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The problems of the preservation of quaternary paleogeographycal monuments in the conditions of the Russian-Ukrainian war

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Abstract. The article is devoted to the analysis of the problem of preservation and protection of paleogeographic monuments of the Quaternary period under the conditions of the large-scale Russian-Ukrainian war. In the context of the available information, the influence of the military conflict on certain key areas of Ukraine's territory is outlined, where the most famous paleogeographic monuments of Quaternary sediments are found in the form of subaerial and subaquatic facies, reflecting the history and peculiarities of the development of natural conditions in the past. Damage, destruction, or loss of anthropogenic paleogeographic geosites in Ukraine poses a serious threat, as these processes lead to an irretrievable loss of unique scientific information about the historical development of the natural environment not only within Ukraine but also on a global scale. These geosites contain crucial data on climate change, ecosystems, and landscapes from past geological epochs, offering deep insights into the planet's evolution and the adaptation of ecosystems to climatic shifts. Thus, their loss would mean the destruction of irreplaceable evidence essential for scientific research and for making future predictions. To preserve this valuable resource, it is necessary to systematize, generalize, and unify all existing data on paleogeographic heritage sites that are under threat of destruction or at risk of being lost. This involves creating a unified information framework that would include the registration and monitoring of such sites at the national level, along with the use of modern technologies for collecting, storing, and processing information about them. Additionally, for the effective protection of quaternary paleogeographic geosites in Ukraine, it is essential to actively promote public awareness of their scientific and cultural significance. A significant step in this direction would be the creation of a single register of such geosites, allowing them to be integrated with other elements of Ukraine's historical and cultural heritage, as well as ensuring state-level registration. This would enhance the legal protection of these sites, ensuring their proper preservation and utilization for scientific and educational purposes, thus safeguarding valuable evidence of Ukraine's and the planet's natural development for future generations.

Keywords: paleogeography, Quaternary period, natural monuments, russian aggression against Ukraine, preservation and protection of natural heritage.

Проблема збереження палеогеографічних пам'яток четвертинного періоду в умовах російсько-української війни

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Анотація. Стаття присвячена аналізу проблеми збереження та охорони палеогеографічних пам'яток четвертинного періоду в умовах широкомасштабної російсько-української війни. В контексті наявної інформації окреслено вплив воєнного конфлікту на окремі ключові ділянки території України, де у вигляді субаеральних та субаквальних фацій представлені найвідоміші палеогеографічні пам'ятки четвертинних відкладів. Пошкодження, руйнування чи знищення палеогеографічних пам'яток антропогену в Україні є серйозною загрозою, оскільки такі процеси ведуть до безповоротної втрати унікальної наукової

інформації про історію розвитку природного середовища не лише в межах України, але й у глобальному контексті. Ці пам'ятки містять відомості про зміни клімату, екосистем та ландшафтів у минулі геологічні епохи, які допоможуть краще зрозуміти еволюцію планети й адаптацію екосистем до кліматичних змін. Таким чином, їх втрата означала б знищення незамінних доказів, необхідних для наукових досліджень і прогнозів. Для збереження цього цінного ресурсу необхідно здійснити систематизацію, генералізацію та уніфікацію всіх наявних даних щодо об'єктів палеогеографічної спадщини, які перебувають під загрозою руйнування або ж можуть бути втрачені. Це потребує створення єдиного інформаційного простору, що включає облік і моніторинг таких об'єктів на національному рівні, а також використання сучасних технологій для збору, зберігання та обробки інформації про них. Крім того, для ефективного захисту палеогеографічних пам'яток антропогену на території України необхідно активно популяризувати знання про їх наукову та культурну цінність серед громадськості. Важливим кроком на цьому шляху є створення єдиного реєстру таких пам'яток, що дозволяє об'єднати їх з іншими об'єктами історичної, культурної та природної спадщини, а також провести їхню паспортизацію на державному рівні. Це сприятиме посиленню правового захисту таких об'єктів, їхньому належному збереженню та використанню в наукових та освітніх цілях, зберігаючи для майбутніх поколінь цінні свідчення розвитку природи України.

Ключові слова: палеогеографія, четвертинний період, пам'ятки природи, агресія росії проти України, збереження та охорона природної спадщини.

