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Permafrost peatlands in southern limit of the East European Cryolithozone

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Monitoring and preservation of permafrost peatlands are important, because of huge natural reservoirs of soil organic carbon (SOC), conserved mostly in upper permafrost, and, as expected, an accelerated mineralization of SOC previously being in the frozen state due climate change.
Field studies were conducted in the southern limit of discontinuous and sporadic permafrost area in the European North-East. Peat plateau complexes, complicated with thermokarst formations and alluvial terraces have been studied. Mostly rounded peat mounds are composed of peat deposits up to 2.3 and more meters thick, the diameter of 5-15 m. Peat mounds and numerous small thermokarst lakes are surrounded by sedge-sphagnum unfrozen fens (from 15 to 30 m2) serve as water conduits in the partly frozen terrain. Peat in mounds is mainly dark brown, well-decomposed, alternating with layers of weak-decomposed wood peat. The mound core is composed of bluish-brown sandy loams and loams.
Reducing the bogs surface under the influence of erosion and thermokarst processes is one of the main reasons of peatlands formation. Mounds are considered as outliers former bogs and fens surface which are not damaged by erosion and thermokarst. SOC has been formed in the peatland from 9-7 thousand years to the present, however the degree of peat decomposition and humification is slightly changed down the profile. Peat deposits are initially and primarily accumulated under unfrozen mesotrophic and eutrophic bogs. Permafrost aggradation initiated erosion processes 2000-3200 years ago, resulting to peat mounds formation (Becher, 2011). Thus, studied peatland remains to be frozen during relatively short period of its development (approximately 22-36%).
Currently, a lot of scientists claim that the so-called sub-zero temperatures inhibit mineralization of SOC stored in permafrost. Permafrost thaw will lead to a rapid remobilization and mineralization of organic matter that occur during the decades (Schuur, Abbott, 2011). However, due to the insulating properties of dry peat, active layer will be very slow deepening in the mounds. Scenarios for the SOC release under permafrost thaw were described by Hugelius et al. (2012). They suggest that further disintegration of the thawed SOC will depend not only on the increase thaw depth, but on changes in the hydrothermal soil regime resulting in water logging, thermokarst lakes expansion. Conducted by Knoblauch et al. (2013), model experiment with Holocene and Pleistocene permafrost peat deposits in northeastern Siberia revealed that even under permafrost thaw the release of greenhouse gases, i.e. mineralization occurs much more slowly than previously considered. Their obtained that during 100 years 15.1% of all SOC has been mineralized under aerobic conditions in the form of CO_2 and 1.8% under anaerobic conditions as CH4.
Permafrost thawing is not the main factor of SOM mineralization. To inhibit organic matter decomposition, the presence of anaerobic conditions is the most important issue, rather than permafrost occurrence.
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