

# The oldest pottery in hunter-gatherer communities and models of Neolithisation of Eastern Europe

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**ABSTRACT** – *The characteristics of the oldest pottery in Eastern Europe, located in three main regions, the Lower Don and Lower and Middle Volga, and a description of different Early Neolithic types of pottery production are described in this article. We present ideas on how and when the oldest pottery traditions were distributed through Eastern Europe according to radiocarbon dates. Also, models of the Neolithisation of Eastern Europe are suggested based on archaeological evidence and absolute chronology.*

**IZVLEČEK** – *V članku predstavljamo značilnosti najstarejšega lončarstva in zgodnje neolitske keramične tipe v treh vzhodno evropskih regijah: Spodnjem Donu, Srednji in Spodnji Volgi. S pomočjo radiokarbonskih datumov pojasnujemo, kako in kdaj so se najstarejše lončarske tradicije širile prek Vzhodne Evrope. Predlagamo model neolitizacije Vzhodne Evrope, ki temelji na arheoloških podatkih in absolutni kronologiji.*

**KEY WORDS** – *Early Neolithic; Neolithisation; pottery technology; radiocarbon chronology*

## Introduction

New discoveries about Early Neolithic cultures and sites in Europe, their radiocarbon dates, and information about climatic conditions (Weninger et al. 2006; Berger, Guilaine 2009) led to a new wave of discussion about the components of the 'Neolithic package' (Özdoğan 2011), and ways, forms and models of the distribution of Neolithic innovations (Dolukhanov 2000; Demoule 2007; Cauwe et al. 2007; Davison et al. 2009; Fort 2009; Feugier et al. 2009; Mazurkevich et al. 2006; Budja 2013). In addition to a productive economy, pottery and polished tools, it was proposed that prestigious/cultic objects, architecture, settlement organisation, and a new way of life should also be included in the Neolithic package (Özdoğan 2011: 419). In order to outline the importance of the changes occurring during this time, besides the term 'Neolithic revolution', definitions of other revolutions were proposed: the 'secondary product revolution', introduced by Andrew Sherratt (use of domesticated animals for the purpose of pro-

ducing 'secondary products', such as milk, wool, and draught power at the end of Neolithic/Bronze Age) (Greenfield 2010), and the 'ceramic revolution' (describes how Neolithic innovation was distributed in Eastern Europe) (Mazurkevich et al. 2006: 20). However, the 'Neolithic revolution' that occurred in technological and ideological spheres is not now regarded as a rapid process which had an equal influence on all Mesolithic groups that came into contact with Neolithic cultures (Barnard 2007: 17).

It is supposed that we can trace the integration and coexistence of Mesolithic people with new Neolithic traditions/incomers, rather than an abrupt change in Mesolithic traditions during the earliest stage of Neolithic cultural development in different regions (Guilaine, Manen 2007; Bentley 2007; Hartz et al. 2007). Pottery is the only archaeologically visible marker of changes in the cultures of Eastern Europe, unlike in other parts of Europe, where not only pot-

tery but also other components of the Neolithic package were distributed. This is why Eastern European cultures were excluded from the general Neolithic context in Europe. Various definitions have been proposed to describe the cultures of hunter-gatherers acquainted with ceramic manufacture, such as 'Boreal Neolithic', 'Sub-Neolithic', 'Initial Neolithic' (Davison et al. 2007.140; Gronenborn 2010; Dolukhanov, Shukurov 2009.36; Tallavaara et al. 2010.253; Cohen 2014). However, it is suggested that the level of social development and complicated social networks that existed should be taken into account in order to estimate the crucial changes that occurred in this transitional period (Oshibkina 1996). Radiocarbon dates have recently shown the old age of the first pottery in eastern Europe, attributing it to the first half of the 7<sup>th</sup> millennium calBC<sup>1</sup> (Vybornov et al. 2008; 2012; Mazurkevich et al. 2013) (Map 1, Fig. 7). This material is some of the earliest evidence of pottery among communities of hunter-gatherers in Eastern Europe.

The early appearance of pottery that is not related to the distribution of productive economies can also be traced in Southern China at the 20–16<sup>th</sup> millennium BP, in the Far East and Japan at 17–15<sup>th</sup> millennium BP, in Southern Siberia at the end of the 14<sup>th</sup> millennium BP (Budja 2010.118; Cohen 2014.62), and in the 10–8<sup>th</sup> millennium BP in Southern Africa (Close 1995). Pottery appeared in these regions independently and has been discovered over a vast area. After pottery making appeared in Southern Africa, it spread over a distance of 3000km (Close 1995.32). Recently, a hypothesis suggesting the eastern origin of East European pottery has been discussed (Gibbs, Jordan 2013.16). However, there are no intermediate sites with pottery similar and synchronous with the first pottery in the Far East over a huge area from the Far East to the Southern Urals, a distance of over 9000km, which could prove this theory; nor might any similarities be found between the pottery of Eastern Europe and early Eastern or Western Siberian ceramic assemblages.

We suggest that the oldest pottery in Eastern Europe had special characteristics which could make it part of a near-eastern Neolithic package that arrived here in different ways and from different places, whereas the further development and appearance of other cultural traditions in Eastern Europe can be connected with the regional development and interaction of hunter-gatherer communities (Map 2).

Different groups can be distinguished in the pottery assemblages of Eastern Europe ascribed to the Early Neolithic that differ in their technological, morphological and decorative features. Some are very similar, although separated by hundreds of kilometres. At the same time, the deposit of Early Neolithic pottery together in one stratigraphic layer suggests the simultaneity of these events, which can in reality be separated by long periods. This is why a technological and typological analysis of pottery, together with radiocarbon dates and stratigraphy, is necessary in order to distinguish the oldest groups within pottery assemblages.

An overview of the oldest pottery traditions of Eastern Europe is presented in this article, along with a discussion of their chronological position, distribution and origin.

### **Absolute chronology of Early Neolithic pottery in Eastern Europe**

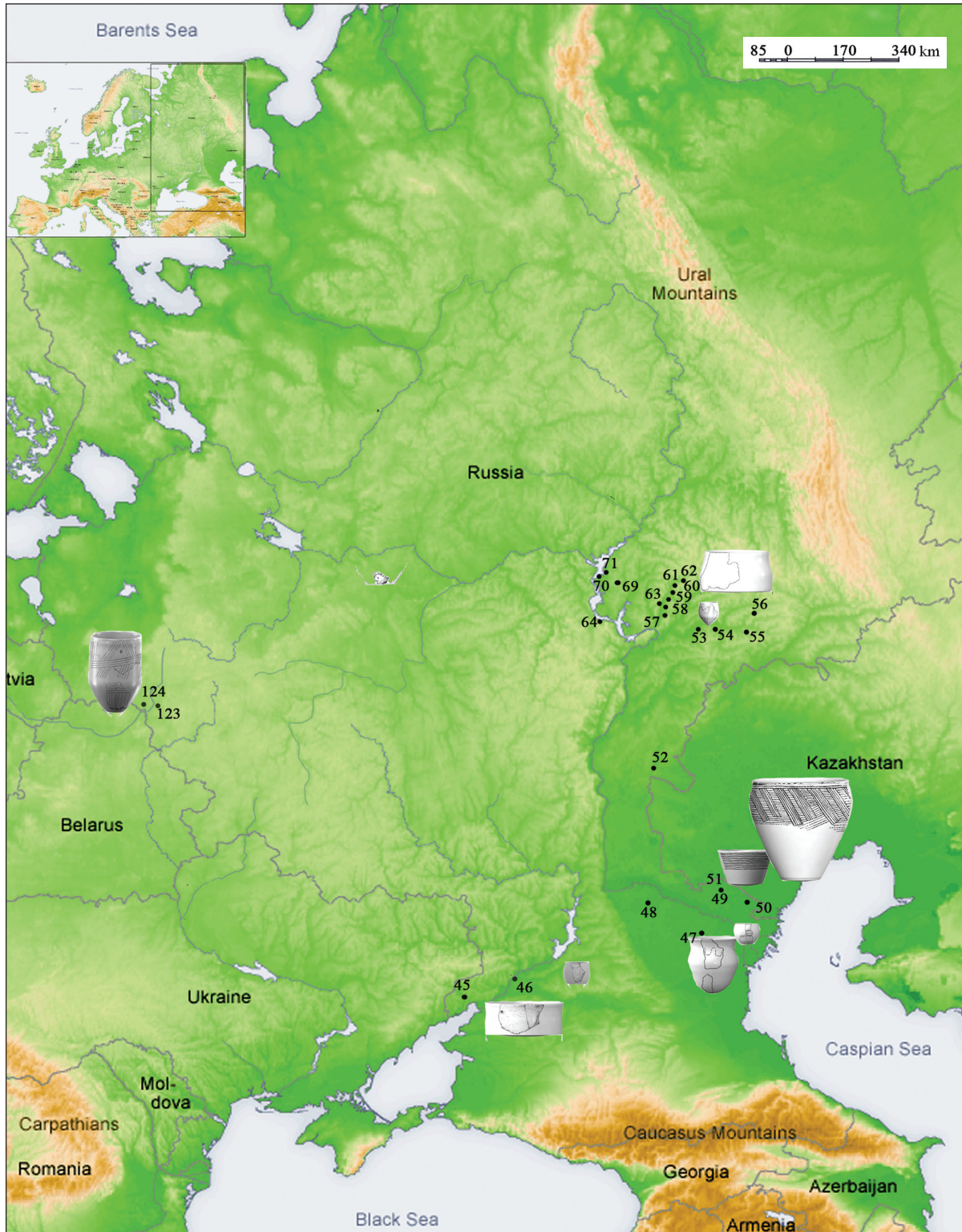
The analysis of the radiocarbon dates attributed to the Early Neolithic pottery of Eastern Europe (according to Vybornov 2008; Vybornov et al. 2008; 2012; 2013; Ivanischeva 2009; Hartz et al. 2012; Smolyaninov, Surkov 2014; Tovkailo 2010; Gaskevich 2010; Karmanov 2008; Zaiceva et al. 2014) makes it possible to divide dates into groups (Figs. 4–6). These groups relate to different types of the earliest pottery, represented by undecorated vessels, pottery decorated with impressions (triangular and/or dots) and with incised lines, as well as vessels of later stages with different technological and typological characteristics.

