MICROBIOME AND SUBDUCTED CARBON VULNERABILITY IN ARCTIC PERMAFROST SOILS

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LECTURE

Arctic permafrost soils contain about half of the global soil organic carbon. One third of this is stored in subducted organic matter (cryoOM) by the cryoturbation processes. We present results from the Arctic project aimed at identifying the role of microbial functioning for OM decomposition in cryoturbated soils (Siberia, Greenland, Canada) and at assessing the potential vulnerability of this OM in a future climate. Our main findings were:

1. Abundance of bacteria and fungi closely correlates with carbon loss. Low fungal to bacterial ratio may be one of the reasons of slow decomposition of cryoOM and can be used as cryoOM vulnerability predictor. The microbial community is distinctly different from topsoil and more similar to surrounding subsoil communities. There is, therefore, a mismatch between microbial community composition and OM quality that added to the retarded decomposition of cryoOM.

2. OM availability is reduced and nitrogen cycling decelerated. In several incubation experiments including experiments with labelled substrates we demonstrated different nutrient limitations of the microbial communities in cryoOM. The nitrogen-containing substrates led to a significant priming effect, indicating a strong nitrogen limitation of the microbial community. High portion of cryoOM is bound to clay minerals which may contribute to lower availability for microbial decomposition and lower vulnerability of cryoOM.

In summary, we demonstrate that, in addition to unfavorable environmental conditions, decomposition processes in cryoturbated arctic soils are retarded by a combination of changes in microbial community composition, reduced OM availability and decelerated nitrogen cycling.