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Transport and Seasonality of Trace Elements in Arctic Soils

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Increasing air temperatures in the Arctic have potential to thaw permafrost and accelerate the downward migration of the seasonally thawed 'active' layer into previously frozen material. This process will likely affect the partitioning of trace elements to soil pore water in the Arctic. Determining watershed system responses to a changing climate relies heavily on soil composition and the partitioning of trace elements from soil to soil pore water. As solid-phase water in permafrost thaws, a higher proportion of 'interfacial water' may be present, altering the localized microenvironment of the transition zone. Associated changes could increase biochemical reactivity and/or changes in water density, viscosity, conductivity, and soil wettability. The goal of this study is to identify seasonal variability in trace element flux as well as characterize the bulk solid and aqueous phase chemical composition on a watershed scale. In order to characterize the seasonality of trace element geochemistry in an Alaskan Arctic watershed, concentrations of trace and major elements in soils and pore waters were measured during the summer period, from spring melt to early winter. Soil temperatures were also monitored as a function of depth to identify the permafrost soil thermal regime over time and to track active layer thaw. Results from this study indicate distinct element distributions related to permafrost depth (surface versus deeper in the active layer), and it is expected that future increasing air temperatures will alter trace element concentrations in soil pore water by exposing fresh soil to weathering processes as the active layer thaws into previously frozen material.