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Holocene Climate and Environment Dynamics in Kamchatka, NE Russia

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In the scope of the Russian-German KALMAR project, our subproject deals with the reconstruction of late Quaternary land environments, inferred from lake-sediment records and peat sections. The study follows a multi-proxy approach, using fossil bioindicators, such as diatoms (see Hoff et al.), pollen (see Dirksen, V. et al.) and chironomids, as well as geochemistry, radiocarbon dating, and tephra stratigraphy (see Dirksen, O. et al.). In addition to available peat samples from former field work, lacustrine sediment cores were taken during a limnogeological expedition to Kamchatka in September 2007. Promising mid- to late Holocene sediment records were obtained from Two-Yurts Lake, situated in a former proglacial basin of the central Kamchatka mountain chain. The hydrology of Two-Yurts Lake is characterized by an open system with three major riverine inflows and one outflow. Lake waters reveal neutral pH values, fresh-water conditions, and slight oxygen undersaturation in summer. The lake basin morphology is characterized by a flat profundal plain at 21-27 m water depth. A terrace at 2 m above present level and another subaquatic terrace at 16 m water depth give evidence of former lake-level fluctuations. Sediment core PG1857 was taken from the central part of the lake basin. Radiocarbon dating and tephra stratigraphy suggest a basal age of 7.5 ka BP, consistent with dating results from an offshore peat section that covers a glacial moraine to the east of the lake (see Dirksen, O. et al.).

Above a basal clay, the lake sediments consist of diatomaceous oozes with interspersed ash layers. Fossil diatom assemblages are dominated by planktonic cold-water forms indicating low to intermediate trophic lake status (see Hoff et al.), as also indicated by low concentrations of total organic matter (TOC) and low TOC/TN ratios. In addition to diatoms, the lake sediments include abundant fossil chironomid head capsules, exhibiting a higher biodiversity than in temperate climate zones. Changes in chironomid assemblages give insight into changes in lake ecology, water depth and temperature. The lacustrine pollen records point to vegetation changes in the catchment. On the basis of preliminary data, the variability of proxy data in sediment core PG1857 suggest a higher than present biological productivity, lower lake level and higher temperature before 3.7 ka BP. Subsequent lake-deepening and cooling appeared in conjunction with increased detrital sediment supply, possibly pointing to enhanced fluvial run-off. The observed environmental changes towards the late Holocene are consistent with the onset of neoglacial climate deterioration on Kamchatka.