І. ТЕОРЕТИКО-МЕТОДОЛОГІЧНІ ДОСЛІДЖЕННЯ

http://doi.org/10.17721/1728-2721.2019.75.1
УДК 501.92 (477)

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PALAEOENVIRONMENTAL FACTORS INFLUENCING THE RISE AND THE COLLAPSE OF THE SABATYNIVKA FARMING CULTURE IN SOUTHERN UKRAINE

A pollen and soil study of deposits of the Novokyivka site sheds light on the environment of the Sabatynivka culture (Late Bronze Age, XIV-XIII cent. BC), which was located in the central part of the southern steppe of Ukraine: this record demonstrates that this time span was characterized by a sharp increase in humidity. This is reflected in the spread of mesophytic herbs in the area between the River Dnieper and the Sea of Azov. The dry treeless Artemisia-Poaceae steppe that existed in southern Ukraine at the threshold of the Late Bronze Age was replaced by an association of forbs and Poaceae. The area of the Oleshya woodland, in the low reaches of the River Dnieper, was larger than today, and mesophilic species (Carpinus betulus, Ulmus sp., Quercus robur, Tilia cordata, Corylus avellana) grew there. Earlier pollen and palaeopedological studies of the Late Bronze settlements in the forbs-Poaceae steppe of SE Ukraine also indicate a strong southward shift of meadow-steppe and forest-steppe zones. All of this evidence indicates a significantly higher humidity of the climate than today. The Sabatynivka culture demonstrates an unprecedented rise in the number of settlements and in arable agricultural development. The latter is confirmed by the presence of pollen grains of Cerealia and segetal weeds. The decline of the Sabatynivka culture was caused by another climatic shift: to aridification, that started in the XII cent. BC, and culminated in the X-VIII cent. BC. The population of the xeric steppe between the River Dnieper and the Sea of Azov was not able to continue the previous sedentary agriculture that had typified the Sabatynivka culture. Only temporary camps of cattle breeders occurred in the south-east of Ukraine. This crisis was not caused by the human-induced exhaustion of soil-biological resources, but by climatic factors, as it was not a local phenomenon: this strongest aridification at the end of the Late Bronze Age is revealed everywhere in areas of semi-arid and arid climate in the East-European steppe and the Mediterranean realm.

Key words: short-period climatic changes, steppe zone, palynology, paleopedology, mesophytication and xerophytization of vegetation.

Introduction. A study of palaeoenvironmental impact (particularly cyclic, extreme and short-lasting changes) on economical adaptation of ancient societies, the rise and the collapse of the old civilizations, and migration processes form a basis for the elaboration of probable scenarios of the future changes in the system "environment – society". That is particularly relevant at the present time of global change, and it has to be considered in ensuring strategic and the social-economic safety of Ukraine. The study of environmental influences on human adaptation patterns is of a special significance in those areas sensitive to climatic changes, as, for instance, the southern steppe of Ukraine, which is very vulnerable to decreases in precipitation. The study here is on the Late Bronze Age Novokiyvka site, located between the lower reaches of the Dnieper and the Sea of Azov, in the southern (dry) subzone of the steppe belt of Ukraine (46°21'N, 33°19'E). At present, elevated winter and summer temperatures there cause high evaporation rates (900 mm/yr), whereas the mean annual precipitation is only 300-350 mm (250 mm during the recent warm period). That leads to low air humidity, very low (if any) run-off, and, thus, most unfavorable conditions for traditional (without irrigation) farming. The treeless southern steppe is characterized by xeric (*Artemisia*-Poacae-Chenopodiaceae) vegetation and solonized Kastanozems.

Before an account of the Novokyivka site was published in brief [9, 11], no palaeoenvironmental studies of the archaeological sites in this arid area had not been carried out. Only palaeoethnobotanical analysis of fossilized grains contained in ancient pottery had been done [17]. Nevertheless, in other extra-arid areas of the Mediterranean and, particularly, the Middle East, interactions between human groups and their environment have been intensely studied on several scales [13-16]. For instance, on the basis of pollen and sedimentological records, combined with the palaeofluctuations of the level of the Dead Sea, for the time interval of ~2500–500 BCE, which covers the time period of the Intermediate Bronze Age into the Iron Age, significant environmental changes in the Levant have been reconstructed in great detail. Dramatic settlement fluctuations happened at this time. Other studies, carried out on buried soils in the East-European steppes [2-4, 6], have also demonstrated palaeoenvironmental crises influenced by a sharp climate aridification. As arid environments have a strong rainfall deficiency and a very reactive geosystems to climatic forcing, it is well worth studying their impact on archaeological sites distribution, land use and land management in the driest part of the Ukrainian steppe.