The dates of these types of pottery are believed to be distributed non-uniformly in the time span, but concentrated in certain periods. This might be explained by the increase in the number of sites, materials and, perhaps, population during these periods. These dates make it possible to synchronise different events reflected in the appearance of various types of pottery, and also show that bearers of different traditions could coexist during the same periods in the same area. Several explanations may be proposed: the appearance of various types of pottery at the same sites could have been separated by short periods which cannot be detected from radiocarbon dating, and also the coexistence of societies with different pottery or 'Mesolithic' and 'ceramic' communities might be supposed.

<sup>1</sup> calBC – calibrated dates according to OxCal 3.10 (Bronk Ramsey 2005).

The oldest pottery assemblages from Eastern Europe date to the first quarter of the 7<sup>th</sup> millennium calBC. One of the oldest complexes with pottery can be found at Rakushechny Yar in the Lower Don basin (Map 1).

The next period with a concentration of dates is attributed to the beginning of the second quarter of the 7<sup>th</sup> millennium calBC, connected to the Elshanskaya culture pottery in the Middle Volga region. According to the radiocarbon chronology, the Elshan-

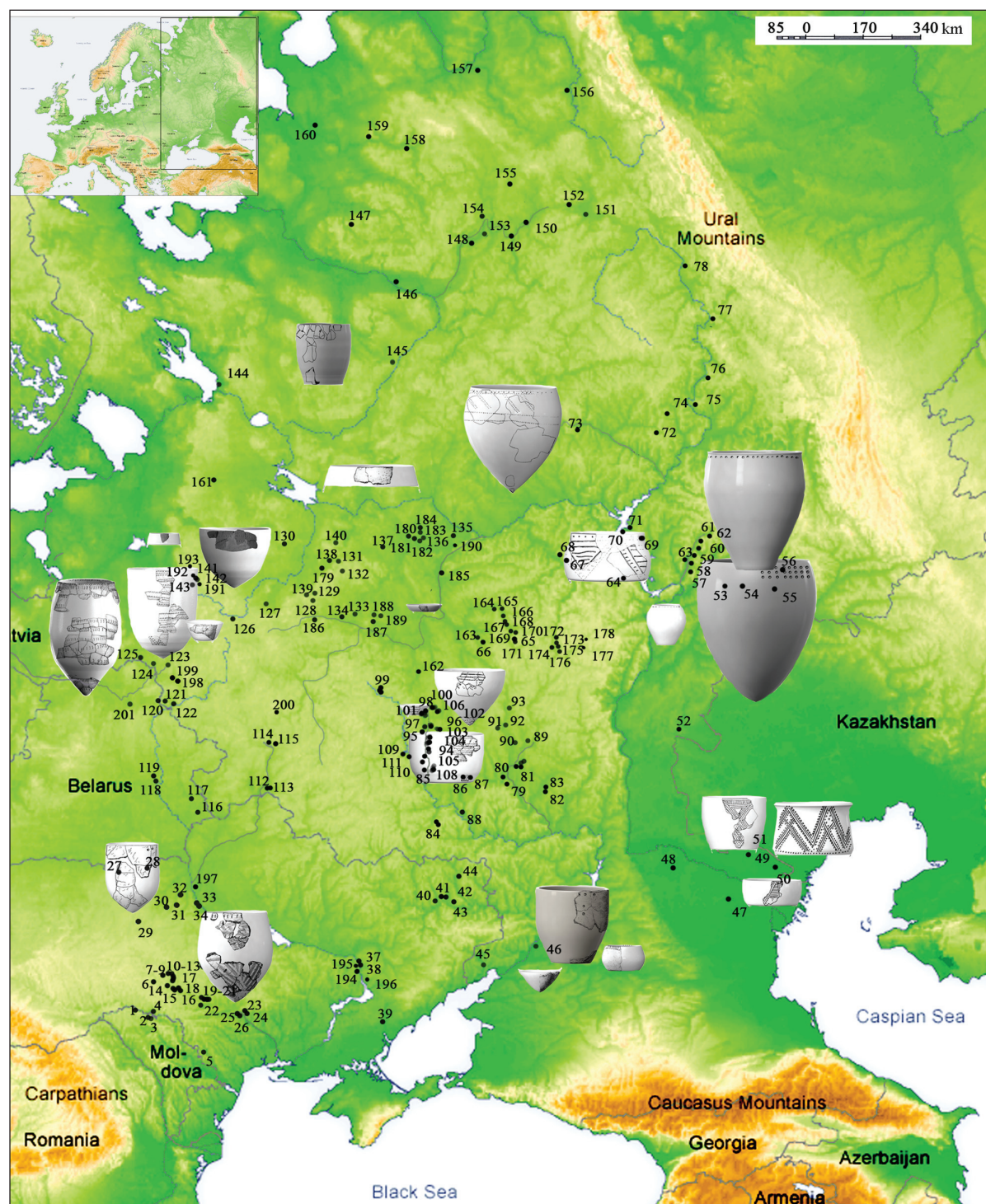


**Map 1.** Distribution of sites with the oldest pottery during the first half of the 7<sup>th</sup> millennium calBC in Eastern Europe (according to radiocarbon dates).

skaya culture existed here for a long period (Vybornov 2008).

The concentration of dates around the middle-second half of the 7<sup>th</sup> millennium calBC is connected

with pottery decorated with triangular impressions and dots from the Lower Volga and the Caspian basin. It might date to an even older time, evidenced by the appearance of this type of vessel in the first ceramic assemblages of Elshanskaya culture (Viska-



**Map 2. Sites with Early Neolithic pottery in Eastern Europe dated to the middle of the 7<sup>th</sup>–6<sup>th</sup> millennium calBC (site positions according to Gaskevich 2010; Vybornov 2008; Krainov 1996; Smol'yaninov 2009; Surkov 2007; Smirnov 1991; Sinyuk 1986; Karmanov 2008; Tyurina 1970; Stavickii, Hrekov 2003; Lychagina, Cygvinceva 2013; Urban 1996; Gurina 1997; Telegin 1996; Cvetkova 2011; Cetlin 2008; Kotova 2002). For the list of Neolithic sites 1–195 see Appendix.**

lin 2014). The distribution to the north of populations in the northern Caspian and Lower Volga region can be dated to the second half of the 7<sup>th</sup> millennium calBC, which led to the formation of a new culture in the Middle Volga basin (Andreev 2014: 14).

Radiocarbon dates between 8000–7500 BP yield a large spread of possible calendar age ranges because of a plateau in the calibration curve (Alekseev et al. 2005: 42). This makes it difficult to obtain narrow calibrated spans for different ceramic traditions and to date more precisely their distribution in various areas (Fig. 4a).

It is interesting that the increase in the quantity of radiocarbon dates at sites with decorated pottery in the Caspian region happened at the end of the 7<sup>th</sup> millennium calBC and beginning of the 6<sup>th</sup> millennium calBC, but this was absent at sites with undecorated pottery. Elshanskaya culture stage II appears at the end of the first/second quarter of the 6<sup>th</sup> millennium calBC. This stage also includes ceramic complexes from other areas dated to the second half of the 6<sup>th</sup> millennium calBC. Pottery assemblages of sites located in the north Caspian Region, such as Jangar (layer 2), Kachkarstau, Tenteksor I, date to the middle of the 6<sup>th</sup> millennium calBC. Another concentration of dates for pottery decorated with triangular impressions can be traced in the second half of the same millennium.

The increasing quantity of dates from the forest and forest-steppe zone achieved recently fall in the interval of the middle/second half of the 7<sup>th</sup> millennium calBC, which can hardly be explained solely by an age offset due to the reservoir effect. According to recent research, the hard-water effect, which could have influenced these dates, could be absent or minimal in some regions (Kulkova et al. 2014). Moreover, the dating of modern materials does not allow us to determine the real age offset which must be taken into account in date calculation (Kulkova et al. 2014; Philippsen 2014). Also, the analysis of early Neolithic vessels from Eastern Europe reveals that some were used to cook non-aquatic products, which excludes the possibility of any reservoir effect (Meadows 2014).

It seems that these dates reflect some cultural processes occurring since the second half of the 7<sup>th</sup> and middle of the 6<sup>th</sup> millennium calBC. This is a period when local, regional traditions in the Upper Volga, Middle and Upper Don, Dnepr-Dvina regions and

other territories formed and developed and spread to neighbouring areas (Map 2, Fig. 5).

Besides the oldest dates from the Lower Don, Lower Volga and Middle Volga regions, there are also dates falling in the interval of the first half/middle of the 7<sup>th</sup> millennium calBC obtained from organic crust on vessels or synchronous materials from northern territories, which shows the very old age of this pottery, almost synchronous with the appearance of the oldest pottery in the southern areas (Mazurkevich et al. 2013).

It is important to understand how this almost simultaneous appearance of ancient pottery occurred in various regions of Eastern Europe that are separated by hundreds and even up to 2000 kilometres; can we trace these processes in archaeological material, not only in radiocarbon dates, and what cultural model could best explain this type of evidence?

### Description of different regional cultures with the most ancient ceramic traditions

#### *Lower Don Region: the ceramic assemblage from the Rakushechny Yar site*

Rakushechny Yar is located at the north-western end of the modern island of Porechny on the Don River (Fig. 1). An area of approx. 1000m<sup>2</sup> was excavated by an expedition from Leningrad State University under the direction of Tatyana D. Belanovskaya in 1961–1966, 1968, 1971, 1976–1977, 1979 (Belanovskaya 1995: 9–12); new excavations of the oldest layers were conducted by Pavel Dolukhanov, and later by Andrey Tsybriy and Andrey Mazurkevich (Tsybriy et al. 2014). The cultural layer at Rakushechny Yar consists of several isolated outcrops of different sizes, often at a distance from each other, where excavations II – V were made. Excavation I was in the central part of the site. Belanovskaya divided the site into six horizons, with several layers forming the sixth horizon (Fig. 2); all were identified as cultural layers separated by sterile interlayers. Layers 9–23 were attributed to the Early Neolithic.