Introduction

The unjustified Russian military intervention in Ukraine in 2014 and the full-scale invasion, starting in February 2022, have caused irreparable losses to the Ukrainian people and all areas of their lives. Monuments of culture, history, and nature were no exception.

Paleogeography, as a science that studies the natural landscapes of the past and the causal processes of their changes, is based on the study of the deposits in the Earth's crust, which are indicators of the physical and geographical conditions at the time of their formation, that is, paleogeographic monuments. For the Quaternary period of geological history (the Quaternary period), such monuments include fossil and buried soils, loess, mineral formations, remains of flora and fauna, etc. They can be studied in vertical paleogeographical (geological) sections – artificial or natural outcrops exposing deposits from different periods on the surface (coastal cliffs, ravines, landslide walls, quarries, roadside ditches, boreholes, etc.). In some such sections, one can observe typical alternations of different chronological layers of soils, loess, clay, sand, limestone, and other rocks of heterogeneous composition, color, density, and other features. Paleontological remains (fossils) are also found in the deposits – bones of vertebrates, shells of mollusks, remains of wood, and imprints of leaves. They almost always contain pollen and spores of ancient plants. Additionally, they may contain traces of early human presence: bones, tools, and other material remains.

One of the criteria for inclusion in the UNESCO World Heritage List is that the proposed site must be an outstanding example representing the main stages of the Earth's history, particularly a monument of the past, an important indicator of geological processes manifested in the development of the relief, or a representative of geomorphological or physical-geographical features (Criterion VIII) («The Criteria for Selection …,» 2024). Thus, the most complete and unique geological sections of Ukraine with various types of paleogeographic monuments meet criterion VIII but, unfortunately, have not yet been entered into the official register. In our opinion, the task of Ukraine, as a signatory country that has ratified the UNESCO Convention on the Protection of the World Cultural and Natural Heritage («States Parties are countries …,» 2024), is to promote the protection and preservation of paleogeographic monuments, ensure their popularization and comprehensive study to address issues related to the history of natural development in the past, which has important fundamental and practical significance.

Materials and Methods

The purpose of the research is to focus the attention of the scientific community and the public on the problem of preserving and protecting paleogeographical monuments of the Quaternary period, which became especially acute in the conditions of the Russian-Ukrainian war. During the preparation of the publication, methods of analysis, synthesis, and interpretation of various analytical materials and literary sources were used.

Study Results and Analysis

The state of study of the issue, the main works on the study of paleogeographical monuments of the Quaternary period of Ukraine

After the full-scale invasion of Russia into Ukraine, a significant number of geographic studies have been dedicated to the impact of the Russian-Ukrainian war on society and the natural environment. In particular, Ukrainian scientists have outlined the image and mission of geographical science in the daily life of

modern society, including its role in addressing the problems provoked by the military invasion of the Russian Federation (Dronova et al., 2023). They have highlighted the possibilities of using new geographical approaches in the study of prolonged, multi-level conflicts on the basis of a new interdisciplinary scientific field – geoconflictology (Mozghovyi, 2023). Other studies have examined issues of urbicide and the destruction of Ukrainian cities (Pidgrushnyi and Sikorska, 2024), population migration (Dzhaman and Dzhaman, 2024), new approaches to the classification of territorial communities (Palekha et al., 2023), and the problems of assessing technogenic threats at industrial enterprises located in the combat zone (Chumachenko et al., 2024). The potential of the tourism industry in the context of war and post-war reconstruction has also been analyzed (Havrylenko et al., 2024; Reimann et al., 2023; Roik et al., 2023), etc. Foreign colleagues have examined the potential socio-demographic, economic, and infrastructural consequences that may arise in Europe and Poland as a result of the war in Ukraine (Komornicki et al., 2023) and assessed the role of geography and geographical factors in military conflicts (Sayadyan, 2023), etc.

Among the components of the natural environment, scientists have particularly focused on analyzing the impact of military operations on the soil cover (Baliuk et al., 2023; Splodytel et al., 2023).

The main task of this work is to draw the attention of the scientific community and the public to the problem of preserving and protecting paleogeographic monuments of the Quaternary period, which contain unique information about the peculiarities of the development of nature in Ukraine in the past (from about 2 million years ago to the present day) and are currently being negatively affected by the armed aggression of a neighboring state.

