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GEOARCHAEOLOGY OF THE PALEOLITHIC IN THE EAST EUROPEAN PLAIN

ABSTRACT: The process of primary peopling of the East European Plain has begun at Acheulian time. The Acheulian campsites very seldom occur in the territory, being located only in its southernmost part. During the Middle Paleolithic cultural stage, the south-western part of the Plain was permanently inhabited. All Mousterian sites existed at the beginning of the Valdai Ice Age. Mousterian hunters have occasionally penetrated further to the north, though such invasions were irregular. Large-scale peopling of the Russian Plain began in the Late Paleolithic, during the second half of the Valdai epoch (starting at 30–35 ky B. P.). Three main stages of Late Paleolithic peopling may be distinguished: 1) 32–24 ky (the Bryansk Interstadial); 2) 23–16 ky (the time span including the maximum cooling in the periglacial zone); 3) 15–11 ky (the late last glacial). The human population was concentrated within three main river catchment basins of the Russian Plain – the lower and middle Dniester, the middle and upper Dnieper, and the middle Don Rivers.

KEY WORDS: Russian Plain – Acheulian – Mousterian – Late Paleolithic – Pleistocene – Geochronology – Paleoecology – Natural habitat

INTRODUCTION

The East European Plain is one of the extratropical areas of the globe, where intensive primary peopling took place. At the same time, considerable irregularities in the distribution of paleolithic sites over the plain are evident. First of all, their concentration within the western part of the plain is obvious (*Figure 1*). Acheulian sites of the second part of the Middle and early Late Pleistocene (such as Mikhailovski and Khryashchi in the Severskyi Donets River basin, and Vykhvatintsy in the Dnieper basin) seldom occur within the Plain and are represented only by stone implements (Praslov 1969, Velichko 1988). Such a type of sites indicates that the Acheulian people in this region made only first cautious attempts to penetrate the territory of the Russian Plain from the mountains of Crimea and Caucasus. Although there is some evidence of the Acheulian inhabitance in the Kama River basin, rather far north (Guslitser, Pavlov 1993), further investigation is required to estimate the geological age of these sites. On the whole, a low level of adaptation to the boreal climate of the Acheulian tradition forced humans to seek for protection in the mountain regions and act in a way "advance – retreat".

The situation has changed considerably during the Mousterian cultural stage due to a higher level of early human adaptation. Numerous stratigraphic, paleogeographical and radiocarbon data from paleolithic sites of East Europe indicate that an active peopling of the European plains coincided with the beginning of the last glacial epoch (Velichko 1961, 1969, 1973, 1993, 1997, Velichko *et al.* 1969, 1992, Gromov 1948, Gromov, Shantser 1958, Ivanova 1965, 1969, 1982, Lazukov *et al.* 1981, Markov, Velichko 1967, Velichko, Kurenkova 1990). The Mousterian occupation sites advanced into the southern Russian Plain, where humans could live

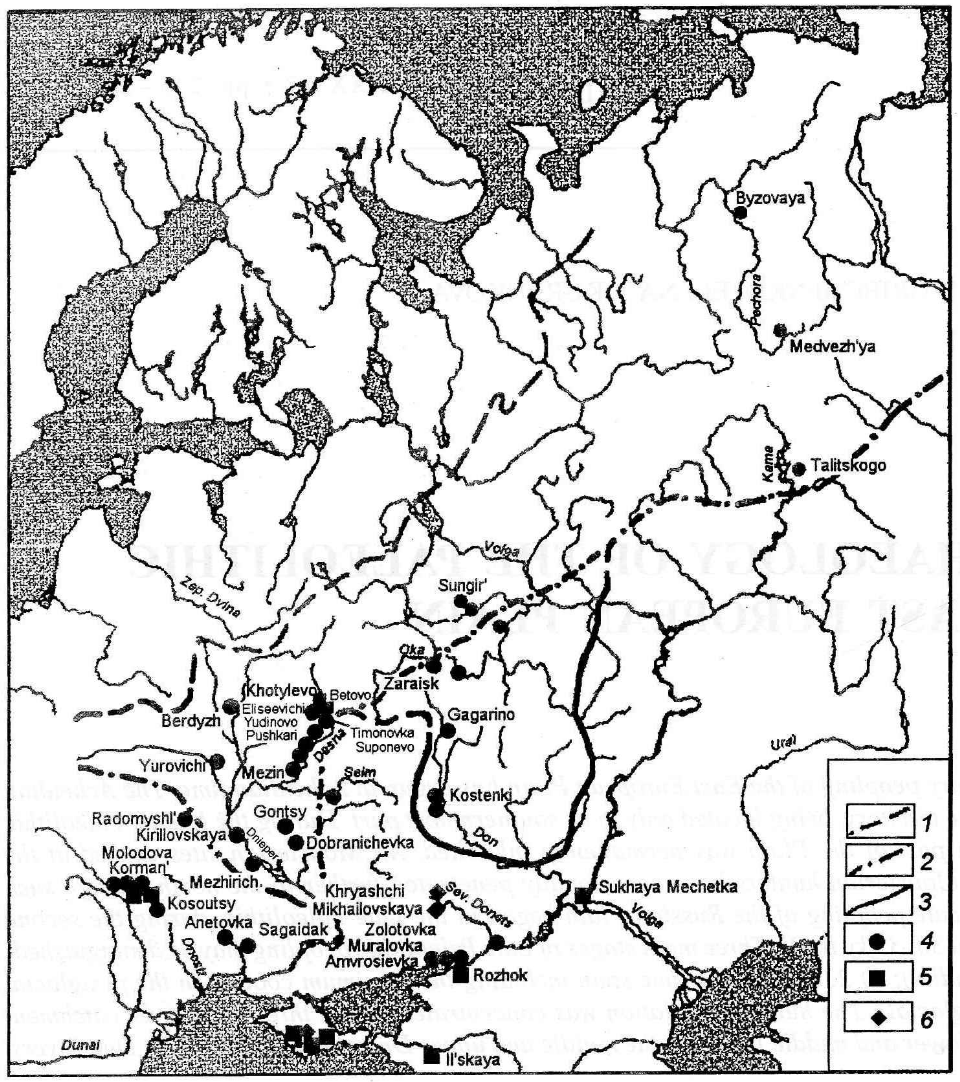

FIGURE 1. Distribution of Paleolithic sites on the East European plain. 1–3: boundaries of the ice-sheet: 1 – Valday, 2 – Dnieper, 3 – Don; 4–6: main paleolithic sites: 4 – Late Paleolithic, 5 – Mousterian, 6 – Acheulian.

permanently in the paraperiglacial conditions during the earlier part of the last glaciation. This is evidenced by the data on a number of sites: Molodovo, Korman' in the Dniester River basin, Rozhok site in the Azov Sea coastal area (Goretskyi, Tseitlin 1977, Goretskyi, Ivanova 1982, Praslov 1969, Velichko1988). Even with the cooling in progress, Mousterian people could develop initial migrations and explore the grounds not only in the southern part of the Russian Plain (Sukhaya Mechetka site in the Volga basin), but also in its northern part (Khotylevo I in the Desna River catchment). The most important dating method for the Mousterian sites is the paleogeographical analysis of the sediments containing artifacts and their correlation with the main stratigraphic units of the regional loess-and-soil sequence.

The primary peopling of the plains of East Europe has a characteristic feature: a gradual increase of the populated area from Early to Upper Paleolithic. There were three principal regions more or less permanently inhabited by Mousterian, and later on, by Late Paleolithic communities. The first of these regions, the western one, includes the Dniester River valley, the second one – the Dnieper basin, and the third one – the Don River area.

GEOARCHAEOLOGY OF THE PALEOLITHIC SITES IN THE RUSSIAN PLAIN

The Dniester River basin

Within the region a number of fully investigated paleolithic sites are situated (Goretskyi, Tseitlin 1977, Goretskyi, Ivanova 1982, Chernysch 1989, Velichko 1988). Such sites as Molodovo I, Ketrosy, Korman' IV, Molodovo V belong to the Mousterian stage of peopling. All of them are multi-layered sites with several cultural layers corresponding to the cycles of peopling traceable over the area. The main feature of the Mousterian open-air sites of the Dniester River basin is that even the earliest Mousterian cultures lie in the stratigraphic sequence higher than the fossil soil, correlated with the Brorup Interstadial, which corresponds to the Krutitsy soil of the Mezin paleosoil complex (Velichko, Morozova 1972).

Both starigraphic and paleopedological data confirm the assumption that an active peopling of the Dniester basin has begun not during the warm interglacial epoch, but at the beginning of the Late Valdai (OIS 4) glaciation. The most important Mousterian site of the region is Molodovo I. Only one of five Mousterian cultural layers at the site (the lowermost one) has been dated by radiocarbon method (>44,000 yr BP), while three Upper Paleolithic layers have not been dated *(Figure 2)*. The stratigraphic sequence at the site includes several developed and initial soil horizons containing some of the cultural layers. Numerous levels with high concentration of artifacts indicate repeated appearance of paleolithic occupation at the site.

Several soil horizons and levels with high humus content can be traced within the sediment sequences containing cultural layers of the Molodovo V and Korman' IV sites (Ivanova 1987, Chernysh 1989). The upper soil horizon is correlated to the Bryansk soil. The main cultural layer at the Molodovo V site is related to the upper horizon of this buried soil and is fixed by radiocarbon dates to 23,700±320 (GIN-10) and 23,000±800 yr BP (MO-11). The overlaying loess-like sandy clay stratum contains several more layers with higher concentration of artifacts, dated to approximately 17 ky and from 13 to 10 ky BP (the uppermost layers). There is no clear evidence of soil forming process there, but according to palynological data, one can assume a relative warming, corresponding to the cultural layer of 17 ky BP. It was correlated to the Lascaux Interstadial (Ivanova 1987).

The sediment sequence containing cultural layers of the Korman' IV site has rather similar features. A paleosoil, dated to the interval 23–18 ky BP at this site, is of special interest. It was formed in the coldest conditions for the whole Late Pleistocene (Goretskyi, Tseitlin 1977). Therefore, it became clear that the soil horizons at the Paleolithic sites of the Dniester basin correspond to the periods of relative stability of the surface and decrease of clastic accumulation, rather than to a general warming of climate. On the other hand, the multi-layered structure of the sites of the region and age distribution of the cultural layers show that the peopling of the territory has begun early in the Valdai glacial epoch and continued without interruption even during the most severe stages of the maximum cooling.

