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Reconstruction of Holocene palaeoclimate and environment in the Khatanga region, Russian Arctic

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Arctic regions are highly sensitive to changes in temperature and precipitation, and their Late Quaternary environmental history is very important for understanding of present and past climate trends. Though the timing of Holocene climate change is well established for wide parts of the Northern Hemisphere, suitable palaeoenvironmental records are still scarce in the Russian Siberian Arctic. Taimyr Peninsula (74oN, 100oE) is the northernmost part of Russia. Thus, this area is probably one of the most promising regions for the reconstruction of the Late Quaternary environment in dependence on changes in global and regional climate and the atmospheric circulation. (Andreev et al., 2004).The area is characterized by a continental climate with long, severe winters, and short summers. The modern temperatures are about 10–14oC in July, and – 32 to 34oC in January. Annual precipitation ranges from about 300–400 mm at low elevations to about 600–800 mm on the western slopes of the Putorana Plateau (Atlas Arktiki, 1985). The frost-free period is ca. 35 days. Almost all the territory is underlain by continues permafrost. Periglacial landscape is dominated by tundra and taiga vegetation.

Aquatic organisms such as chironomids (Insecta: Diptera) are recognized as the best biological indicators for quantifying past changes in air temperature or lake chemistry (Letter et al., 1997; Brooks and Birks, 2000; Battarbee, 2000; Massaferro and Brooks, 2002; Solovieva et al., 2005). Chironomids belong to the most abundant group of fresh-water bottom-dwelling macroinvertebrates. Because of their short life cycle, chironomids quickly adapt to environmental changes and in global scale the distribution and abundance of chironomids are mostly limited by temperature (Walker and Mathewes, 1987; Warwick, 1989; Hann et al., 1992; Walker et al., 1992). Larval head capsules of chironomids preserved in lake sediment as subfossils are abundant, identifiable and serve as indicators of the environmental conditions in Quarternary Period and especially in Holocene (Smol et al., 2005; Nazarova et al., 2013).

Main aim of our the research is to perform a high-resolution Holocene temperature reconstructions for Taymyr (the northern most region of Russian Arctic) using lake sediments from Chatanga region, and statistical chironomid-based inference models for estimation of mean July air temperature and water depth from lakes in north-eastern Russia. We performed a multy-proxy reconstruction of palaeoclimate and environment in the Holocene using a 132 cm sediment core covering 6 ka of sedimentation. Based of the chironomids analysis we performed a quantitative reconstruction of mean July air temperature in the Chatanga region (Taymyr Peninsula). Our investigation has shown that modern fauna is well represented along the whole sediment core. Dominating taxa along the core are cold stenotherms such as Chironomus anthracinus-type, Hydrobaenus lugubris-type and Tanytarsus lugens-type. Faunistic composition of lower part of the core (before 5 ka BP) is characteristic for a warmer conditions, which is in accordance with the earlier studies showing that mean summer temperatures may have been 2.5° to 5.0°C warmer than today in Taymyr peninsula between 9 and 4 ka BP. During the last 3500 years, our record suggests cooler conditions as elsewhere in the Russian arctic.

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