Controls on methane cycling in the Baltic Sea

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The Baltic Sea is an ideal model to understand the environmental factors controlling methane production and methane cycling in coastal marine sediments. Salinities range from marine to nearly limnic, temperatures vary seasonally, and the stratified water column leads to widespread anoxia. During the BONUS+ project, BALTIC GAS, an international group of researchers studied sediment geophysics, free gas distribution, methane fluxes and organic carbon mineralization to determine the constraints on methanogenesis and methane emission to the water column and atmosphere.

The entire Baltic Sea region was ice-covered during the last glaciation, and modern methanogenesis primarily takes place in organic-rich sediments from the past <10,000 years. Sub-surface methane fluxes are highly dependent on the thickness of these Holocene sediments. In fact, the geographic distribution of dissolved methane and free gas can only be understood in the light of post-glacial geology as revealed by seismic-acoustic mapping combined with targeted coring and geochemical analyses. When Holocene deposits exceed a theshold thickness of 6-10 m, the methane partial pressure builds up to form gas bubbles. The underlying post-glacial clay, in contrast, may be a sink for methane.

Ebullition of free gas appears to be insignificant in the main Baltic Sea basins, yet hotspots with outgassing associated with pockmarks have been found by multibeam bathymetry, mostly in the Polish and Russian sectors. Outgassing also occurs in the most eutrophic coastal zone. Enhanced ebullition was not found associated with the low sulfate concentrations in the Bothnian Bay. Elevated methane concentrations in the bottom water are confined to the anoxic basins and methane is retained and oxidized in the chemocline of the water column. The Baltic Sea basins are thus generally robust towards methane emission to the atmosphere, although studies during extreme water level fluctuations are still lacking.

Hierarchy of two drivers of soil organic matter biodegradation: microbial habitat properties versus microbial communities

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Soil microbial communities live in a complex 3-D framework in which a range of habitats with a variety of properties exists. The importance of these habitat properties relative to the intrinsic properties of microbial communities in the regulation of soil organic matter decomposition is still unclear.

In order to uncouple effects linked to microbial habitat properties from ones linked to microbial communities, we sterilized 6 contrasted soils and performed to crossing inoculations. Each soil microbial community was extracted from its native soil by a saline solution, and inoculated in each on the six different sterilized soils. During the incubation, we measured C mineralisation as well as the microbial communities structures. Microbial habitat was the dominant determinant of SOC decomposition and of microbial community structure.

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