At the moment, the most detailed information related to the study of paleogeographic monuments of the Quaternary period is contained in the four-volume edition *Geological Monuments of Ukraine* (Kalinin and Gurskiy, 2006; Kalinin and Gurskiy, 2007; Kalinin and Gurskiy, 2009; Kalinin and Gurskiy, 2011), which provides data on 601 geological monuments, 47 of which contain deposits of the Quaternary period (see Table 1). Paleogeographic geosites with the oldest Quaternary period deposits (Eopleistocene) are primarily found in southern Ukraine, particularly in sections of Crimea, the Northern Black Sea region, and the Azov region. There are paleogeographic monuments of soil-loess and glacial formation from the Early and Middle Pleistocene within the Dnieper and Pobuzh regions. In Polissia, most monuments belong to the Late Pleistocene and Holocene.

These monuments include:

5 monuments within the boundaries of Volyn-Podillia: «Outcrop of the Middle Pleistocene glacial deposits in Polissya in the village of Rostan,» «Outcrop of the Pleistocene loess formation in Polissya in the village of Korshiv» (Volyn region), «Section of Pleistocene sediments in the village of Strilche» (Ivano-Frankivsk region), «Outcrop of the floodplain terrace of the Styr River near the village of Naberezhne-Boremel,» «Glacial moraine outcrops along the Styr River (village of Stara Rafalivka, Rafalivka-Balahovichi)» (Rivne region) (Kalinin and Gurskiy, 2006);

13 within the Ukrainian Shield: «Stratotype of the Kaydaky Horizon,» «Basan Quarry,» «Typical relief of hilly sands (kuchugur),» «Mount Kalytva» (Dnipropetrovsk region), «Domotkan Boulders,» «Divocha Hora Outcrop,» «Forest Deposits near the village of Khaycha» (Zhytomyr region), «Myroniv Cut of Quaternary Deposits» (Zaporizhzhia region), «Kirovohrad Refractory Clay Quarry» (Kirovohrad region), «Dashukiv Quarry of the Cherkasy Deposit of Bentonite Clays,» «Reference Section in the village of Katerynopil,» «Reference Section of Quaternary Sediments in the city of Chyhyryn,» «Regional Landscape Park 'Trakhtemyriv'« (Cherkasy region) (Kalinin and Gurskiy, 2007);

Table 1. Distribution of anthropogenic monuments by regions of Ukraine in the 4-volume edition «Geological Monuments of Ukraine» (Kalinin and Gurskiy, 2006; Kalinin and Gurskiy, 2007; Kalinin and Gurskiy, 2009; Kalinin and Gurskiy, 2011)

Edition volume	Region (administrative regions of Ukraine with anthropogenic monuments)	The total number of geological monuments	Number of anthropogenic monuments
I	Volyn-Podillia (Volyn, Ivano-Frankivsk, Rivne regions)	177	5
II	Ukrainian shield (Dnipropetrovsk, Zhytomyr, Zaporizhzhia, Kirovohrad, Cherkasy regions)	187	13
III	The Black Sea region and the Crimean Peninsula (Mykolaiv, Odesa, Kherson regions)	115	10
IV	Donetsk folded structure and Dnipro-Donetsk depression (Donetsk, Kyiv, Poltava, Sumy, Kharkiv, Chernihiv regions)	122	19

10 within the Black Sea region and the Crimean Peninsula: «Reference Section of Quaternary Sediments (village of Rybakivka)» (Mykolaiv region), «Reference Section of Quaternary Sediments (village of Krasnosilka),» «Reference Section of Quaternary Sediments (stratotype of Kryzhaniv Climatolite),» «Reference Section of Quaternary Sediments (Sanzheyka village),» «Outcrop of the Vth ('Babel') Terrace of the Danube River,» «Gypsum Exposure near the village of Kalcheva,» «High Floodplain and First Supraflood Terrace of the Danube River» (Odesa region), «Exposure of Pleistocene Sediments (Shyroka Balka village),» «Landslide (Stanislav village),» «Sand Dunes (Zburyivka village)» (Kherson region) (Kalinin and Gurskiy, 2009);