The Dnieper River basin

The Dnieper River basin is not uniform from the point of view of the initial peopling. The most important part of the region for the early human colonization was the Desna River basin (Desna is the left-hand tributary of Dnieper), where numerous sites of both Middle and Upper Paleolithic were situated *(Figure 3)*. There is a well-known group of Mousterian sites within the region: Khotylevo I, Betovo, Negotino, Chulatovo III and some others. The most important site there is Khotylevo I. The distribution and boundaries of the cultural layer at the site are still poorly studied. Judging by the geological situation, all of the

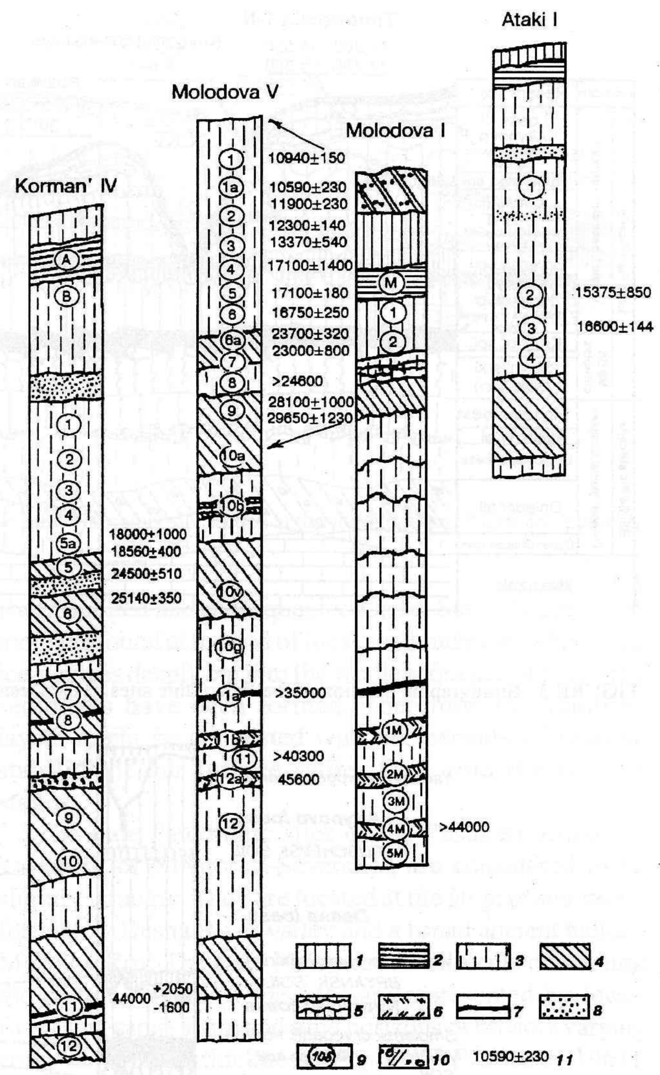

FIGURE 2. The geological sections of the main Paleolithic sites, Dniester River basin. 1 – soil A, 2 – soil B, 3 – loess loam, 4 – fossil soil, 5 – deluvium, 6 – gley, 7 – ash lenses, 8 – cultural layers, 9 – indexes of the layers, 10 – rock debris, 11 – radiocarbon dates. (After A. P. Chernysh).

artifacts represented there by flint implements and remains of big mammals were resituated into the sediments.

The position of the finds in the sediments and a complexity of modern topography at the site, inherited generally from the ancient relief structure, show that the settlement of primitive hunters was situated on the surface limited by the valley rim and old balkas (flat-bottomed gullies). Probably, the site was reworked by gully erosion soon after it had been abandoned. Stratigraphic study of the sediments at the site *(Figure 4)* enables to estimate the relative age of sand and gravel lenses containing the artifacts. Their relation with overlaying humus horizon of the Mezin soil complex and facial transition from the balka alluvium and horizon B of the soil complex indicate that the artifacts might be displaced during the period of cooling following the Mikulino interglacial (Velichko 1988).

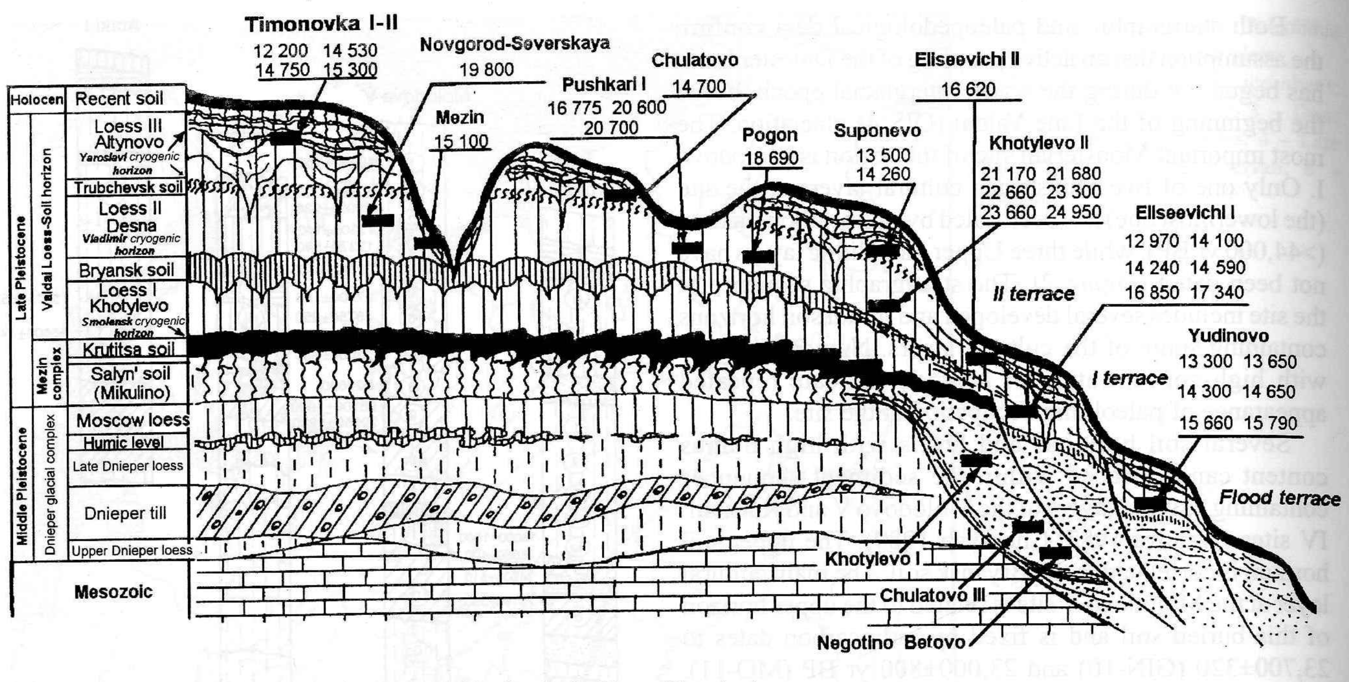

FIGURE 3. Stratigraphic position of the Paleolithic sites in the Desna River basin.

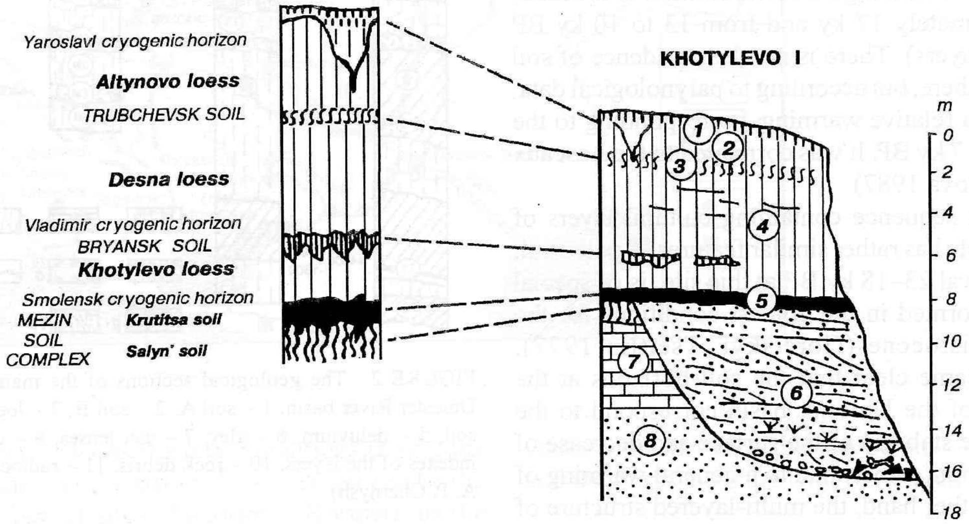

FIGURE 4. Geological section of the Paleolithic site Khotylevo I.

Therefore, the Mousterian stage of peopling at the Khotylevo I site corresponds to an early cold stage of the Late Pleistocene.

For the later part of the Late Paleolithic, the period of active occupation of the Russian Plain by primitive hunters, it is possible to estimate ages of the sites not only by means of stratigraphic correlation, but directly by the radiocarbon method. The combination of paleogeographical and archaeological investigations provides a possibility to correlate the main events of the landscape and climate change during the Late Pleistocene with the stages of paleolithic peopling. Existence of such a relation is proved beyond any doubt (Velichko1993, Velichko *et al.* 1997, Velichko *et al.* 1992, Velichko, Kurenkova 1990, Kurenkova *et al.* 1995). In many instances, however, the sediment sequences, containing layers rich in artifacts, lack stratigraphic horizons typical for the Late Pleistocene of the Russian Plain. In such a case it is difficult to determine the stratigraphic position of the culture.

The characteristic feature of the majority of sites in the Desna basin is their location within the outcrops of chalk containing in abundance flint concretions, which were mainly used by humans to make stone tools. As well as the Mousterian sites, the earliest of the Late Paleolithic sites (Khotylevo II, Pogon and Novgorod-Severskaya) are situated higher on the slopes near the watershed on the right side of the Desna River valley. One of the best known sites, especially important for resolving the problem of the initial occupation of the territory, is the site Khotylevo II, situated on the slope of the Desna valley near the

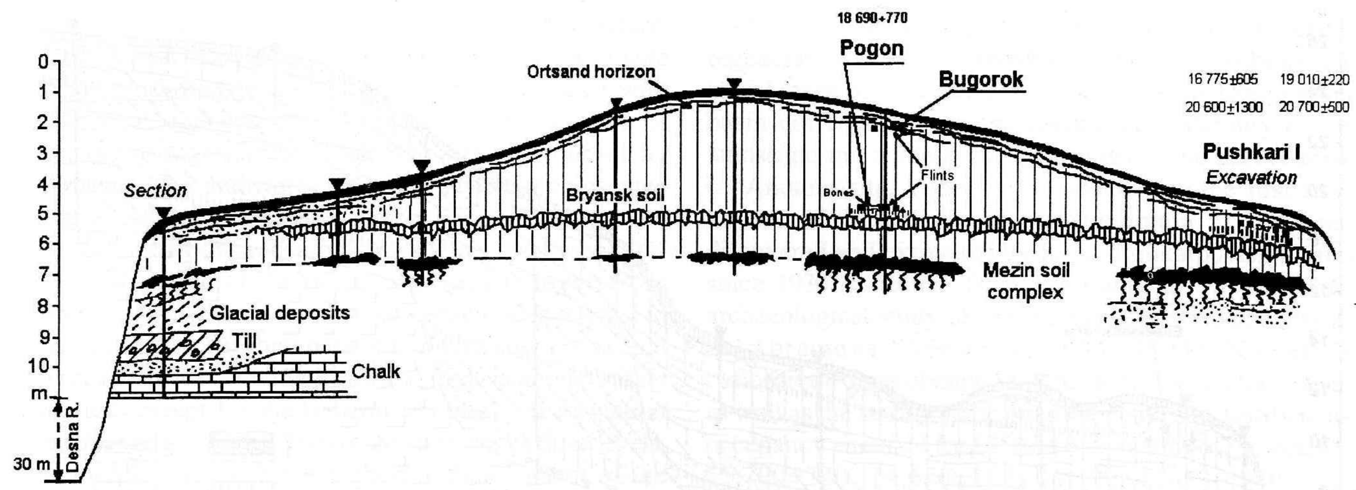

FIGURE 5. The Geological position of the Pushkari group of upper Paleolithic sites. The composite section at the sites Pushkari, Pogon and Bugorok.

watershed, with the chalk layer at the base of the slope. The stratigraphy of the sediment sequence containing the cultural layer at the site is different from that at the Khotylevo I site (Velichko *et al.* 1977a).