The first researchers to investigate the site outlined its unique character and traced analogues with Near Eastern materials (Belanovskaya, Timofeev 2003). However, only a small part of the excavated lower layers, uncovered in 1965 when the level of the Don was very low, yielded a very restricted complex of finds, which appeared to be very small in the lowest layers (23–21). This should be considered when in-

investigating this Early Neolithic complex, which reveals a small fragment of the ancient history of this region.

In this research, ceramic materials from layers 23–11 from excavation I (housed in the Department of Archaeology of Eastern Europe and Siberia of the State Hermitage Museum) were studied. The assemblage consists of 2421 wall and rim fragments of vessels and 272 fragments of bottoms and low vessel parts attributed to approx. 490–500 vessels.

The petrographic studies by Marianna Kulkova determined the mineral composition of the paste, identified tempering materials, and determined their quantity (Mazurkevich et al. 2013). Several raw materials were distinguished which could be located at different hypsometrical levels and which have different origins. The use of these different types of clay and silty raw materials probably depended on variations in the level of the river. The characteristics of the raw materials of these vessels point to an origin near the site, which allows us to suppose that the pottery was made locally. Thus, Neolithic potters used various raw materials to produce pottery, depending mostly on its accessibility at different times.

The following pastes used in pottery making were identified by visual analysis:

- Plastic clay with natural inclusions of shells, with or without a small amount of temper. The clay was well kneaded at the pre-treatment stage, which is typical of pottery from the lowest layers. Also, there are vessels made from the same type of paste, which was poorly kneaded, and with a great quantity of natural organic matter. This type of vessel increases in quantity in the upper layers.
- Clay mixed with organic temper was also found at the site.
- Also, there is a type of a paste with grog or crushed pottery temper added to the paste, which was confirmed by the petrographic analysis (Mazurkevich et al. 2013).

That the technology of pottery making was stable is proved by the existence of definite *chaînes opératoires* in all layers. Several types of coil modelling were identified: N, U (Tab. 1.1), and S-type of coils



**Fig. 1. View of the Rakushechny Yar site.**

junction (Tab 2.4), and the slab technique (Tab. 3.2). The thickness of vessel walls is 0.6cm, 0.7–0.9cm, and 1.2cm. Coils were stretched in most cases when N-junctions of coils were applied (Tab. 3.3). N-junctions of coils with stretching predominated in vessels from the lowest layers 23–11 (Tabs. 1.2, 2.3). Additional pieces of clay were often used (Tab. 3.1), which is clearly seen in radiographic photographs of the fragments.

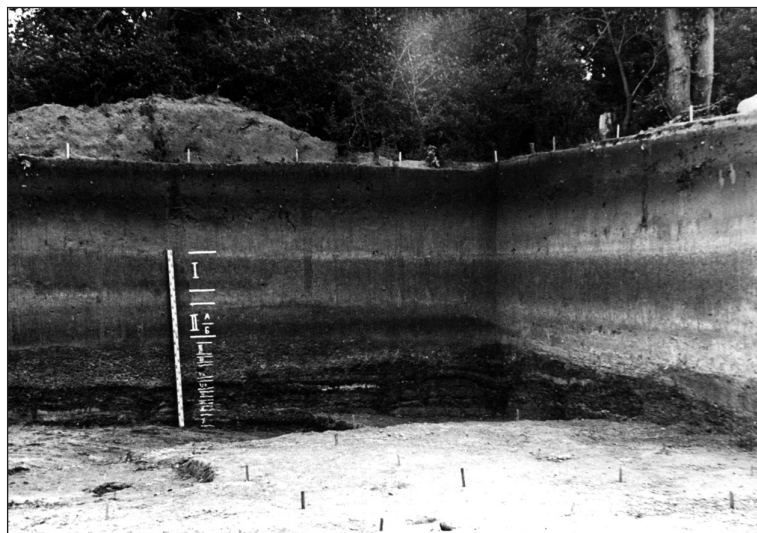
Vessels from layers 13–11 were made with long coils stretched vertically, and consisted of two to three layers (Tab. 1.3). In addition, the ‘paddle and anvil’ technique appeared in layers 13–11; the diameter of anvils might not have exceeded 3–4cm. Vessels made with the slab technique appeared here, as well as with blocks of coils which were attached with a U-shaped junction. These were made by long coils stretched vertically. This type of modelling could have been used for large vessels with diameters of about 40cm.

The forming of the rim was the same on all the vessels from layers 23–11. Rims have almost perfectly flat and symmetrical edges, which shows that a technique was used that allowed the vessel rims to appear almost uniform. Usually, the flat edge of the rim was formed either by a coil that was bent out or by the addition of a small coil to thicken the edge of the final coil. The rim was then pressed with fingers, which is evident from the traces of finger pressure, and treated with some tool with a flat edge. In several cases, we observed traces of pebble use.

The surface treatment included the redistribution of excess clay and levelling of the surface with a comb-like tool and further smoothing and polishing. The vessel surfaces are eroded due to post-depositional

conditions and further cleaning of finds. This is why some traces of surface treatment did not survive. The surface was usually smoothed; there are traces of smoothing made with 'wet hands', pebbles, and also traces of bone tools (see *Martineau 2001.Figs. 17-18*). Traces of a comb-like tool left in the process of roughening can often be observed on the inner surface, which was especially important while making vessels with thick walls to remove or redistribute surplus clay. Traces of working with comb tools are often smoothed. In rare cases, they can also be traced on the outer surface of the vessels that is well smoothed. Elaborate polishing is rarely observed and is usually present on surfaces of thin-walled vessels decorated with dots or undecorated. Smoothing and polishing was often made after decoration, which is proved by the indistinct form of the impressions. Fragments of thick walls (to 1.2cm) with traces left by a thin comb tool on both surfaces which were not smoothed later were found in layer 20 and the layers above. This type of technique corresponds with a new clay paste with organic temper. Traces left by comb tools are very rare on vessels from layers 15-11, which can be explained either by very careful smoothing of the surfaces of these vessels or because comb tools were no longer used. A new tool for surface smoothing, probably a wooden tool or a shell, was used in this period, leaving thin linear traces on the surface of vessels (see examples of traces in *Glushkov 1996*).

Vessel bases were made with slabs pressed together or from coils formed in a spiral from the centre of the base (Tab. 1.6.1). The vessel was then shaped by stretched coils. This is clearly seen due to the 'gro-



**Fig. 2. Rakushechny Yar. View of excavation I (1964) and layers (after Belanovskaya 1964.Tab. 2).**

ove' along the perimeter of the flat base (Tab. 1.7a) which appeared as the result of finger pressure while attaching the first coil of the body to the base.

Some 13 vessel forms were identified in total (Pls. 1, 2) in layers 23-11 (Tabs. 4-10) (*Mazurkevich, Dolbunova 2012*). Vessel rims are predominantly flat and roundish, while pointed rims are rare.

In most cases, only the upper parts of vessels can be reconstructed, but due to the parts near the base and the profile features, it can be supposed that most had flat bases. Flat bases have varying diameters (4-6cm, 7-9cm, 10-11cm, 12cm, 16cm). Bases with a diameter of 7-9cm are the most widespread. The analysis of divergence angles of the low parts of the vessels allowed us to trace several features (Pl. 3). Divergence angles of 65-70° were typical of bases in the lowest layers; in the upper layers, bases of different types appeared (from 46° to 80°). Four different divergence angles existed in layer 20 (50°, 60°, 65° and 70°). In layer 13, bases had different angles (from 48° to 78°). Some definite standardisation of the divergence angles of bases were found in layer 12 (55°, 65°, rarely 70° and 75°). The maximum standardisation is seen in layer 11. In this layer, bases were made with three main standards (65°, 70°, 75°); bases with other angles were rare in this layer (46-48°; 55-62°). This strict standard may testify to the use of some forms for making the bases of vessels or the use of tools bevelled at a definite angle for pottery moulding.

Pointed bases from layers 13 and 11 can be found in the collection of the State Hermitage Museum (Tabs. 9.15, 10.11). *Belanovskaya (1995. 104)* noted the existence of a pointed base in layer 20, but the method of production and the forming suggest it is more probably a fragment of a flat base. Pointed bases have two standards of divergence angles (90° and about 110°). Also, round bases probably existed in layers 21, 20, and 13-11.

We can observe from reconstructed vessels that the height/diameter ratio is 1 to 1.3. Vessel forms can be divided into four volume groups according to their diameter (which are 7-9cm, 12-16cm, 18-24cm and 30-40cm). Vessels have estimated volumes of 0.25-0.4, 1-2, 5-6 and 14.5-

20 litres, correspondingly. A particular group consists of 'bowls' and 'plates' (forms 6 and 12) where the height/diameter ratio is 0.3 to 0.4, and the volume is about 0.15 to 0.3 litres (form 12).

Most of this pottery is undecorated, and decorated vessels comprise only 9% of the assemblage; in individual layers this percentage is even lower (*Mazurkevich, Dolbunova 2012.Tab. 1*). Vessels covered with red and yellow ochre on the outer and/or inner surfaces are also present at the site. A layer of red ochre can clearly be seen on some of the vessels, but usually only small parts of ochre survived on the surfaces. Also, an *Unio* shell with a layer of ochre inside was found in layer 20. The analyses (microscopic, microchemical, X-ray fluorescence spectroscopy, infra-red spectroscopy) made in the State Hermitage Museum by L. Gavrilenko of these fragments in order to identify the material on the surface lead us to believe that more than 10% of the whole ceramic assemblage was covered with red and/or yellow ochre consisting of iron oxide (II, III) and iron hydroxides with traces of titanium and manganese compounds.

The pottery is decorated with different impressions and incisions: small and large triangular, roundish (in layer 20), rectangular and large denticulated impressions, double toothed, impressions of belemnite (in layer 14), large pinches (in layer 15), drop-like dots, vertical and horizontal incisions, and also impressions made by a comb-tool creating several motifs. The design techniques vary: pin action, 'rocking-chair', drawn, individual marks linked through a single continuous stepped back drawn movement. A variety of techniques is seen in pottery from the lowest layer, where material decorated with triangular and rectangular impressions was found, drawn traces of 'comb', lines and denticulated impressions made with the 'rocking-chair' technique (in layers 23-22).

