THE RESULTS OF UNDERWATER EXCAVATIONS AT SERTEYA II, AND RESEARCH INTO PILE-DWELLINGS IN NORTHWEST RUSSIA

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Abstract

In the Middle to Late Neolithic, pile-dwellings existed in Russia only in the Dnepr-Dvina basin and in the European region, in the Alpine zone, and probably in the western Baltic region. Investigations of sites in the Dnepr-Dvina region with underwater excavation methods have been conducted since the 1970s. The history of the development of these methods is presented here. The preliminary results of complex investigations of the Serteya II site are also covered in this article. An analysis of the remains of fauna, palynological analysis, and traceological analysis of bone tools, and modelling with GIS-technologies, allowed us to recreate the economic activities of the inhabitants of the Serteya II settlement. It had a complex character: it was a hunter-gatherer economy that existed alongside a small productive economy. The latter probably had a prestigious character, and did not play a significant role in the economy of ancient people. A comparison of data from typo-technological pottery inquiries with dendrochronological and radiocarbon dates allowed the determination of peculiarities of the material culture of every construction, and the distinguishing elements of local and newly arrived cultures. An analysis of types of wood allowed us to determine the areas of their origin, and to understand when and from what kind of forest repairs were made. Research shows that further investigation in this region will lead to uncovering other pile-dwellings.

Key words: Middle and Late Neolithic, pile-dwellings, underwater archaeology, pottery technology, GIS-technology, traceology, dendrochronology.

Introduction

The Serteya II site is situated on the small River Serteyka, a left tributary of the River West Dvina in the Smolensk region (Fig. 1, see Plate III). Lake-glacial lowlands and fluvioglacial plains are mostly widespread in the upper reaches of the West Dvina. Their formation is connected with the reflux of slushy glacial water that carried away sandy-clastic material from the edge of a receding glacier (San'ko 1987, pp.122, 133). These areas, which are associated with glacial lake areas where lakes were formed in the Holocene, are rich in archaeological sites. They form districts that have been given the name of archaeological micro-regions (Serteya, Usviaty, Zhizhitsja, Sennica).

The Serteya micro-region is situated in a valley in the shape of a canyon that was formed as a result of the activity of the Dvinsko-Kasplyansky tongue, a feature of the Lovat lobe, inside morainic formations. Consequently, there is not a flattened and smooth relief that is characteristic of areas of glacial lakes where the Usviaty and Sennica micro-regions are situated (Fig. 1, 6, see Plate III). The Serteya micro-region constituted of a chain of palaeolakes joined by rivers in the Early and Middle Holocene. The glacial lake was located in a long (up to 4km) and narrow (200 to 600m) valley, occupied now by the Serteya peatbog. Its shores were covered with coarse-grained sand and pebbles, and a layer of aleurite formed on the bottom. Gyttja began to accumulate in the Holocene. Pile-dwellings appeared here at this time (Miklyaev 1982, p.25).

In 1972, during explorations of the River Serteyka, the Serteya II and Serteya I settlements were discovered. A trench was dug along the left shore of an artificial channel. Two cultural layers were found in the trench: the upper one (A) a sandy lens, and the lower one (B) was in the layer of gyttja, with material from Middle Neolithic Usviaty culture. The excavations were very difficult to carry out, because of the high water content of the peat bog. Liquid gyttja was squeezed out from the trench walls due to the weight of the overlying layers, and they flooded the already cleaned parts. In the end, the excavation walls collapsed (Miklyaev 1982, p.20ff). These excavations showed that it would be better to investigate the site using underwater archaeological methods.

Methods of excavation

The discovery of peat bog sites in 1963, and their excavation, immediately raised the question of improving excavation methods. The search to develop methods continued all the time, and led to the development of 3D methods of excavation on the Rudnya Serteya site

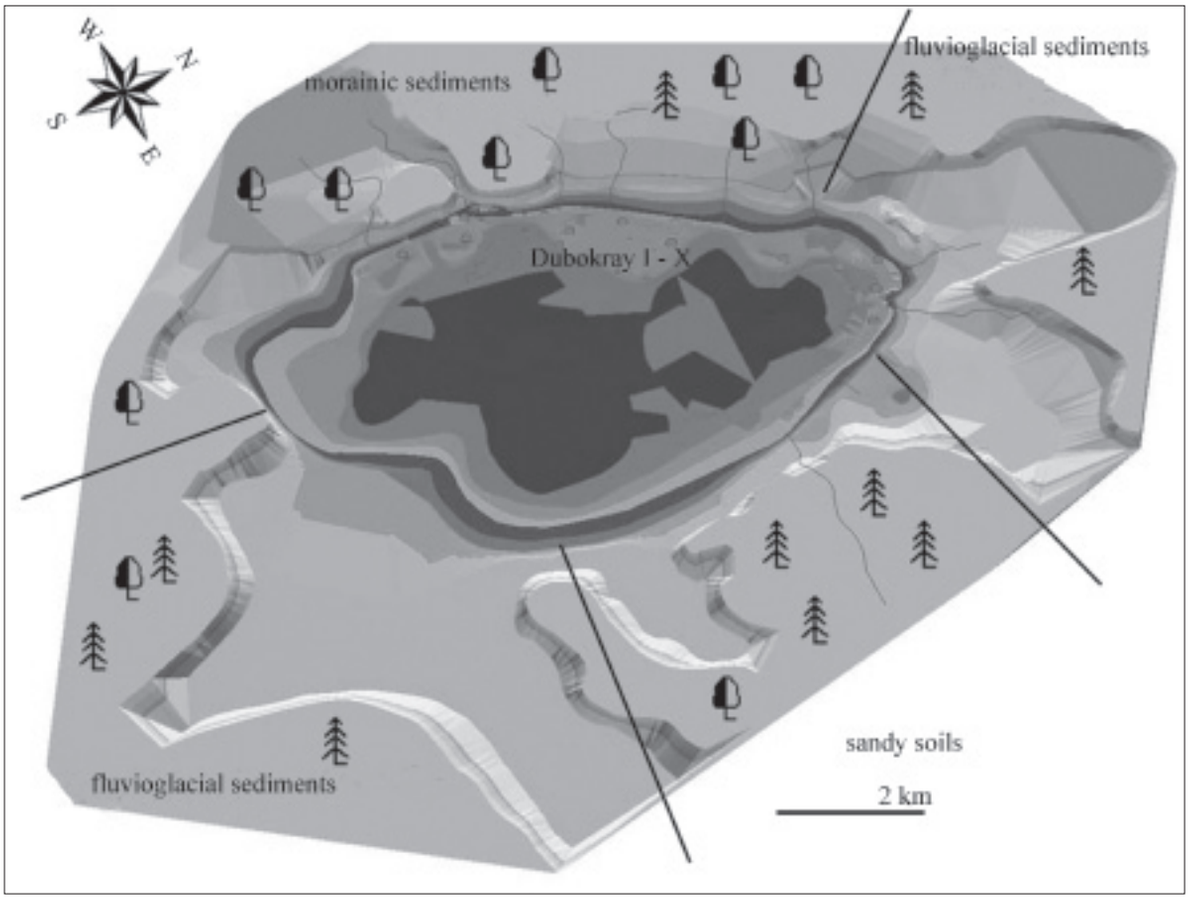

Fig. 2. The location of pile-dwellings on Lake Sennica (Pskov region). A 3D reconstruction of the relief, with palaeolakes, at the end of the fourth to the third millennium BC (1m contour interval) (E. Dolbunova).

between 1984 and 1987. At the same time, underwater excavation methods were developed, the first of which were made on Lake Sennica in the Pskov region in 1979. A long session of underwater excavations helped us to gain vast experience of organising underwater explorations in different conditions (Miklyaev 1982; 1990; Mazurkevich *et al.* 2000).

Sites situated underwater can be divided into several types. The first one is sites situated in lakes with zero visibility (the bottom of lakes Sennica and Usviaty) (Fig. 2). The whole area of the site on Lake Sennica was marked out in 20-metre grids, which was the basis for a topographical survey of the site and the surrounding area. The grid was oriented according to cardinal points. An adjacent part of the lake more than one hectare in area with the remains of pile-dwellings was also covered with a square grid 20 metres by 20 metres, based on the already elaborated grid. It served as a base for a topographical survey of this part of the site, as well as for the development of a more precise square grid for the more detailed measuring of material. The cultural layer of the site located on the bottom of the lake at a depth of 70 to 120 centimetres after an artificial water descent was destroyed by ice formations and waves. All the wooden constructions were destroyed. The visibility was almost zero (the maximum distance where a white circle was seen under water was 25 to 30cm). These obstacles determined the methods of excavation on the site in 1979: the material and cultural layer was brought up to the surface for sieving. These methods were then used during the excavations of the Dubokrai II to VI sites located at the bottom of Lake Sennica (Fig. 3).

The remains of an iron workshop dated to the middle of the first millennium AD were found in 1986 in a deeper part (120 to 150 cm deep) of the lake. A square of 14 metres by 16 metres was excavated here, using underwater excavation methods. The construction remains consisted of a blockhouse divided inside into chambers of four by four metres. Slag was found inside and on the periphery of this construction. The most difficult task was to measure the locations of the objects, in conditions of near zero visibility. Firstly, divers found the external corners of the construction. Poles were placed by their external and internal parts. Details of the construction, as well as the accumulation of slag, were measured, and excavated levels were marked by cuts on these poles and marked on the site

Fig. 3. The first underwater excavations: A.M. Miklyaev (photograph by V. Konovalenko).

plan. The position of pottery fragments was marked according to cuts on the nearest poles. The cleaning of the constructions and the cultural layer was made almost blind, by touch.

