stable meromixis developed at the periods when the lake level increased due to increase in annual atmospheric precipitation. Consequently, we presume that the older sediment layers with high okenone content indicate the periods of sharp increases in Lake Shira level.

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ENVIRONMENTS OF SOUTHWESTERN SIBERIA AND NORTHWESTERN MONGOLIA IN THE LATE HOLOCENE (BASED ON THE LAKE SEDIMENTS STUDY)

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The Southern part of West Siberia and neighboring Northwestern Mongolia are regarded a key connection for human migrations between the Central Asian steppes and the North Asian forest-steppe. Holocene environmental changes are hypothesized to have had a significant influence on the development of the human societies in this region. Many well-studied world-famous archaeological objects from the Bronze, Iron and Middle Ages are situated in Southwest Siberia (e.g. Chicha, Tartas, Vengerovo, Pazyryk).

This study has an overarching goal to establish the link between past climate change, human migration and society development at the boundary of Asian steppe and North Asian forest-steppe. The first specific task of the research is providing a general scheme of environmental dynamics in Southwestern Siberia and Northwestern Mongolia as a natural transitional area between North and Central Asia during the Holocene by combination of bioproxy records from the key sites and previously published data.

To address past linkages between humans and climate in NW Asia, we have collected a suite of lake sediment archives over the region based on the following criteria: (a) location at the steppe/forest boundary sensitive to past climate variations, and (b) location within the corridor for human migrations in Bronze, Iron and Middle Ages. The time span of our study is Late-Holocene (last 4 kyr BP) which is presented in all our studied lake sediment cores.

Our studied lakes (Fig. 1):

1. Bolshie Chany and Bolshie Toroki (Zhilich et al., 2017) in the Baraba forest-steppe (Novosibirsk region, Russia).

2. Kuchuk in ghe Kulunda steppe (Altai region, Russia).

3. Teletskoye in the Altai Mountains (Altai Republic, Russia; Rudaya et al., 2016).

4. Bayan Nur (Uvs aimak, northern Mongolia).

Methods:

Coring and sampling; radiocarbon dating using AMS; geochemical and sedimentological methods; pollen methods: pollen analysis, biomization, best modern analogue (BMA) method for climate and woody coverage reconstruction, quantitative transfer functions for climate reconstruction; diatom analysis; chironomid analysis; analysis of stable carbon isotopes.

Preliminary results:

Clear tendency of the increase of the July temperatures (Tjuly) after 1.5 kyr BP and decrease of annual precipitation (PANN) after 0.9 kyr BP show both palaeorecords from lakes Bolshie Chany and Kuchuk. Pronounced peak of decrease of Tjuly and increase of PANN is revealed at 2-2.1 kyr BP. Based on the biomization of Bolshie Toroki and Bolshie Chany pollen records forest spread in the Baraba region at that time.

