International Conference

Solving the puzzles from Cryosphere

Pushchino, Russia, April 15-18, 2019

Russian Academy of Science
Institute of Physicochemical and Biological Problems in Soil Science RAS
“Okabiolab” Ltd.

International Conference
‘‘Solving the puzzles from Cryosphere’’

PROGRAM
ABSTRACTS

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The International conference «Solving the puzzles from cryosphere» organized by: Institute of Physicochemical and Biological Problems in Soil Science RAS and “Okabiolab” Ltd.

Conference Committees.

Chair of the Organizing Committe: Andrey Alekseev (Corresponding member of RAS, Director of IPCBPSS RAS)
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Chair of the local Organizing Committee: Andrey Abramov (Soil Cryology Laboratory, IPCBPSS RAS)

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metal-reducing Firmicutes increased with depth from 6.8 to 36.3%. The highest abundance of Archaea with dominance of methanogenic Methanosarcinales, Methanomicrobiales, and methylotrophic Thermaplasmata was detected in samples with methane. Other sequences were affiliated with halophilic, sulfate or sulfur reducing Archaea. Among Deltaproteobacteria dominance of sulfate and sulfite reducing bacteria was detected, other deltaproteobacteria were related to halophilic and marine myxobacteria.

Analyses of the lake-alluvial and marine permafrost samples showed evident decrease of DNA yield and increase of DNA damage in older samples for both sites. Uncultured bacteria identified in both sites had closest cultivable relatives that were halotolerant, nitrate reducing, grew well at 15% NaCl, and were isolates from Arctic soils or marine sediments.

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Role of the Transient Layer in the Methane Emissions on the Dominant Landscapes of Typical Tundra under Climate Warming

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The Arctic is the one of the largest natural sources of methane (CH_4) emissions. In these high-latitudinal regions, permafrost is almost universally occurs and serves as a natural waterproof layer. This causes a high degree of swamping and ensures the existence of anaerobic conditions within the seasonal thawing layer. In these conditions, methanogenic microorganisms are actively reproducing.

It was established, that in addition to entering significant amounts into the atmosphere, methane could persist in the frozen soil horizons throughout the winter. In horizons that thaw seldomly for many years, more quantity of the methane accumulating for a longer time. In this regard, particular interest is the quantifying the methane content in the transient layer of cryolithozone, that is the layer that thaws periodically only in some particularly warm years. The

content of methane in frozen soils depends on the composition (particle size distribution) of the soil and the moisture content (ice content). In this regard, we conducted studies on determine the methane content in the active layer and the transient layer of permafrost in dominant landscapes of the Marre-Sale geocryological station (western coast of the Yamal peninsula) located in typical tundra.

Sampling in the dominant landscapes of Marre-Sale was made in 2016, 2017 and 2018. Degassing of samples was performed using the "head space" method. All samples have doubles. The methane content in the gas phase was determined at the Institute of Physicochemical and Biological Problems in Soil Science (Pushchino town) on a KHPM.4 gas chromatograph (Russia) with flame ionization detector (FID) and in the laboratory of the "VNIIIOkeangeologiya" (St. Petersburg) on a gas chromatograph Shimadzu GC-2014 (Japan) with FID. A total of 189 samples were selected. Concurrently with, samples to study the particle size distribution, moisture content, density, and organic carbon content were taken.

Analysis of the data obtained presented the methane content in the studied landscapes of typical tundra varies within very wide limits. In the seasonally thawed layer, the methane content varies from 0 to 12546 ppmV (6.9 ml/kg), 1372 ppmV (0.8 ml/kg) on average. Within the transient layer the methane content varies from 25 ppmV (0.01 ml/kg) to 19933 ppmV (8.9 ml/kg), 4191 ppmV (2.2 ml/kg) on average. Practically everywhere, the methane content from the transient layer is increased compared with the overlying and underlying sediments. The increased methane content in the transient layer can be explained by the extrusion of methane during the autumn freezing and the conservation of the displaced methane in the intermediate layer. The climate warming in the Arctic leads to a partial or complete thawing of the transient layer, which is reflected in an increase in the annual budget for the methane emission into the atmosphere.

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Microorganisms from permafrost ecosystems of marine origin

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Permafrost is one of the most vulnerable parts of our planet. Interest in the study of permafrost deposits and preserved into them paleobiota is largely due to the increase in the permafrost temperature, which was recorded as a result of long-term monitoring. One of the main factors causing warming is an increase in the concentration of such carbon-containing greenhouse gases like carbon