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
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 the key process to regulate methane emission from wetlands. In this study we determined the potential methane oxidation rate of the wetland soils of a Taiga-Tundra transition zone in Northeastern Siberia. Peat soil samples were collected in the summer from depressions that were covered with tussocks of sedges and *Sphagnum* spp. and from 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 collected from depressions in the moss- and sedge-dominated zones exhibited active methane oxidation with no lag. The potential methane oxidation rates at 15 ºC ranged from 270 to 190 nmol h^{-1} g^{-1} dw. Methane oxidation was active over the depths including the water-saturated anoxic layers. 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. The methane oxidation rate was temperature-dependent and the threshold temperature of methane oxidation was estimated to be -4 to -11 ºC, which suggested methane oxidation at subzero temperatures. Soil samples collected from the frozen layer of *Sphagnum* peat also showed immediate methane consumption when incubated at 15 ºC. The present results suggest that methane oxidizing bacteria keep their activity in the wetland soils even under anoxic and frozen conditions and immediately utilize methane when the conditions become favorable. On the other hand, difluoromethane, the inhibitor of methane oxidation, did not alter the methane flux from the sedge and moss vegetation, indicating the undetectable levels of methane oxidation associated with the peat plants.

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