After the successful experience of underwater excavation of this iron workshop, it was suggested to try to excavate part of the remaining cultural layer in the eastern part of the Dubokrai V site. A geological examination of the bottom sediment on the periphery of the site, on the slopes of the sandy butte, was made to determine the most informative part of the site. This allowed researchers to gain information about the character and the thickness of the layers, and to locate the place with the thickest cultural layer. A two-by-two-metre square was made here, oriented according to the cardinal points. The bottom sediment was cleared from layer to layer: part of the already treated soil was lifted to the surface, and sifted through. The depth of the clearing process was measured, and large fragments of pottery were put on the plan. The soil was very liquid, and the walls leaked. This is why the square of the investigated part was narrower at the final stage, only one metre by one metre. However, this work allowed us to learn some very important information. The stratigraphy was determined here: a layer of silt 55 centimetres in thickness lay underwater at a depth of 110 centimetres, then a cultural layer lying in peat with gyttja 28 centimetres in thickness, then sand to aleurite. Fragments of pottery that belonged to the second phase of Usviaty culture were found in the lower part of the silt and the upper part of the peat. Fragments of pottery that belonged to the first phase of Usviaty culture were found in the lower part of the peat with gyttja. Fragments of pottery of Linearbandkeramik (LBK) culture were found on the border of the peat and the gyttja (Mazurkevich *et al*. 1998, p.19). An accumulation of Mesolithic materials located apart from the Late Neolithic materials were found on the Dubokrai VI site.

A topographical survey of the lake bottom was made in order to reconstruct the relief of the lake; also, holes were bored which allowed researchers to determine sediments of Holocene lakes in several places. GIS-modelling of the data attained allowed for the reconstruction of an ancient landscape, and to determine the location and distribution of sites in the past (Fig. 2).

The second group represents sites located in rivers with medium visibility. The excavation of the Serteya II site was begun after the first attempts of underwater excavation on Lake Sennica (Fig. 4). Absolutely different conditions here allowed researchers to use other more precise methods, and to gain results comparable with excavations on the surface. However, here we faced several obstacles in determining the supplementary specificity of underwater excavations: poor visibility (0.1 to 1.5m), a low water temperature (11° to 14°C) and shallow depths (0.7 to 3m) (Miklyaev 1982; 1990; Mazurkevich *et al*. 2000). This made us develop excavation methods in such conditions on the basis of our experience and the experience of our colleagues. Firstly, we faced the problem of low water temperature, which meant divers could only stay underwater safely for 45 to 60 minutes each day. Furthermore, a diver has to stay almost motionless under the water so as not to disturb the silt, in order to maintain good visibility, which also leads to rapid cooling, whether he uses a diving wet suit or a dry suit. The first stage of the work consists of the organisation of a working platform for

Fig. 4. A view of the Serteya II site (photograph by A. Mazurkevich).

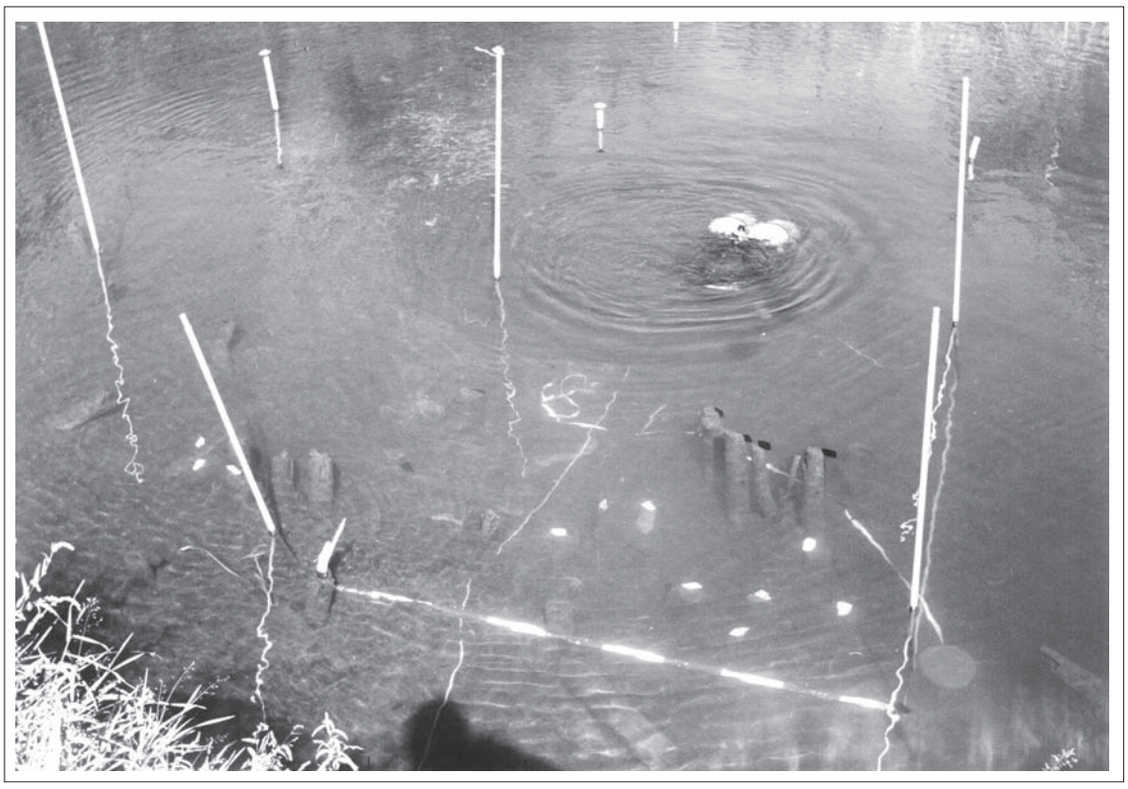

Fig. 5. The Serteya II site: the process of underwater excavation (photograph by A. Mazurkevich).

divers, the preparation of a convenient approach to the water, the installation of a gangway, clearing the excavation site of vegetation, and the removal of recently accumulated silt with a hand-dredge. During the underwater excavations, the site area is marked with two-metre grids from a base line situated on the shore. Our protocol for archaeological finds consists of reporting the character of an object, defining the perimeters of the object by washing out the ground around it, measuring the object's location by fixed-point triangulation, and reporting this data to the surface (Fig. 5). The data is noted in the field inventory which is maintained by grid squares. Fixed piles and other elements of constructions are marked with labels with numbers, which are attached underwater and marked on the site plan. The clearing of the cultural layer is also conducted in grid squares, beginning downstream and going progressively from deeper to shallower. The dredge is applied to create a more intense stream in order to remove debris.

Methods of treatment of the materials

The study of the materials from Serteya II included the analysis of typology, manufacture technique and functional use.

Several main features consisting of the 'chaine operatoire' are used to reconstruct the techniques of pottery making. We regarded all the main features, paste composition, ways of modelling different parts of a vessel, methods of forming, the surface treatment (polishing, using an additional layer of liquid clay, traces of combing), using the paddle and anvil technique. The morphological characteristics include a description of the construction and forms of constructive elements which constitute a vessel. This description is based on the idea that every vessel has definite points ('critical points') that mark places where the vessel profile changes direction (Shepard 1985, p.226). Thus, a vessel consists of several main constructive elements: edge, rim, neck, belly, bottom, tray, and a few additional elements (nose, bail, etc). They are described in geometric terms. The design as a system consists of several sub-systems which are analysed: graphic sign, element, motif and composition. The study of symmetrical transformations made on different levels of this system and described through a code system formed the basis of our analysis of the design.

Ethnoarchaeological investigations by different authors showed the existence of lots of techniques that correspond with cultural differences. This is a fundamental model on which researchers base their study (Martineau 2000, p.6). All changes in pottery-making technology are regarded as a marker of an inner transformation of family life, society, etc. This idea is based on a concept of the regularity of the technical process and its conditionality by traditions handed down from craftsman to apprentice.

A functional approach is used to study bone and antler tools. It is based on traceological study, which is not yet well developed for tools made from hard animal materials. This approach consists of the identification and analysis of use-wear patterns registered on archaeological tools with the help of a comparative collection, constituting ethnographic tools, but also with reproduced and used experimental implements (Semenov 1964; Maigrot 2003). Bone work from the Serteya II site includes tools, waste and roughout. Such artefacts represent an important source of information for those who are interested in techniques, because they offer an opportunity to reconstruct the different steps in the manufacturing process.

Natural-scientific methods

Radiocarbon dating of piles of different constructions was carried out in order to develop an absolute chronology for this site. A total of 35 dates were obtained. These dates were statistically treated, and a mean age was obtained for the site and for the dwellings (Mazurkevich *et al.* 2009, p.151; Davison *et al*. 2009, p.197ff).

The analysis of archaeological wood with the help of dendrochronological methods is well known (Bailly 1982) and widely used. Consequently, there are a lot of possibilities to find specialised software and hardware, presented on professional websites. This is not very complicated for dry samples with a large number of tree-rings, preserved in good conditions such as permafrost, especially if there is additional proof of the dating (radiocarbon, archaeological typology and archives). Prehistoric time is another situation. The use of wood differs from modern times, and the time-series are local and floating (Bailly *et al*. 1997). Thus, archaeologists are not so interested in difficult work with inconclusive results.