19 within the Donetsk Folded Structure and the Dnieper-Donetsk Basin: «Azov Outcrop of Quaternary Sediments» (Donetsk region), «Stratotype Section of Cenozoic Sediments in the village of Novi Petrivtsi,» «Outcrop of Quaternary and Neogene-Paleogene Sediments in the village of Stari Petrivtsi,» «Outcrop in the village of Pyrohove,» «Reference Section in the village of Krenychi» (Kyiv region), «Vyazivok – Reference Section of Quaternary Sediments,» «Yareskivska Lysa Hora,» «Holovkova Krucha,» «Pyvykha Mountain» (Poltava region), «Shpilivskyi Quarry,» «Moraine Formations in the village of Volokytyne,» «Vilna Reference Section of Quaternary Sediments» (Sumy region), «Donetsk Horodyshche,» «Balka Solonetska: Exposure of Volcanic Ash in Quaternary Deposits» (Kharkiv region), «Reference Section of Quaternary Deposits near the village of Yehorivka,» «Quarry in the city of Novhorod-Siverskyi,» «Outcrop in the village of Mezyn,» «Outcrop in the village of Hirky,» «Outcrop of Anthropogenic and Upper Miocene Sediments in the village of Holubivka» (Chernihiv region) (Kalinin and Gurskiy, 2011).

The list of paleogeographic monuments of the Anthropocene period in Ukraine is far from being limited to the mentioned objects. A huge number of paleogeographical objects (sections) within Ukraine (probably about a thousand) have also been investigated by other outstanding Ukrainian paleogeographers (A.B. Bogutskyi, N.P. Gerasimenko, M.F. Veklych, M.S. Komar, V.I. Krokos, V.V. Manyuk, Zh.M. Matviishyna, N.O. Sirenko, S.I. Turlo, P.K. Zamoriy and their students and colleagues) (Zamorii, 1961; Veklych et al., 1973; Sirenko and Turlo, 1986; Matviishyna et al., 2010; Paleolithic Ecumene…, 2015; Komar, 2015). A large amount of information on paleogeographic reconstructions, based on the study of new Quaternary monuments, has been published by the authors in co-authorship with colleagues (Doroshkevych, 2018; Dmytruk et al., 2014; Kushnir, 2020; Matviishyna and Doroshkevych, 2013, 2019; Matviishyna et al., 2021; Lanczont et al., 2014; Matviishyna and Kushnir, 2018; Manyuk, 2013, 2017, 2021; Stepanchuk et al., 2013; Zalizniak et al., 2013).

Each of the previously investigated sections of Quaternary deposits has its own uniqueness and varies in the degree of study, depending on the research period, the sophistication and availability of various methods, the nature of the author's interpretations, etc. Therefore, these sections require further detailed research, including correlation, unification, and refinement of data regarding past natural conditions and processes.

The impact of military operations on paleogeographic monuments.

The occupation of certain territories in Ukraine, the construction of military fortifications, and missile, aviation, and artillery attacks by Russia not only cause direct destruction to the natural environment and infrastructure but also threaten Pleistocene and Holocene monuments. For example, the presence of Russian occupation forces in the Chernihiv region (Interactive Online Map…, 2024) and missile attacks on the city of Pryluky (Shelling of Pryluk…, 2022), along with damage to the surrounding area, have hindered access to one of the most studied paleogeographic monuments of the Pleistocene, the 'Pryluky Section' (Fig. 1). Within this section, the stratotypes of fossil soil complexes from the Pryluky age and the Uday and Tyasmin loess horizons were substantiated and determined (Veklych et al., 1969).

Missile attacks by Russian troops on the Lubny community in Poltava region (Russia shelled…, 2022) have made access to the well-known reference monument of Pleistocene and Holocene sediments, the 'Vyazivok Section' (Fig. 2), impossible. This section contains identified stratotypes of the Dnipro, Lubny, and Sula horizons of Pleistocene sediments (Veklych et al., 1982) and other important paleogeographic monuments of this region (Havrylenko, 2000). Access to the temporarily occupied territories of the Azov region, including the sites of the Quaternary deposits 'Zhdaniv' (now Mariupol; stratotype of the Priazov loess horizon), 'Shyrokyne' (stratotype of the Rykhin soil horizon) (Veklych, 1982), and 'Bezimenne' (Karmazinenko, 2014), is impossible (Interactive Online Map…, 2024). These sites are under threat of destruction due to the aggressor country's reckless treatment of the coastline (War and the Sea…, 2022).

