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# シベリア永久凍土域におけるタイガ林の有機物層の生分解と養分供給ポテンシャル
# Nutrient release during biodegradation of organic horizons in the Siberian taiga underlain by continuous permafrost

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Organic horizons under the Siberian taiga forest have a significant role of nutrient supply for plants through their biodegradation processes and of heat insulation for permafrost table underneath shallow mineral soil layer. Lower weathering stages of mineral soils underlain by permafrost have lower potential of soil nutrient retention and release, indicating that summer growing vegetation can expect to fill their nutrient requirements released by organic matter degradation. Decomposed organic matter can supply mineral and biogenic nutrients to plants and microorganisms. Organic horizons often suffer from frequent forest fire in the Siberian forest. Forest fire moves through organic horizon on the ground because of low tree density in the forest stands. Relatively low burning temperature can leave organic residue on the forest ground. Ground temperature during forest fire is a key variable for changes in properties of organic horizons. Solutes release potential and biodegradability of organic horizons was evaluated in this study along with heating temperature gradient. To estimate the effect of forest fire on the biodegradation processes of organic horizons, we prepared organic horizon samples heated between 65$^o$C and 550$^o$C under a relatively oxygen limited atmospheric condition.

A sampling site located in the Evenkia province in the central Siberia. Soils are classified as Oxyaquic Cryosols or Gelic Cambisols according to the WRB classification system. Organic horizon samples were taken depending on hummock topography. Air-dried and powdered samples were heated in a muffle furnace between 105 and 550$^o$C for 15minites. Organic residues were applied to incubation experiment to evaluate biodegradation and solutes release. Biodegradation was evaluated from mineralization rates being calculated using temporal changes in $CO_2$ concentration during an incubation experiment and total organic carbon content in heated solid samples. During the same incubation time course, biogenic elements released from the heated samples were determined after water extraction by ICP-AES, Ion-chromatography and TOC-L with total nitrogen module unit.

Solutes release from heated organic horizon samples by water saturation was different between samples depending on the heating temperature. Larger amount of nutrient elements were released from organic horizons taken from trough points on the hummock. Samples heated at 250$^o$C released the highest amount of solutes mainly dominated by dissolved organic C. Basic cations and major anions including phosphate, nitrate and chloride were also largely released from the sample heated at 250$^o$C. Higher the heating temperature was, solutes concentration was lower. Solution pH was higher with increasing the heating temperature. The ratios of carbon to nitrogen in solid samples were decreased with increasing the heating temperature. The temperature dependence of solutes release was different along with hummock topography.

The maximum mineralization (%) was approximately 4% of total C in samples heated at lower temperature below 180$^o$C. The mineralization rate was not largely different between samples, indicating that the biodegradation process in all heated samples mainly depends on the amounts of easily decomposable carbon source, such as DOC. There are significant correlations between the maximum mineralization rate and DOC or inorganic N. Solutes mainly consisting of nutrients and energy source for microorganisms can be a significant controlling factor for the biodegradation process of organic horizons. The difference in solutes composition and the biodegradation were mainly depending on heating temperature of organic horizons. Heating temperature during a forest fire is an important parameter controlling the further degradation of organic matter in organic horizons and the fate of carbon dynamics in the boreal permafrost affected forest region.

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