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Modern and fossilized biological communities from sediments of Bolshoy Harbei lake (Bolshezemelskaya tundra, Russia) and their response to climate change

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High-altitude regions are subjected to the threats of global warming. During the last decade the depth of seasonal melting of permafrost in Northern Russia, significantly increased. Investigation of lake sediments from polar regions has an extreme importance for understanding of the modern environmental processes and their influence on northern ecosystems and biological diversity of these regions. Invertebrate communities are used for diagnostic of lake ecosystems because they have a great sensitivity to climatic changes (Andronnikova, 1996; Lazareva, 2008; O'Brien et al., 2005). The data can be used as well as a basis for inference models for reconstruction of the paleoclimatic conditions. Chironomid-based, Cladocera-based and diatom models have successfully been developed (Nazarova et al., 2008, 2011; Self et al., 2011) and can be used for precise paleotemperature reconstructions (Kienast et al., 2011).

In summer 2012, we investigated complex of Kharbei lakes, located in the interfluve of Korotaiha and Bolshaya Rogovaya rivers in the east side of Bolshezemelskaya tundra, Russia (67°33′22″ N, 62°53′23″ E). Six different lakes were investigated using modern hydrobiological and palaeoecological methods. In total 9 cores were obtained, cut, dated and further investigated using sedimenthological, geochemical, and paleobiological methods.

The standard hydrobiological methods have shown that the modern zooplankton communities did not change significantly during the last 40 years. Taxonomic composition and structure of planktonic communities didn't change, except for appearance of crustaceans Polyarthra euryptera and Daphnia cucullata. In planktonic communities of Bolshoy Harbei lake we revealed 39 species and forms of Rotifera, 19 – Cladocera and 11 – Copepoda. In zoobenthic communities we registered 24 taxonomical groups characteristic for large tundra lakes of the North East of Russia. Chironomids and Oligochaeta are dominant groups of invertebrates. 103 taxa of chironomids from 5 subfamilies were found: Tanypodinae - 7, Prodiamesinae - 3, Diamesinae - 2, Orthocladiinae - 39, Chironominae – 52.

Paleolimnological investigation has shown that the major compositional changes in diatom, cladoceran and chironomid communities are synchronous. The chironomid-inferred summer temperature show an increase during the last 100 years, which can be related to the end of LIA in the region and support previous investigations (Solovieva et al., 2005)