Any computer program using correlation procedures available for the correct dendroscale construction (software and hardware…) requires the length of the time-series to be more than 100 years, because it is a requirement of the statistical approach based on correlation methods. Our series are shorter, but that is not a reason to reject them. The proposal to use fuzzy logic (Hookk *et al*. 2007) appeared. A simple manual transformation of the tree-ring width to one of the six linguistic variables, without microscope use or any

statistical standardisation, allows the distinguishing of years of extreme growth. At the same time, we are able to measure all samples just in situ, taking them into the laboratory only for radiocarbon dating or some additional investigation. Thus we obtained 36 time-series in order to compare them in-between. The floating chronology with the 'combs' was proven by several radiocarbon dates (Hookk *et al*. 2007).

An assessment of the kind of wood was made after the anatomical analysis of the wood in the Department of Scientific Examination and Authentication of Works of Art at the State Hermitage Museum. An analysis of the type of wood used for piles and objects was made in order to understand the logic followed by ancient inhabitants in their choice of wood.

Palynological investigation was made using GIS-modelling, in order to reconstruct the palaeo-relief. Three palynological diagrams were obtained which showed changes in the vegetation in different parts of the valley, as well as peculiarities of the vegetation near the settlement. A geomorphological analysis of different sediments from the Serteya micro-region was also carried out. This allowed for the reconstruction of borders of palaeolakes and zones of different types of landscapes (Fig. 6, see Plate III). A hundred sondages and down-holes were made in order to obtain these results. A diatom analysis was carried out as well (Mazurkevich *et al*. 2009; Subetto *et al*. 2009, p.113).

The results of the work

Stratigraphy

A layer of clay ten centimetres thick lies under a layer of peat 30 centimetres thick, then a layer of gyttja 150 centimetres thick, gyttja with wooden remains, and nutshells (cultural layer) 30 centimetres thick. An aleurite layer lies lower down.

The settlement (cultural layer B) was destroyed by the transgression of the lake. Some of the material was moved to the shore and developed the A1 cultural layer, which is not very thick. After the middle of the second millennium BC, a peat bog appeared on the site of the lake. However, its development was interrupted from time to time by returning to lake, which is marked by sand and clayey sediments. The site probably appeared here during one of these stages, which is marked by the layer ά (Miklyaev 1982, p.26). However, some of the material from this site is synchronous to materials of the Serteya II pile-dwelling.

Constructions

The remains of several constructions were found at the Serteya II site (Fig. 7). Construction No 1 was most fully excavated, and that is why the description of constructive features of the dwellings is made on its basis. The constructions consisted of rectangular platforms of about seven by 4.5 metres, attached to piles with the aid of ropes (pieces of rope made from bilberry rhizome are often found pressed in the piles) and supported from below by 'horned' piles. The basis of the platform consisted of logs nine to 12 centimetres in diameter, oriented west-east. Poles five to eight centimetres in diameter were densely laid on the logs in transverse position. Treated piny slabs about six centimetres thick were placed above at right angles to the poles. A layer of moss lay above, strewn with coarse-grained white sand eight centimetres thick. A hearth situated on sand was formed, with big stones laid out in a circle about 53 centimetres in diameter.

Some of the piles were pillars serving as the basis of the walls. These pile-pillars were made of tree trunks eight, nine, ten, 12, 14, 16, 18 and more than 20 centimetres in diameter. The walls could have been made of branches cleaned from lateral branches. A large amount of the latter was found in the cultural layer, generally lying near rows of piles. Pile-pillars large in diameter were installed mainly at the corners of the platform, pairs of pile-pillars smaller in diameter were placed between them along the perimeter. Parts with sandy filling for hearths were strengthened with pile-pillars and supports. Spruce and ash were generally used to make the piles, more rarely pine, elm, maple, oak, willow, birch and poplar (Kolosova *et al.* 1998). Also, fragments of eaves and slabs with a lateral support for floors, and beams with holes, were found. The distribution of wild boar's faeces suggests that boar were kept for some time on the site, not inside the constructions but apparently next to them, in a pen. Several piles are located near dumps forming a semi-circular construction that could have been a pen.

The pile-dwellings were situated along the shore, and were joined by pathways (Miklyaev 1971; Mazurkevich 1998a). The platforms were encircled by rubbish dumps full of kitchen waste located along one of the short walls and adjacent parts of long walls. There was probably a doorway here. This distribution of overlying dumps from different constructions makes it difficult to determine exactly which finds belong to which construction. These are common platforms that could have joined two synchronous dwellings, as a result of which their dumps were intermixed.

Constructions No 4 and No 5 are situated in squares O-P-R/1, No 2 occupies squares N-O-P-R/III-IV, dwellings No 1 and No6 squares R-S-T/1-III, construction

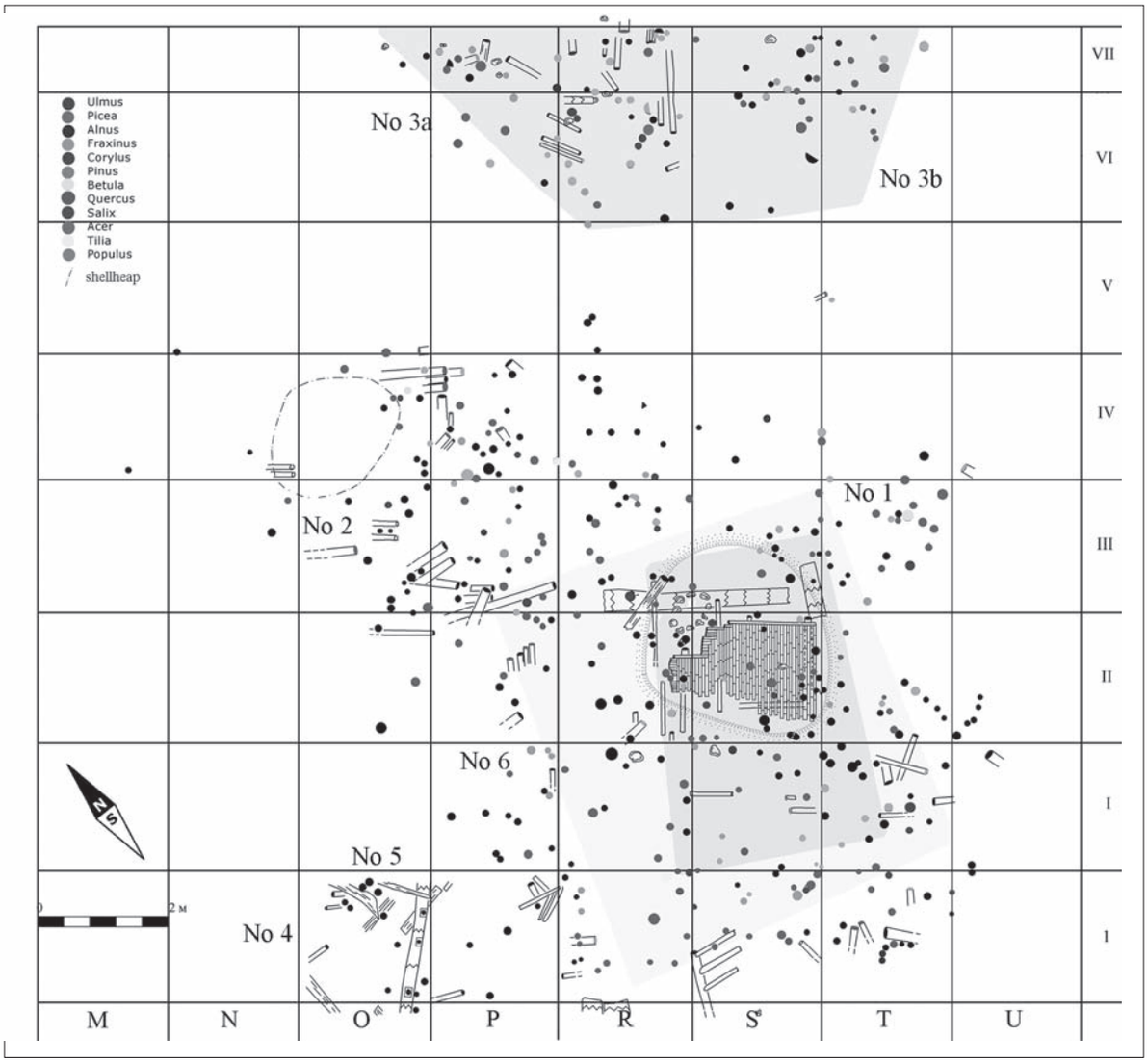

Fig. 7. A map of the constructions of the Serteya II site (compiled by A. Mazurkevich, D. Hookk, E. Dolbunova).

No 3a squares O-P-R/VI-VII, and No 3b R-S-T/VI-VII.

Most of the piles have a diameter of between six and eight centimetres (49% of the piles), the next size range is nine to 11 centimetres (39% of the piles), the piles from the bearing points of the constructions have a diameter of between 12 and 28 centimetres (12% of the piles). Types of wood of about 283 piles were determined over the last ten years. The distribution of kinds of wood shows that oak (*Quercus sp.*) was a very rare type of wood at that time, at only 6%. Other types (*Pinus sp.* 11%, *Ulmus sp.* 7%, *Betula sp.*, *Populus sp.*, *Acer sp.*, *Almus sp.*, *Salix sp.*, and *Corilus sp.* about 1% or less) are not numerous either. Fir piles (*Picea sp.*) are more numerous, at approximately 50%. Ash (*Fraxinus sp.*) piles (18%) are numerous, but not typical for cross-dating scales, even though they have the longest time-series.