The decoration is very simple, consisting of horizontal and parallel lines of impressions (*e.g.*, Tab. 4.1-3) usually covering only the upper part of the vessel. Vessels decorated with a net of impressions left by a comb-tool were also found (Tab. 6.4). Pottery decorated with a figure made with triangular impressions was found in layers 20 and 19. Pottery



Pl. 1. Rakushechny Yar. Vessel forms in layers 23-14.



with geometrical motifs consisting of diagonal parallel lines appeared in layer 21, and pottery with other diagonal compositions in layer 16 (Tab. 8.3). It was in this layer that not only new compositions appeared, but also new impressions for decorating vessels in this style (for example, Tab. 9.9,14).

**Chronology, genesis and characteristics of Early Neolithic complexes at Rakushechny Yar**

The pottery assemblage from Rakushechny Yar consisted of flat-bottomed vessels of different forms, with standardised rims and bases of vessels, the existence of several *chaînes opératoires*, characteristic types of technology used to make definite forms of vessels, the rare use of decoration and traditions of surface treatment with red or yellow ochre.

The great variety of raw materials and clay pastes used for pottery shows the ability of potters to adapt to different types of materials which were available at different periods, which might be an indicator of developed skills and experience in pottery making (Mazurkevich et al. 2013). The ability to adapt different types of raw material and their use in the framework of different *chaînes opératoires* could be interpreted as a developed cultural tradition. This was not typical of pottery making in northern areas, such as the Dnepr-Dvina Region, where the process was rather conservative and where definite pottery recipes were used in various ‘ceramic phases’. The range of similar technological operations typical of vessels of the lowest layers (e.g., surface smoothing and vessel treatment with a comb-like tool, modelling of symmetrical flat rims, predominance of the coil technique with N-junction, use of well-kneaded clay and additional pieces of clay for modelling, typical vessel forms) allow us to characterise this pottery assemblage as one made according to established cultural standards. Standardisation of pottery making could reflect the level of specialisation and quantity of pottery made (Roux 2003:768). This observation is of special interest in the context of this material that was excavated outside the central set-

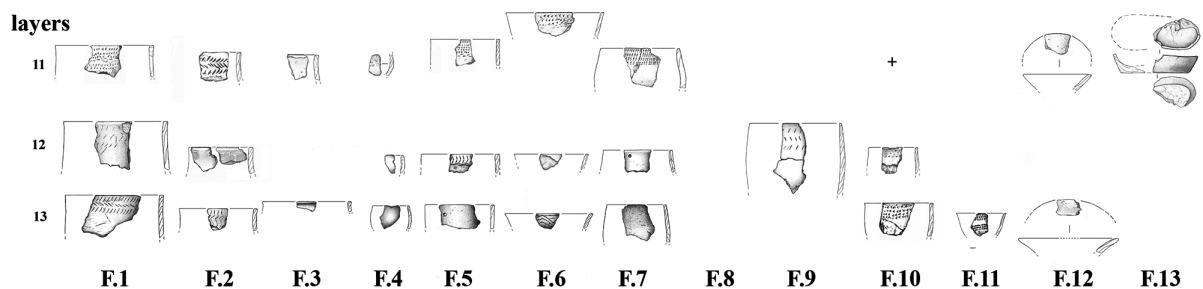
tlement at Rakushechny Yar, which was probably a seasonal area connected with fishing (Girja, Lozovsky 2014).

The variety of pottery found at Rakushechny Yar might testify to its functional diversity: a variety of forms and volumes, as well as the use of different pottery operational sequences can be traced here. The most widespread vessel form (Form 1, made from coils with an N-junction, slightly stretched, with a smoothed surface) could be interpreted as kitchen ware. Alongside this, there were several other categories of vessels, some of which could also have served some utilitarian purpose, while some could have played a particular role (vessels covered with ochre on the inner and outer sides; vessels for ochre storage).

The chronology of the material culture from Rakushechny Yar can be reconstructed from the <sup>14</sup>C dates of different materials: charcoal, soil, organic crust on pottery from excavation I (Belanovskaya, Timofeev 2003:Tab. 1). In addition, several dates are known for the different materials (bone, pottery, soil with charcoal and soil) from the test pit excavated in 2008, which was dug 25m from excavation I (Fig. 7).

The dates from excavation I correlate well with each other (Fig. 3), except for the dates on shell and some of the dates on charcoal and soil samples. These dates show the existence of different sites over a long period in this area. The oldest date, of an elk bone, comes from below layer 23 of the new excavation and may date the first stages of this occupation to 7970±110 BP (SPb-729).

Dates from layers 20–17 show that the early Neolithic complex can be placed at the turn of the 7<sup>th</sup> millennium calBC (Figs. 3, 7), which indicates that Rakushechny Yar was occupied over a period of approx. 800 years without any great changes. Later, many changes in pottery decoration, morphology



Pl. 2. Rakushechny Yar. Vessel forms in layers 13–11.

and technology can be seen to occur over approx. 500 years (layers 16–9). The end of the Early Neolithic at Rakushechny Yar can be dated to the end of the 6<sup>th</sup> millennium calBC (Fig. 3).

The buried soil X (Aleksandrovsky et al. 2009, Fig. 4) deposited at the base of the cultural layers of the test pit is dated to 7380±100 BP (Ki-15181), *i.e.* a period later than the lowest layers of Belanovskaya's excavation I (Fig. 4). This suggests that this area was inhabited approx. 600 years later. It was located on ground higher than the area of excavation I, and the soil was formed here when the occupation of the excavation I area started. The beginning of occupation of this area correlates with the period when cultural layer 20 of excavation I was formed. The differences in <sup>14</sup>C dates and the number of cultural layers (their thickness and characteristics) supports Belanovskaya's hypothesis that the cultural layers identified at the shore, in test-pits and in the numerous excavations at Rakushechny Yar in different parts of the island cannot be simply correlated. Synchronous layers might also occupy different hypsometric positions. This 'diversity' is evidence of asynchronous and repeated occupation of this area.

The origin of the Rakushechny Yar complex raises many questions and discussions. The appearance of this complex can be dated to the first quarter of the 7<sup>th</sup> millennium calBC (Timofeev et al. 2004; Davi-

son et al. 2009; Aleksandrovsky et al. 2009; Tsybriy et al. 2014), *i.e.* contemporaneous with Early Neolithic (ceramic) complexes in the Near East (Belanovskaya, Timofeev 2003). During this time, the oldest pottery centres were formed in the steppe areas of Eastern Europe, which could have occurred under the influence of Neolithic cultures in the Caucasus (Belanovskaya 1995.181–182), whereas the Southern Caucasus area was within the zone of influence of early Anatolian Neolithic cultures during the Pre-Pottery Neolithic B period (PPNB) (Kiguradze, Menabde 2004.353). However, no such ancient sites with pottery have survived in the Caucasus, where Early Neolithic complexes have been dated to the end of the 7<sup>th</sup> and to the 6<sup>th</sup> millennium calBC (Arimura et al. 2010; Hansen et al. 2007; Hamon 2008).

However, based on a range of similar features, *i.e.* similar forms of pottery and similar ceramic techniques (the use of coils or slabs, the simplicity of pottery, rare use of decoration) (Vandiver 1987.9–23; M. le Mière, Picon 1999.5–16; Nishiaki, M. le Mière 2005.59–63; Voigt 1983), the existence of specific types of tools with a longitudinal groove, similar to tools distributed in the Levant and Western Mesopotamia (Arimura et al. 2010.80), adobe architecture and the proximity of radiocarbon dates, we might also suppose direct infiltrations from the Near East to the Lower Don Region. Relations be-

Layers	Organic crust	Charcoal	Soil with charcoal	Bone	Shell
			5290±260 (Le-5327)		
layer 2		4830±90 (Le-5383)	6300±300 (Le-5343)	4180±100 (Le-5428)	
layer 3		4360±100 (Bl1704)			
				5060±230 (Le-5140)	
layer 4				6300±90 (Le-5482)	
			6320±40 (Le-5582a)	5920±90 (Le-5479)	
layer 5			6440±35 (Le-5582b)		7840±105 (Ki-955)
layer 8		6070±100 (Bl1177)			
layer 9					7180±250 (Le-5344)
	6930±100 (Ki-6478)				
	6950±100 (Ki-6479)				
layer 15	7040±100 (Ki-6480)				
	6841±40 (Ua-41365)				
layer 18	(δ <sup>13</sup> C - 28,0**)				
	7156±41 (Ua-41364)				
layer 19	(δ <sup>13</sup> C - 28,0**)				
	7290±50 (Ua-37097)				
	(δ <sup>13</sup> C - 28,6)				
	7690±110 (Ki-6475)				
	7860±130 (Ki-6477)				
layer 20	7930±40 (Ki-6476)			7970±110BP (SPb-729)*	

Fig. 3. <sup>14</sup>C dates made on different materials found at excavation I of Rakushechny Yar (\* dates obtained on material found during recent excavations; \*\* estimated value).

