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SPECIAL ISSUE PATHWAYS
OF EVOLUTIONARY GEOGRAPHY 2. PART 1.
PALAEOGEOGRAPHY OF THE QUATERNARY

EDITORIAL

The idea of this special issue of the journal “Geomorphology” arose from the 2nd International Conference “Pathways of Evolutionary Geography” (November 2021, Moscow) dedicated to the 90th anniversary of professor A.A. Velichko, one of the eminent geographers, who made a great contribution into the Quaternary science and outlined the new direction in the geographical research – the evolutionary geography.

This special issue includes 15 papers on a wide range of subjects including vegetation and climate changes during the Pleistocene and Holocene, human–environment interaction in the past, sources of dust in eolian sediments and loess-paleosol sequences, lacustrine and marine sedimentation, wetland development, dendrochronology, and approaches for hydrological modelling. The papers highlight the main directions of evolutionary geography, developed by A.A. Velichko and present the results of recent studies conducted in various regions of Northern Eurasia – Kola Peninsula, East European Plain, Caucasasia, Caspian Lowlands, Western and Eastern Siberia and the mountains of Southern Siberia.

The papers demonstrate that the expertise of the modern state of natural ecosystems and projections of their future changes is quite impossible without comprehensive understanding of the past environment evolution. Of considerable interest is detailed reconstruction of S.A. Kuzmina and her co-authors of the climate and environment during a period from the end of the Middle Pleistocene glaciation to the early stages of the Late Pleistocene glacial epoch based on fossil insects (mainly beetles), small freshwater invertebrates, pollen and plant macrofossil data from lacustrine-peat deposits exposed in the gravel pit near the town of Dmitrov, Moscow region. These records enabled us to recognize the environmental changes in a wide range from warm and wet climate of Mikulino interglaciation (MIS 5), and the relatively cold and dry climate of the Valdai time (MIS4 and, probably, the early MIS 3) and to trace the temporal pattern of the lake-bog-land succession.

The advantages and usefulness of multi-proxy records, including paleobotanical and lithological analysis for the investigation of the Holocene environmental change are shown in a series of five papers in this special issue. The specific feature of the most studies is the detail radiocarbon dating and robust age-depth model that is an essential part of current scientific research.

The studies of O.K. Borisova with co-authors were devoted to reconstruction of the changes in the lake productivity and vegetation composition in response to the short-term climatic oscillations during the Late Glacial and Early Holocene in the North-western European Russia with a special focus on the cold Preboreal oscillation. The analysis showed that the influence of Preboreal Oscillation on the ecosystems in the north-western part of the East European Plain was probably weaker than in western and central Europe. T.V. Sapelko with co-authors reconstructed the history of Kanozero Lake in the Kola Peninsula based on pollen, diatom and lithological records, and highlighted the importance of the Late Glacial and Early Holocene time for the regional ecosystem transformation. According to these data, the dynamics of Kano-zero Lake included a Late Glacial lake phase, subsequent drainage, several lacustrine and terrestrial phases and final transformation to the modern shallow lake. Other records from the Kola Peninsula are presented in the paper by S.N. Timireva and co-authors, who studied the paludification process and vegetation history during the last 8000 years in the western part of the Tersky Coast. The results of pollen, plant macrofossil and quartz sand grain morphoscopy analysis revealed that wetland development in this area was preceded by aeolian processes, occurred after deglaciation.

Pollen, plant macrofossil and charcoal data obtained by E.Yu. Novenko and her co-authors from frozen peatland located near the town of Igarka (Yenisei Siberia) made it possible to reconstruct vegetation and climate changes and biomass burning during the last ca. 4700 years. Those authors showed that during the Late Holocene climatic warming phases the boundaries of the vegetation zones in the region shifted about 200 km northward compared to their modern location. Farther south, on Oka Plateau in the east Sayan Mountains, the southern part of Eastern Siberia (see paper of E.V. Bezrukova et al.) vegetation, biomes and climate changes during the Late Glacial and Holocene were revealed by high resolution pollen records. These

data were superimposed to the global climatic events and environmental changes in the Siberia giving an insight to the regional pattern of ecosystem dynamics.