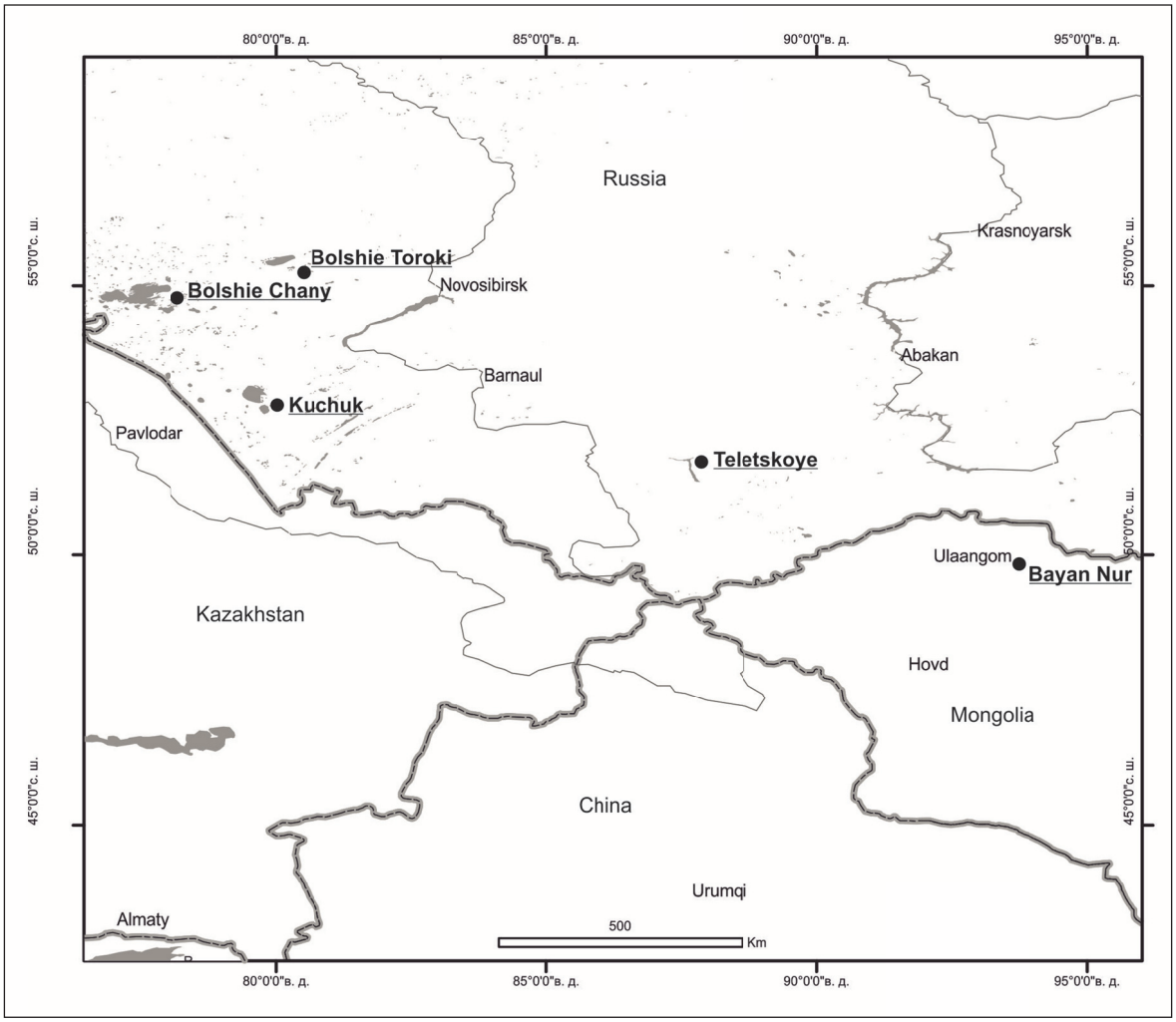

Fig. 1. Map of the studied area and studied lakes

Results of pollen study of Lake Teletskoye are to a certain degree intermediate between those from the lake Bayan Nur situated southwestward and from our investigated Siberian lakes situated northwestward. Decrease PANN during last 1 kyr remind data from Bolshie Chany and Kuchuk, however, with simultaneous decrease of Tjuly makes it closer to Bayan Nur.

Palaeorecord from Bayan Nur reveals significant increase of PANN after 1.2 kyr and decrease of Tjuly after 1.5 kyr BP. Maximal afforestation around Bayan Nur is recorded between 1.2 and 0.4 kyr BP.

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METHODS OF CONDUCTING COMPLEX STUDIES TO RESTORE THE PALEOLIMOLOGICAL CONDITIONS AND UNDERWATER LANDSCAPES OF LARGE LAKES BY THE EXAMPLE OF PETROZAVODSK BAY OF LAKE ONEGA

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Paleolimnological studies of lakes are one of the most effective ways of restoration paleogeographic conditions in the late Neoplestocene-Holocene At the present time, at the international level, a methodology has been developed for the study of small lakes, consisting in the drilling of the entire thickness of loose sediments and carrying out high-resolution biostratigraphic and lithological studies and conducting absolute dating. One of the favorable factors in this case is the presence of thick layers of organogenic silt. Researchers of large lakes meet great difficulties from to their size, depth, and the presence of permanent water cover. The deterrent is the position of these lakes in densely populated areas, as well as the fact that they serve as strategic reserves of drinking water for large areas. This imposes restrictions on the carrying out on them of production, including geological exploration work.

Despite its great importance of European lakes - Ladoga and Onega, is still not well understood, especially in the field of modern geophysical methods. Until now, the main weapon of researchers are easy sampling of sediments. In total (using samplers and heavy seismic profiling) are also in 90 years time, serious studies have been conducted on Lake Ladoga. On the Lake of Onega at the same time, Finnish researchers conducted a comprehensive study of bottom sediments using modern research methods. Palaeolimnological new stage of work is largely associated with the Institute of Water Problems of the North Karelian Research Center, which began systematic studies paleolimnological on both lakes. These works were conducted jointly with the MSU Science Park, as well as with the involvement of the staff of the Institute of Earth Sciences of SPbSU. Within this framework, the complex geological and geophysical studies in the Lake Onega for various tasks have been organized, including palaeolimnological. Petrozavodsk Bay was chosen as an experimental polygon.

Complex of geophysical methods included: Very High Resolution Seismic (VHRS), Ultra High Resolution seismic (UHRS) sonar and echosounding. The task of this block of research was to