Khotylevo II site lies at the base of the thick layer of Valdai loess, on the promontory limited by the rim of the river bank and large balkas, cut 0.5–1 km deep into the slope of the watershed. General stratigraphic sequence of the Late Pleistocene was investigated in a number of sections and drilling cores at the promontory and up the slope from it. In the surrounding of excavations the sediment sequence is represented by loess-like sandy clay, overlying a horizon with complex pattern of cryogenic deformations which contain remains of humus matter of a fossil soil. Relation of the cultural layer to the underlying horizon with cryogenic deformations and a considerable thickness of the overlying loess (Desna Loess II) allow to come to a conclusion that the results of radiocarbon dating of mammoth bones from the site (23,600±400; 24,960±400 yr BP, see *Table 1*) correspond well to its stratigraphic age (Velichko *et al.* 1977a). The finds, connected with occupation and land-management activities of early people, are represented by mammal bones (largely those of mammoth and polar fox), charred bone and numerous flint tools. The character of the layer, enveloping underlying deposits, shows that the site has been inhabited when the surface became relatively stable, after a period of active solifluction. On the other hand, the great thickness of the overlying loess broken by a system of large polygonal cracks more than 3 m deep indicates that the permafrost existed in the area not only in the end of the Bryansk time, but also during the period when the site was inhabited, and even much later. Within the loess horizon there are two layers of incipient soil formation with a higher humus content. The lower one is close to the cultural layer and disturbed by a system of small polygonal ice cracks. Microstratigraphy of the sediments together with pollen analysis and paleofaunistic study reveal only minor landscape and climatic changes at the time when the site was inhabited and subsequently buried. Such changes were more profound at the end of loess accumulation, when large ice-wedges deeply cut into the whole sequence of overlying sediments have been formed. Therefore, the humified layers might be connected with the periods of relative stability of the surface rather than with the warmer stages.

The Late Paleolithic sites of the Pushkari group, 25 km north of Novgorod-Severskyi, are considered to be slightly younger. They are located at the large promontory, formed by Desna River valley and a broad ancient balka – Mosolov Rov. The Late Pleistocene sediments containing the cultural layers of the sites are represented by loess, fossil soil, sandy loam and sand horizons of broadly varying composition and thickness *(Figure 5)* (Velichko 1961). Judging by distribution and stratigraphy of the sediments at the promontory, their accumulation was connected with morphological structure of ancient erosion pattern. Morainic and fluvioglacial deposits of high thickness are often found in the area within the balkas cut into Cretaceous rocks and on their slopes. The Mezin soil complex and the Bryansk fossil soil are spread over the promontory rather uniformly, so that one can recreate an evolution of relief in the area. Paleoreconstructions show an irregular development of accumulation and erosion over the promontory surface. At the Pushkari I site (the ^{14}C dates 19,010±220; 16,775±605; 20,600±1300; 20,700±500 yr BP), the cultural layer is separated from the Bryansk soil by a thin layer of loess containing two slightly humified levels (initial pedogenic horizons?). The cultural layer is in turn overlain by a layer of sand one meter thick. In the central part of the promontory the Pogon site is situated (18,690±770 yr BP). Its cultural layer is buried by a loess horizon, about 5 m thick, which contains a cultural layer of the Bugorok site in its uppermost part. The flint inventory from the Bugorok site is similar to that from the Timonovka I (Velichko, Grekhova, Gubonina 1977), which is characterized by radiocarbon dates 12,200±300; 14,530±120; 14,750±120; 15,300±700 yr BP. Thus, the

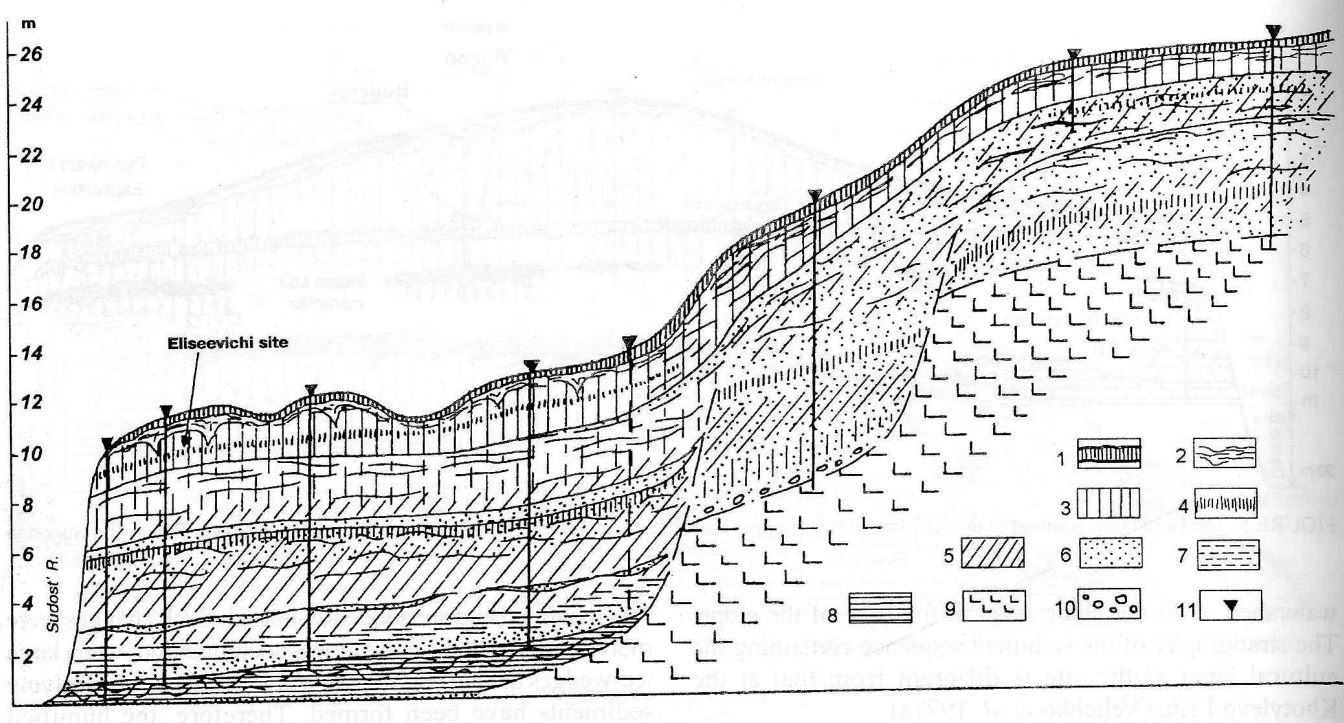

FIGURE 6. The geological profile of the Sudost' River valley. Eliseevichi I site. 1 – recent soil, 2 – ortsand horizon, 3 – loess, 4 – humic loam with traces of soil-forming processes, 5 – loam, 6 – sand, 7 – layering of sandy loam and sand, 8 – clay, 9 – marl, 10 – gravel, 11 – cores.

cultural layers of the paleolithic campsites at the Pushkari promontory occur within the loess horizon. Its accumulation has begun after the Bryansk interval and continued most intensively during the time span from the glacial maximum to the beginning of the Late Glacial. Probably, the Late Paleolithic people inhabited the site during the periods of relative stabilization of the surface.

The Late Paleolithic sites of the region were occupied during the most severe time of maximum cooling of the last glaciation. They were abandoned by people (as well as Khotylevo sites) due to local environmental changes (activation of the relief-building processes, such as gully and slope erosion, wind erosion, etc.). These changes caused considerable destruction of cultural layers and of storage pits at the sites, and also a rapid accumulation of the overburden loess-like sandy loam and sand deposits. Presumably, the sites of Pushkari group, as well as the Timonovka and Eliseevichi sites, situated farther to the north in the Desna basin, were abandoned by people just because of destabilization of the surface by these processes.

A more recent Late Paleolithic Eliseevichi site is situated in the Sudost' River valley north of Pogar, in the Bryansk region (Velichko *et al.* 1997). The locality consists of two sites: Eliseevichi I and Eliseevichi II. The first one is found at the second terrace of the Sudost' River, within a typical promontory formed by the river valley and a large balka *(Figure 6)*. The geological sequence there consists of three main facies: alluvium-floodplain sediments, alluvial-colluvial (sheet-wash) slope sediments and aeolian colluviated slope sediments, accumulated during the successive cycles of terrace development. The first evidence of human occupation at the site is represented by small debris of mammal bones and charred bones at the top of the middle layer of the colluvium, outcropping in the riverbanks. By their distribution within the interlayers of sand and sandy loam, as well as by the size and "fresh" morphology, they moved only a short distance down the slope. This gives a basis to assume that the first brief appearance of people in the region took place at the time when the site of the main Eliseevichi occupation was still a part of the flood-plain. Large ice-wedges found at the site indicate a presence of continuous permafrost in the region. It persisted over a longer period of time, when the site appeared near the transition from the alluvium-slope wash to aeolian-slope wash sediments overlying the river terrace. Radiocarbon dates obtained on mammoth bones and charred bone show that the site was inhabited during a considerable time interval. The earliest dates (17,340±170; 16, 850±120 yr BP) allow to conclude that the site existed simultaneously with the Pushkari group of sites. A series of younger dates (14,590±140; 14,240±120; 14,080±70 yr BP, and others) along with a few intermediate ones (about 15,000 yr BP) show that the site had still been inhabited when such sites as Yudinivo, Suponevo, Timonovka, and others, existed. There are also still younger dates (12,970±140; 12,630±360 yr BP) which indicate that the Upper Paleolithic people would return to the site until major changes of landscape and climate occurred during the Pleistocene/Holocene transition.

The cultural layer at the site has a complex structure, which, connected with distribution of constructions made of mammoth bones, and of storage pits, and also with subsequent deformations, appeared in the process of permafrost degradation, when the site was buried by sediments. The undisturbed cultural layer is represented by detached mammoth bones, pieces of bone charcoal and flint tools, or by their accumulations. They occur in a silty-sandy loam which forms a transitional layer from underlying alluviumslope-wash laminated deposits to overlying loess. The thickness of the latter does not exceed 1.5 m. The layer containing cultural finds is not definitely stratified, except for the horizon of initial soil formation (Velichko *et al.* 1977b). The horizon consists of three levels. The middle one, with the highest humus content of the three, corresponds to the ancient inhabited surface, while the fragmentary upper level partly overlaps some of the cultural finds. Besides, many big artificial pits (up to 2.5 m in diameter) were found at the site. Their filling is rich in large mammoth bones, bone charcoal and flints. Another type of large bone accumulations is represented by destroyed storage constructions, becoming part of the filling of the ice-wedges in the course of their degradation. Such bone accumulations form linear structures, where individual big mammoth bones are situated under steep grades towards the axis of the ice-wedge casts. These bone accumulations are thought to be of natural origin. They were formed afterwards in connection with development of cryogenic structures. The ice-wedge casts form polygonal structure on the surface of the promontory and adjacent slope of the watershed. This structure was studied in many excavations and digs. The cultural finds in association with paleocryogenic structure suggest existence of permafrost during the occupation period. Degradation of the ice-wedges begun at the early stage of the cultural layer burial by a subsequent sediment (loess) accumulation, and deformations of the cultural layer were mainly due to this process. As the result, the filling of the ice-wedges is rich in reworked artifacts, associated with economic activities of paleolithic hunters.