The 44 specimens of all fir (*Picea sp.*) piles turned out to be the best for cross-dating. These samples can be divided into three groups. The first group belongs to secondary forest: the growth of the width of the rings consequently decreases from the first year to the last one, and there are no rings that represent extreme growth on which dendrochronological dating is based. The environmental conditions were permanent. The second group has a more dynamic growth, and belongs to trees influenced by changes in the water level; some natural cycles could be found. The third group has a lot of rings characterising years of a very intense or very depressive growth. These trees were possibly under the influence not only of natural factors like changes in water level or sunlight, but also artificial ones: the cutting of the forest by ancient inhabitants that led to changes in the conditions for the growth of trees. Thus, their progressive growth was reproduced (Baillie *et al.* 1997).

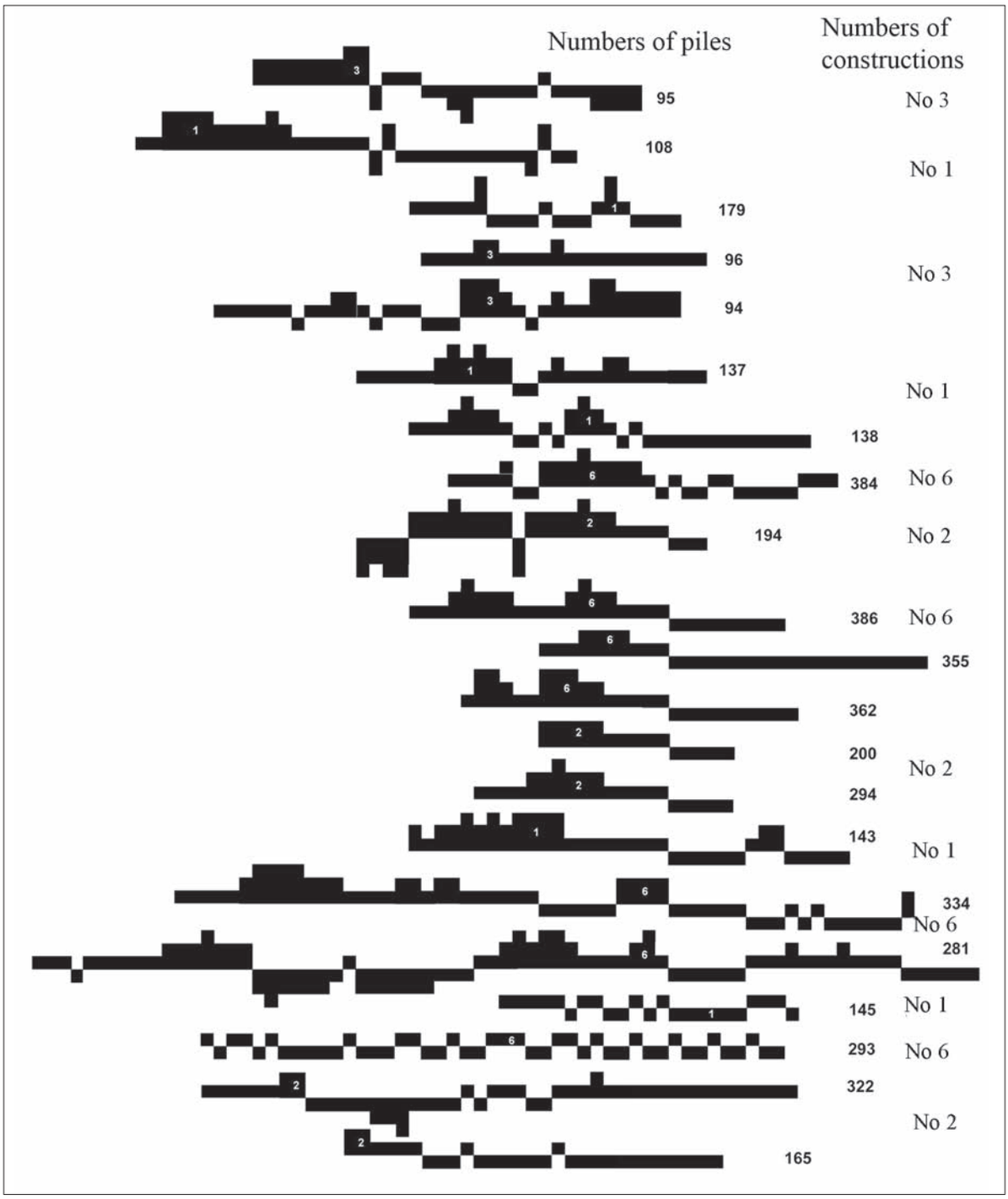

Fig. 8. A dendrochronological scale for the Serteya II site (D. Hookk).

Broad-leaved forests were used for the construction settlements at the time of Usviaty culture. This is why we suppose that the settlement appeared here concurrently with the disappearance of ash trees as a building material. Later, when only fir-piles were used for construction, people continued to use the same dwellings, and only reconstructions and replacements can be fixed. The period of time between the first tree in the dendroscale and the last is equal to 34 years, probably two generations of the local human population. Construction No 1 consists mainly of trees growing in wet sites (so-called type 1, complacent tree-ring series). Examples of the same type from constructions No 2 and No 6 are very rare. Examples sensitive to shortage in rainfall (type 2) belong to constructions No 2 and No 6. Examples reflecting very intense or very depressive growth (type 3) and those influenced by anthropogenic factors (type 4) can be observed in all the constructions except construction No 2. According to the proposed hypothesis, the sequence of the appearance of constructions on the site is (Fig. 8): initially, construction No 2 was installed; then construction No 1; later

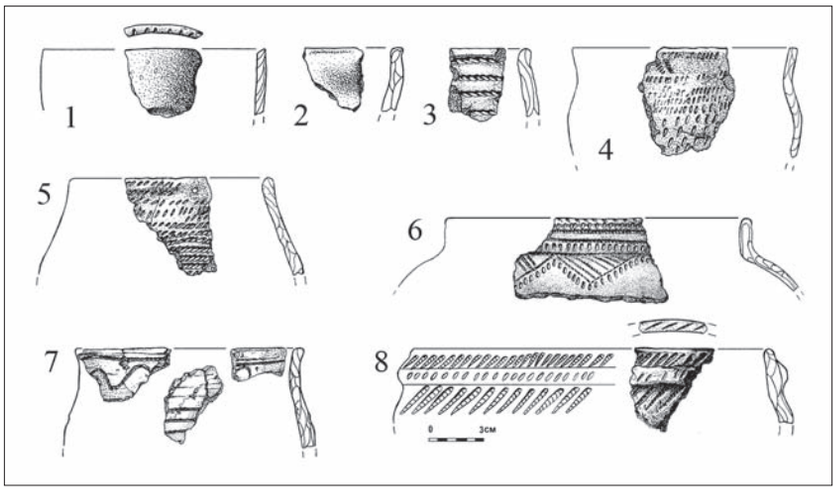

Fig. 9. The Serteya II site's 'imported' vessels: 1, 2 construction No 3b; 4, 5, 8 construction No 1; 3 construction No 2; 6, 7 construction No 3a (drawing by Ksenia Dubrovina).

construction No 3 appeared, with simultaneous reconstructing near construction No 1; we gave No 6 to this new construction; at that time construction No 2 became uninhabited.

Pottery

Fragments of nine pots and one conical bottom were found in construction No 4. Thirty-six pots and fragments of five bottoms were found in construction No 1, and in construction No 2, 15 pots, fragments of one bottom, and fragments of approximately six vessels. Eight pots, fragments of two bottoms and of approximately four pots were found on the common platform of constructions No 1 and No 2. Ten vessels, three bottoms, and fragments of approximately four vessels were found in construction No 3a. Three pots, one bottom and fragments of one pot were found in construction No 3b. There were 16 pots, one bottom and fragments of approximately seven vessels on the common platform of constructions No 3a and No 3b. It is difficult to determine the exact distribution of fragments of approximately 12 vessels. Only construction No 1 was excavated almost fully, part of construction No 2 was excavated, and even smaller parts of dwellings No3a and No 3b were investigated. Eight 'import' vessels were found, as well: in construction No 1, a fragment with a band (Fig. 9.8), a fragment with cord impressions (Fig. 9.5), and a small vessel with impressions (Fig. 9.4); in construction No 2, a fragment with large cord impressions (Fig. 9.3); in construction No 3a, a fragment with cord impressions (Fig. 9.7) and a fragment of a vessel of Middle-Dnepr culture (Fig. 9.6); in construction No 3b, fragments of two non-decorated vessels (Fig. 9.1, 2).

In this research, typology is regarded as a system that consists of several sub-systems, including technological, morphological and ornamental types. Such an elaborate typology is a consequence of specificity of pottery that includes several characteristics, technological, morphological and ornamental. All of them are determined by definite features, each of which has its own meaning and value.

