Understanding the microbial controls on biogeochemical cycles in permafrost ecosystems

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Project Goals: Permafrost soils contain a broad diversity of cold-adapted microbes, whose metabolic activity depends on environmental factors such as temperature changes that cause cycles of freezing and thawing in the soil. Microbial metabolism leads to decomposition of soil organic matter, substantially impacting the cycling of nutrients and significantly affecting the arctic landscape. However, the relationship between permafrost microbial properties and biogeochemical cycles is poorly understood. This project will use state of the art molecular techniques to resolve complex microbial processes governing the biogeochemical cycles in arctic soils and permafrost to better inform efforts to access uncertainties surrounding ecosystem responses.

Permafrost soils are one of the world's largest terrestrial carbon reservoirs thus an important focal point for climate change research. With increasing global temperatures, arctic landscapes are changing and becoming a potential source of greenhouse gas (GHG) emissions. While carbon turnover at depth is proposed to be slower than surface, especially the fate of carbon in deep permafrost, which is currently protected from the warming climate, is uncertain. This project will use field experiments, laboratory manipulations, and multi-omics approaches to examine how microbial processes, biogeochemical transformations, and hydrology interact during permafrost thaw in different sites in Alaska in order to determine how these factors drive biogeochemical cycles in different arctic soils.

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