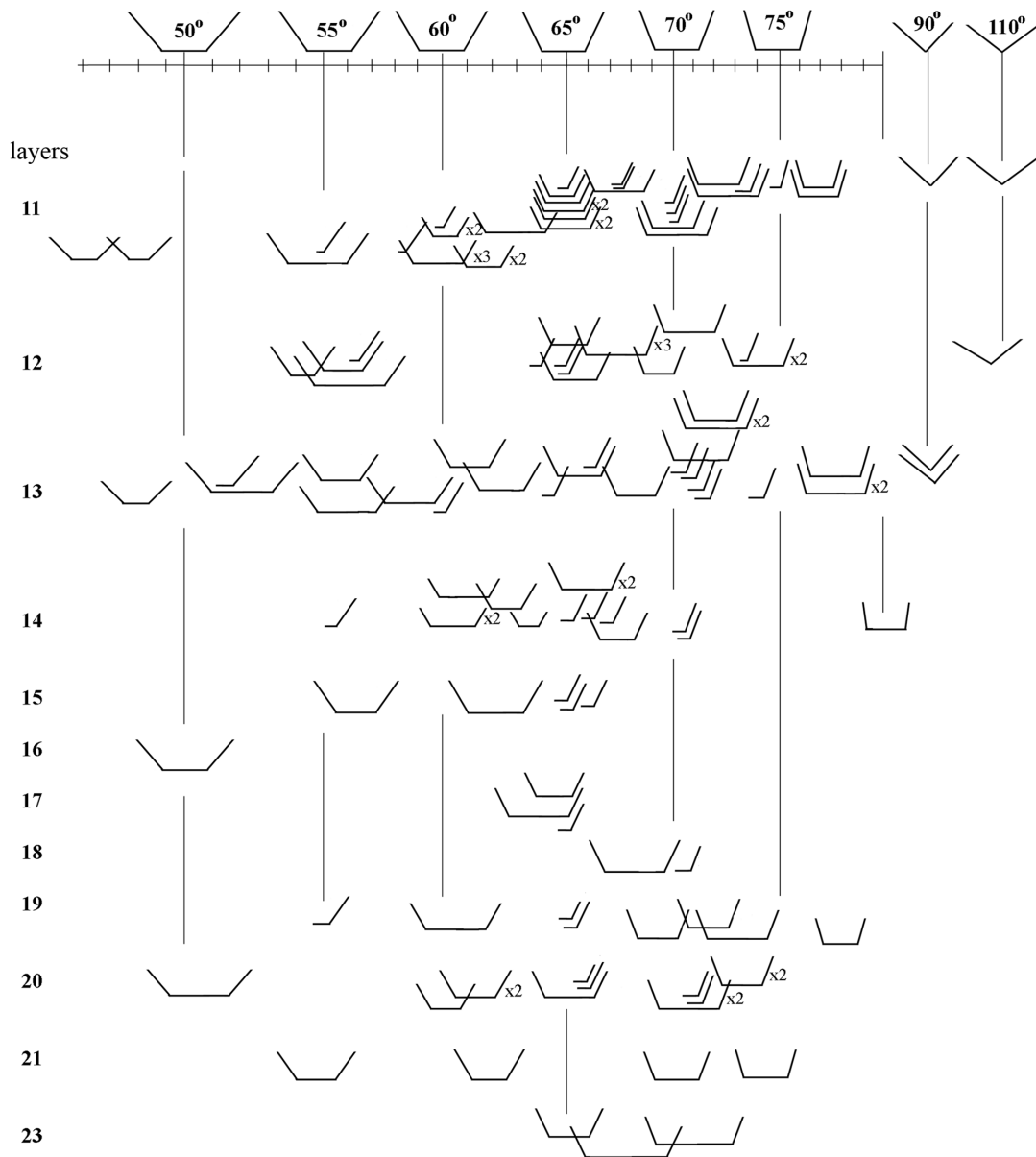
tween the steppe areas of Eastern Europe from the Black Sea to the Azov Sea with Armenia and Central Anatolia could also be evidenced by finds of obsidian that originated from deposits located in the latter regions (Biagi et al. 2014). Recent research has revealed traces of the penetration of Near Eastern cultural traditions dating to an even earlier period into these areas (Gorelik et al. 2014). This might testify to multiple cases of penetration by bearers of Near Eastern cultural traditions with different components of the ‘Neolithic package’ in the Lower Don region.

**Sites in the Lower Volga River basin**

A detailed description of early Lower Volga Neolithic sites can be found in publications by Aleksander A.

Vybornov (Vybornov 2008; Vybornov et al. 2012; 2013). We present here a description of pottery of this region based on these publications and also on the results of pottery analyses from different sites. The pottery assemblages are presented here in the chronological order proposed by Vybornov (2008) based on an analysis of pottery, the stone industry and the radiocarbon dates of organic crusts on pottery, and other materials attributed to different periods.

Sites in the Lower Volga River basin are divided into two groups, one on the left bank and another on the right bank of the river (Map 1) (Vybornov 2008). Almost all the pottery from the North Caspian area was made from silts with organic solutions (definitions



Pl. 3. Rakushechny Yar. Divergence angles and base' diameters in layers 23–11.

of raw materials by *Vasilieva 1999; 2010*); later, shells were incorporated into the paste (*Vasilieva, Vybornov 2012*). According to Irina N. Vasilieva, the Early Neolithic pottery of the North Caspian was made from slabs put together in spirals (*Vasilieva 1999.84–85*). Large vessels could have been made from slabs organised into blocks or with the moulding of vessels (*Vasilieva 1999.86–91*).

The early chronological stage of the Volga left-bank group (termed Kairshak-Tenteksor) includes the Kugat IV and Kulagaisi sites (Tab. 12.1–3). Vessels were made from paste with crushed shells and organic remains; they have straight walls and round bases. Decoration did not cover the whole surface, and was made by incised lines or oval-form impressions (*Vybornov 2008*). The dates of the first and second stages overlap and have aroused some controversy, which needed to be explained (Tab. 12). The conservation of Mesolithic traditions in the stone industry can be traced during this stage (*Vybornov 2008*). These sites could reflect the first wave of distribution of pottery-making traditions in this region.

The second chronological stage is represented by Kairshak I–IV (Tab. 12.6–30) and Burovaya 42. Vessels were made from sandy silts with a natural admixture of shells and organic material; they usually have bowl-like forms, with flat, somewhat concave bases. Decoration consists of various motifs (*Vybornov 2008*), while some fragments of undecorated pottery, similar to the undecorated pottery from the lower layers at Rakushechny Yar, were found at Kairshak III.

The third chronological stage includes Tenteksor I, Je-kolgan, Kachkarstau, Kyzyl-hak II. Vessels were made from sandy silts with a natural admixture of shell and organic material; they have flat bases with a simple or complex profile and flat or roundish rims. Most of the vessels are decorated with oval or quadrangular-form impressions, while geometrical curvilinear decoration is typical of this material (*Vybornov 2008*).

The Jangar-Varfolomeevskaya group was located on both banks of the Lower Volga. Tu-buzgu-huduk represents the earliest stage; pottery was made from clay paste with a mixture of sand and organic remains. Vessels have straight walls and closed forms; bases are flat and roundish. Decoration is rather simple, consisting of triangular and oval impressions in the upper part of the vessels forming horizontal rows of impressions and zigzags (*Vybornov 2008*).

The second chronological stage includes the second and third layers at the Jangar site (Tab. 13.11, 23–26) and layer 3 at Varfolomeevka (Tab. 13.1–10, 12–23). Vessels from Varfolomeevka were made from silt, similar to those from the North Caspian area. The pottery in layer 3 was made with shell temper. Most of the vessels from layers 2 and 2a were made from silty clay (*Vasilieva 2010*). This pottery was constructed from coils; the outer surface was polished, and the inner surface smoothed by a comb tool or grass (*Yudin 2004*). The coils could have been stretched and attained up to 2.5–3cm. Most vessels have straight walls; bases are predominantly flat, but slightly concave compared to the flat bases at Rakushechny Yar, and they rarely have a clear angle between the base and the wall. Pottery was decorated with triangular impressions, usually covering the upper part of the vessels or the whole pot; a technique with dot impressions was applied. Complex motifs consisting of zigzags and geometrical figures, as well as simple compositions of horizontal lines, are typical. Rims are slightly cut, straight and roundish (*Yudin 2004*).

The vessels from Jangar were made from silts, although some pots were made from silty clay. Bases are usually flat, although some vessels have round bases, with straight walls, and a closed or complex profile. Decoration on the upper part is in the form of triangular, oval and quadrangular impressions. The decorative compositions vary (*Vybornov 2008; Koltsov 1988*).

Several major ceramic forms were identified (Pls. 4–5), which include open vessels (form 1, form 8), vessels with a complex profile (form 2.1, form 4.1, form 7) and small bowls (form 10). The volumes of vessels from the earliest sites (Kugat IV, Kulagai-si) are 0.3, 1.5 and 3 litres. Vessels from Varfolomeevka (layer 3) have volumes of 0.15, 0.3, 0.8, 1.5–2.2 and 5 litres. Later, large closed vessels were more common (form 4.2, form 12), open big vessels (form 8), and small bowls (form 11). The volumes of vessels increased in this period: for examples, at Kairshak III, vessels of 0.7, 1.2–1.5, 3, 5–6 and 13–14 litres were found. We might also suppose, due to the diameter of the upper parts, that there were larger vessels in the assemblage. The volumes of examples from Varfolomeevka (layer 2B) are 4, 6 and 18.5 litres, and from Jangar (layer 2) 0.5 and 10 litres.

#### **Sites in the Middle Volga basin**

The description of the ceramic collection from this region is based on an analysis of published materi-

als and observations made when analysing some of the ceramic finds from various sites.

Elshanskaya pottery appeared in the second quarter of the 7<sup>th</sup> millennium calBC in the Middle Volga basin. Its origin may have been connected to the penetration of the conical ware ceramic tradition, poorly decorated, from south-western areas, from the Eastern Caspian area and Aral region, bypassing the Caspian plain (*Vasilliev, Vybornov 1988.24*). It has also been proposed that this ceramic tradition originated in this region, which was only slightly influenced by southern groups (*Kuz'mina, Lastovskii 1995.43*). Early Neolithic complexes in the southern forest-steppe of the Volga-Ural region can be found at sites located on the banks of the Samara, Sok and Tok rivers (*Morgunova 1995.14*).

Three chronological complexes can be identified in the Elshanskaya materials (Tabs. 14–15): early, middle and late (*Vasilieva, Vybornov 2012*). Vessels were predominantly made from silty clay with an admixture of organic solutions and grog (crushed pottery) (*Vasilieva 2011; Vybornov 2008.241*). Vessels were made from slabs on different moulds or arranged by sections (*Vasilieva 2011*). The 'paddle and anvil technique' was also applied. Wall thickness is 3–4mm. The coil technique with N-junction appears on some vessels from Staroelshanskaya II and Chekalino IV. Smoothing and polishing were the main types of surface treatment. Pottery was fired at low temperatures (*Vasilieva 2011*).

The early Elshanskaya complex includes undecorated pottery with thin walls, with predominantly S-profile or straight walls and conical bases. Although it might be supposed that flat bases would have been among the most ancient types (*Andreev 2012*).

The middle Elshanskaya complex includes pottery with decoration (short incisions on the rim, incised lines organised in a net, bands of impressed dots, combined with incised decoration and triangular impressions). This pottery was rarely made from silt. Vessels have round and flattened bases (*Vasilieva, Vybornov 2012*).