The Late Bronze Novokyivka settlement belongs to the Sabatynivka culture (XIV-XII cent. BC) that spread from the Danube and Dniester Rivers up to the lower reaches of the Dnieper valley and the middle reached of the Southern Bug. According the Ya. Gershkovich [10], this time was associated with a dramatic shift in settlement density, when highest pre-modern indices were recorded. Habitation sites were distributed extensively throughout what is today arid steppe, including its hinterland. The Novokyivka is the most south-eastern site in the described inner-steppe domain. This steppe society developed a subsistence economy based on intensive plant husbandry and pastoralism [11]. The organic material discovered in the Novokyivka settlement consist of the following: *Triticum dicoccum, T. aestivum, T, compactum* (types of wheat), *Hordeum vulgare* (barley) and *Panicum milliaceum* (millet) [17]. Though there are the imprints of grains of cultivated plants on ceramics, as well as their macro-remains, these could have been derived from imported wheat rather than locally grown Cerealia. Thus, pollen analysis of the site deposits have been carried out to provide more authentic proof of local agriculture.

The site setting. The Novokyivka site is located on a flat surface between the upper reaches of an old dry gully with gentle slopes and a closed depression (a solutional hollow, or 'pod'). The modern vegetation cover differs from the typical xeric coenoses of the southern steppe, which normally consist of *Festuca*, *Stipa*, *Agropyron, Artemisia*, *Camphorosma, Limonium*, *etc*. At the studied site, forbs, including *Inula, Dianthus, Polygonum, Agrimonia, Vicia* and *Medicago* grow, though the halophyte *Limonium* is abundant.