Pottery from Late Usviaty culture was found in construction No 4. Shell was used as temper, and grass was used in three cases. Vessels were made in an 'S' technique, and also by several stretched short coils. Fragments of vessels of Usviaty culture were also found in constructions No 1 and No 2. Vessels made in the 'S' technique and by several stretched short coils are represented in construction No 2. Here, vessels with mixed temper prevail: shell and grass. The tradition of using shell is predominant among pots from construction No 1; mixed temper, shell and grass, was also used here. Vessels were made by several stretched short coils, or coils put above each other and slightly stretched. The latter coil technique exists mainly in construction No 1. Grass as temper prevails among the pottery-making traditions of construction No 3. Vessels were made mainly by several stretched short coils.

Thirteen different types of form (Fig. 10) were distinguished here, as well as several types of bottoms: conical with a hole in the bottom, pointed, roundish, and roundish with a detailed lower part (Fig. 10, 14-17). The following ceramic forms are represented almost equally in all the constructions: vessels with a belly in the form of a cylinder (No 5; Fig. 10.5), a belly in the form of a reduced bicone or an ellipse with a roundish and slightly turned-out rim (No 6; Fig. 10.6), a globe-shaped belly and a turned-out rim (No 9; Fig. 10.9), vessels of a restricted form with a globe-shaped belly

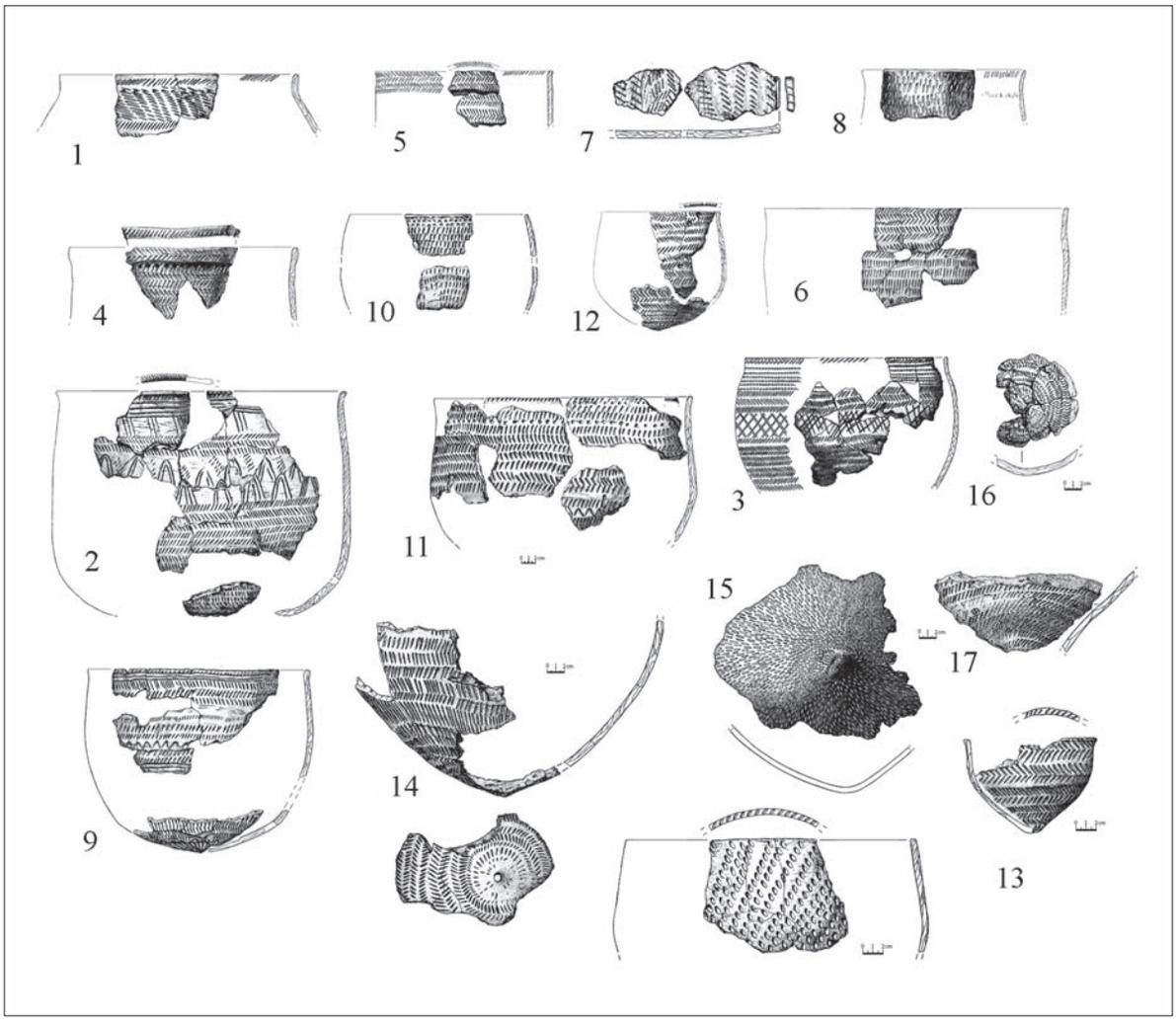

Fig. 10. The Serteya II site: morphological types (the number of vessels is equal to the number of forms) (drawing by K. Dubrovina).

(No 10; Fig. 10.10), and a belly in the form of two different cones with a large base (No 11 and No 12; Fig. 10-12). A vessel of the form No 12 can be reconstructed in construction No 4.

Several forms are situated in some definite constructions. Vessels of forms of type No 2 (a belly in the form of a reduced and flattened globe, with a turned-out rim with a roundish edge; Fig. 10.2), No 3 (a belly in the form of a reduced globe with a roundish, slightly turned-in rim; Fig. 10-3), No 4 (a belly in the form of a converging cone with a turned-out flat/roundish rim; Fig. 10-4) are situated in constructions No 1 and No 2. Specific forms (No 13) characteristic of Usviaty culture are also represented in these constructions (Fig. 10-13). Vessels of type No 7 (so-called plates; Fig. 10-7) are located probably only in construction No 1. Vessels with a globe-shaped belly with an element such as shoulders (No 1; Fig. 10-1) are represented in constructions No 1, No 2 and No 3a. Pots of the form of type No 8 (the surviving upper part represents a cylinder with concave walls; Fig. 10-8) are situated in constructions No 1 and No 3a.

Large vessels 30 to 40 centimetres in diameter are represented only by morphological types No 1, No 2, No 3, No 9 and No 11 (Fig. 10.1, 2, 3, 9, 11). The diameter of others lies in intervals between 20 and 30 centimetres; there are also small pots with diameters of up to 15 centimetres.

The compositions consisted of rows of impressions set at angles to each other, and horizontal rows of impressions prevail among the types of design (Fig. 11.7). Vessels decorated with such compositions are represented in all constructions. There are fewer compositions that consist of impressions organised in staggered rows (Fig. 11.3), lines forming a net pattern (Fig. 11.6, 4), or impressions set at an angle to each other forming triangles (Fig. 11.1). Complicated forms of pottery might be underlined by ornamental means: by a combination of different motifs, the borders of which mark the places where the profile of the ves-