The late Elshanskaya complex includes vessels with thick straight walls, with a row of impressions below the rim, and predominantly flat bases (found at Krasny Gorodok, Vilovatovskoe and other sites in the northern Middle Volga basin). Pottery surface treatment included smoothing with a comb (*Vasilieva, Vybornov 2012a*).

A separate group that includes undecorated vessels with round and flat bases found at Vilovatovskoe was also attributed to Elshanskaya culture (*Vasilieva, Vybornov 2012a*).

According to the analysis of reconstructed vessel forms published in the literature, Elshanskaya pottery had estimated volumes of 0.16, 1.5–2 and 5–6 litres in the early stage. The forms of the vessels are open with an out-turned rim (Pls. 4–5), made from combined cones (form 2.1, 2.2), cylinder and ellipse (form 3), closed forms (form 5), and cylindrical ware (form 9). The pottery of the middle complex had volumes of 1, 2.5, 5–6, 10 and 40 litres. As well as bowls (form 11), the pottery forms of this stage are 3, 5, 4.1, 6, and 12. The forms of flat-bottomed ware of the final stage have the same form as the conical ware (forms 3, 5). The vessel volumes are 0.25, 0.44, 5.7, 7 and 20–23 litres. Also, small bowls with volumes of 0.11, 0.15, 0.22 and 0.45 litres (form 11) were found at Ozimenki 2, Imerka 8, Lebyazhinka IV, and Ivanovskoe.

#### **Early Neolithic sites of the Dnepr-Dvina region**

The basin of the Upper Western Dvina River is one of the first regions in the forest zone of Eastern Europe where pottery appeared at the beginning of the 7<sup>th</sup> millennium calBC. This was probably the result of migrations of small groups and/or 'migrations of ideas' (*Mazurkevich et al. 2006*), firstly from the territory of the Lower Don and later from the Lower Volga region (*Mazurkevich 1995*). During the early Neolithic, various types of pottery appeared here, which have been defined as 'ceramic phases' which mark changes in pottery technology, morphology, and design (*Miklyaev 1995*) (Pl. 6). The analysis of pottery assemblages allows us to trace several technological, morphological and decorative traditions, the formation of which was influenced by a variety of factors. The appearance of bearers of other cultural traditions here can be traced primarily in the changes in morphology and decoration; in most cases, the technology changed little. We also deduce from our analysis that specific ceramic recipes were used for specific *chaînes opératoires*, which is typical of the pottery of this region.

*Phase 'a-1'* is represented by fourteen vessels from eight sites situated in the Serveysky (Serteya X (Fig. 8), XXII, XIV, XXXVI, 3–3) and Usviatsky (Romanovskoe, Cyganovy Nivy, Uzmen') micro-regions (Tab. 16). Vessels were made from lean kaolinite clay with a high content of clastic material, and sand and grog temper (dry clay). Vessels were constructed with the

coiling technique, with coils set at an obtuse angle in vertical and horizontal section 0.9–2cm high (Tab. 17). Wall thickness is from 0.7–0.8cm to 1–1.1cm. Traces of a comb-like tool left in the course of surface roughening after covering the vessel with a layer of liquid clay are visible on both surfaces; they show through a thin layer of surface covering that had been polished or smoothed. The vessels are not decorated. They have a straight form, with a slightly out-turned flat edge, which is characteristic only of the pottery of this phase, and there is one example of a pointed rim.

*Phase 'a'*. Thirteen vessels from four sites in the Ser-teysky (Serteya X, 3-3; Rudnya Ser-teyskaya) and Usvyatsky micro-regions (Poloneika) have been discovered. They were made from clay of hydromica composition, with an admixture of sand and grog or aleurite sediments without temper, and constructed with the coiling technique (Tab. 19). Coils are at an obtuse angle in the vertical and horizontal sections, which are 0.9–2cm high. The wall thickness varies from 0.7–0.8cm to 1–1.1cm; some fragments have 0.4–0.6cm thick walls. The vessels have traces of comb on both surfaces showing through a thin layer of polished covering. The vessels were decorated with incised short lines, put in horizontal and diagonal rows. The pottery forms from this phase have pointed to round and straight rims.

*Phase 'b'*. Ninety-nine vessels (Tab. 20) were discovered at 22 sites located in the Ser-teysky (Serteya X, XII, XIX, XX, XXI, XXII, XXIV, XIV, XXVII, XXXV 3-1, 3-3, 3-4, 3-5, 3-6; Rudnya Ser-teyskaya), Usviatsky (Usviaty II, Uzmen', Romanovskoe, Cyganovy Nivy) and Sennitsky (Froly I, Dubokrai I) micro-regions. Several vessels were made from aleurite sediments without temper. However, most were made from two types of clay paste: aleurite and hydromica sediments (lean clay) with an admixture of sand, and grog, as well as more plastic clay with a greater percentage of grog and sand. A change in raw material sources can be noted in the pottery of phase 'b': gytija sediments from lakes and aleurite from riverside areas were used most frequently as raw material. Furthermore, this trend was associated with the occurred river transgression and, consequently, the appearance of new sources of raw materials.

The pottery technology of phase 'b' differs little from phase 'a'. The coil technique was used, and slabs could also have been added. Surfaces were polished or smoothed. It is possible that they were coated with a thin layer of liquid clay and then roughened,

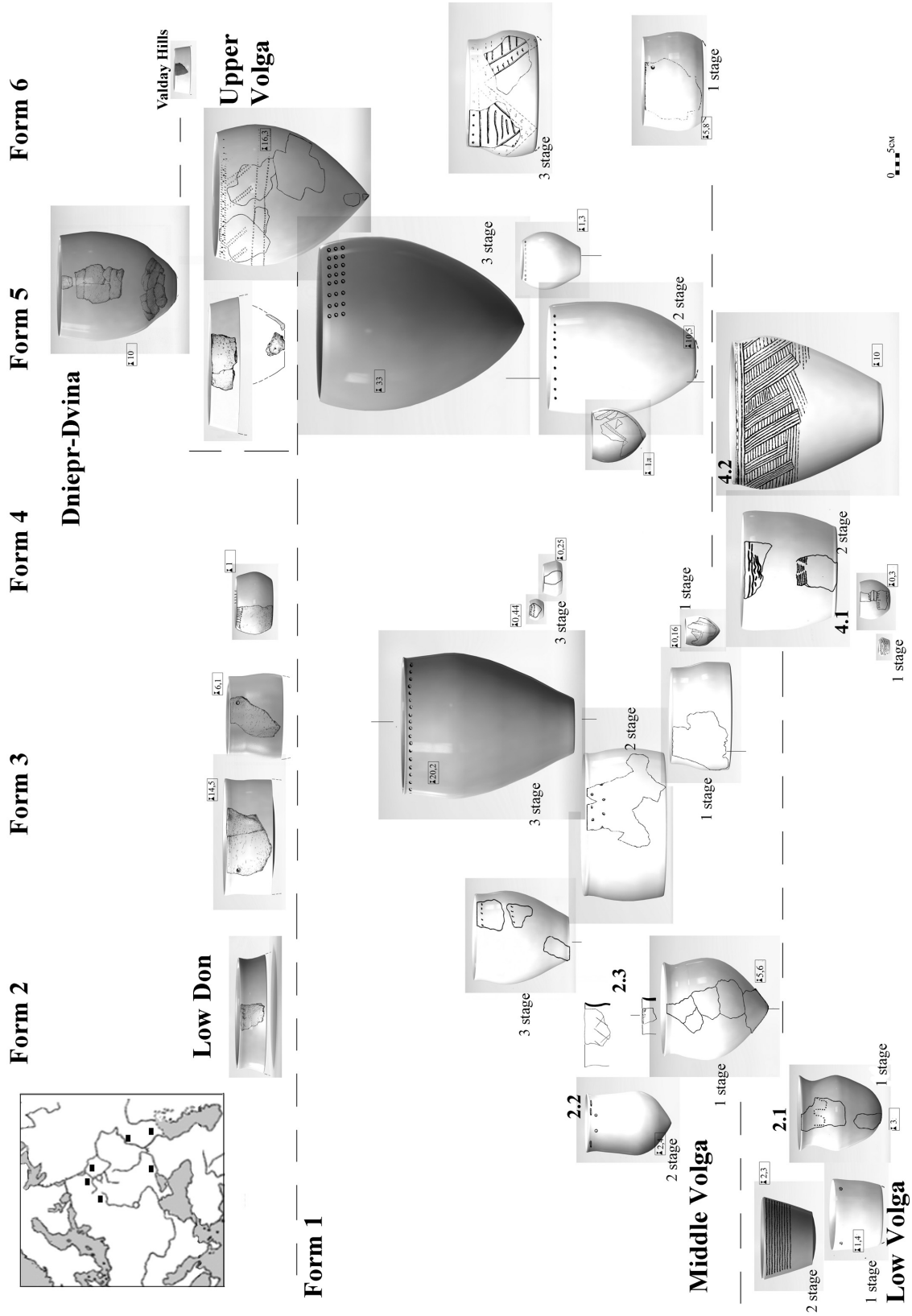
as in the case of the other phases. Vessels are decorated with drop-like impressions, triangular impressions and incisions. Compositions consisting of motifs in horizontal rows predominate. There are also compositions with a rhomboid and rectangular grid system similar to nets. Vessels take different forms: open with straight, out-turned rims, as well as some with parallel walls and round-edged rims, with either conical or rounded bases.

### ***The cultural and chronological position of the early Neolithic ceramic complex in the Dnepr-Dvina region***

In 1964, and later in 1985, when this pottery was discovered, it was almost impossible to define its Early Neolithic age based on similarities. These similarities came from different, rather distant territories (as far as the north Caspian region), and the materials were from mixed artefact assemblages (Miklyayev et al. 1987). In addition, radiocarbon dates were not available for most of these complexes. In recent years, with the appearance of new materials and radiocarbon dates of Early Neolithic pottery from Eastern Europe, these proposed similarities have come to be accepted by a wide scientific community.

At the beginning of the Atlantic Period, two waves of pottery traditions penetrated this region. This happened during a period of significant climatic change. This is also supported by greater anthropogenic influence on the ecosystem and palaeo-lakes in comparison with the preceding Boreal period (Mesolithic). However, the traditions of phase 'a-1' pottery did not become very widespread, whereas the traditions of phase 'a' demonstrate their further development in this region, as does the appearance of phase 'b' pottery decorated with triangular impressions.

