the frequency of historical anoxic events in the marine environment, which occurred before any substantial anthropogenic impact. To improve the interpretation of the historical archives, studies of cycling of RSE in recent coastal sediments can provide more detailed information about under what conditions the RSE are transformed.

**KEYWORDS:** benthic flux, diffusion, eutrophication, marine sediment, organic matter, pore water profile, redox reaction, solute transport

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