Research on other sections of Pleistocene sediments is dangerous due to the mining of the coast-

Fig. 1. Photo of the international seminar «Forest – Periglacial – Paleolithic» on the reference section of the Quaternary sediments of «Pryluky» (1967) (photo from the collection of Zh. Matviyishina)

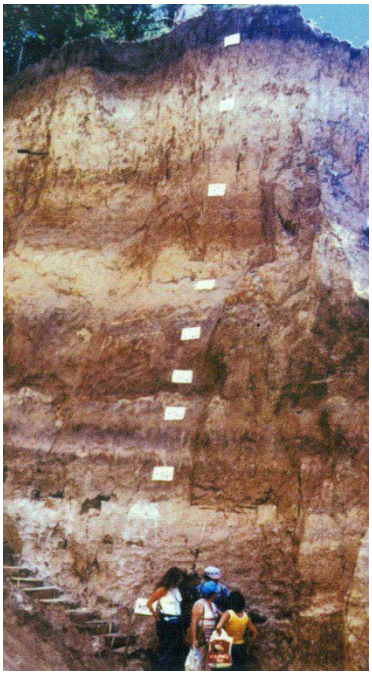

Fig. 2. Study of the section of anthropogenic deposits «Viazivok» (photo from the collection of Zh. Matviyishina)

al zone of Ukraine (Map of mined territories …, 2024) and the regular shelling by Russia of the port infrastructure within the Odesa and Mykolaiv regions, where the stratotypes and parastratotypes of the Prychornomorsk horizons (sections in the coastal outcrops between the villages of Kurortne and Primorske), Dofinivka horizons (outcrops east of the estuary overflow near the village of Nova Dofinivka), and Shyrokino horizons of Pleistocene sediments (sections «Nova Dofinivka», «Kryzhanivka», «Primorske», etc.) (Veklych, 1982), as well as other unique sections of natural and Quaternary deposits («Roksolany» (Fig. 3), «Rybakivka», «Illichivsk», etc.).

Sections of Pleistocene sediments in the coastal outcrops of the Dnipro-Buzka estuary in the area between the villages of Shiroka Balka and Stanislav (Kherson region) are not accessible for research due to the threat of artillery fire from the left bank of the Dnieper. There, M.F. Veklich determined the stratotypes of the Bug and Tiligul loess horizons (Veklych, 1982).

The territory of Medzhybizh Fortress (The Medzhybizh fortress …, 2023) was also shelled, near which, with the help of a geoarchaeological approach, one of the oldest human habitation sites on the territory of Ukraine was established (Fig. 4) (The location of «Medzhybizh» …, 2014).

Further research into the nature of the Holocene within the archaeological sites «Olvia» (Fig. 5), «Kamiana Mohyla», «Konsulivske Horodyshche» and many others is impossible due to the occupation or active hostilities nearby (Interactive online map …, 2024), and the sites themselves are also subject to destruction.

Russia's attempt to seize the northern territories of Ukraine provoked the demolition of a number of dams on the Zhytomyr and Chernihiv Polissya rivers, which led to the flooding of the floodplains of these rivers and, at the same time, Holocene natural monuments such as «Stoyanka», «Vypovziv», «Lytky», «Rozhny» and others. A significant number of

Fig. 3. Coastal outcrops of Quaternary sediments in Dniester Estuary area («Roksolany» section; photo by S. Doroshkevych)

Fig. 4. Report by Professor Zhanna Matviyishina at the seminar on the study of the Paleolithic monument «Medzhybizh» (photo from the collection of Zh. Matviyishina)

Holocene sections within the boundaries of ancient hillforts, barrows, and ramparts («Khodosiivka», «Bilsk», «Shestovytsia», etc.) (Fig. 6–7) were destroyed or partially damaged due to the construction of defensive fortifications.