Ceramic phases 'a' and 'a-1', which constitute the oldest pottery traditions, appeared in this region, each with their own origin. Phase 'a-1' seems to be the oldest in this region, given the typological-technological analysis and  $^{14}\text{C}$  dates, and could have originated in the pottery of the Rakushechny Yar site. It was dated to  $8380 \pm 55$  BP (Ua-37099) based on organic crust from a vessel fragment. A very low percentage of  $\delta^{13}\text{C}$  ( $-33.8\text{‰}$ ) in the charred food crusts is evidence of a hard-water reservoir effect, so the date could be older (Fischer, Heinemeier 2003). This pottery fragment was found in the lowest sandy layer at Serteya XIV. The sand was probably formed at the same time as that on the site at Rudnya Ser-teyskaya. Based on these assumptions and also analogues in Neolithic cultures in southern part of East-



Pl. 4. Distribution of forms 1–6 in the Lower and Middle Volga, Lower Don, Dniepr-Dvina regions, Upper Volga with indication of vessel volumes. \*1 Koryl'tay 1 (after Arheologiya Mordovskogo kraya 2008, Fig. 32).

ern Europe, the appearance of these materials might date to the first half of the 7<sup>th</sup> millennium BC.

The pottery of phase 'a' is similar to the early Neolithic pottery of the Northern Caspian region and to the range of cultures in the Middle and Upper Don region (*Smol'arinov 2005.Fig. 2.8*), the Middle and Upper Volga (*Vybornov et al. 2000.186, Fig. 1; Krajinov-Khotinsky 1977.Fig. 4.3, 14, 15*) and the Sura-Moksha basin. The traditions with triangular impressions first found in materials of phase 'a' continued into phase 'b'. It was probably during this time that the influence of this decoration of steppe cultures first spread in different directions along the basins of the Middle Volga, Middle Don, Upper Volga, Sursko-Moksha basin, Desna, Upper Dvina, Upper Dnepr and Valdai valley.

At the Rudnya Serteyskaya site, phase 'a' pottery was found in a layer of sand, and some of the fragments attributed to this phase were found in a layer of bluish, sandy, shell-rich gyttja (Fig. 9). The formation of the sandy layer occurred in the Boreal period, when regression occurred, and the interruption in sedimentation can be traced in the pollen diagram (*Dolukhanov et al. 1989*).

At Serteya X, fragments of phase 'a' pottery were also found in a layer of bluish, sandy, shell-rich gyttja. There were three horizons of cultural layers divided by sterile inter-layers of bluish-grey sandy gyttja. This gyttja deposit at the bottom of the lake basin is dated to 7800±120 BP (Lu-4255) - 7510 ± 140 BP (Lu-4256), which is when sites with phase 'a' pottery existed on the lake shore. This can be proved by dates obtained from organic crust on phase 'a' pottery. The accumulation of gyttja, which covered the sand at Rudnya Serteyskaya, and on which phase 'b' artefacts from the Serteya X site were found, can be dated to 7380 ± 130 BP (Lu-4258) - 6680 ± 150 BP (Lu-4277) due to the investigation of bore-hole 63 (*Arslanov et al. 2009*). Some of the vessels from this phase were found in layer A-2 at Serteya X, which correlates with the date obtained on wood from the same layer, 7300 ± 80 BP (Le-5260).

The dating of organic crust from phase 'a' pottery corresponds to 7870 ± 100 BP (Ua-37100) ( $\delta^{13}\text{C} = -31.7\text{‰}$ ) (Rudnya Serteyskaya site) and 7150 ± 50 BP (Ua-37098) ( $\delta^{13}\text{C} = -31.2\text{‰}$ ) at Serteya X, layer b. Thus, we may suppose that phase 'a' pottery may be dated to 6800–6100 calBC. Despite rather high negative values of  $\delta^{13}\text{C}$ , the determination of  $\delta^{13}\text{C}$  alone cannot be a definite marker, which shows the

older age of the sample, as some plant materials also have high negative  $\delta^{13}\text{C}$  values (*Boudin et al. 2010*).

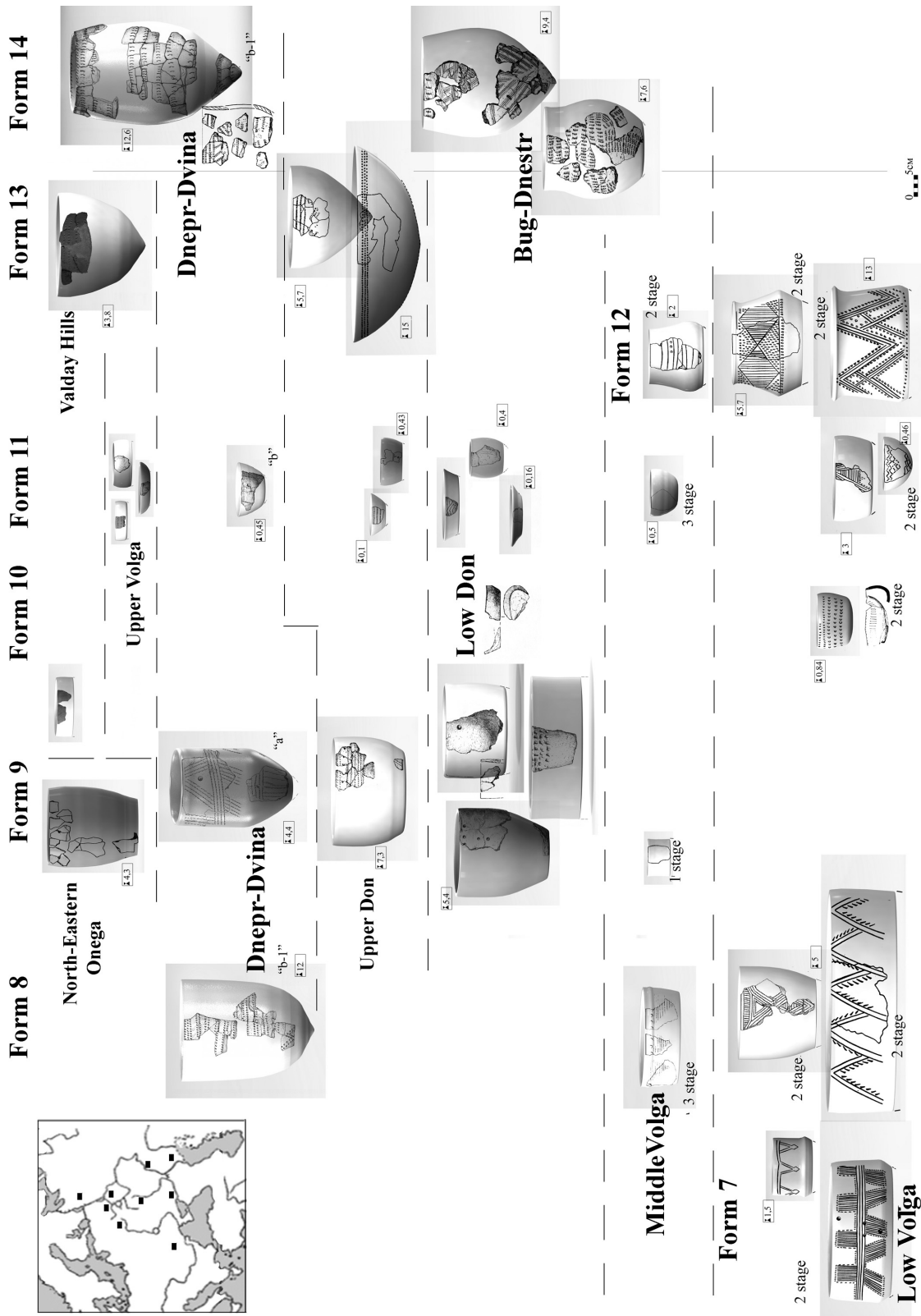
## Discussion

The oldest pottery traditions in Eastern Europe were distinguished on the basis of specific technological-typological characteristics and radiocarbon dates. We might also suppose the existence of intermediate sites located between the southern and northern areas with the oldest pottery assemblages, which is also evidenced by the analysis of Early Neolithic materials found in mixed complexes with pottery dating to different periods. For example, undecorated pottery similar to the Rakushechny Yar ceramic tradition was identified at sites located in the Middle Don and Upper Volga regions.