Similar features formed by active cryogenic processes were discovered at the Timonovka site, situated on the promontory of watershed surface. The promontory is limited by a steep bank of the Desna River and a large gully (Velichko *et. al.* 1977a). By geomorphological situation the site is close to those of Pushkari group. It is also connected with outcrops of chalk containing flint concretions. Both radiocarbon dates of the cultural layer (15,300±700; 15,110±530; 14,530±120; 14,750±120; 12,000±300 yr BP) and its stratigraphic position are similar to those of the Eliseevichi site. As well as at Pushkari, the cultural layer overlies the sequence of Late Pleistocene deposits including Mezin soil complex and fragmentary Bryansk fossil soil. The thickness of the youngest loess horizon covering the cultural layer within the promontory of Timonovka does not exceed 1.5–2.0 m in its central part (Velichko *et. al.* 1977a). As at the Eliseevichi site, there were several phases of cryogenic structure regeneration at the Timonovka site. By all probability, the initial stage of permafrost degradation in the Desna River basin corresponded to the increasing instability of the landscape and climate change during the late Last Glacial.

Another site, Yudinovo, is situated on the first river terrace of Sudost' above the floodplain. It had been discovered and excavated by K. M. Polikarpovich (1968) since 1934. Later on, from 1980 until the present time, archaeological study of the site has been conducted by Z. A. Abramova (Abramova 1993, 1995). Numerous radiocarbon dates obtained for the finds from cultural layer, as well as the stratigraphic position of the site, testify to its occupancy about 14 ky BP (the main series of ^{14}C dates is 15,790±320; 14,650±105; 14,300±110; 13,980±110; 13,300±200 yr BP and others). A few earlier dates exceeding 17 ky BP are questionable because of their provenience on a bone charcoal.

The cultural layer of the site is represented by a complex pattern of loess-like sandy loam layers enriched by animal bones (mainly of mammoth), flints and bones burnt to a various degree. The complex structure of the layer is due to variations of interlayers and lenses in thickness and genesis. Within the site area, three main geomorphological levels can be identified: the floodplain and 1st and 2nd terraces, with poorly formed sub-levels (Velichko 1961). The occupation itself was situated on the gently sloping promontory, limited by shallow gullies with secondary Late Pleistocene thermokarst depressions in their bottom parts. Both of the terraces are covered with rather thick loess-like sandy loam, the cultural layer being related to the base of the cover. Finely laminated alluviumslope-wash sands lie at the base of the river terrace.

The stratigraphic sequence of the site consists of three main layers of deposits. The lowermost layer corresponds to accumulation of alluvium on the flood-plain. The middle layer was formed during a transitional sedimentation cycle, when growing amount of mineral particles was washed down the adjacent slopes and accumulated on the floodplain occasionally subjected to river floods. The cycle being completed, a horizon of poorly developed embryonic soil was formed on the stable surface. Within the horizon the main concentration of artifacts are found. At places with large accumulations of mammoth bones, associated with remains of storage constructions and pits, various layers of the horizon are preserved in parts.

The lower layer of the humified horizon is characterized by a pattern of small polygons, formed by cracks 2–3 cm wide and 20–30 cm deep. Their origin likely relates to seasonal permafrost processes. A system of large ice-wedge casts following the ancient polygonal cracks is found at the Eliseevichi site, situated about 50 km farther north within the same valley of the Sudost' River. The data available testify to the wide spread of permafrost over the Russian Plain during the Late Pleistocene (Velichko 1961, 1973). Its boundaries were shifted much further to the south not only at the glacial maximum, but also during the Late

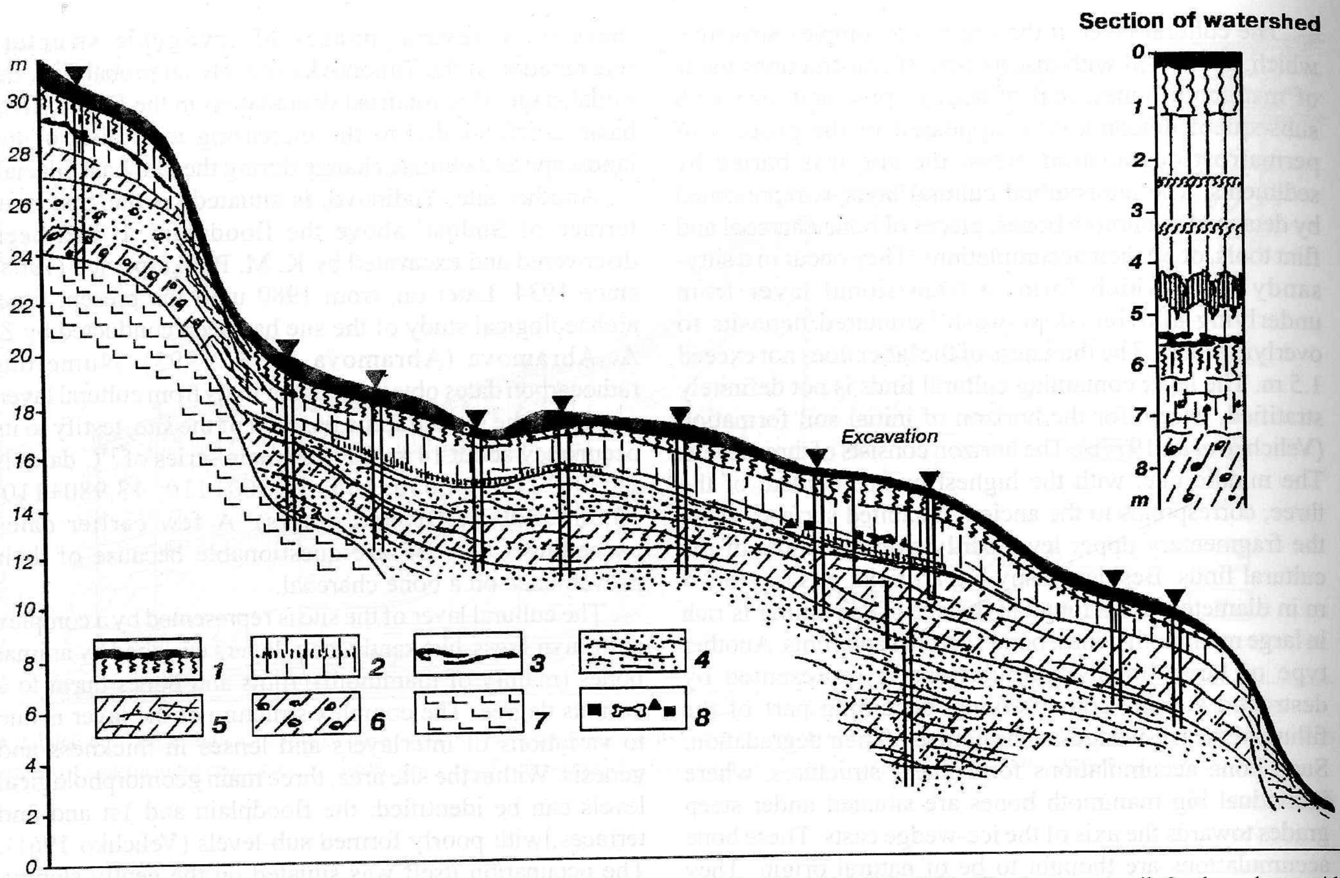

FIGURE 7. Geological cross-section of the left bank of the Ros' River with the Mezhirich Paleolithic Site. 1 – recent soil, 2 – loess loam with humic loam, 3 – humus horizon of Mezin soil complex, 4 – sand, 5 – layering of loam and sand, 6 – till of Dnieper glaciation, 7 – marl, 8 – artefacts.

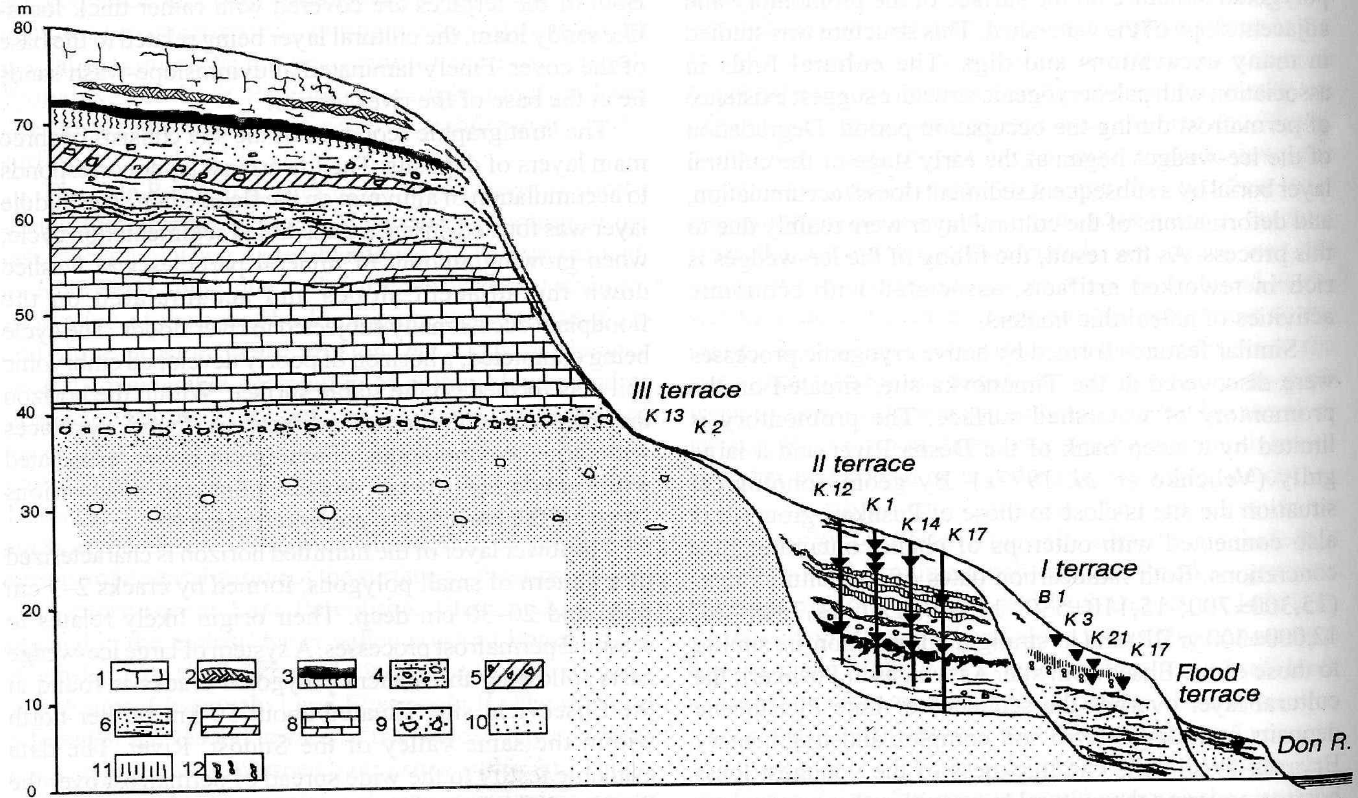

FIGURE 8. Chronostratigraphic position of the Kostenki-Borshevo Paleolithic group of sites (Don River Basin). 1 – loess loam, 2 – volcanic ash, 3 – fossil soil, 4 – fluvioglacial deposits, 5 – till, 6 – clay and sand, 7 – marl, 8 – chalk, 9 – sand of Mesozoic with phosphorites, 10 – quartz sand, 11 – humic horizon, 12 – carbonate concretions.