The damage, destruction, or removal of such objects results in the loss of valuable information about the development of nature not only in Ukraine and Europe but also globally. The International Association for the Preservation of Geological Heritage, ProGEO, which is a subdivision of the International Union of Geological Sciences (IUGS) and a member of the International Union for Conservation of Nature (IUCN), is engaged in the preservation of geological monuments, including paleogeographical geosites of the Quaternary period. The organization condemned the Russian invasion of Ukraine, but, unfortunately, it has not initiated large-scale projects aimed at preserving these natural monuments in Ukraine affected by the military aggression of the Russian Federation.

Preservation of paleogeographic monuments in the conditions of the Russian-Ukrainian war and post-war reconstruction.

Fig. 5. «Olvia» monument (Mykolaiv region). View of the central part of the settlement (photo by Victoria Kotenko, 2021)

Fig. 6. Earthen embankment of the «Khodosiivka settlement» between the villages of Ivankovychi and Kruhlyk (photo by S. Doroshkevych)

In order to preserve irreplaceable information about the evolution of Ukraine's natural environment over the past two million years, efforts are being made to compile and consolidate all available data on objects that have been destroyed or are at risk of destruction. This can be implemented primarily in the form of electronic databases based on GIS technologies. Similar work is already being carried out at the Institute of Geography of the National Academy of Sciences of Ukraine (Fig. 8), as part of the scientific project «Methodology for Phased Reconstructions of the Natural Conditions of the Plain Territories of Ukraine in the Quaternary Period and Its Implementation in a Geoinformation System» (0112U107465; https://paleo.geohub.org.ua). However, chronic underfunding and a limited workforce hinder the full implementation of this project. Additionally, the challenge of conducting comprehensive field research on the most well-preserved Quaternary sections, wherever possible, remains pressing. Such research will not only yield new insights into past environmental changes but, more importantly, will contribute to their preservation.

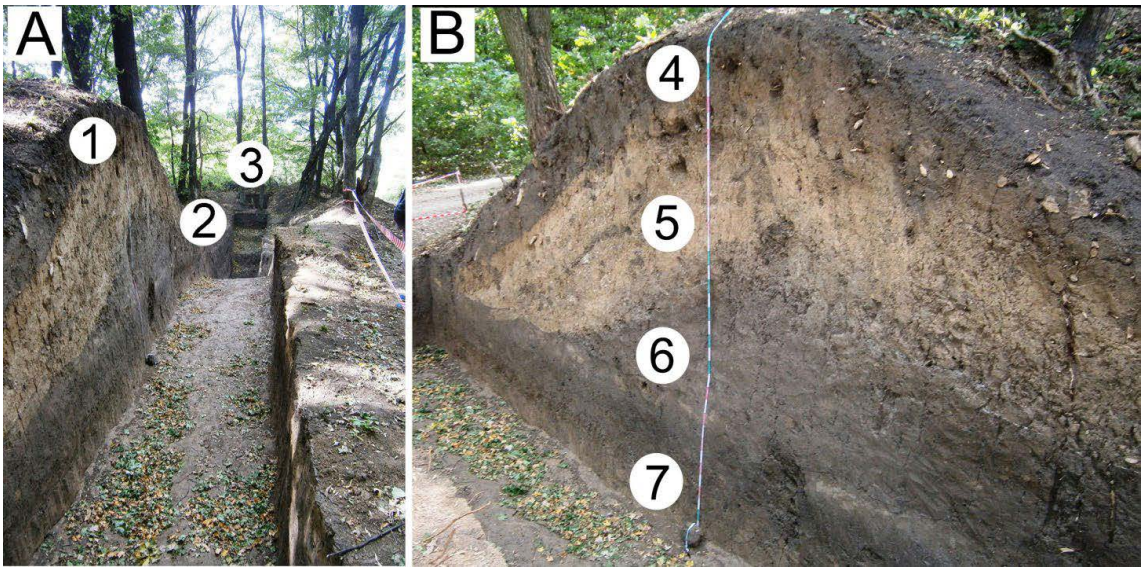

Fig. 7. Section of the Eastern Rampart (excavation site No. 37) within the boundaries of the «Bilskyi settlement» of the Scythian period (Poltava region): A (schematic section): 1 – section of the main rampart; 2 – section of the ditch; 3 – section of the outer rampart. B (stratigraphy of the main rampart section): 4 – modern turf and chernozem soil profile; 5 – embankment of the rampart body composed of Pleistocene loess; 6 – embankment of ancient chernozem soil with turf remnants; 7 – buried soil dating back to the time of the embankment formation. (photo by A. Kushnir).