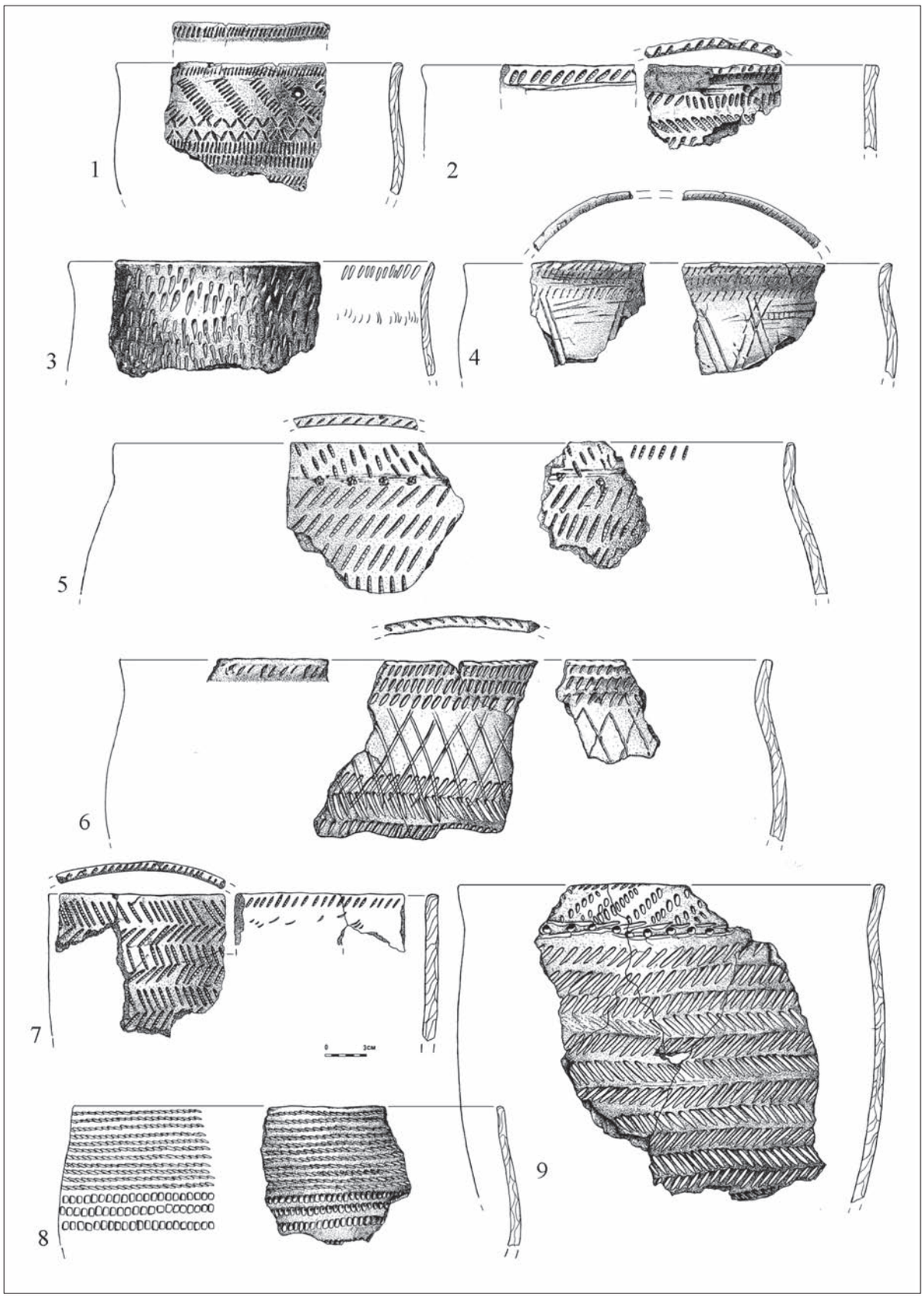

Fig. 11. The Serteya II site's vessels decorated with different motifs: 1, 2, 5, 9 construction No 2; 4 construction No 3b; 3, 6, 7, 8 construction No 1 (drawing by K. Dubrovina).

sel changes its direction. There are also several motifs that play the same role: a horizontal row of round impressions (Fig. 11.2, 9) or impressions of nodules (Fig. 11.5), cord made of bark (Fig. 11.2, 5) or cord.

It is notable that vessels decorated with impressions of cord made of bark (Fig. 11.2, 5) and imitations of them (Fig. 11.9) are represented only in construction No 2. Lots of vessels decorated with an additional element, such as a horizontal row of round impressions or impressions of nodules under the rim, are also represented here. Simple compositions, consisting of impressions set at an angle to each other (Fig. 11.7) or organised in horizontal rows, prevail in construction No 1. A combination of different types of composition is characteristic of vessels from construction No 3. A combination of different motifs and a homogeneous ornamental system probably represents two different decorative traditions. Their combination on one vessel might be a sign of a mixture of cultural traditions. Fully filling the surface with design is a characteristic of these vessels. Traditions of the alternation of empty zones and design are not widespread, and are represented only by vessels from constructions No 3a and No 1, and evidently have different origins. Pots with cord impressions were found in constructions No 1 (Fig. 11.8) and No 3a.

Almost all types of form, manufacture and design are represented in all the constructions. However, a prevalence of different types can be noticed.

Artefacts made of hard animal materials, amber, flint and wood

Antlers, bones and the teeth of wild animals (elk and boar) were used to produce tools. More precisely, the ulna, metacarpus and antlers of elk, as well as the teeth of boar, were used. Tools were made from whole bones or from broken bones. In the last case, bones were mainly reduced by percussion. Roughouts were shaped by scraping and grooving, and more rarely by abrading. Techniques such as grooving and scraping were carried out with flint tools. It is suggested that these lithic tools are to be found in the local flint industry. Thus, the range of tools used by Neolithic people for bone-working may be identified at some time in the future. Tools and decorations were produced very carefully. Neolithic people put lots of time and energy into producing tools and decorations, which might be evidence of the importance of bone implements in their life. Bone tools were widely used for various activities: for leather-working, for fish scaling, for woodwork, etc. Already finished implements (tools and pendants), as well as waste products, are represented among the collection from Serteya II. The existence on the site of blanks shows that at least a number of items were made on the spot.

Two retouched diaphysis flakes, one cone-shaped arrowhead with birch tar remains, one bevel-ended elk ulna, one roughout of a tool made from a rib split in half, one broken diaphysis with traces of scraping and one fragment of elk antler are represented in construction No 1. One scraper made from a boar's tusk and one knife from the ulna of an elk (Fig. 12.6) was found on a common platform of constructions No 1 and No 2.

The following artefacts were found on a common platform of constructions No 3a and No 3b: one distal fragment of a bevel-ended tool made from a long bone of a big ruminant (probably elk), one pre-form of barbed point, one bevel-ended elk ulna, one spoon made from an elk antler, one knife made from a long bone splinter, one point from a long flake, two points made from metacarpus of elk, of which one was decorated with small transverse incisions (Fig. 12.7, 8), and one long and fine needle with a distal conical part and an indentation on the proximal part identified earlier as an arrowhead (Fig. 12.1). The use-wear analysis showed that the bevel-ended elk ulna was probably used to work leather; the point decorated by incisions to make perforations in leather; and the knife made from a long bone splinter to scale fish.

The following articles were found in construction No 3a: two scrapers from a boar's tusk (Fig. 12.4), one net weight made from a short cylinder of elk beam grooved on its circumference, one probable tool from a beaver incisor, one point on an elk metacarpus, and one proximal decorated fragment of indefinite tool made from elk metapodium. Traceological studies allowed us to determine that tools made from boar's tusk could have been used as scrapers for woodwork.

The following articles were found in construction No3b: one probable roughout of a long projectile point with a conical end, one pre-form of a spoon made from an elk antler, one bevel-ended elk ulna, one perforated pendant on an upper incisor (Fig. 12.3), one zoomorphic perforated pendant on bone (Fig. 12.2), one mesial fragment of a metapodium with traces of scraping, and one fragment of a comb pre-form (Fig. 12.5). The bevel-ended ulna was probably a kind of chisel used to carve wood.

Flint tools are also represented on the Serteya II site. The following articles were found in construction No 2: knives on blade-like flakes, an end-scraper on a flake with a rounded edge, a triple side-scraper on a rectangular flake, an oblique end-scraper, an oval heavy duty tool with an oval back and traces of grinding on the

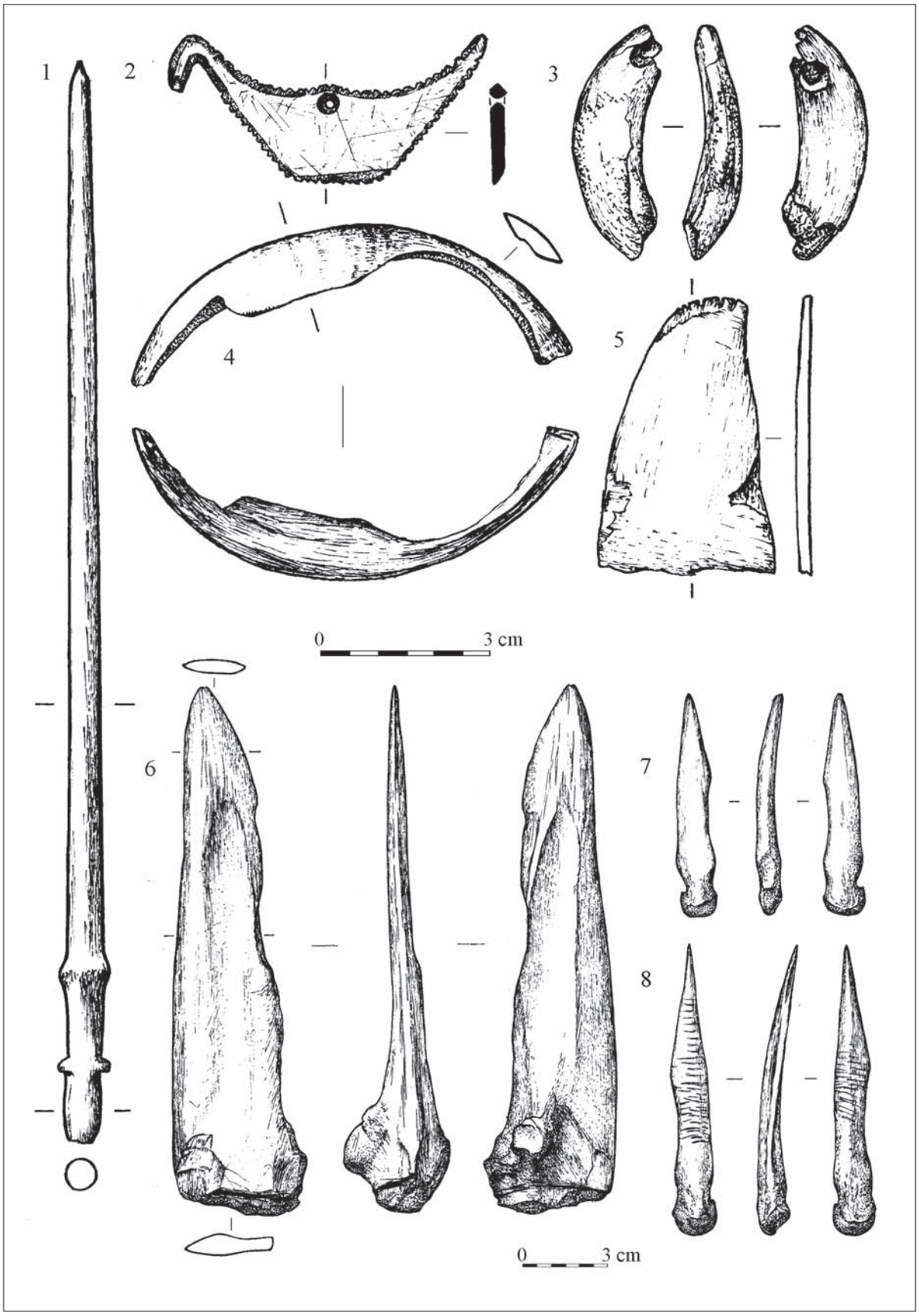

Fig. 12. The Serteya II site's tools and decorations made from hard animal materials: 1, 7, 8 common platform of constructions No 3a and No 3b; 2, 3, 5 construction No 3b; 4 construction No 3a; 6 common platform of constructions No 1 and No 2 (drawing by K. Dubrovina).