Glacial. Besides, the spread of cryogenic processes over the area is evidenced by numerous large saucer-like depressions. They were formed due to the melting out of hydrolaccoliths, which existed at the end of the Pleistocene.

The cultural layer at the site is dissected by a system of parallel microfaults with vertical dislocations along them. Such dislocations are of special interest, considering the permafrost development mentioned above. The microfaults were formed in the course of block sagging of underlying sediments with variable ice content, when the permafrost melted. They are oriented not toward the Sudost' River valley, but toward the saucer-like thermokarst depression closest to the site. Judging by the character of such deformation and by fractured mammoth bones in places where the cultural layer is broken by microfaults, the displacement occurred after the remains of human activities and the ancient floor of the site had been buried.

The structure and lithological features of the lower part of the loess-like sandy loam cover indicate that its accumulation took place after people had abandoned the site. The period of sedimentation coincided with the beginning of the last cycle of Late Pleistocene loess sedimentation. Though the relative relief is low within the area, at the higher topographic levels the sedimentation of wind-blown loess dust was accompanied by a permanent introduction of more clayey or sandy material washed down slopes. Similar characteristics were described at the Eliseevichi site, which is also situated near the transition from the second terrace of the Sudost' River to a gentle slope of the watershed (Velichko *et al.* 1977). During the Late Paleolithic occupation, the overall topography of the site was similar to the present-day one. Their main difference was that the promontory represented a highest spot on the flood-plain which was not flooded by the river due to a rather wide train of slope sediments, built by fans in balkas or gullies only barely visible in modern relief.

Among many of the Late Paleolithic sites in the Russian Plain, a group of sites in the Desna River basin can be distinguished *(Figure 3)*. Along with the Timonovka, Suponevo and Karachizh sites, also such well-known sites as Novgorod-Severskyi, Chulatovo, and Mezin belong to the group (Velichko 1961). For many of the above sites some radiocarbon dates are available, though their stratigraphic positions are not clear. A variety of ^{14}C dates on the Mezin site (27,500±800; 21600±2200; 15,100±200 yr BP), complicated geological and geomorphological situation of the site within the slope-wash sediments of the balka terrace make it difficult to define the stratigraphic position of the cultural layer. Nevertheless, a general stratigraphy in the region surrounding the site (Velichko *et al.* 1969) and relation of the site's level to the sequence of terraces of the Desna River indicate that the age of the site hardly exceeds 20,000 years. A great thickness of slope sediments overlying the cultural layer shows that a major change of environment, which occurred after humans had abandoned the site, caused active slope erosion, and the cultural layer was rapidly buried by slope-wash sediments.

The problem of age estimation of the Novgorod-Severskyi site is still more complicated. Presumably the site is of a Middle Pleistocene age (the final part of the Dnieper Glacial), or a little younger (Pidoplichko 1947, Velichko 1961), but the only ^{14}C date obtained on a mammoth tooth from the cultural layer (19,800±350 yr BP) testifies to the Late Paleolithic age of the site.

Comparing the geological and geomorphological situation of cultural layers at other sites of the Desna River basin and their position within the containing deposits, it can be supposed that there were two cycles in evolution of the relief-forming and sedimentation processes following the Bryansk interstadial. The first of them lasted from 18 to 16 ky BP, the second one begun around 14–13 ky BP. The composition of the Late Pleistocene loess and soil sediment sequence in various parts of the Desna basin shows that the most intensive loess accumulation took place after the Bryansk interstadial between ca 23 and 16 ky BP. The process reached its peak intensity at the maximum cooling, ca 20–18 ky BP (Velichko 1973).

The Mezhirich site can be considered as one of the most interesting sites of the final stage of the Late Paleolithic. The site is situated on the surface of a low terrace of the Ros' River adjoining a steep slope of the watershed cut by a number of large balkas and gullies. I. G. Pidoplichko (1976) discovered the site in 1965. The Mezhirich settlement consists of four unique constructions made of mammoth bones and of a series of big storage pits scattered around them. The site is located near the mouth of a large ancient gully opening into the Ros' River valley on the surface of a young terrace overlaid by an alluvial fan *(Figure 7)*. This position determined to a considerable extent the process of accumulation of deposits containing the cultural layer during the paleogeographic history of the region. The slope processes played an important role in accumulation of the lower layers of these sediments, but gradually diminishing in time. By the time when people inhabited the site the surface was no more subjected to the accumulation of alluvium as a part of flood-plain, so that it became stable. Later, a loess-like sandy loam of aeolian and slope origin was accumulated on the surface.

The complex stratigraphy, sediment facies diversity forming the slope of watershed adjoining the site influenced the composition of deposits underlying and overlying the cultural layer. On the other hand, the topography of the site area was important for the formation of the local microrelief both during the occupation of the campsite and later during its burial. Quaternary geology of the area surrounding the site is very diverse, as there are several levels of river terraces represented in fragments along the steep slope of the watershed. Sediments washed from balkas and slopes are found in combination with alluvium. Glacial and fluvioglacial deposits of the Dnieper Glaciation overlying Paleogene sediments are widespread over the watershed surface. Their thickness exceeds 20 m at places. The mineral composition of Late Pleistocene loess-soil series represented by Mezin and Bryansk fossil soils

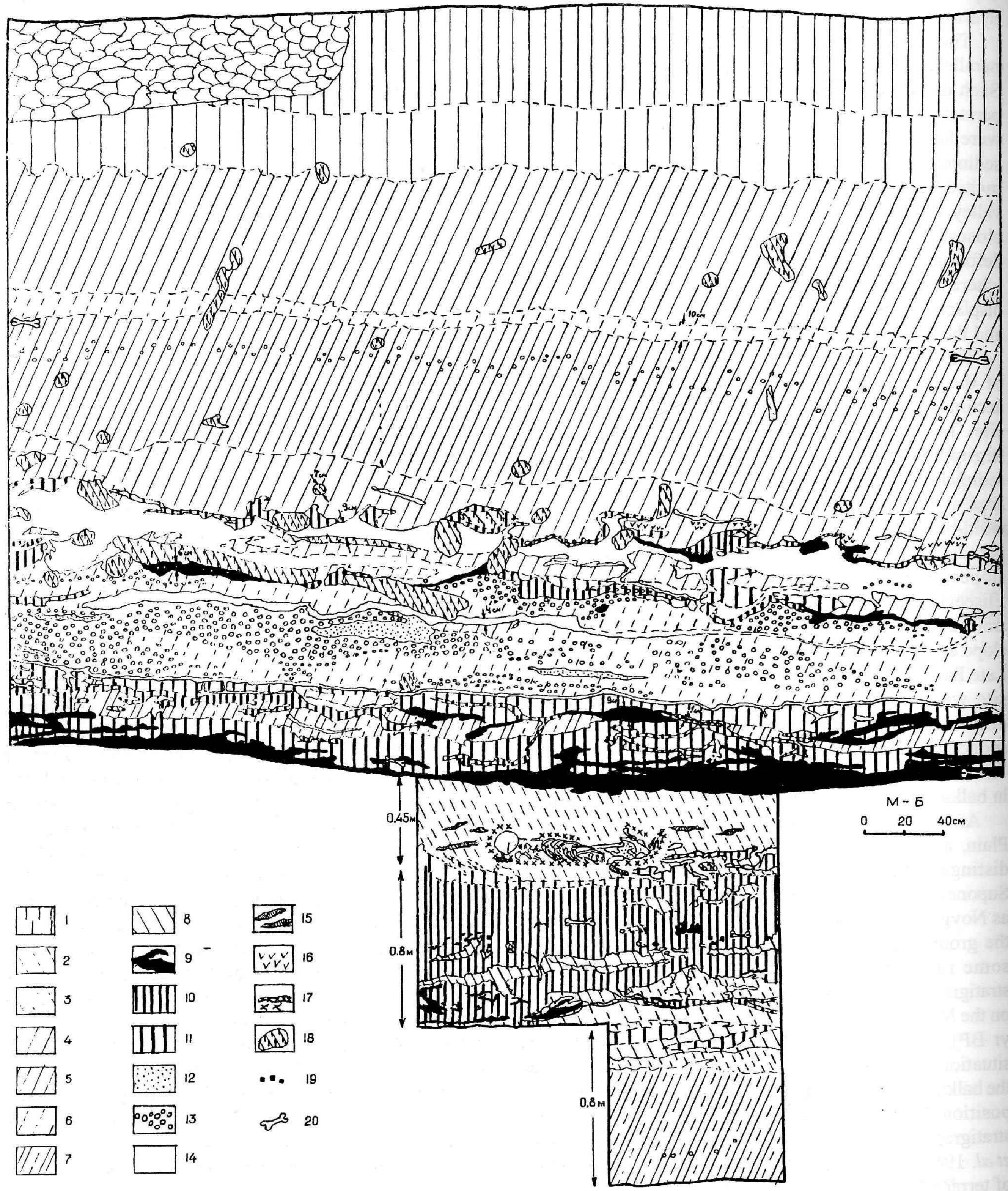

FIGURE 9. Kostenki XIV. 1 – horizons A-B recent soil, 2 – loam greyish, 3 – loam grey light, 4 – loam grey-brown light, 5 – loam grey-brown, 6 – loam light, 7 – loam grey-brown, 8 – loam grey, 9 – loam very humic, 10 – loam average humic, 11– loam weakly humic, 12 – sand, 13 – chalk fragments, 14 – loam light with chalk fragments, 15 – volcanic ash, 16 – ferruginization, 17 – carbonate concretions, 18 – krotovinas, 19 – wood charcoal, 20 – cultural layer.

interleaved by loess I and overlain by Late Valdai loess is relatively uniform, which suggests a homogenous source of initial disintegrated rock matter. Minor lithological difference between the loess and fossil soil horizons is due to the diagenetic changes and intensity of accumulation.

The Mezhirich site situated at one of the first terrace levels of the Ros' River is characterized by a peculiar texture of sediments. Due to combined processes of alluvial and slope accumulation that were most active shortly before the human occupation, the sediment sequence underlying the cultural horizon is represented here by interlaid silty-clay and silty-sand layers of various thickness. At the upper part of the section at least two slightly humified levels can be seen, possibly corresponding to the stages of greater stability of the surface and development of a thin ephemeral soil. More uniform sediments, immediately underlying the cultural layer, indicate that by the time of the human inhabitation the site became sufficiently stable and was no more subjected to flooding by the river. The cyclic character of sedimentation is manifested by unclear or concealed lamination, as well as by thin darker layers possibly related to cycles of ephemeral soil formation. Cryogenic deformations represented by microfractures forming a pattern of small polygons are associated with those darker layers.