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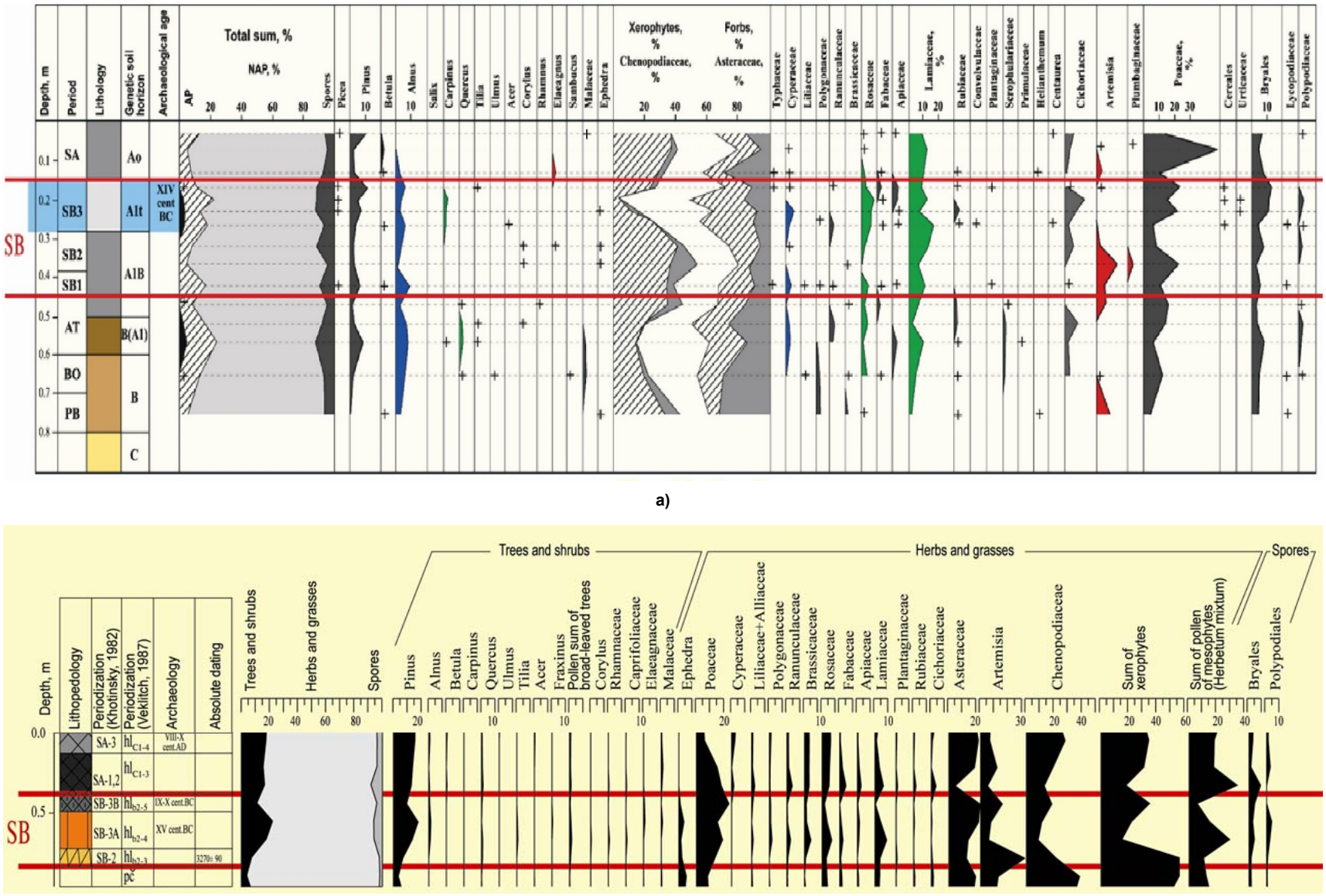
The mesophytication of the steppe associations may be connected with the climatic changes registered in the steppe zone recent decades (namely, with the increase in precipitation [5]), or they may reflect the impact of the former irrigation of the area. An abandoned irrigation canal is located at a distance of 20-30 m from the site, and *Typha* is presently growing there. The surface pollen sample from the site also differs from the surface pollen assemblages registered in samples in the subzone of dry steppe of Ukraine, which are dominated by Chenopodiaceae and *Artemisia* pollen [1]. In the surface sample at Novokyivka, there is no *Artemisia* pollen, the proportions of forbs and Chenopodiaceae are equal (34-37%), and Poaceae pollen is rather abundant (13%), as opposed to its usual under-representation in soils' pollen spectra. There are no agricultural plots in the area, and no pollen of Cerealia was found, but one grain of *Centaurea cyanus* was. Pollen of forbs include Asteraceae (17%), Lamiacaeae (9%), Lactuceae (4%), and rarely Rosaceae, Apiaceae and Fabaceae. Arboreal pollen (12%) is dominated by *Pinus sylvestris* (10%), and single pollen grains of *Picea* and arboreal Rosaceae occur. The spores consist of Bryales (4%) and one palynomorph of Polypodiaceae. Such a composition in a surface pollen sample corresponds to those from the middle subzone of steppe [1], which may indicate climatic change more than local factors (the irrigation canal was constructed rather recently). In any case, the composition of non-arboreal pollen in the surface sample corresponds well to that of the association existing on the local modern steppe. The noticeable percentages of *Pinus sylvestris* pollen is controlled by the closeness of the site (45 km) to the pine massifs in the lower reaches of the Dnieper on the Oleshya sands. The presence of the *Picea* pollen grain clearly indicates long-distance transport from the west in this open steppe area.

Material and methods. Samples for pollen analysis have been taken from the Kastanozem, which includes the Sabatynivka cultural horizon represented by the ashy bed at the depth between 0.15m and 0.30 m (Fig. 1a). Ash heaps and beds are typical for the Sabatynivka settlements [9]. In general, for several sedentary farming cultures they are regarded as attributes of a ritual connected with abandonment of households. In the adjacent soil profile (section 2), the thickness of the light-grey ash horizon, with pieces of ceramics and animal bones, is 45 cm. In section 1, the Ah (Ao) horizon is only 0,2 m thick, dark-grey, loose, with granular structure, penetrated by herb roots, with distinct downward transition. The cultural horizon is light-grey, slightly compacted, without soil structure, transected by rootlets filled with humus material, with distinct uneven transition downward. The ABw (A1B) horizon (0.30-0.60 m) is a dark-brown heavy loam, strongly compacted, with prismatic structure and large krotovinas that are filled with Ah horizon material. Small carbonate nodules appear from a depth of 0.5 m. The Bwk (BA1) horizon (0.60-0.80 cm) is bright-brown heavy loam, strongly compacted, prismatic, with large krotovinas filled both with humus material of the A1 horizon and light-yellow loess from the underlying bed. It includes infrequent small carbonate nodules ("beloglazka"), the transition downward is distinct, biogenic, with worm tubes. The soils in the studied area are formed on typical loess – pale-yellow, porous and loose. The characteristic feature of Kastanozems is development of solonets processes, which are triggered by an abundance of SiO_2, Mg, sesquioxides of Al and Fe and alkaline metals in the products of decay of *Artemisia* plants. As *Artemisia* is not present in the described vegetational association, recent pedogenesis does not include the solonets process (or the latter is weakly developed).