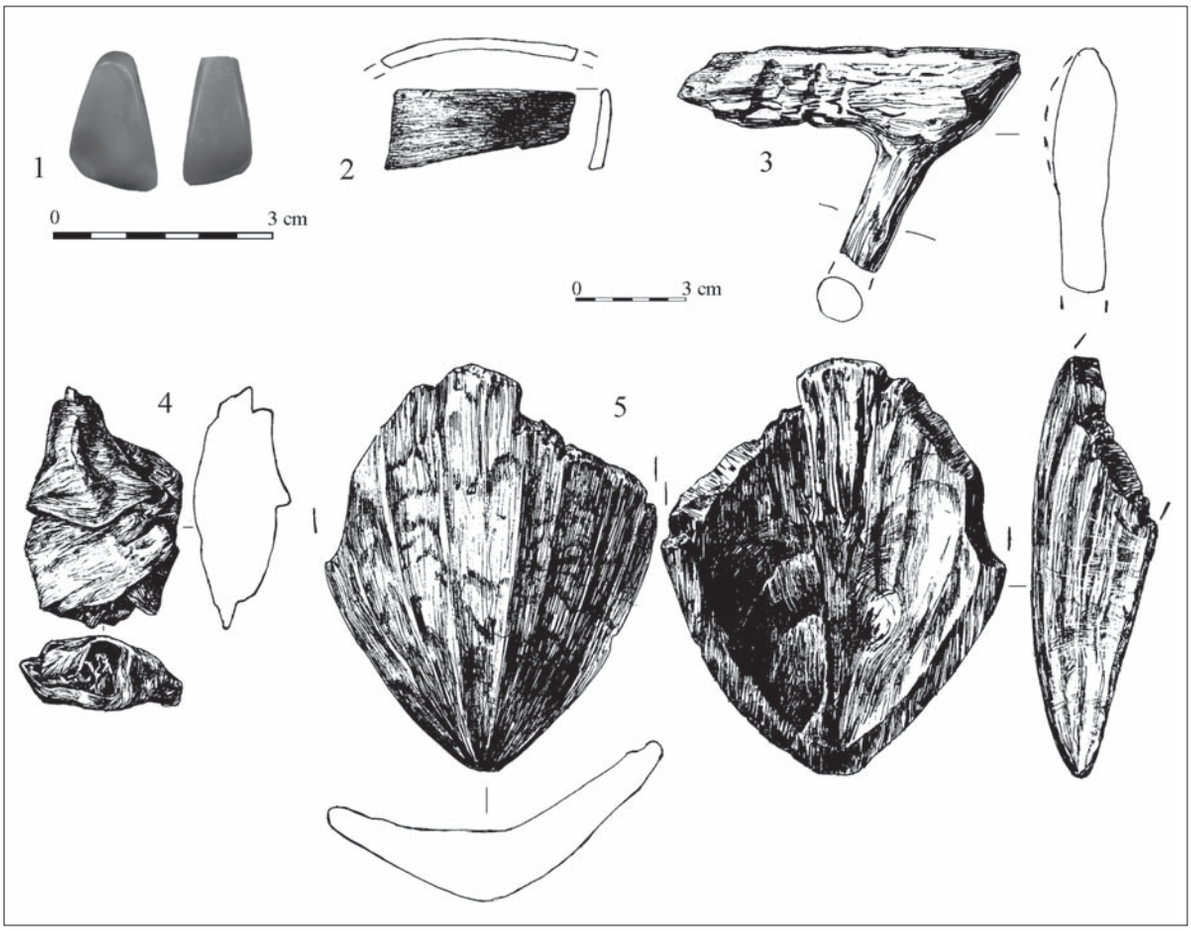

Fig. 13. The Serteya II site's amber pendants and wooden artefacts: 1 construction No 1; 2, 3, 5 common platform of constructions No 3a and No 3b; 4 construction No 2 (drawing K. Dubrovina; photograph by A. Mazurkevich).

blade, a point, and a three-cornered arrowhead with a concave base. Knives on blades, end-scrapers on flakes with a rounded edge were found in construction No 1. An oval heavy-duty tool with an oval back and traces of grinding on the blade, an end-scraper on an oval flake with a rounded edge, a pre-form of a tool, and a reamer were found on a common platform of constructions No 3. A scraper on a flake with a straight blade, a scraper on a rectangular flake with a convex blade, fragments of composite tools on flakes, and a fragment of a knife were found in construction No 4.

Two trapezoid amber pendants made of Baltic amber with longitudinal drilling were found near the eastern wall of construction No 1 (Shedrinsky *et al.* 2004) (Fig. 13.1).

Artefacts made of wood were found only in constructions No 1 and No 3. A piece of a spoon was found in construction No 1. Three pieces of the bent handles of axes (Fig. 13.3), a fragment of a scaphoid bowl (Fig. 13.5), and a fragment of a dish (Fig. 13.2) were found in construction No 3. One sinker made from bark was found in construction No 2 (Fig. 13.4). Two pieces of rope were found in construction No 1, and three in construction No 3. They were woven from two threads made of lime-bast that were intertwined with thread made from bilberry roots. A piece of a fishing net made from bilberry roots fastened to a viburnum trap net was found in dumps in the eastern corner of construction No 1. The mesh size is four by four centimetres. A piece of mat or textile woven from thread made from willow bark was found in construction No 3a.

Discussion

An analysis of the material allows us to suggest the following ideas. Grass and sand were used as temper to produce the pottery of Zhizhitsian culture, which is distinct from the pottery of Early Usviaty culture. The shell admixture is characteristic of the latter. The Serteya II site was found evidently by bearers of traditions of Usviaty culture. The small amount of pottery of this culture is represented in constructions No 1, No 2 and No 4. It is represented by vessels made by coils or several stretched short coils, with biconical bellies, made with a shell admixture. Morphological types No 11 and No 12 might be regarded as a continuation of the development of forms of Usviaty culture.

A definite dynamic of change in the technical process can be traced. Pottery from constructions No 1, No 2 and No 4 was made predominantly of paste with a shell admixture, whereas pottery from construction No 3 was made mainly of paste with grass used as temper. Pots from construction No 1 were made of coils, put above each other and slightly stretched, from construction No 2 in the 'S' technique and by several stretched short coils, and from constructions No 3 by several stretched short coils. The greater complexity and combination of different geometric figures in one vessel indicate the changes in dynamics of forms.

This tendency towards complication is also traced in the design, which began to combine different motifs. Former motifs were reinterpreted. The Usviatian motif, impressions set at an angle to each other forming a row of triangles in combination with empty zones situated usually on the belly marking changes in the vessel's form, was preserved. This motif continued to be used later, but empty zones began to be filled with design (Fig. 11.1).

All these processes are not only chronological markers, but reflect different historical events, seen by changes, as well as the appearance of new techniques of pottery-making and choice of forms. For example, pottery decorated by cord made of bark, and its imitation from construction No 2, reflects the appearance of new cultural traditions in this region, and existed here for a short period of time. On the other hand, it shows a change in the initial ornamental tradition and its distinctive interpretation. The loss of tradition may have occurred during the lifetime of two generations, which is proven by the absence of pottery of this type in other constructions, and the dates of construction No 2 which existed for 50 to 60 years. The appearance of this type of pottery is connected with cultural impulses from the region of the Dnepr basin, the area of the distribution of Dnepr-Donets culture. The tradition of decorating pottery with impressions set at an angle to each other, or in staggered rows, can be connected with areas in the Dnepr region, as well as the River Upper Oka. The appearance of pottery decorated by cord impressions is another example of cultural contacts or the infiltration of new groups of people. Besides, there are several types of cord impressions differing from their chronological position. This could mark the existence of firm relations with groups that bore the traditions of Corded Ware culture.

An analysis of the pottery revealed cultural relations with different areas and gradual processes of change in the initial traditions of pottery-making. Radiocarbon, dendrochronological analysis and the analysis of pottery have allowed us to develop a chronological scheme of constructions and reconstructions on the Serteya II site and to explain the identified diversity of cultural relations. The following succession of constructions may be proposed: construction No 4 was the earliest one, due to radiocarbon dates (4150+/-80 BP, 4120+/-60 BP) and pottery analysis. Construction No1 appeared later, which corresponded with the date 2304+/-113 BC. Construction No 3 was made five years later (2295+/-123 BC). At the same time (2372+/-82 BC), construction No 2 was either installed or reconstructed. The reconstruction of dwelling No 1 was made 17 years later, and five years later the repair of construction No 2. Concurrently, construction No 1 was enlarged, and thus turned into construction No 6 (2219+/-184 BC). The latter existed for a long time, and was reconstructed every five years. It is notable that the period between repairs is about five years. The character of the use of wood is more evidence of this fact, as stated above. The time of the dwellings' existence comes to 100 years, thanks to radiocarbon analysis. However, according to the preliminary results of dendrochronological analysis, the constructions existed for 30 to 40 years, i.e. one and a half or two generations of people. Continuous existence of two dwellings can be observed.

