PALEOLIMNOLOGICAL TRANSECT (PLOT) PROJECT: THE PREGLACIAL TO POSTGLACIAL HISTORY OF THE RUSSIAN ARCTIC BASED ON THE PRELIMINARY POLLEN RESULTS

Andreev A.[1], Savelieva L.[2], Baumer M.[1], Fedorov G.[2], Gromig R.[1], Krastel S.[3], Lebas E.[3], Shumilovskikh L.[4], Wagner B.[1], Wennrich V.[1], Melles M.[1]

[1]University of Cologne, Institute of Geology and Mineralogy, Cologne, Germany
[2]St.Petersburg State University, Institute of Earth Sciences, St. Petersburg, Russia
[3]Institute of Geosciences, University of Kiel, Ludwig-Meyn-Str. 10, 24118 Kiel, Germany
[4]Georg-August University, Department of Palynology and Climate Dynamics, Göttingen, Germany

The joint Russian-German project "PLOT - Paleolimnological Transect" aims to investigate the Late Quaternary climatic and environmental history along a >6000 km-long longitudinal transect across the Eurasian Arctic. For this purpose, seismic surveys and sediment coring were conducted on five lakes, which are located along transect and have the potential to host preglacial sediments. Following a pilot expedition on Lake Ladoga close to St. Petersburg in summer 2013, the full PLOT project commenced in Nov. 2015. Since then, sediment coring was conducted at Lake Bolshoye Shuchye (Polar Urals) in spring 2016, followed by a seismic survey and a coring campaign on Lakes Levinson-Lessing and Taymyr (both Taymyr Peninsula) in summer 2016 and spring 2017, respectively. A joint seismic and coring campaign was also achieved on Lake Emanda (Verkhoyansk Range) in summer 2017. Here, we provide an overview of the interpretations made on the basis of the initial studies of the sediment cores.

Lake Ladoga is the largest lake in Europe. Although the postglacial history of the lake was studied over the last decades, the preglacial history remained unknown. It is assumed that during the Last Interglacial Lake Ladoga was part of a precursor of the Baltic Sea, which had a connection via Ladoga and Onega Lakes to the White Sea. Subsequent coring provided a new 22.75 m sediment record. Its upper 13.30 m comprise Holocene and Late Glacial sediments separated from the lower 11.45 m of preglacial sediments by a hiatus. The preglacial sediments were investigated for lithology, chronostratigraphy, and palynology (Andreev et al. submittted). They consist of highly terrigenous sediments and according to OSL datings were deposited 118-80 ka ago. Between 118 and 113 ka (MIS 5e) birch and alder forests with broad-leaved taxa dominated in the area, suggesting climate conditions more favourable compared to the Holocene. A high contents of well-sorted sands and poor-preserved palynomorphs indicate a shallow-water environment at least temporarily. More fine-grained sediments and better preserved organic remains suggest deeper waters between *c.* 113 and 88 ka. Pine and spruce became dominant during this interval, while broad-leaved taxa started to disappear especially after *c.* 90 ka, pointing to a gradual climate cooling at the beginning of the Early Weichselian. An increase of open herb-dominated habitats *c.* 88-86 ka (beginning of MIS 5b) reflects colder and dryer climate conditions. However, later (*c.* 86-82 ka) pine and spruce again became more common in the area. Birch and alder forests dominated in the area *c.* 82-80 ka. Although open treeless habitats also became more common at this time, a slight increase of hazel may point to slightly warmer climate conditions coinciding with the beginning of MIS 5a. The studied sediments also contain numerous remains of fresh-water algae (*Pediastrum*, *Botryococcus*) and cysts of marine and brackish-water dinoflagellates and acritarchs documenting that the present lake basin was part of a brackish-water basin 118-80 ka ago, likely a gulf of the Pre-Baltic Sea.

The pollen record from the upper 13.3 m documents regional vegetation and climate changes in northwestern Russia in high temporal resolution over the last 13.9 cal ka BP (Savelieva et al. submit.) The late Glacial chronostratigraphy is based on varve chronology, while the Holocene stratigraphy is based on AMS ^{14}C and OSL dates, supported by the comparison with regional pollen records. The shrub-grass communities dominated between 13.9 and 13.2 cal ka BP. The increase of *Picea* in pollen spectra at ca 13.2 cal ka BP probably reflects the appearance of spruce in the Ladoga area in Allerød.

