EGU22-8348
https://doi.org/10.5194/egusphere-egu22-8348
EGU General Assembly 2022

Molecular biomarkers and carbon turnover data in ice-rich permafrost in Yakutia

Loeka Jongejans[1,2], Kai Mangelsdorf[3], Susanne Liebner[4,5], Guido Grosse[1,2], Mikhail Grigoriev[6], Alexander Fedorov[7], and Jens Strauss[1]

[1]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research Potsdam, Permafrost Research Section, Potsdam, Germany (loeka.jongejans@awi.de)

[2]Institute of Geosciences, University of Potsdam, Potsdam, Germany

[3]GFZ German Research Center for Geosciences, Section Organic Geochemistry, Potsdam, Germany

[4]GFZ German Research Center for Geosciences, Section Geomicrobiology, Potsdam, Germany

[5]Institute of Biochemistry and Biology, University of Potsdam, Potsdam, Germany

[6]Laboratory of General Geocryology, Melnikov Permafrost Institute, Siberian Branch of the Russian Academy of Science, Yakutsk, Russia

[7]Laboratory of Permafrost Landscapes, Melnikov Permafrost Institute, Siberian Branch of the Russian Academy of Science, Yakutsk, Russia

With ongoing climate warming, ice-rich permafrost, such as late Pleistocene Yedoma permafrost, is especially vulnerable to rapid and deep thaw processes. Such permafrost sediments contain a large organic matter storage that becomes increasingly accessible to microbes upon thaw. Only a few studies analysed organic matter in deep (>10 m) permafrost and thawed permafrost sediments. We studied Yedoma sediments from four sites in Yakutia in the Russian Federation: at the Arctic Ocean (Bykovsky Peninsula), inside the Lena Delta (Sobo-Sise Cliff), close to the northern hemisphere's cold pole (Batagay) and in central Yakutia (Yukechi Alas). We measured biomarker concentrations of sediment cores taken from below thermokarst lakes and sediment samples taken from the headwall of a coastal bluff and a retrogressive thaw slump. In addition, we carried out incubation experiments to quantify greenhouse gas production in thawing permafrost. Here, we present the first molecular biomarker distributions (alkanes and fatty acids) and organic carbon turnover (anaerobic CO_2 and CH_4 production) data as well as insights in organic matter decomposition processes in deep frozen and thawed Yedoma sediments. We show that biomarker proxies are useful to assess the source and degree of degradation of permafrost organic matter. Furthermore, the organic matter in frozen Pleistocene Yedoma sediments was better preserved than in thawed Holocene sediments. These findings show the relevance of studying organic matter in deep permafrost sediments.