In the future, such knowledge should become an integral component of the creation of a detailed, step-by-step reconstruction of the paleoenvironments of Ukraine, Europe, and the world. The international dissemination of this information will facilitate the integration of Ukrainian scientists into the global scientific community, enhancing opportunities for cooperation with European Union researchers. This will foster a deeper scientific dialogue, mutual understanding, and more efficient data exchange among scientists from different countries. From a legal perspective, preserving and protecting key paleogeographic monuments requires raising awareness about existing sites and establishing a unified register. Particular attention should be given to developing official documentation for paleogeographic monuments, each detailing its significance for understanding past environments, its current state of preservation, and the necessary measures for conservation and/or the sustainable use of the area surrounding it. This, in turn, will lay the foundation for the development of an appropriate regulatory and legal framework for the preservation of Ukraine's paleogeographic heritage and its proper representation on the global stage.

We understand that, as of this moment, the main problem that hinders scientific activity (threatens scientists' lives, prevents the organization of research, and limits sufficient funding) is the extreme circumstances of today caused by Russia's full-scale aggression against Ukraine. Accordingly, all the efforts of the Ukrainian state, its citizens, and partner states are aimed at victory. However, in the post-war perspective, it is necessary to implement measures for the protection and preservation of paleogeographic monuments of the anthropogenic period in Ukraine. This should take place in close cooperation between paleogeographers, other natural scientists, relevant public organizations, international associations, and, of course, state institutions, which serve as the driving force behind such efforts.

Conclusions

The occupation of territories, the construction of military fortifications, as well as missile, aviation, and artillery attacks by Russia have caused significant damage to the natural environment of Ukraine and its infrastructure. Pleistocene and Holocene sites in various regions of Ukraine are also under threat of destruction or significant damage. Some anthropogenic deposit sites in the Azov region, such as Zhdaniv (Mariupol), Shyrokyne, Bezimenne, and other sections, have become inaccessible for research due to the occupation. The mining of coastal areas and the shelling of port infrastructure complicate the study of Quaternary deposits in the Odesa and Mykolaiv regions. Artillery attacks from the left bank of the Dnieper pose a danger to the study of Pleistocene deposits in the Kherson region. The destruction of river dams and the construction of defensive fortifications have led to the partial or complete destruction of many Holocene sites, including those

