Methane microbiology of Arctic thermokarst lake sediments in response to warming

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Permafrost covers 24% of Northern Hemisphere land surface and contains 50% of global belowground organic C stocks. IPCC models estimate up to an 8 °C rise in mean annual temperature in Polar Regions by 2100 due to climate change leading to increased permafrost thaw and thermokarst formation. Climate change can alter organic matter decomposition rates resulting in emission of CO_2 and CH_4. Here we investigated the effect of increasing temperature on microbial community structure and metabolic activity in the methane cycle from thermokarst lake sediments in an attempt to predict how warming will affect methane fluxes. Archaeal and bacterial 16S rRNA genes were sequenced to gain insight in the diversity of the original thermokarst lake sediments. Sediment slurries were incubated at various temperatures to study the activity of methanogens and methanotrophs in response to warming. Our results showed an increase in both methane production and consumption at higher temperature. Enrichment cultures were established to isolate potential novel methanogens and methanotrophs, and the metagenomes of the enrichments were sequenced. This study will help to better understand the processes behind global warming and to improve future climate projections and predictions.