ARCTIC POLYGONAL TUNDRA DETERMINES SMALL-SCALE CHANGES OF METHANOTROPHIC COMMUNITY STRUCTURE AND ACTIVITY

Susanne Liebner[*], Juliane Griess[1)], Christian Knoblauch[2)], Mette M. Svenning[3)], Josef Zeyer[4)], and Dirk Wagner[1)]

[*]present affiliation: Alfred Wegener Institute for Polar- and Marine Research, Telegrafenberg A45, 14473 Potsdam, Germany
[1)]Alfred Wegener Institute for Polar- and Marine Research, Telegrafenberg A45, 14473 Potsdam, Germany
[2)]University of Hamburg, Institute of Soil Science, Allende-Platz 2, 20146 Hamburg, Germany
[3)]University of Tromsø, Department of Arctic and Marine Biology, 9037 Tromsø, Norway
[4)]Institute for Biogeochemistry and Pollutant Dynamics (IBP), Federal Institute of Technology (ETH), CHN G47,Universitätstrasse 16, 8092 Zürich, Switzerland

Northern wetlands and tundra are a net source of methane (CH_4) with an estimated annual release of on average 7.2% of the global total CH_4 emission (IPCC 2007). Polygonal tundra constitutes the typical peatlands of the Arctic covering around 3% of the Arctic landmasses. Its contribution to the overall greenhouse gas budget of Arctic peatlands is essential. Aerobic methane oxidizing bacteria (MOB) constitute the major sink for CH_4 in polygonal tundra, thus considerably influencing the amount of CH_4 released to the atmosphere.
The small-scale shift between water-saturated, waterlogged and unsaturated sites characteristic for polygonal tundra determines heterogeneous redox-conditions and potentially shape the community structure and activity of MOB. We studied methanotrophy in the oligotrophic, mainly neutral polygonal tundra of Samoylov, a small island in the Siberian Lena Delta. Applying molecular techniques, we observed that elevated, unsaturated sites promote type I MOB. Thereby, MOB were restricted in their *in-situ* diversity. Only members of the genera *Methylobacter* and *Methylsarcina* were detected with the majority of sequences closely related to methanotrophs isolated from Arctic wetlands (e.g. *Mb. tundripaludum*). Enriching methanotrophs at different temperatures, however, revealed a potentially diverse community consisting of various genera of type I as well as type II MOB. In contrast to unsaturated sites with pronounced aerobic soil layers, the active community of MOB in open water polygonal ponds investigated through stable isotope probing consists mainly of type II MOB. This community lives symbiotically with aquatic brown-mosses and together with those establishes a very effective buffer for methane emissions. MOB associated to aquatic mosses showed much higher potential methanotrophic activities than MOB in adjacent bulk soil. Polygonal tundra must be considered a very heterogeneous environment for MOB particularly sensitive to environmental change.