The layer containing artifacts is rather thick due to the settlement structure, microrelief of the surface and economic activities of Paleolithic people. The sediments of the cultural layer are similar to those of overburden. During the entire occupation, the sedimentation process was steady and slow. The site was buried because of an increased accumulation of loess.

The Don River basin

Well-known sites of the Kostenki-Borshchevo region located within a rather small area 10–15 km across on the right-hand side of the Don River are highly significant in the history of Late Paleolithic occupation of the Russian Plain. More than fifty Late Paleolithic campsites were found within the area. The data throwing light on the geological and geomorphological features of the region, as well as those characterizing individual sites, were published by M. N. Grishchenko (1939, 1950), G. I. Lazukov (1954, 1957), A. A. Velichko (1961, 1963), and lately by I. I. Krasnov (1980). The works by P. P. Efimenko (1915, 1958 and others), A. N. Rogachev (1958, 1965 and others), P. I. Boriskovski (1963), N. D. Praslov (1964), M. V. Anikovich (1993), and also the monograph "The Paleolithic of the Kostenki-Borshchevo region on the Don River"(1982) contain numerous data of geochronological character.

The paleolithic campsites are associated with the low terraces of the Don River and large balkas. Only a few sites (Kostenki XIII and some others) were located on the higher terrace (30–35 m high) within a sequence of sheet-wash slope sediments, and sometimes also on the surface of the Senoman sandy deposits *(Figure 8)*. The sediment sequence of the second terrace (28–25 m high) is the most complex. It contains two humified layers with lenses of volcanic ash in between. The upper layers of these deposits were affected by slope wash as evidenced by a general inclination of beds corresponding to the slope angle. Besides, the undulated texture of the humified layers indicate that they were distorted by cryogenic processes. Absences of distortion in both the cultural horizons and the overlying clays show that they were formed after the permafrost deformations.

The composition of colluvial deposits overlying alluvium of the second terrace in both the Don valley and in balkas reveals certain common features. One of the typical sections shows a close similarity with the site Kostenki XIV (Markina Gora), situated about 2–2.5 km from the valley *(Figure 9)*. The upper humified horizon, consisting of three layers separated by a whitish marl containing light-pale loam interlayers, is found there at the depth of 2.4–4 m under light gray-brown loam. The humified interlayers and lenses, just as at the Kostenki XVII site in the Don valley, are deformed and undulating due to solifluction processes. Their bases bear tongue-like ledges and veins indented into underlying sediments. At the depth of 4.10–4.15 m lenses of volcanic ash were found. The lower humified horizon lies within the depth interval from 4.4 to 4.9 m. It is represented by less disturbed interlayers of loam with medium humus content. Judging from its structure, one can assume that in this sediment sequence, as well as in some other sections, the lower humified horizon has certain features of an initial pedogenic development that was subsequently subjected to a minor slope displacement.

In general, the Kostenki sites can be divided into two essential age generations. The earlier occupation includes the sites situated on the second terrace, the more recent those located on the first terrace (see *Figure 8*). The majority of multilayered sites belong to the first generation. All of them occur in the upper part of sediment sequence of the second terrace, from the lower humified horizon up. There are three main chronological groups within the generation. The first consists of the earliest sites as determined according to both archaeological and radiocarbon data. The cultural layers of these sites are correlated with the lower humified horizon. The sites Kostenki I (Layer 5), V (L. 3), VI, VIII (L. 4), XII (L. 2, 3), XIV (L. 4), and XVII (L. 2) belong to this group. According to calibrated radiocarbon dates (Damblon, Haesaerts, Van der Plicht 1996), their ages are within the time span from 32(33) to 27 ky BP.

The second chronological group lies in the upper humified horizon, separated from the lower horizon by a layer of loam with lenses of volcanic ash. The group consists of sites Kostenki I (L. 3), VIII (L. 2,3), XII (L. 1,2), and XVII (L. 1). The radiocarbon age of these sites is within the range 22–20 ky BP. Finally, the sites of the third, youngest group occur in the loam overlying the upper humified horizon. It includes Kostenki I (L. 1–3), VIII (L. 1), XIV (L. 1, 2) and some other sites. Their radiocarbon ages are within the time span from 22 to 20 ky BP.

Some sites related to the loam layer of the younger first terrace (about 10–12 m high) are contiguous to the above group. In the slope-wash deposits overlying the terrace such sites as Kostenki XIX, III, XXI, IV, VI, Borshchevo I, II, III, and Rudkino are located. For a long time, only the position of sites forming the latter group in the sediment sequence of the first terrace was used to estimate their relative age, taking into consideration the height of the terrace. Later, ephemeral soil formation horizons were detected (Anikovich 1997, Praslov 1964, Velichko 1961) which are now used for correlation of cultural layers of single occupation sites. For example, the cultural layer of Kostenki XIX has an age close to the lower cultural layer of Kostenki XXI. Similarly, the age of the upper cultural layer of Kostenki XXI, which lies at the upper part of the same horizon, is close to that of the site Kostenki III. The time span of the sites situated on the first terrace is from 22 to 12 ky BP.

Radiocarbon data suggest that the sites of the first and second age groups correspond to the chronological interval of the Bryansk interstadial. This conclusion is supported by paleobotanical data (Fedorova 1963). The latter show that the pollen zone, including both lower and higher humified horizons, corresponds to a single phase of climate warming when periglacial steppe vegetation was replaced by forest including some broad-leaved trees. The beginning and the end of this warm interval were marked by development of cryogenic processes, mostly by solifluction.

The third age group of the Kostenki sites corresponds to the subsequent, post-Bryansk period of the Late Pleistocene when periglacial conditions were re-established over the Russian Plain with one minor climatic amelioration phase. This is manifested by traces of soil formation in the sequence of slope-wash deposits on the first terrace above the Don River.

The Oka River basin

The Zaraisk site is located on a high slope on the right bank of the Osetr River, the right tributary of Oka. The region of the site belongs to the eastern slope of the Central Russian Uplands. The cover of the Late Pleistocene deposits in the region is thin. They are represented by the Valdai loess and loess-like loam interstratified by Mezin and Bryansk fossil soils with a total thickness of 1.5–2.0 m. These horizons are easy to trace in many sections in the Oka River basin because of characteristic features of the soil profiles. The loess corresponds by the grain size distribution to a light loam with a varying content of sand, thus representing a northern form of loess of the Russian Plain. The Mezin and Bryansk soils separating the loess horizons have distinct morphological features (Velichko, Morozova 1972).

The geomorphic and stratigraphic situation of the cultural layer of Zaraisk site is characterized by location on a gentle slope of the watershed forming a promontory delimited by a deeply incised gully and a gently sloping balka. Ancient gullies and balkas in the region are filled with rather thick loess-like loam deposits interbedded by fossil soil horizons. Generally such soils are not automorphic, so they have a specific structure. Besides, the traces of sediment redeposition down-slope can be found in the soil sections on the sides of gullies. As the result, a structure of soil profile can vary even within a short distance along the slope. The loess-like loam interlaying the soils also bears traces of slope accumulation, such as lamination and non-homogeneous composition of the sediments.

At the upper part of the section, in the layer of weakly developed fossil soil, fragments of large bones and flints connected with the cultural layer of a campsite were found. The radiocarbon date of this soil is 18,900±200 yr BP. The underlying layer of humified loam is considerably disturbed by cryogenic deformations. The upper soil profile can be correlated with a soil horizon found at the Pushkari I site above the Bryansk soil, based on its morphology and stratigraphic position. The layer of loess-like loam overlying the soil is thin, which is characteristic of the Late Valdai loess in the Oka River catchment. Judging by its granulometric composition, porosity and content of carbonates, the loess loam was formed by aeolian processes combined with active slope accumulation. By their properties these sediments are identical to a thin cover of loam overlying the cultural layer in the main excavation. Stratigraphy of the section indicates that conditions of sedimentation in both watershed areas and at the site were relatively stable, even within numerous ancient balkas and gullies, during the entire Middle and Late Pleistocene. It is assumed that such a stability of the surface at the site was the main criterion for establishment of the paleolithic site.

The upper cultural layer is related to the bottom part of the loess-like loam overlying a mottled horizon of interstratified sands and loams. The transition between these two layers is distinctive by colour and composition of sediments. It forms an uneven surface with scattered cauldron-like depressions of various depth and diameter. Some of these penetrate through the whole mottled horizon. They were possibly associated with human activities. Radiocarbon dates on mammoth bones and a charred bone fall into three groups: 15-16 ky, 18-19 ky, and 21–22 ky BP *(Table 1)*. Small fissures 10–15 cm wide penetrate through the layer, separating it into blocks. The fissures are occupied by medium-grained ferruginous clayish sand. In the middle part of the layer, fragments of a finely laminated grayish mottled loam can be found. The loam is saturated with dust carbonates and spotted with dove-coloured gleyed and brown ferruginous mottles typical of an incipient pedogenic horizon.

TABLE 1. Radiocarbon dates of Upper Paleolithic sites on East-European plain.