Results. The cultural layer was sampled in the section 1, which description is given above, and also in the section 2. Pollen samples were collected at 5 cm intervals through the sections. They were processed following treatment with 10% HCl, 10% KOH, disintegration in a solution of sodium pyrophosphate, cold treatment of HF and separation in heavy liquid (CdI_2 +KI) of specific gravity 2.2. The pollen grains are very well preserved. In the pollen diagram (see Fig. 1a), the main groups of palynomorphs includes pollen of arboreous plants (AP), non-arboreal plants (NAP) and spores. The percentages of different taxa have been calculated in relation to the total sum of microfossils. The correction factors between vegetation and the resulting palynospectra for the steppe zone [1] have been applied in the interpretation of the pollen diagram.

The pollen diagram for section 1 shows that, during the time of soil formation, the site was located within the steppe zone. Nevertheless, the ratios between the main components of NAP, xerophytes, forbs (which include mainly mesophytic herbs) and grasses, change drastically. That clearly indicates changes in the subtypes of steppe vegetation, and, thus, climatic fluctuations during the soil's formation. The pollen spectra of the Sabatynivka culture archaeological horizon have extremely low percentages of xerophytes in section 1, 4-13%, and 26% in section 2. The xerophytes are represented mainly by Chenopodiaceae (only single pollen grains of *Ephedra distachya* and *Artemisia*). On the contrary, pollen percentages of forbs in the cultural layer are at their highest at 35-52% in section 1 and 27-42% in section 2. Lamiaceae pollen dominates among forbs, though commonly Asteraceae is dominant in steppe pollen spectra [1]. In the described pollen assemblage, Asteraceae share the second place in abundance with Rosaceae. The pollen composition of forbs is more diverse than in the surface sample: with Lactuceae, Ranunculaceae, Rubiaceae, Apiaceae, and Fabaceae. Pollen of Cyperaceae are present in both sections (1-5%) and single microfossils of *Typha*. The appearance of Cerealia palynomorphs is of a great significance. Judging from their poor preservation in soils, even a few pollen grains of Cerealia directly indicate the existence of plant husbandry near to the studied area [7, 12]. In addition, pollen of segetal weeds (*Centaurea cyanus* and Convolulaceae) were found, as well as pasture weeds (Plantaginaceae). The other synanthropic plants are represented by ruderals (Urticaceae and *Sonchus*).

The AP percentages are larger (14-23% in section 1 and 12-18% in section 2) and more diverse than in the surface sample. Pollen of *Pinus sylvestris* is co-dominant with *Alnus glutinosa* (5-7%), and *Carpinus betulus* pollen reaches 4%. Single pollen grains of *Acer* sp., *Tilia cordata, Picea* and *Betula* occur in several samples. No palynomorphs of broad-leaved species were found in the surface sample. As pollen of *Carpinus, Acer* and *Tilia* are not normally subject to the long-distance transport [12], they may have been wind-blown from the Oleshya woodland. At present, *Quercus robur, Alnus glutinosa* and *Betula pubescens* grow there in depressions between the sand massifs. The occurrences of heavy Polypodiaceae and Lycopodiaceae spores, which also are not carried large distances, confirms the input of palynomorphs from the Oleshya woods. It is noteworthy that a lot of microcharcoal particles are found in pollen slides from these levels.



a)

b)

Fig. 1. Pollen diagrams: a) the Novokyivka section, b) the Komyshuvata XIV section (modified from Gerasimenko, 1997)

