

A02-P05

THE RELATION BETWEEN THERMOKARST LAKE SEDIMENTS, HOLOCENE CLIMATE DEVELOPMENT AND ICE-WEDGE PATTERNS IN NORTHERN SIBERIA

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Although thermokarst activity is a widespread arctic feature, the relationships between limnogeological processes, periglacial features and climate change in the Siberian Arctic are yet not sufficiently understood. Highly dynamic processes are closely connected to both, climate changes and spatio-temporal permafrost variability.

To gain insight into climatic and non-climatic processes we investigated diatoms, grain-size distributions, organic contents, elemental and mineralogical compositions, stable carbon isotopes and plant macrofossils from different lake sediments in the Lena Delta area and its hinterland. Thermokarst is cutting into Pleistocene Ice Complex and Holocene alas sediments. Sr/Rb ratios (related to feldspar and illite) serve as high-resolution grain-size proxies, Br correlates with the TOC content, and the Fe/Mn ratio reflects the degree of oxidation.

Radiocarbon dated samples indicate that the Late Pleistocene were affected by fire, which in some cases potentially triggered the initiation of thermokarst processes. At Lake El'gene-Kyuele, a number of fine sand layers with the maximum age of ~10.9 cal. kyr BP are linked to depositional events associated with thaw slump activity on the orthogonally oriented patterns of the ice-wedge networks in the ice-rich permafrost. Besides the general dependence to hydroclimate variability, repeated phases of fine sand input and retrogressive thaw slumping indicate a close linkage with the orthogonally oriented permafrost patterns within the catchment area.

Lake Sysy-Kyuele exhibits a more direct link between the limnological, ecological, and sedimentological development and the regional climate variability. The Holocene Thermal Maximum (HTM) in the lower Lena River area reveal a temporal delay from north to south. The temporal pattern of the HTM can be linked to regional environmental features that influence the global climate system, providing evidence of teleconnection between the North Atlantic region and northern Russia through the westerlies.

Another lake in the Lena Delta, Arga region, shows rather constant climate during the last 3000 years but still remarkable changes in the sedimentary regime traced by shifts in the diatom distribution and chemical sediment properties.