Dendroclimatic potential of stable carbon isotopes in tree-ring cellulose of *Pinus sylvestris* L. in the central part of European Russia is presented in the paper by V.V. Matskovsky with co-authors. Authors demonstrate that stable carbon isotopes in tree rings may serve as an important proxy of past climatic and environmental changes. Their studies conducted in Yaroslavl and Kostroma regions revealed that δC^{13} in wood cellulose amount is well correlated with climatic characteristics, including a drought index.

The intensive palaeogeographical and environmental studies of the last decades clearly demonstrate the importance of sedimentological approaches and their technological development. D.O. Sadokov with co-authors obtained the high-resolution data from lake sediments in the northern Mologa-Sheksna Lowland including x-ray fluorescence scanning, x-ray diffraction, total organic carbon, grain-size and magnetic susceptibility measurements. Their finding revealed series of short-term oscillations in sedimentation and paleoenvironments during the Late Glacial and Early Holocene. The detailed analysis of microstructure features, grain-size and mineralogical compositions of so-called chocolate clays, the polyfacial marine sediments of disputable genesis widely distributed in the Lower Volga region, were discussed in the paper by R.E. Musaelyan with co-authors. The obtained data allowed authors to determine specific micromorphological characteristics of chocolate clays and their sedimentation conditions.

The problem of the source of mineral dust, which makes up the loess-paleosol sequence is argued in the paper by E.A. Konstantinov with co-authors. The results of multi-proxy lithological studies together with OSL-dating of three boreholes forming the subaltitudinal transect of the Upper Pleistocene and Holocene loess-paleosol sequence in Ciscaucasia (south of the European part of Russia) revealed the mainly westward direction of the aeolian transport during the Late Pleistocene and Holocene. Secondary sources of mineral dust were local sandy massifs occurred on the terraces of Don and Kuban rivers. According to their data, the intensity of eolian processes was higher during cold climatic periods and lower during warm ones.

The discussion of the source of eolian sediments is continued in the paper by V.A. Alekseeva with co-authors, who explored the ridge (crest)-hollow relief forms in the southern part of Western Siberia. The results of complex mineralogical analysis included

quartz grains surface textures study using SEM allowed them to reconstruct the sedimentary history and deposition environments of the crest strata formation in Tyumen region. They showed that Oligocene, Neogene and Quaternary alluvial-lacustrine sediments, common in the study area, are likely to be the primary sources for the crest deposits.

The relationship between modern landscape structure and Late Pleistocene climate history is highlighted in the paper by A.G. Ryabukha with co-authors. Their study is focused on specific landscapes defined as chalky polygons formed on chalky rocks across the south-east of the East European Plain. The results of field observation in Orenburg region, analysis of cryotextures in soils and sediments together with the processing of the high-resolution satellite images demonstrated the essential role of permafrost and cryogenic processes in chalky polygons development.

The relationships between floodplain sedimentation, climate changes and human settlements in two key sites located in the bottom of river valleys – Shnitkino (Toropa valley, Western Dvina river basin) and Gnezdovo (upper Dnieper valley) during the last millennium are discussed in the paper of L.V. Shasherina with co-authors. According to their data an essential role in historical events and economics of ancient people belongs to the local paleoenvironmental dynamics, particularly river regime changes.

The paper of A.G. Georgiadi and I.P. Milyukova is devoted to the reconstruction of Volga River water flow changes in the Last Interglacial climatic optimum (~125 ka BP), the Holocene Thermal Maximum, Volga River water flow in modern period (starting from 1981), and projections for its possible dynamics under climatic changes in the current century using modelling approach together with palaeogeographical data. The results of this study supposed that the most noticeable differences in the Volga runoff during climatic warming in the Holocene optimum, modern and scenario periods appear as changes in the intra-annual variability of water flow.

The papers presented in the special issue cover a broad range of research topics, methodological approaches and study regions with a focus on evolutionary geography. The guest Editor would like to acknowledge all the many authors, who submitted their state-of-the-art research results and valuable discussions to the current volume, thus helping in closing some gaps in knowledge and indicating directions for future work.

E. Yu. Novenko, guest-editor