The pollen assemblages in the beds that overlie and, particularly, underlie soil horizons are strikingly different. In the latter, the NAP reaches up to 89%, due to an increase in pollen of xerophytes (45%), whereas pollen percentages of forbs do not exceed 25% and their diversity is very poor (Lamiaceae and Asteraceae share dominance, and Lactuceae is present). Pollen of Chenopodiaceae are commonest among the xerophytes, but Artemisia reaches 20%, pollen of Plumbaginaceae are very noticeable, and a few grains of Ephedra distachya occur. Poaceae pollen constitutes 9%. The AP portion drops to 5-8% and includes xero- and halophytes such as *Elaeagnus angustifoila*. A few pollen grains of *Alnus glutinosa* and *Corylus avellana* occur (again, obviously wind-blown from the Oleshya woods). The pollen spectrum from the bed immediately overlying the cultural layer also has the very low percentages of AP (4-7%), and the proportion of *Elaeagnus angustifoila* pollen is noticeable, *Corylus palynomorphs* are absent, but few pollen of *Betula pubescens* appear. The NAP (87%) is dominated by xerophytes (37%) represented mainly by Chenopodiaceae (*Artemisia* pollen make up 4%, and one grain of *Helianthemum* occurs). Palynomorphs of Asteraceae (28%) dominate among forbs, and Lamiaceae is second in abundance. Only single pollen grains of other forbs occur (Rosaceae, Fabaceae, Rubiaceae and Lactuceae). Spores are represented only by Bryales that is typical for the steppe zone. No pollen of synanthropic vegetation was found.

Interpretation and Discussion. The analysis of pollen assemblages from the Sabatynivka culture archaeological horizon compared to those from enclosing beds allows a reconstruction of vegetational and climatic changes, which proceeded and followed this culture at Novoyivka. Before the appearance of the settlement, the studied area was located in the dry steppe subzone that was dominated by *Artemisia*-Poaceae associations. It corresponds well to the experimentally obtained from surface samples results [1] that show the domination of Chenopodiaceae over *Artemisia*, and *Artemisia* over forbs in pollen assemblages of the dry steppe, and Poaceae were regarded as dominants if their percentages were not less than 5%. Only a few bushes of xero- and halophytic *Elaeagnus angustifolia* occurred on the steppe. In comparison to the surface sample it can be seen that the xeric vegetation spread much more extensively than nowadays, and the climate at Novokyievka was then significantly drier than nowadays. This dry spell evidently corresponds to the arid time of the Middle Subboreal or its phases between 4200-3200 BP [2-4, 6, 8-9, 12-16]. The sharp aridification of the climate at 4200 BP – "a mega-drought that crushed a number of civilisations worldwide" – has been chosen as the boundary between the two Holocene Ages in the International Chronostratigraphic Chart. The south-eastern part of the Ukrainian steppe (near the Sea of Azov), which at the present day is covered by mesophytic steppe, was occupied by *Artemisia*-Poaceae steppe at 3720±90 BP (Fig. 1b). Pedogenic processes were so weakened that the Middle Subboreal deposits on slopes were rather similar to loesses, and on plateaux a level with desiccation fissures was formed in some polygenetic soils [8]. Only short-lasting settlements existed here during the XVIII cent. BC (3700-3600 BP), at the beginning of the Late Bronze Age.

Starting from XVII-XVI cent. BC, completely different environments appeared in the Ukrainian steppe, when the sedentary Zrubna (Timber-Grave) culture spread into its eastern part, whereas the farming Sabatynivka culture flourished during XVI-XIII cent. BC in the western and central part of the steppe [10, 11]. The Novokyivka site was located in the subzone of forbs-grass steppe, with herbal associations similar to those of the modern northern subzone of the steppe, where the precipitation rates are 420-450 mm/per year. As the southern boundary of the modern northern steppe subzone, with mean July temperatures of +22°, lies 160 km N from the site, its strong shift to the south could have been controlled either by higher precipitation in the site area, or by the lower July temperatures and, thus, significantly less evaporation. The extent of both grasses and forbs was larger than nowadays, and the composition of forbs differed in having greater diversity and in the larger participation of plants from the Rosaceae (including *Potentilla*), Fabaceae (including *Vicia*), Ranunculaceae and Apiaceae families. Cyperaceae and Lactuceae also was more abundant than at present, though the latter, in general, is very typical for the prehistoric settlements [6]. Sedges and *Typha* are present in the modern vegetation cover, but their pollen is absent in the surface sample: thus, the suggestion can be made that hydrophytes occupied larger areas in depressions than nowadays. On the contrary, xerophytes practically disappeared from steppe coenoses at the end of the XIV cent. BC. The mesophytic type of steppe indicates there was sufficient humidity to foster extensive agricultural development in the area. Fields of Cerealia existed around the settlement, as well as rich pastures. The presence of segetal and pastoral weeds provides additional evidence of agriculture. No pollen of synanthropic plants was found in the surface sample from the abandoned steppe plot at Novokyivka.

