Specialisation and diversity of methane oxidising communities in Siberian permafrost soils

Susanne Liebner[1], Jens Harder[2] and Dirk Wagner[1]
[1]Alfred Wegener Institute for Polar and Marine Reserach, Research Department Potsdam, Telegrafenberg A43, Potsdam, Germany and [2]Max Planck Institute for Marine Microbiology, Celsiusstrasse 1, Bremen, Germany
sliebner@awi-potsdam.de

Within the context of global climatic change, the Arctic is of major interest. Its wet tundra environments are considerable sources of methane, a relevant greenhouse gas. Moreover, the Arctic is observed to warm more rapidly and to a greater extend than the rest of the earth surface. The potential impact on the terrestrial methane oxidation is likely to be influenced by the diversity and the specialisation of the methane oxidising (methanotrophic) community (MOC). However, until now little is known about how these factors determine the stability of microbial communities.
Incubation experiments on soil samples from the Lena Delta, Siberia, using $^{14}CH_4$ showed shifting temperature optima of the potential methane oxidation with increasing depth of the seasonally thawed permafrost layer (‘active layer’). In deep layers close to the permanently frozen ground maximum rates were detected at 4°C. These results contradict the idea of a ‘community of survivors’ in permafrost soils but indicate ‘cold loving’ MOC in constantly cold permafrost layers. The abundance of methanotrophs determined by fluorescence *in situ* hybridisation was highest in soil layers with a potential methane oxidation independently of the temperature. In contrast, cell counts were significantly lower in soil layers exhibiting a distinct temperature optimum. In combination with the analysis of structure and diversity of the MOC as reflected in bacterial clone libraries, these results give first insights into the correlation between specialisation and diversity with regard to microbial stability in extreme habitats.