Sites	Dates	Lab. No.	
Yudinovo	12 300 ± 200	OxA - 696	Bone charcoal
- " -	13 300 ± 200	OxA - 695	Bone charcoal
- " -	13 650 ± 200	LU - 153	Bone
- " -	13 720 ± 210	LE - 3303	Bone
- " -	13 830 ± 850	LU - 103	Bone charcoal
- " -	13 980 ± 110	ISGS - 2085	Bone
- " -	14 300 ± 110	ISGS - 2084	Bone
- " -	14 470 ± 160	AA - 4801	Bone charcoal
- " -	14 500 ± 200	GIN - 5588	Bone charcoal
- " -	14 610 ± 60	GIN - 5661	Bone charcoal
- " -	14 650 ± 105	AA - 4802	Bone charcoal
- " -	15 660 ± 180	LU - 127	Bone
- " -	15 790 ± 320	LE - 3301	Bone
- " -	17 800 ± 810	LE - 3302	Bone charcoal
- " -	18 630 ± 320	LE - 3401	Bone charcoal
Eliseevichi I	12 630 ± 360	GIN - 4137	Mommoth tooth
- " -	12 970 ± 140	LU - 102	Bone charcoal
- " -	14 080 ± 70	GIN - 4135	Bone charcoal
- " -	14 100 ± 400	GIN - 4139	Mommoth tooth
- " -	14 240 ± 120	GIN -. 5475	Bone charcoal
- " -	14 470 ± 100	LU - 126	Mommoth tooth
- " -	14 590 ± 140	GIN - 4186	Mommoth tooth
- " -	16 850 ± 120	GIN - 4138	Mommoth tooth
- " -	17 340 ± 170	LU - 360	Mommoth tooth
- " -	15 600 ± 1350	QC - 889	Bone charcoal
Eliseevichi II	15 620 ± 200	IGAN - 556	Mommoth tooth
Khotylevo II	23 660 ± 400	LU - 359	Mommoth tooth
- " -	27 024 ± 960	IGAN - 73	Mommoth tooth
Timonovka I	12 200 ± 300	IGAN - 86	Mommoth tooth
- " -	14 530 + 120	GIN - 8414	Mommoth tooth
- " -	14 750 + 120	GIN - 120	Mommoth tooth
Timonovka II"	15 300 ± 700	GIN - 2003	Bone
- " -	15 110 ± 530	LU - 358	Mommoth tooth
Suponevo	13 500 ± 100	GIN - 3381	Bone
- " -	14 260 ± 120	GIN - 3719	Bone
Chulatovo I	14 700 ± 250	OxA -	Mommoth tooth
Pushkari I	16 775 ± 650	QC - 899	Bone
- " -	19 010 ± 220	AA - 1389	Bone
- " -	20 600 + 1300	GIN - 8529	Mommoth tooth
- " -	20 700 + 500	GIN - 8529A	Mommoth tooth
Pogon	18 690 ± 770	LU - 361	Mommoth tooth
Novgorod-Severskyi	19 800 ± 350	OxA - 698	Mommoth tooth
Mezin	15 100 ± 200	OxA - 719	Mommoth tooth
- " -	21 600 ± 2200	GIN - 4	Mommoth tooth
Berdyzh	15 100 ± 250	OxA - 716	Mommoth tooth
- " -	23 430 ± 190	LU - 104	Mommoth tooth
Yurovichi	26 470 ± 420	LU - 125	Mommoth tooth
Radomyshl	19 000 ± 300	OxA - 716	Mommoth tooth
Gontsy	13 200 ± 270	ISGS - 1740	Bone
- " -	13 400 ± 180	QC - 898	Mommoth tooth
- " -	14 350 ± 190	ISGS - 1739	Bone
- " -	14 600 ± 200	OxA - 717	Mommoth tooth
Dobranichevka	12 700 ± 200	OxA - 700	Mommoth tooth
Kirillovskaya	19 200 ± 250	OxA - 718	Mommoth tooth
Mezhirich	12 900 ± 200	OxA - 709	Mommoth tooth
- " -	14 300 ± 300	GIN - 2596	Bone
- " -	13 320 ± 270	QC - 897	Mommoth tooth
- " -	14 400 ± 250	OxA - 712	Mommoth tooth
- " -	14 420 ± 190	AA - 1317	Mommoth tooth

Sites	Dates	Lab. No.	
- " -	14 530 ± 300	GIN - 2595	Bone
- " -	14 700 ± 500	GIN - 2593	Mommoth tooth
- " -	15 245 ± 1080	QC - 900	Mommoth tooth
- " -	17 355 ± 950	KI - 1054	Bone
- " -	18 020 ± 600	KI - 1055	Mommoth tooth
- " -	18 470 ± 550	KI - 1056	Bone
- " -	19 280 ± 600	KI - 1058	Bone
Avdeevo	16 565 ± 270	QC - 621	Bone
- " -	16 960 ± 420	QC - 886	Bone
- " -	17 200 ± 1800	GIN - 1571A	Bone charcoal
- " -	19 800 ± 1200	GIN - 1570	Bone
- " -	20 100 ± 500	GIN - 1746	Bone
- " -	20 800 ± 200	GIN - 1747	Bone
- " -	21 000 ± 200	GIN - 1748	Bone
- " -	21 200 ± 200	GIN - 1569	Bone
- " -	22 200 ± 700	GIN - 1970	Bone
- " -	22 400 ± 600	GIN - 1969	Bone
- " -	22 700 ± 700	GIN - 1571	Bone
Gagarino	17 930 ± 100	LE - 1432A	Bone
- " -	20 150 ± 300	LE - 1432Á	Bone
- " -	20 620 ± 300	LE - 1432B	Bone
- " -	21 800 ± 300	GIN - 1872	Bone
- " -	30 000 ± 1900	IGAN - 83	Bone charcoal
Kostenki I (layer 1)	18 230 ± 620	LE - 3280	Bone charcoal
- " -	19 010 + 120	LE - 2950	Bone charcoal
- " -	19 540 + 580	LE - 3292	Bone charcoal
- " -	19 860 + 200	LE - 2949	Mommoth tooth
- " -	20 100 + 680	LE - 3277	Bone charcoal
- " -	20 315 + 200	AA - 4800	Bone charcoal
- " -	20 855 + 260	AA - 4799	Bone charcoal
- " -	21 330 + 400	GIN - 2534	Bone charcoal
- " -	21 680 ± 700	LE - 3279	Bone charcoal
- " -	22 020 + 310	LE - 3282	Mommoth tooth
- " -	22 300 + 230	GIN - 1870	Bone charcoal
- " -	22 300 + 200	GIN - 2533	Bone charcoal
- " -	22 700 + 250	LE - 2969	Mommoth tooth
- " -	22 760 + 250	LE - 2800	Teeth mammont
- " -	22 800 + 200	GIN - 2530	Bone charcoal
- " -	23 000 + 500	GIN - 2528	Bone charcoal
- " -	23 010 + 300	LE - 3276	Mommoth tooth
- " -	23 260 + 680	LE - 3289	Mommoth tooth
- " -	23 500 + 200	GIN - 2527	Bone charcoal
- " -	23 640 + 920	LE - 3283	Tusks
- " -	23 770 + 200	LE - 2951	Mommoth tooth
- " -	24 100 + 500	GIN - 2529	Bone charcoal
Kostenki I (layer 3)	24 500 + 1300	GIN - 4850	Charcoal
- " -	25 600 + 1000	GIN - 4852	Charcoal
- " -	25 730 + 1800	LE - 3541	Charcoal
- " -	25 900 + 2200	GIN - 4899	Cultural layer
- " -	26 200 + 1500	GIN - 4885	Charcoal
- " -	38 080 + 5460	AA - 5590	Wood charcoal
Kostenki I (layer 4)	27 390 + 300	LE - 2030	Mommoth tooth
Kostenki 2	11 000 + 200	GIN - 93	Bone
- " -	16 190 + 150	LE - 1599	Bone
Kostenki 8	27 700 + 750	LE - 1509	Wood charcoal
- " -	27 700 + 750	GrN - 10509	Charcoal
Kostenki XI (layer 1a)	12 000 ± 100	LE - 1403	Bone
- " -	14 610 ± 120	LE - 1637	Bone
- " -	17 310 ± 220	LU - 1704B	Bone

Sites	Dates	Lab. No.	
-"-	19 900 + 350	GIN - 2532	Bone charcoal
Kostenki XI (layer 2)	21 800 ± 200	GIN - 2531	Bone
Kostenki XI (layer 3)	22 760 ± 340	LE - 1638	Bone
Kostenki XII	20 900 ± 390	TA - 157	Bone
-"-	23 060 ± 300	GIN - 89	Bone
-"-	30 240 ± 400	LE - 1428B	Mommoth tooth
-"-	31 900 ± 200	LE - 1428G	Bone
-"-	32 700 + 700	GrN - 7758	Charcoal
Kostenki XIV	22 780 + 250	OxA - 4114	Bone
-"-	25 909 ± 310	LE - 1400	Bone
-"-	26 400 + 660	LU 59A	Bone
-"-	28 380 + 220	GrN - 12598	Charcoal
-"-	28 200 ± 700	LU - 59B	Bone
-"-	28 580 + 420	OxA	Bone
Kostenki XV	21 720 + 570	LE - 1430	Bone
Kostenki XVI	25 100 + 150	LE - 1431	Bone
Kostenki XVII	26 750 ± 700	LE - 10511	Charcoal
-"-	32 200 + 2000	GrN - 10512	Charcoal
-"-	32 780 ± 300	LE - 1436	Bone
-"-	36 400 ± 1700	GrN - 12596	Charcoal
Kostenki XIX	17 420 ± 150	LE - 1705A	Bone
-"-	18 900 ± 300	LE - 1705B	Bone
Kostenki XXI	20 250 ± 100	LE - 1437B	Bone
-"-	22 270 ± 150	LE - 7363	Wood charcoal
-"-	22 900 ± 150	LE - 1437B	Wood charcoal
Molodova V (1a)	10 590 + 230	GIN - 7	Bone
-"-	10 940 + 150	GIN - 54	Charcoal
(layer 2)	11 900 + 230	GIN - 8	Bone
-"-	12 300 + 140	GIN - 56	Charcoal
(layer 3)	13 370 + 540	GIN - 9	Charcoal
-"-	17 100 + 1400	GIN - 147	Charcoal
(layer 7)	23 000 + 800	MO - 11	Wood charcoal
-"-	23 700 + 320	GIN - 10	Soil
(layer 9)	29 650 + 1320	LG - 15	Charcoal
Korman' IV	24 500 + 500	GIN - 1099	Wood charcoal
-"-	27 500 + 100	GIN - 832	Soil

Sites	Dates	Lab. No.	
Amvrosievka	15 250 ± 150	LE - 1637	Bone
-"-	20 620 ± 150	LE - 1805	Bone
-"-	21 500 ± 340	LE - 3403	Bone
Anetovka II	19 170 ± 120	LE - 2947	Bone
-"-	18 040 ± 150	LE - 2424	Bone
-"-	18 265 ± 1650	LE - 4066	Bone
-"-	19 090 ± 980	LE - 4610	Bone
-"-	24 600 ± 150	LE - 2624	Mommoth tooth
Muralovka	18 780 ± 300	LE - 1438	Bone
-"-	19 630 ± 200	LE - 1601	Bone
Sagaidak	20 300 ± 200	LE - 1602B	Cultural layer
-"-	21 240 ± 200	LE - 1602A	Cultural layer
Zolotovka	17 400 ± 150	GIN - 1938	Bone
Leski	19 200 ± 200	LE - 200	Cultural layer
-"-	23 770 ± 1540	LE - 4456	Cultural layer
Sungir	21 800 ± 1000	GIN - 326A	Charcoal
-"-	22 500 ± 600	GIN - 326B	Charcoal
-"-	24 430 ± 400	GrN - 5446	Charcoal
-"-	25 500 ± 200	GrN - 5425	Bone
-"-	27 700 ± 500	GIN - 5880	Bone
Rusanikha	27 180 ± 340	IGAN - 555	Mommoth tooth
Zaraisk	15 600 ± 300	GIN - 6095	Bone charcoal
-"-	16 200 + 1000	GIN - 2487	Bone charcoal
-"-	18 300 ± 200	GIN - 3727	Mommoth tooth
-"-	19 000 + 200	GIN - 8975	Bone charcoal
-"-	19 100 + 260	GIN - 8397	Bone charcoal
-"-	19 100 + 200	GIN - 8396	Bone charcoal
-"-	19 200 + 300	GIN - 8486	Bone charcoal
-"-	19 900 + 260	GIN - 8484	Bone
-"-	21 000 + 430	GIN - 8975	Bone
-"-	21 400 + 500	GIN - 8488	Bone charcoal
-"-	22 300 ± 300	GIN - 3998	Mommoth tooth
Byzovaya	18 320 ± 280	TA - 121A	Bone
-"-	25 450 ± 380	TA - 121B	Bone
-"-	25 740 ± 500	LE - 3047	Bone
Medvezh'ya	16 130 ± 150	LE - 3060	Bone
Talitskogo	18 700 ± 200	GIN - 1997	Mommoth tooth

PALEOENVIRONMENTS OF THE PALEOLITHIC OCCUPATION OF THE RUSSIAN PLAIN

Based on the existing records, it can be concluded that the first Mousterian sites appeared in the southern part of the Russian Plain along with the final Acheulian sites during the Mikulino Interglacial (OIS 5). During the first part of the Valdai (Wistulian) Glaciation (OIS 4), the Mousterian people did not migrate, but tended to stay in the area by adapting to the initial climatic deterioration of the last glacial. This environmental adjustment was facilitated by a gradual transition from interglacial to pleniglacial. At the beginning of the Valdai Glaciation, the first cryogenic horizon was evidenced, rather warm conditions were resumed over the Russian Plain correlated with the Krutitski Interstadial (possibly corresponding to Verkhnevolzhsk / Brorup / Amersfort Interstadials). The Early Valdai Glaciation was characterised by a climatic instability and diversity of landscapes with copmplex pattern of open grassland and forested parkland. In such "para-periglacial" conditions, still further ameliorated during long warm interstadials, some Mousterian groups penetrated farther to the north, as evidenced by the Khotylevo I campsite. Nevertheless, the southern part of the Russian Plain was the main occupation area during this period. There, paleolithic people survived through more severe conditions established at the beginning of Middle Valdai Stage (OIS 3), though some phases of a relative climatic amelioration close to interstadials occur at that period. Such phases were rather cool, as climatic oscillations were manifested mainly in changes of humidity, rather than of temperature.

