



Biogeochemical dynamics in 20 m deep coastal sediments: The transition between the shallow subsurface and the marine deep biosphere

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At present a large tidal flat area extends along the coastline of the southern North Sea. On longer geological time scales this area has, however, transformed from a terrestrial- to a marine-dominated landscape owing to changes in sea level. Biogeochemistry and microbial abundance have been intensively studied in the present tidal-flat sediments, down to about 5 m depth. However, very little is known about biogeochemical and microbial processes in deeper sediment layers, which were deposited before the establishment of today's tidal flat area.

To study whether the geological history of sediment accumulation and thus the paleo-environment has an impact on pore water biogeochemistry and microbial abundance, Quaternary coastal deposits were investigated down to 20 m depth. In the tidal flat area of Spiekeroog Island (NW Germany) two geological settings were selected which are located close to each other but differ in sediment age and paleo-environmental conditions: A paleo-channel filled with mainly Holocene sediments and a sedimentary succession with the oldest sediments deposited during the Saalian glaciation ca. 130,000 years ago.

The interdisciplinary analysis clearly shows that microorganisms are more abundant in the Holocene sediments. Here, almost all Archaea appear to be methanogenic as indicated by the presence of the *mcrA*-gene. About 12% of the Bacteria harbor the key gene for sulfate reduction. In contrast, only 1% methanogens and 0.5% sulfate-reducing bacteria were found in the older sediments. Furthermore, this study supports the concept that certain biogeochemical and microbiological features show astonishing similarities between the upper 5 meters of tidal-flat sediments and the upper hundred meters of deep-sea sediments. In the investigated 20 m-long sediment cores, the microbiological and geochemical response to sedimentary settings is transitional between the shallow subsurface of tidal-flat sediments and the marine deep biosphere.