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Freezing and hungry? Hydrocarbon degrading microbial communities in Barents Sea sediments around Svalbard

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The Polar Regions are characterised by varying temperatures and changing ice coverage, so most of the primary production take place in the warmer season. Consequently, sedimentation rates and nutrient input are low. The diversity and metabolic potentials of the microbial communities inhabiting these sediments in the Northern Barents Sea are largely unknown. Recent reports on natural methane seeps as well as the increase in hydrocarbon exploration activities in the Arctic initiated our studies on the potential of indigenous microbial communities to degrade methane and higher hydrocarbons under in situ pressure and temperature conditions. Furthermore, the subseafloor geochemistry in these areas was studied, together with important microbial groups, like methanotrophs, methanogens, metal and sulfate reducers, which may drive seafloor ecosystems in the Northern Barents Sea.

Sediment samples were collected in several areas around Svalbard in the years 2013-2016 ranging from shallow (200m) areas on the Svalbard shelf to deep sea areas on the eastern Yermak Plateau (3200m water depths). Shelf sediments showed the highest organic carbon content which decreased with increasing depths. Iron and manganese as potential electron acceptors were found in the porewater especially in the top 50 cm of the cores, while sulfate was always present in substantial amounts in porewater samples down to the end of the up to two metre long cores. Concentrations of dissolved methane and carbon dioxide were low.

The potential of the indigenous microorganisms to degrade methane and higher hydrocarbons as well as different oils under in situ temperatures and pressures was widespread in surface sediments. Degradation rates were higher under aerobic than under anaerobic conditions, and decreased with increasing sediment as well as water depths. Similar pattern were found for other metabolic processes, including sulfate, Fe and Mn reduction as well as carbon dioxide and methane production rates. Ongoing molecular biological analyses of original sediments and enrichment cultures indicate the presence of diverse and varying microbial communities.