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Geochemical and molecular analyses of lake sediments to understand methane emissions

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Northern lakes are potential sources of carbon dioxide (CO_2) and methane (CH4) to the atmosphere. Accelerated warming in the sub-arctic is projected to increase emissions of CH4 from lakes through diffusive loss and ebullition (bubbling). Ebullition events have been quantified over four summers in two lakes in Stordalen Mire, a site located in the discontinuous permafrost zone in northern Sweden. The following measurements were made on cores taken from four sites that differed in water depth and ebullition rates: (a) incubations of lake sediment at three depths and two temperatures for CO_2 and CH4 production rates, (b) sediment and water CH4 concentrations and δ13C-CH4 (c) pore water dissolved inorganic carbon (DIC) and δ13C-DIC , (d) microbial community profiling, by sequencing 16S rRNA gene amplicons from extracted DNA, (e) total organic carbon, total organic nitrogen, and calcium carbonate, (f) isotopic signatures of δ13C and δ15Nof lake sediment.We observed that variability of CO_2 and CH4 dynamics in sediments (based on sampling at different water depths and locations) is closely related to carbon content of the sediment and ebullition rates measured at the lake surface.