Bearers of local traditions lived in dwelling No 4 (Usviatian culture pottery). People with a later alien tradition that did not influence local people greatly lived in construction No 2 (pottery decorated by cord made of bark and the imitation of it). Traditions of decoration by cord existed in constructions No1 and No3a. The appearance of new technical and decorative traditions could not be explained only by marriage ties, because at the same time new types of weapons, such as three-cornered arrowheads with a concave base, battle-axes and imitations of them, tanged axes and oval axes with a wedged cross-section, and several types of scrapers, also appeared. It was a complex process of interrelations between local and newly arrived people, when the latter were assimilated at the same time as preserving prestigious elements of their culture.

An analysis of faunistic remains allows us to suppose that ancient inhabitants lived on this site all year round. The majority of the bones found on the pile-dwellings belonged to elk, with fewer examples coming from bear, boar, hare, sable, marten, otter, beaver, wolf, roe deer and mink. These animals represent a complex of species adapted to life in broad-leaved and mixed forests (Kuz'mina 2003). Judging from the age groups, elk was hunted throughout the year. The number of fishbones indicates the considerable economic significance of fishing. There are bones of large catfish, pike, perch and sander, as well as small fish. Birds were also hunted (Sablin, Siromyatnikova 2009, p.153ff). Boar's

faeces were found in the base of the cultural layers, filled with small fishbones and scales. This fact testifies to the fact that at the beginning of the existence of the pile-settlement, a number of caught boar were not killed immediately, but were kept for some time on the settlement, and these animals were fed with fish. Thus, we can observe the initial stage of the domestication of pigs in this area. Another situation can be observed on other sites of the region. The bones of already domesticated pig and the bones of a cow and a dog were found on the Usviaty IV settlement, dating from the end of the fourth millennium BC. The teeth of a horse were found as well on the Serteya XI site, dating from the beginning of the third millennium BC. The small sizes, thin enamel and weak painting indicated that these teeth belonged to an old domesticated horse *E. Caballus L.* (Kuz'mina 2003).

The gathering of food was of considerable importance as well: a great number of shells from nuts and acorns were recovered, as were cockleshells from the lake. At least 30 edible wild plants were used for food. Processed hazelnut and water chestnut (*Trapa natans*) became the surrogate of bread and the main source of plant protein.

A palynological diagram showed that the inhabitants of the Serteya II site practised agriculture. This is indicated in the early Subboreal (Sb-1), when we observe the spread of agriculture. Judging from palynological data, it is not the first evidence of the appearance of agriculture; but all previous attempts were discontinued, i.e. agriculture did not adapt to the local environment, for unknown reasons. On the palynological diagram, during the same time, a high content of grassy vegetation is shown, which marks the spread of open spaces, which could be used for agriculture and cattle rearing. Furthermore, an analysis of the palaeolandscape at the beginning of the Subboreal allows us to suppose that fertile soil in coastal parts of the lakes could have been used as fields for crops and cattle rearing. This soil appeared as a result of the coast being swamped. Data of the chemical compounds of gyttjas and coastal sandy-argillaceous sediments could also testify to the appearance of agricultural activity (Mazurkevich 2003; Dolukhanov *et al.* 2004).

The Serteya II site is situated on the border of different types of landscape. Such features are characteristic of pile-dwellings in the region. The spatial analysis of the economically favourable zone surrounding the settlement reveals a definite pattern. It includes three distinct landscape types: a lake plus low-lying terraces and offshore mires; end-morainic formations with predominantly clayey soils covered with broad-leaved species; and glaciofluvial plains with podzolic sandy soils covered with pine forests (Dolukhanov *et al.* 1986). We suggest that this preference for particular types of landscape might be regarded as a cultural sign.

The Serteya II site was situated on the shore of an island like other pile-dwellings of the Middle and Late Neolithic of this region. It became clear after GIS-modeling of Serteya valley and other archaeological microregions (Fig. 2). There are also synchronous materials on an upper part, some 60 metres away (layer ά). Ancient inhabitants probably moved here when transgressions took place. This was due to small cyclical changes occurring every ten years, rather than global changes in the water level.

In the Middle Neolithic, only the territory of the lake basin was controlled by inhabitants of one pile-dwelling. Kitchen debris, including a large number of non-edible parts (hooves, teeth, caudal vertebra, etc) represented in the faunal remains, and the absence of small hunting camps, proves that in the Middle Neolithic whole carcasses of large animals were brought to the site where the butchering was done. The remains of animals and birds hunted all year round testify to the long-term life of pile-dwellings in one place. The latter is also proven by an analysis of the lighting of pile-dwellings: sites were situated in places lit to the maximum in any season.

All this data has changed our conceptions about the economic system of the inhabitants of pile-dwellings. The economy of the builders of pile settlements was complex, with the prevalence of appropriating strategy: hunting prevailed over fishing and the known share of food gathering. The combination of different types of landscape with rich natural resources made the hunter-gatherer economy so effective that people began to live in one site during the whole year, and the formation of a productive economy was delayed for rather a long time. Settlements were inhabited all the year round, and the population became more settled and started to store food and water. At this particular time, on the boundary of the Atlantic and the Subboreal, high-capacity vessels appeared. The population increased. The system of food distribution changed, which inevitably resulted in a change to the social structure (Mazurkevich 2003).

The appearance of pile-dwellings in the fourth millennium BC was a common European event the eastern border of which was the Dnepr-Dvina basin. It was probably a specific form of adaptation by ancient inhabitants living in particular landscape and climatic conditions.

Climatic changes occurred everywhere at the Atlantic/Subboreal boundary (3700–3200 BC), and led to the

water level falling, and in these places marshes appeared. Hence, ancient people tried to settle near water, by small eutrophic stagnant lakes surrounded by marshes. The dwellings had to be constructed on the marshes along the shores; pile-dwellings could not be erected in the lake because of freezing-over in winter. According to the analysis, the Atlantic and the Subboreal were characterised by frequent changes of the water level in the lakes. The building of pile-dwellings ensured the settlement was not affected by the large seasonal and gradual small changes in the water level which were caused by climatic changes. At this time, pile-dwellings also appeared in southern Germany and Switzerland in the same sort of landscape: they were situated on the shores of lakes in front of moraine formations of the Wurm Glaciation.

The mapping of finds in lakes and peat bogs has allowed us to suppose the existence of a 'passage' in front of moraine formations of the Vepsy stage of Valdai glaciation included in the second 'district of lakes' (Miklyaev 1995, p.26). Probably, people bearing the traditions of Globular Amphora and Funnel Beaker, Corded Ware and Bell Beaker cultures appeared along this 'passage' in the upper Dvina region (Mazurkevich 1998a). The further investigation of pile-dweller culture will allow researchers not only to find new sites in the zone of this 'passage', but also to determine more precisely the processes of adaptation and ancient history.

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SERTĖJOS II IR ŠIAURĖS RYTŲ RUSIJOS POLINIŲ GYVENVIEČIŲ POVANDENINIŲ TYRIMŲ REZULTATAI

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Santrauka

Vidurinio–vėlyvojo neolito polinių gyvenviečių aptinkama ne tik Rusijos Dniepro–Dauguvos upių baseinuose, bet ir Alpių bei vakariniuose Baltijos jūros regionuose. Dniepro–Dvinos upių regione polinės gyvenvietės buvo pradėtos tyrinėti nuo 1970 metų.

Šiame straipsnyje pateikiama šių polinių gyvenviečių tyrimų metodika ir preliminarūs kompleksiniai archeologiniai povandeniniai Sertėjos (Pietų Pskovo sritis) II gyvenvietės tyrimai, vykdomi jau nuo 1972 metų. Sertėjos II gyvenvietės radinių archeoosteologinių, palinologinių, traseologinių tyrimų duomenis suderinus su GIS tyrimais, nustatyta ir rekonstruota ūkinė čia gyvenusių bendruomenių veikla: gyventojai čia daugiausia vertėsi medžiokle, rinkiminiu ūkiu, į kurį palengva skverbėsi gamybinio ūkininkavimo šakos. Gamybinis ūkininkavimas, nors, matyt, laikytas prestižiniu, vėliau netapo svarbia ūkio šaka. Technologiniai keramikos, dendrochronologiniai medienos ir radiokarboniniai visų radinių tyrimai įgalino nustatyti kiekvieno Sertėjos II gyvenvietėje aptikto kultūrinio sluoksnio, kaip atskiros polinių statinių statybos konstrukcijos, ypatumus, išryškinti vietinės kultūros raidą ir požymius, kurie buvo perimti iš kaimyninių kultūrų. Detalus medienos tyrimas įgalino nustatyti, iš kokių medžių rūšių ir kokiu laikotarpiu buvo statomi poliniai statiniai. Ateityje tikimasi Sertėjos regione aptikti daugiau vidurinio–vėlyvojo neolito laikotarpio polinių gyvenviečių.

Vertė Algirdas Girininkas