The larger percentages of AP in the pollen assemblages from the Sabatynivka cultural layer, as compared to the surface sample, may indicate the stronger influence of western winds on the climate in the studied area. The presence of single palynomorphs of *Picea*, whose closest habitat is in the Southern Carpathians, indicates the long-distance pollen transport from the west. Nevertheless, the majority of AP is represented by trees which could grow in the nearest woods, those located in the Oleshya sand massifs near the Dnieper. They are made up of pine, alder, maple and lime. The growth of the last in the Oleshya woods is limited nowadays, though other mesophilic trees – oak and hazelnut – form small patches there. For the time span corresponding to the existence of the Sabatynivka culture (uncal 14C 3300-3000 BP), the spread of broad-leaved woodland can be reconstructed using pollen data from the Kardashynsky peatbog, located in the Oleshya [12]. The woods consisted of *Quercus robur, Ulmus campestris, U. glabra, Tilia cordata* and *Carpinus betulus*. The spread of hydrophytic vegetation, Polypodiaceae and Lycopodiaceae also occurred at this time, clearly indicating an increase in humidity during the existence of the Sabatynivka culture.

The mesophytication of the steppe is also revealed for the time of the coeval Timber-Grave culture (XV-XIII cent. BC) when some woodland patches of oak, lime and ash, with hazelnut and other bushes in the undergrowth, appeared in the gullies opening into the Sea of Azov (Fig. 1b). The forest-steppe spread south occupying the Siversky Donets River basin, where clay illuviation developed in soils, and clay weathering increased in the soils of the Pryazov Lowland [8]. In the steppe to the east of the Sea of Azov, the evolution of 'kashtanozems' into 'dark-kashtanozems' and the removal of salts from the soils indicate an increase in climatic moisture starting in the XVI cent. BC and reaching its maximum at XIV-XIII cent. BC [2]. The peak in the pollen of arboreal vegetation represents the well-developed Mediterranean forest in the Levant and the whole eastern Mediterranean around 1350 BC [13-16] – the time corresponding to the existence of the Sabatynivka culture. Thus, the described humid phase was characteristic for arid and sub-arid regions in the whole European part of the continent.

At Novokyivka, the pollen from the archaeologically sterile bed that overlies the Sabatynivka cultural layer indicates an increase in aridity that was reflected in the spread of xeric

steppe associations (Chenopodiaceae dominated over *Artemisia*) and the reduction of forbs. Plants from the Asteraceae family dominated over the other forbs whose diversity became very poor. The comparison of the pollen data obtained from the surface sample (particularly the predominance of Asteraceae over other forbs and the presence of *Artemisia*) shows that the steppe was more xeric than nowadays. Disappearance of cultural and ruderal plant pollen corresponds well to the abandonment of the Novokyivka settlement and to the general scarcity of settlements in this part of the Ukrainian steppe. The settlements of the Bilozerska culture of the Final Bronze Age (XII-X cent. BC) were located mainly near rivers, and mobile cattle breeding was much more significant than cultivation [10]. During the X-VIII cent. BC, only nomadic camps existed in the steppe adjacent to the Sea of Azov [8]. Here Artemisia was as abundant as Chenopodiaceae, Asteraceae and Poaceae, Ephedra distachya spread in all of these xeric associations. A strong reduction in trees occurred, and Elaeagnus angustifolia bushes were scattered through the steppe, indicating solonization of the soils (Fig. 1b). Weak humus accumulation in soils and the formation of desiccation fissures in them provide other evidence of aridity. In the Siversky Donets River basin, forest pedogenic processes were replaced by humus accumulation at this time [8]. At Novokyivka, *Eleaegnus angustifolia* also was the only bush species on the steppe. Judging from the AP percentages at the Novokyivka site, the input of western wind-blown pollen strongly decreased, or the Oleshya woodland (including pine massifs) shrank, and broad-leaved species disappeared. The last fact, particularly the disappearance of Carpinus betulus, indicates that the decrease in humidity caused the contraction of woodland on a much larger scale than the activity of Bronze Age peoples using the wood for metal smelting.