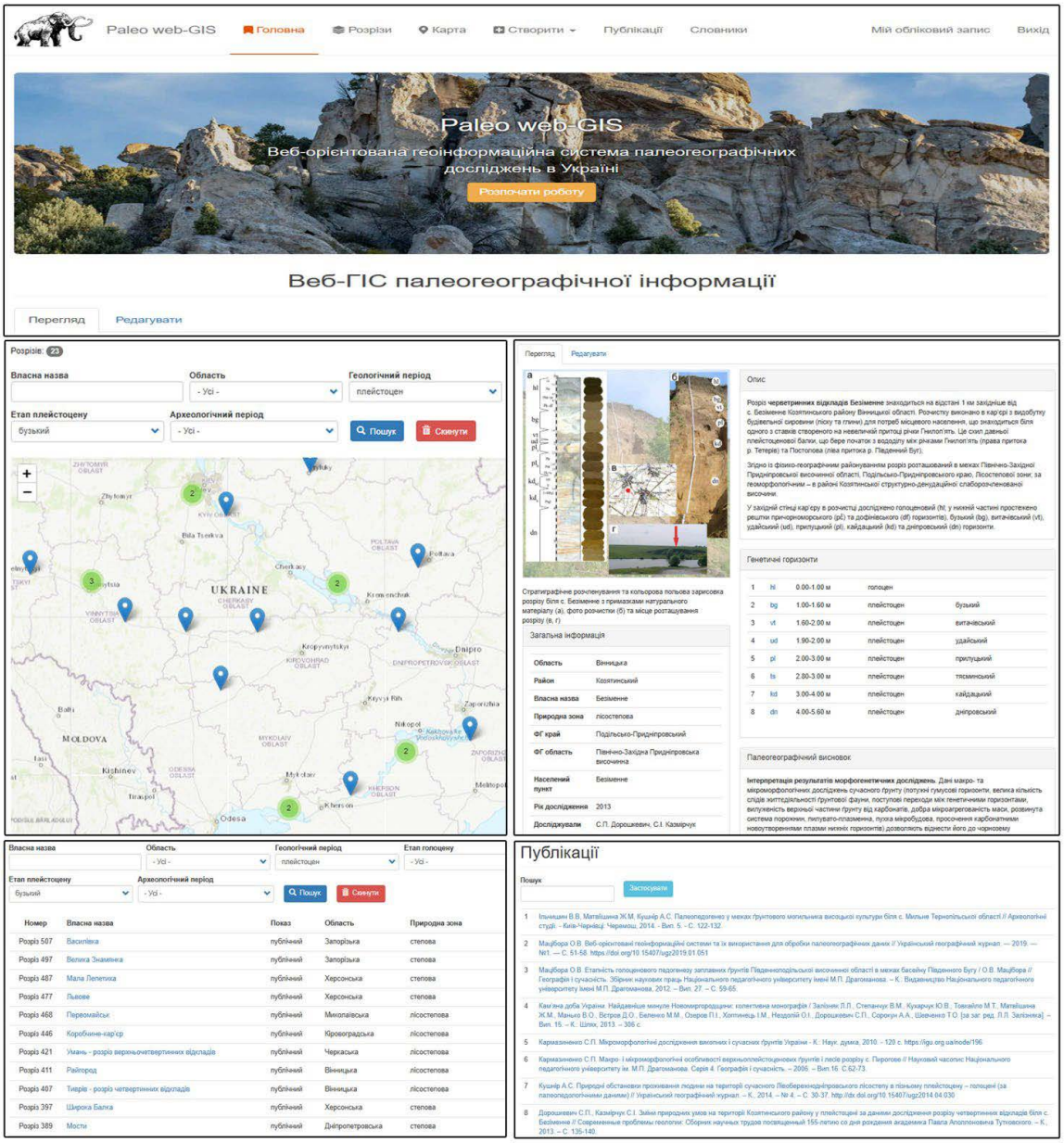

Fig. 8. Fragments of images from the web-based geographic information system for paleogeographic research in Ukraine, which is being developed at the Institute of Geography of the NAS of Ukraine (in Ukrainian).

within river floodplains, ancient settlements, burial mounds, and ramparts. Due to active hostilities or occupation, numerous archaeological monuments have been destroyed or have become inaccessible for research, including Olvia, Kamyana Mogyla, Consuliv Settlement, etc.

The destruction or damage of anthropogenic paleogeographic monuments in Ukraine poses a significant threat due to the potential loss of unique scientific information about the history of natural development, not only in Ukraine but also globally.

To preserve this unique information about Ukraine's past natural environment, it is necessary to compile and standardize all available data on sites that have been or could potentially be destroyed. The most effective way to achieve this is the development of electronic databases based on geographic information systems (GIS). Work in this direction is already underway at the Institute of Geography of the National Academy of Sciences of Ukraine. However, successful project implementation requires additional financial and professional resources.

In the post-war period, it will be necessary to implement measures for the protection and preservation of paleogeographical monuments of the anthropogenic period in Ukraine by raising public awareness, cre-

ating a single registry of such monuments, and documenting these sites through systematic cataloging. This process should take place in close cooperation between paleogeographers and other natural scientists, public organizations, international associations (for example, ProGEO), and administrative institutions.

The acquired knowledge should become the basis for a detailed, step-by-step reconstruction of the past natural conditions not only in Ukraine but also worldwide. Furthermore, it will foster the integration of Ukrainian scientists into the global scientific community.

The scientific novelty of the article lies in outlining the problems of the need for preservation, inventory, monitoring and protection of unique paleogeographic monuments of the Quaternary age of Ukraine, which have significant scientific value (at the state, regional and global levels) and are in a threatening state as a result of Russia's military aggression against Ukraine.

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