北東シベリアタイガ - ツンドラ境界域湿地土壌のメタン酸化ポテンシャル

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Methane Oxidation Potential of Arctic Wetland Soil of a Taiga-Tundra Ecotone in Northeastern Siberia

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Arctic wetlands are significant sources of atmospheric methane and the observed accelerated warming of the arctic causes increased methane formation in water-saturated tundra soil with deepened permafrost thawing. Methane oxidation is regarded as the key process to regulate methane emission from wetlands. Here we studied the potential methane oxidation rate of the wetland soils of a Taiga-Tundra transition zone in Northeastern Siberia with special reference of the spatial heterogeneity and response to environmental parameters. Surface peat soil samples (0-10 cm) were collected in the summer of 2012 and 2013 from depressions that were covered with tussocks of sedges and *Sphagnum* spp. and mounds vegetated with moss and larch trees. The potential methane oxidation rate was estimated by a bottle incubation experiment in which homogenized soil samples were incubated with methane at the initial concentration of 0.5-0.8 %(v/v). Soil samples from the mounds showed no detectable methane oxidation, whilst the soils collected from depressions exhibited active methane oxidation with no lag. The potential methane oxidation rates at 15 ºC were of 270 and 190 nmol h^{-1} g^{-1} dw in the moss- and sedge-dominated zones, respectively. Methane oxidation was active over the depths including the water-saturated anoxic layers, suggesting the resilience of methane oxidizing bacteria from freezing. The maximum methane oxidation rate was recorded in the layer above the water-saturated layer: the surface (0-2cm) layer in the sedge-dominated zone and in the middle (4-6 cm) layer in the moss-dominated zone. Temperature-dependent methane oxidation was observed at the range of temperature from 0 to 15 ºC. The estimated threshold temperature of methane oxidation was -4 to -11 ºC, which suggested methane oxidation at subzero temperatures. Treatment with inorganic nutrients and black carbon did not affect the potential methane oxidation rate. Difluoromethane, the inhibitor of methane oxidation, did not alter the methane flux from the sedge and moss core samples, which indicated the undetectable levels of methane oxidation associated with the peat plants.