The strong climatic deterioration at the beginning of the 1st millennium BC, reflected in the observed characteristics of the soils, buried under kurgans (tumuli) in the Lower Dnieper area, has been named the "xerothermic depression" [3]. This arid climatic spell at the threshold of the 1st millennium BC, at 14C 2900 BP (X-IX cent. BC) has been shown in the study of buried Chernozems and Kastanozems of the south-eastern European steppe [2, 4]. In the Middle East, the driest event of the Bronze and Iron Ages occurred ~ 1250-1100 BC [13-14] (equal to uncal ^{14}C 3000-2900 BP). Shrinkage in the Mediterranean forest could not have been the result of human pressure, because settlement activity was low in many areas at that time [13-14]. Thus, the dry time span at the end of the Late Bronze age took place across a vast geographical area – from the Levant, Greece and Anatolia to the steppe zone of Ukraine and southern Russia, though it started and peaked earlier in the Near East.

Conclusions. A pollen study of the Novokyivka site of the Late Bronze Age Sabatynivka culture has demonstrated, for the first time, that in the central part of the southern steppe of Ukraine, the XIV and XIII cent. BC were characterized by a sharp increase in humidity. The palynological diagram of the site's deposits shows the sharp changes in the pollen percentages of mesophytic and xerophytic herbs and the AP/NAP ratios. The archaeological horizon of the Sabatynivka culture differs strikingly from the underlying and overlying beds by its increase in pollen percentages and diversity of mesophitic herbs and AP, wind-blown from the closest Oleshya forest massifs, and by the appearance of pollen of mesophillic trees, which grew in that woodland. All of these reflects the strong mesophytication of steppe coenoses in the area between the River Dnieper and the Sea of Azov, the spread of mesophilic trees in the Dnieper valley, and, thus, the increase in humidity. Pollen of Cerealia and segetal weeds is revealed, for the first time, in the deposits of the Late Bronze Age in the Ukrainian southern steppe. It confirms that arable agriculture was characteristic of the Sabatynivka economy. Before and after the time of the Sabatynivka culture, dry *Artemisia*-Poaceae steppe occupied the area, which was not suitable for development of a sedentary farming economy. The strong similarity of the Novokyivka pollen diagram with those from the deposits of the Late Bronze Age in south-eastern Ukraine makes it clear that the earlier phase of strong xerophytization occurred at the threshold of the Late Bronze Age (XVIII cent. BC), and the later arid phase took place after the X cent. BC. During the second half of the second millennium BC (particularly during XIV-XII cent. BC), meadow-steppe and forest-steppe zones shifted southward by several hundred kilometres, and this caused an unprecedented rise in arable agriculture, that is, in the area presently occupied by the dry southern steppe. The decline of this farming culture was caused by an opposite shift, to aridification, that started after the XII cent. BC, and culminated in the X-VIII cent. BC. The crisis for the Sabatynivka culture was caused by climatic factors, because this very arid event has been revealed everywhere in the East-European steppe and in the Mediterranean realm. To learn about the duration and type of transitional periods between humid and arid phases in the Middle and Late Subboreal, and the Early Iron Age, is an important task for future investigation, and this is vital for understanding the cyclicity of sharp and short-lasting climatic changes and their environmental effects.

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Надійшла до редколегії 17.12.19

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ВПЛИВ ЗМІН ПРИРОДНИХ УМОВ НА РОЗКВІТ І ЗАНЕПАД ЗЕМЛЕРОБСЬКОЇ САБАТИНІВСЬКОЇ КУЛЬТУРИ ПІЗНЬОЇ БРОНЗИ НА ПІВДНІ УКРАЇНИ

