



Small-scale variability of Holocene alas evolution in Central Yakutia inferred from thermokarst basin deposits

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The degradation of ice-rich permafrost is a major environmental change at high latitudes and results in the expression of thermokarst basins. These geomorphological patterns, called alases, are widespread in Central Yakutia, Eastern Siberia. However, alas sizes and characteristics are varying widely and seem to change due to different cryolithological conditions. Even though the evolutionary history of Holocene thermokarst development is not sufficiently clear, it is presumed that it was a dominantly climate driven process. How and when the Central Yakutian alases were formed or how they have evolved through the Holocene is still subject of contemporary research.

The overall aim of this study was to reconstruct Holocene permafrost degradation processes, their influencing factors and environmental impacts in Central Yakutia. Therefore, in total 14 sediment cores were drilled down to 3-4 m depth and sampled in summer 2013 from two differing thermokarst key sites in Central Yakutia. A multi-proxy approach was applied to analyze the following characteristics with focus on 6 cores: water/ice-content, grain size distribution, mass-specific magnetic susceptibility, TOC and TN contents, CaCO₃, element composition (XRF) and stable carbon isotopes. Additionally, organic material and bulk sediment for selected samples were dated with the AMS method to determine ¹⁴C ages for thermokarst deposits.

Due to the results of the elementary composition different lake phases could be identified. Furthermore, end-member analyses on grain-size distributions could be used to clarify the provenance and transport process of the sediments. The results of the ¹⁴C dating confirm an extensive deposition of reworked Pleistocene sediments in peripheral basin zones during thermokarst lake growth, while the basin centers are characterized by autochthonous subsidence of Pleistocene sediments. A synopsis of all analyzed proxies in consideration of the geomorphological location of the cores, however, reveal a small-scale variability of sediment origin in each Central Yakutian alas.