The Mousterian groups were replaced by Late Paleolithic ones while the continentality of climate over the Plain was increasing prior to the most pronounced interstadial of the Middle and Late Valdai stages – the Bryansk Interstadial fixed by radiocarbon dates between 30–32 ky and 24–25 ky BP, and likely corresponding to the Denekamp Interstadial. Several areas with specific features of geographical and age distribution of the sites may be distinguished on the Plain. In the middle Dniester River valley, the sites make a compact group indicative of stable (continuous) peopling of the area. An important feature of human occupation in the region is that there is usually a sequence of cultural layers at one site formed throughout the Late Pleistocene. Based on modern data, the Dniester region is the only part of the East European Plain with an autochthonous development from the Mousterian (and even Acheulian) to Late Paleolithic culture and possibly even later stages.

The primary peopling of the middle Don River area has its peculiarities. By the absence of Mousterian sites, the local Late Paleolithic occupation implies an allochthonous element in emergence of people in the region, despite the fact that overall the Late Paleolithic stage has a pronounced autochthonous character over the entire region. The Late Paleolithic multi-layer sites are concentrated within a small area (12 km across) on the right bank of the Don River near the Kostenki and Borshchevo villages. There are no sites in the surrounding area, the Gagarino campsite on the Upper Don and those in the Azov-Lower Don region are geographically the closest. A different interaction between early people and the territory existed in the Dnieper River basin. There are no places with high concentrations of multi-layered sites, with the Pushkari site on the Middle Desna being the only exception. The sites are scattered all over the middle and upper Dnieper River basin.

It is evident that several forms of Paleolithic occupation in relation to the local environment of the East European Plain can be distinguished. Insular concentrations of many multi-layered sites within a small area represent the first Late Paleolithic occupation form. This, however, has also been documented in the middle Dnieper basin where it developed successively since the Mousterian Stage suggesting an autochthonous process of peopling *(sensu lato)*. In another case (the middle Don basin), the territory was colonized at the very beginning of the Late Paleolithic (i.e. allochthonously). The local settlement in the region persisted throughout the major part of the Late Valdai Glaciation. In the Dnieper region, the population was dispersed and the sites with a single cultural layer prevail, thus indicating that the peopling process was of a migration type. In sum, three forms of primary peopling in the East European Plain can be distinguished: predominantly autochthonous, autochthonous with an allochthonous initial stage, and a dispersed migration form (Velichko 1993).

This settlement pattern variety seems to reflect local paleoecological factors. In the case of the insular autochthonous type, available hunting resources provided stable existence of residence around the year. The migration type was probably determined by the necessity of a more effective seasonal hunting (also Soffer 1985).

Environmental conditions were not uniform throughout the Upper Paleolithic. Three main paleoecological stages may be recognized within this cultural stage *(Figure 10)*. The first stage, the Bryansk Non-Glacial Interval (OIS 3), was characterized by a less continental climate than the

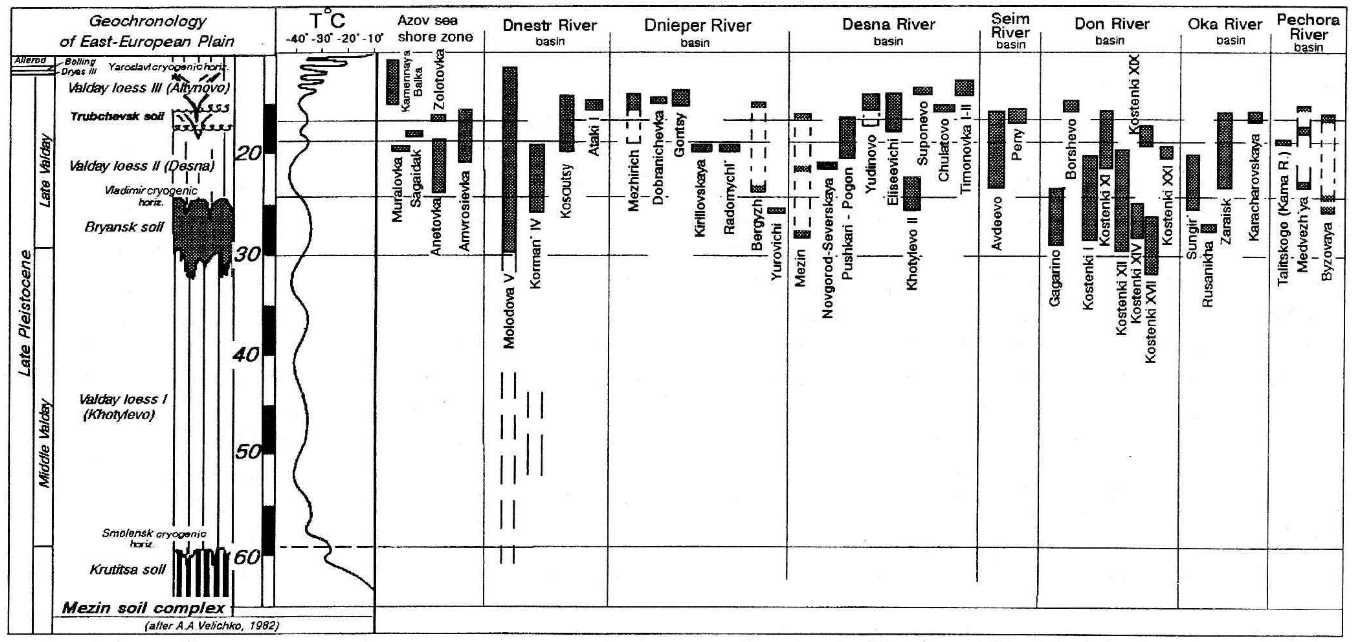

FIGURE 10. Chronological position of main Upper Paleolithic sites of the East European Plain.

following glacial stage. Along with a tundra-steppe vegetation, arboreal species were distributed in the central part of the Plain. Winter temperatures were close to –25–30°C, summer temperatures about 16–18°C. The following glacial stage (OIS 2), lasting from 24–25 ky to 13–14 ky, was the most severe. The periglacial steppe dominated in the landscape, whereas some cold-adapted arboreal vegetation was restricted to some valleys. The permafrost polygonal relief was widespread, winter temperatures were especially low (–30–40°C), as was precipitation both in summer and in winter (with average annual values of 250–350 mm). The local paleolithic occupation is characterized by dwellings made of mammoth bones, often in combination with earth. The third stage includes the last Late Glacial characterized by a minor amelioration of climate followed by a series of abrupt climatic oscillations leading to restructuring of ecosystems from 13–12.5 ky BP. This climate change disturbed the established hunting pattern, requiring more intensive adaptations. At that time, the first Mesolithic cultures have appeared as a result of the economy transformation during the Pleistocene/Holocene transition. A final disintegration of the cryoperiglacial steppe zone and a rapid expansion of the forest zone occurred at the beginning of the Holocene (10,300 yr BP according to the modern time scale).

In sum, the chronological, geological and geomorphological distribution of the sites show that even the most extreme environment conditions of the periglacial zone were sufficiently favourable for the paleolithic occupation. Possibly, they were even more favourable than those of warming stages, such as during the final glacial stage when the transition from periglacial to warmer conditions resulted in destabilization of the surface and landscapes and thus the former and highly productive food procurement strategies. It can be assumed that the choice of the campsite within a limited geographical area was determined by a diversity of paleorelief and sedimentation processes. Such diversity can be clearly seen at the promontory of the Pushkari site, for example. Before the Bryansk Interstadial when the fossil soil was formed, the surface was subjected to a rather uniform geomorphological formation. During the following period, the surface was developing in different ways so the former position of the campsite near the centre of the promontory was no more attractive and later campsites were transferred to its periphery. Similar shifts in residential places within a limited settlement area were found at other sites in the Desna River region (Eliseevichi, Yudinovo) and on a broader scale in Kostenki in the Don River basin. From the features of cultural layers at these sites, it is hard to believe that their transfers were caused by irreversible anthropogenic disturbances of the inhabited surface. Most probably, the regime of erosion and accumulation was changing with time, whereas the influence of human economic activities was insignificant.

While considering the distribution of Late Paleolithic sites over the Russian Plain, their higher concentration in certain regions attracts attention. The highest concentrations are found in the valleys of small rivers, belonging to basins of the Dniester, Bug, Dnieper, Desna, Seim, Oka, and Don Rivers. In spite of their permanent geographical connection with the East European Plain, peopling of these areas became distinctive only during the final Late Paleolithic stage (ca between 15 and 12 ky BP).

Certain stages of peopling the East European Plain by early human groups can be traced by the distribution of the sites within river valleys. Though geomorphological situations of the individual sites are very diverse, some regularities are evident. During the Acheulian Stage, the prevailing was an ephemeral form of occupation of an "exploratory" character. During the Mousterian Stage, only the south-westernmost regions of the Plain were steadily occupied, with some marginal penetration into the central part of the East European Plain. Finally, during the Late Paleolithic, the area experienced a more stable and expanded occupation that included a major part of the territory, except for its north-western and Trans-Volga region. Apart of this general trend, three separate stages of Late Paleolithic peopling may be distinguished (Velichko *et al.* 1992, Kurenkova *et al.* 1995), corresponding to time intervals of ca: 30–24 ky, 23–17 ky, and 16–13 ky BP, respectively.

CONCLUSION

The current studies of interaction between the early human communities and the natural environment over the large territory in the course of the initial colonisation reveal the important role played by the "basin principle" of settlement. This process was essentially predetermined not only by migration routes, but also by a number of other factors, such as the local geomorphological settings, the interaction between ecosystems and economic complexes, etc. Further interdisciplinary geoarchaeological and geochronological investigations should bring new evidence to elucidate timing, forms and specific conditions of the paleolithic occupation of the Russian Plains.

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