На основі результатів палінологічного аналізу розрізу поселення Сабатинівської культури Новокиївка, розташованого у сухостеповій підзоні між пониззям Дніпра та Азовським морем, показано, що час існування цієї культури із небувалим злетом хліборобства у степу (14-12 ст. до н. е.) відзначався різким зростанням зволоження. Воно призвело до зміни сухого полиново-злакового степу, який існував тут на межі середньої і пізньої бронзи, різнотравно-злаковим степом, розширенням лісового масиву Олешшя, у якому стало можливим зростання мезофільних порід (грабу, в'язу, дубу, липи, ліщини). Індикаторами розвитку землеробства на поселенні є паліноморфи культурних злаків та їхніх супутників (волошки синьої, березкових) у відкладах поселення. Виконані раніше палінологічні і палеопедологічні дослідження розрізів поселень доби пізньої бронзи (15-13 ст. до н. е.) на південному сході України відображають зсув рослинності лісостепової зони і північно-степової підзони на південь, розвиток у ґрунтах басейну р. Сіверський Донець елювіально-ілювіальних процесів, а у ґрунтах Приазов'я – посилення глинного вивітрювання. Клімат цього часу був значно вологішим від сучасного і особливо від посушливого клімату попередньої фази, коли відбувалося інтенсивне розтріскування ґрунтів, а гумусонакопичення у них було настільки послабленим, що на схилах утворювалися лесоподібні відклади. Занепад Сабатинівської культури на поселенні Новокиївка був зумовлений новою фазою ксерофітизації степової рослинності, що розпочалася на півдні України у 12-11 ст. до н. е. і кульмінувала у 10-8 ст. до н. е. Різнотравно-злакові степи із багатим складом трав змінили полиново-злакові асоціації; поширення галофіту лоху сріблястого відображало засолення ґрунтів. Тодішнє населення було не в змозі підтримувати осіле землеробство, і лише тимчасові стоянки скотарів існували у південному степу впродовж найбільш посушливішої фази кінця епохи пізньої бронзи. Криза Сабатинівської культури була зумовлена не виснаженням природних ресурсів, а кліматичними чинниками, на що вказує зникнення мезофільних порід із лісів Олешшя, засолення і розтріскування ґрунтів, їхнє збіднення на гумус, і – головне – повсюдне виявлення фази різкої аридизації клімату у кінці епохи пізньої бронзи і у степах півдня Східної Європи, і у Середземномор'ї та на Близькому Сході. Вивчення впливу змін природного середовища (особливо різких, екстремальних і короткотривалих) на господарчу адаптацію давніх спільнот і міграційні процеси є основою розробки вірогідних сценаріїв майбутніх станів системи "природне середовище – людина", що є актуальним на сучасному етапі глобальних змін.

Ключові слова: короткоперіодичні кліматичні зміни, степова зона, палінологія, палеопедологія, мезофітикація і ксерофітизація рослинності.

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ВОЗДЕЙСТВИЕ ИЗМЕНЕНИЙ ПРИРОДНЫХ УСЛОВИЙ НА РАСЦВЕТ И УПАДОК ЗЕМЛЕДЕЛЬЧЕСКОЙ САБАТИНОВСКОЙ КУЛЬТУРЫ ПОЗДНЕЙ БРОНЗЫ НА ЮГЕ УКРАИНЫ

По результатам палинологического анализа разреза поселения Сабатиновской культуры Новокиевка, расположенного в сухостепной подзоне между Нижним Приднепровьем и Азовским морем, установлено, что время существования этой культуры (14-12 ст. до н. э.), отличающейся наибольшим расцветом земледелия в степи в древности, характеризовалось резким возрастанием увлажнения климата. Это привело к смене сухой полыново-злаковой степи, существовавшей здесь на рубеже средней и поздней бронзы, разнотравно-злаковой степью, к расширению лесных массивов Олешковских песков и произрастанию в них мезофильных пород (граба, вяза, дуба, липы, лещины). Выполненные ранее палинологические и палеопедологические исследования поселений поздней бронзы на юго-востоке Украины отражают сдвиг лесостепной зоны и северо-степной подзоны к югу. Климат был значительно влажнее современного. Исчезновение Сабатиновской культуры на поселении Новокиевка было обусловлено последующей фазой ксерофитизации степной растительности, начавшейся на юге Украины в 12 ст. до н. э. и достигшей кульминации в 10-8 ст. до н. э. Во время этого засушливого отрезка конца эпохи поздней бронзы население было не в состоянии поддерживать земледелие и вести оседлый образ жизни. В южной степи существовали лишь временные стоянки скотоводов. Кризис Сабатиновской культуры был обусловлен не истощением природных ресурсов, а климатическими факторами, о чем свидетельствует исчезновение мезофильных пород в лесах Олешковских песков, засоление и растрескивание почв, ослабление в них накопления гумуса, и – главное – повсеместное проявление фазы резкой аридизации климата в конце поздней бронзы на юге Восточной Европы, в Средиземноморье и на Ближнем Востоке. Изучение воздействия изменений природной среды (особенно резких, экстремальных и короткопериодических) на хозяйственно-экономическую адаптацию древних сообществ и миграционные процессы является основой разработки вероятностных сценариев будущих изменений в системе "природная среда – человек", что обусловливает актуальность исследования на нынешнем этапе глобальных изменений.

Ключевые слова: короткопериодические изменения климата, степная зона, палинология, палеопедология, мезофитикация и ксерофитизация растительности.