

Impact of modern thermokarst on mineral element release: case study in Cape Bounty, Canada

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Rapid permafrost thaw, exposing organic matter (OM) to decomposition, is also responsible for mineral alteration and nutrient release from previously perennally frozen materials. Ice-rich permafrost thaw creates local landscape degradations (subsidence) known as thermokarst structures, resulting in development of distinctive landforms. Two different types of structures are studied: an Active Layer Detachment (ALD) which is a one-time event, and a Retrogressive Thaw Slumps (RTS) which repeats annually during summer months. In the Cape Bounty Arctic Watershed Observatory (Canada), the total elemental content and mineral nutrient released from an ALD formed in 2007 and a RTS still very much active were compared. For the disturbed areas, results show an increase in total elemental content (for Al, Ca, Fe, K) with depth as compared to the undisturbed site, as well as an increase in plagioclase content. The mineral nutrient concentration released is also several times higher (Ca : 5 ; Na : 8 ; Mg : 5) for the RTS disturbed site compared to the undisturbed site. For ALD sites, there was no significant difference between the disturbed and the undisturbed areas. We hypothesize that the one-time ALD event was followed by a seasonal depletion of the total mineral nutrient content as well as the soluble mineral nutrient concentrations in disturbed and undisturbed soils since 2007. In contrast, RTS structures expose perennally frozen materials every summer after thaw and degradation. This study suggests that RTS development in the Arctic might constitute an important driver for mineral nutrient release by permafrost upon thawing, which might affect local to regional ecosystem chemistry. The data are also considered in the context of potential changes in organic carbon stability upon disturbance.

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