Younger Dryas cooling led to a significant decrease in spruce and increase of tundra- and steppe-like vegetation after 12.6 cal ka BP. The Younger Dryas/Holocene boundary (*c*. 11.2 cal ka BP) is characterized by a sharp transition from the tundra-steppe communities to birch dominated forests. Pine forests dominated 9.0-8.1 cal ka BP. The most favourable climatic conditions for thermophilic taxa existed between 8.1 and 5.5 cal ka BP. The decrease of tree pollen taxa (especially *Picea*) and the increase of herbs after last 2.2 cal ka BP probably connects with anthropogenic activity. The presence of Cerealia and ruderal herb pollen is permanently recorded since ca 0.8 cal ka BP.

The thickness of the lacustrine sediments in Lake Bol'shoe Shuch'e (Polar Urals) was 54 m. According to the previous studies, most of the study area has remained ice-free over the last 50-60 ka. However, the configuration and timing of the preceding glaciations has remained unclear, because of lack continuous, long-term paleoenvironmental records in the area. Preliminary pollen studies (Fig. 1) show that the sediments between 25 and 54 m were accumulated during the MIS 3, when treeless tundra- and steppe-like communities with some dwarf birches dominated the area; sediments between 11 and 25 m - in MIS 2, when only tundra- and steppe-like grew in the lake vicinity; sediments between 11 and 9 m - in Allerød warming which is characterized by drastic increase in shrubby birch and willow communities; sediments between 11 and 9 m - in Younger Dryas, when birch communities decreased; the uppermost 9 m were accumulated in the Holocene, which pollen spectra reflecting the gradual forestation of the area.

The thickness of the lacustrine sediments in Lake Levinson-Lessing (Taymyr) was ca 44 m. Preliminary pollen studies show that the sediments between 44 and 31.5 m were accumulated during the MIS 3, when treeless tundra- and steppe-like communities with few dwarf birches dominated the area; sediments between 31.5 and 15 m - in MIS 2, when only tundra- and steppe-like grew in the lake vicinity. Numerous coprophilous fungi spores indicate the presence of grazing animals. Pollen assemblages in sediments accumulated in Allerød (15-8.5 m) reflect some increase in shrubby birch and, especially, in willow communities. Younger Dryas pollen assemblages (8.5-6.5 m) show that birch communities decreased. The uppermost 6.5 m were accumulated in the Holocene, their pollen spectra demonstrate gradual increase of shrubby vegetation in the area.

REFERENSES

1. Andreev A.A. // Environmental conditions in northwestern Russia during MIS 5 (~118–80 ka) as inferred from the preglacial pollen record in Lake Ladoga. Boreas (submitted).

2. Savelieva L.A. Vegetation and climate changes during the Late Glacial and Holocene inferred from the Lake Ladoga pollen record. Boreas (submitted).

LATE VALDAI PROGLACIAL LAKES OF THE UPPER VOLGA: GEOLOGICAL AND GEOMORPHOLOGICAL DATA

Baranov D.V., Utkina A.O.

Lomonosov Moscow State University, Moscow, Russia

Proglacial lakes are water bodies formed in periglacial zones. Two ways of proglacial lakes' possible origin are widely recognized in literature (Bylinskij, 1996; Kvasov, 1975). The first one was suggested by Kvasov (1975) who stated that the formation of these lakes was made possible because of river damming. When ice-sheets extended further onto the Russian mainland, north-flowing rivers were blocked, which resulted in appearing of ice-dammed lakes. On the other hand, according to Bylinskij (1996), factor that played the most important role in formation of proglacial lakes was the glacio-isostatic effect. It has long been recognized that horizontal mass transfer in the low viscosity asthenosphere due to glacial loading would have induced uplift and the formation of a peripheral bulge with its axis parallel to the ice sheet boundary. Glacio-isostatic forebulge affected existing fluvial systems which resulted in appearing of proglacial lakes.