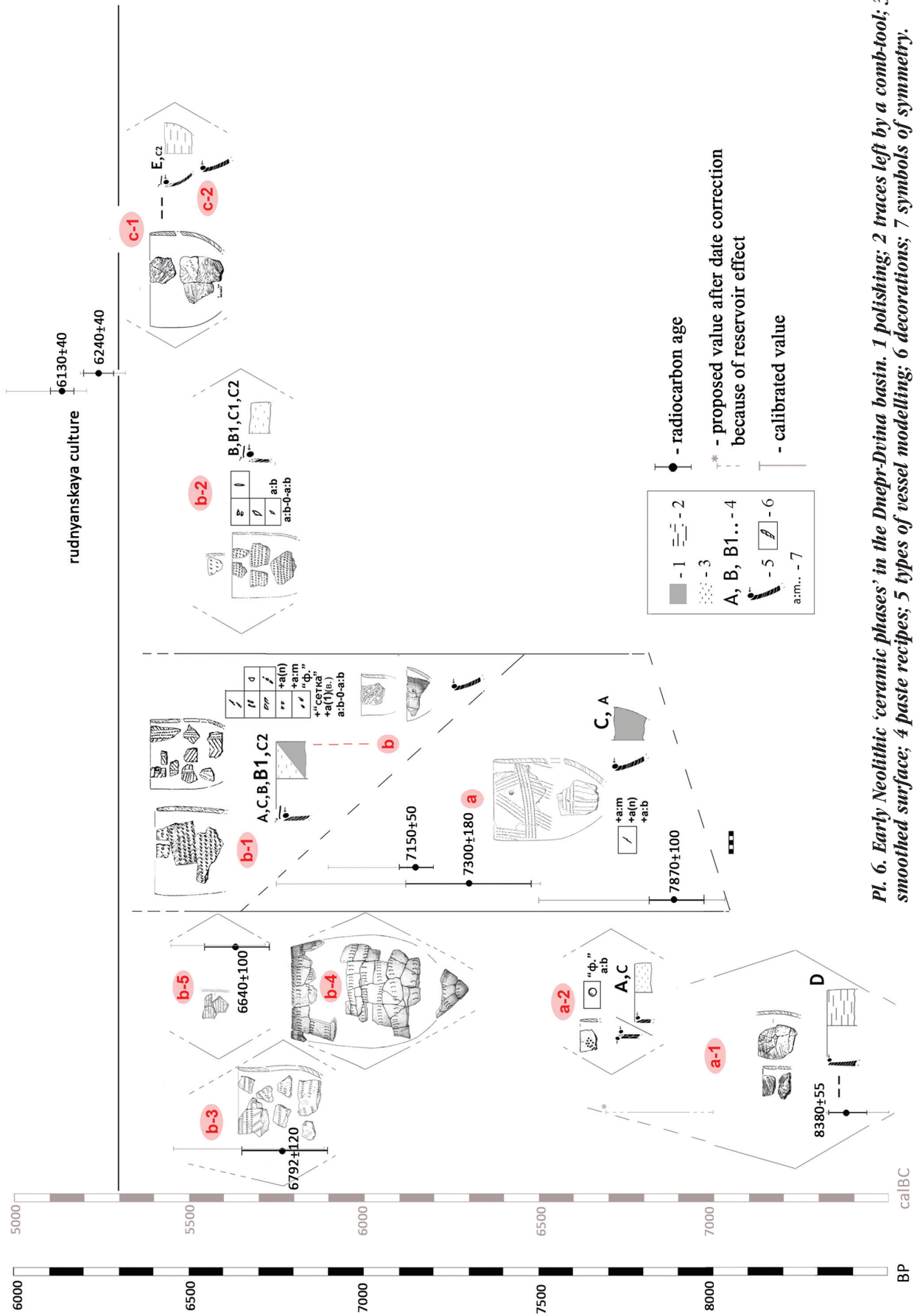
We propose two different models of Neolithisation for the territory of Eastern Europe. The first relates to the 'standard' spread of the 'package of innovations' that marked the beginning of the Neolithic period (pottery, a productive economy, architecture, stone vessels that can be found, for example, at Rakushechny Yar), and to the formation of 'primary' centres of Neolithisation in the Lower Don, Northern Caspian and Middle Volga Regions (which could have been influenced by other early Neolithic ceramic cultures with origins beyond Eastern Europe). The advantages of components of the 'Neolithic package' were not evident to tribes of hunter-gatherers, who could estimate the value of these components and choose those that suited them, namely pottery, which seemed not to be the most important part of the package. The competitive character of different economic strategies can be seen at this stage and the 'readiness' of local populations to admit definite innovations would be important. The absence of a productive economy could be explained by specific characteristics of the local natural environment: low fertility of soils, long winters and rich water and forest resources (*Dolukhanov 1996*), as well as the low population numbers in ecological niches. Later on, cultural impulses began to diffuse from those centres that have been archaeologically fixed through pottery - 'ceramic waves' - throughout Eastern Europe (*Mazurkevich et al. 2013*).

The second model is 'septentrional' - the appearance of only one component of the 'Neolithic package' - pottery, and the formation of 'secondary' ceramic centres. It is important to note that the appearance of pottery-making skills, their dispersed distribution, and further expansion and development in





Pl. 5. Distribution of forms 7–14 in the Lower and Middle Volga, Upper Don, Dnepr-Dvina regions, Valdai Hills, Upper Don, North-Eastern Lake Onega, the Bug-Dneestr basin with indication of vessel volumes. \*1 Berezovaya slobodka II–III (after Ivanisheva, Ivanishev 2006, Fig. 4); \*2 Plautino 2 (after Surkov 2007, Fig. 37); \*3 Karamyshevo 9 (after Smolijanov 2005, Fig. 1–2, 4); \*4 Shurivici-Porrig (after Gaskevich 2010, Fig. 3, 4).



Pl. 6. Early Neolithic 'ceramic phases' in the Dnepr-Drina basin. 1 polishing; 2 traces left by a comb-tool; 3 smoothed surface; 4 paste modelling; 5 types of vessel modelling; 6 decorations; 7 symbols of symmetry.

Eastern Europe are *two different processes*. We suggest that it is necessary to divide the process of 'Neolithic package' diffusion and formation of the oldest ceramic assemblages (related to the first model) and further distribution of pottery traditions in the Mesolithic milieu from other, *secondary*, centres situated in forest and steppe-forest zone. The end of the development of the first Early Neolithic traditions can be regarded as the end of the early Neolithic that happened in different regions at different times.

The appearance of pottery should not be regarded as merely a simple feature. The fact that similar pottery traditions were distributed over a great area in a short period probably had definite reasons. Some techniques, artefacts, materials and designs appear to be trans-cultural and distributed in other regions, whereas the zone of distribution of other items is limited to their place of origin (see *Martineau 2000. 226*). The preciseness in copying pottery technology, choice of raw materials, design and forms of vessels suggest the conservation of initial traditions in the milieu of local populations over a long period, which indicates that pottery became a trans-cultural phenomenon. One of the reasons for this could be the idea of prestige and/or sacred significance of this first ceramic ware. There might be other reasons why pottery could become an object of distribution/exchange, along with a utilitarian function: the use of pottery in feasts (*Heron, Craig 2008*), the high aesthetic and function of certain vessels, their content (*Moore 1995.47*) and prestigious character (*Hayden 1998*) etc.

Several facts could support the hypothesis that pottery and/or the idea of pottery making was distributed over great distances in various regions, and thus be additional evidence of the existence of 'primary' and 'secondary' centres:

- ❶ the existence of vessels made from raw materials that come from deposits in other parts of a micro-region or from other regions, which may be evidence that they were transported over various distances (*Mazurkevich et al. 2013*);
- ❷ the similarity of decorative, technological and morphological pottery traditions found in different areas;
- ❸ the existence of particular vessels that differed in technological, morphological and decorative features from the pottery assemblage of a site. Such 'imports' can be found in materials from the Northern Caspian (Kairshak III), the Upper Volga (Sakhtysh IIa) and the Dnepr-Dvina regions (Uzmen').

'Primary' centres became areas from where pottery-making traditions spread to other territories. One of these centres was in the Lower Don River in the first quarter of the 7<sup>th</sup> millennium calBC. Based on the described evidence, this centre could be regarded as an initial area for the formation of Early Neolithic cultures in Eastern Europe (*Mazurkevich, Dolbunova 2012; Mazurkevich et al. 2013*). In the process of distribution further to the north, this 'Neolithic package' lost most of its constituents, and the only indicator of a new epoch that is archaeologically visible is pottery with definite technological, morphological and decorative features. Similar *chaînes opératoires* and their modifications were distributed in areas in the Dnepr-Dvina region (phase 'a-1'), Upper Volga region (Zamostie 2 is an example, see (*Mazurkevich et al. 2013a*), Sakhtysh sites, type 4 and 7), the Upper Dnepr region, and Valday region (type 1). Similar vessels can be also found in the Middle and Lower Don regions. However, this pottery did not become the only basis for following the formation of Early Neolithic complexes, as at the Raksuhechny Yar site.

The tradition of pottery decorated with triangular impressions, individual linked impressions and lines first appeared in the basin of the Lower Volga and Northern Caspian in the first quarter of the 7<sup>th</sup> millennium calBC (*Vybornov 2008*). The early pottery in the Lower Volga region is accompanied by a stone industry, which, according to researchers of this region, have Mesolithic traits (*Vybornov 2008*) and could have been connected with the first stage in the distribution of ceramic traditions. This conservation of Mesolithic flint traditions in complexes accompanying the first pottery can be also found in different areas of Western and Eastern Europe (*Lozovsky 2001; Polkovnikova 2003; Nikitin 2013.26; Sinyk 1986; Robinson et al. 2013*), although some researchers also outline the possibility that different complexes were mechanically mixed (*Viskalin 2013*). Early Neolithic materials in the Northern Caspian have analogues in Neolithic material from the Caucasus, Lower Volga and Azov areas, and the central Asian Neolithic (*Vybornov 2008*).

Cultural impulses from this centre can be traced over a vast territory of the forest-steppe and forest zones of Eastern Europe (*Miklyayev et al. 1987; Mazurkevich 1995*). In a neighbouring region, at Raksuhechny Yar, a few vessels decorated with triangular impressions have been found deposited with undecorated pottery in lower layers (23, 21–11). Also, there were fragments of pots with typical North Caspian decoration, consisting of a triangular composi-

tion filled by small triangular impressions (layer 19; Tab. 7.9), and a pot decorated with triangular impressions in a drawn technique with single triangular impressions (layer 11).

A small number of 'archaic' items decorated with very specific triangular impressions or in drawn technique can be found in the Dnepr-Dvina region (phases 'a' and 'b'), Upper Dnepr region, Middle and Upper Volga, and Don areas, and the Desna River, and Valday region. The North Caspian pottery traditions appeared in the forest-steppe and forest regions, were conserved and developed further independently from the 'primary' centre and did not change significantly for several hundred years. In contrast, an endogenous development of pottery occurred in the 'primary' centres, evolving more complex forms and decorations as well as changes in technology.

Another early ceramic complex at sites on the Middle Volga River – in the area of Elshanskaya culture distribution – can be dated to the first quarter of the 7<sup>th</sup> millennium calBC. The formation of the Early Neolithic complex of the forest-steppe zone in the Volga basin can be connected to the central Asian region (*Andreev 2014.13*). The slab technique and 'S' pottery techniques, the use of certain raw materials, the complex forms of vessels, and decoration with impressions below the rim are typical features. A mixture of organic fluid and grog (crushed pottery) are among the most typical admixtures in the paste recipes (*Vasilieva, Vybornov 2014.38*), and also for pottery from other areas that might be analogical to Elshanskaya pottery. The use of organic fluid is also found in pottery from the North Caspian basin (*Vasilieva 1999.84*). Traces of organic fluid where the coils are joined, as well as a grog temper, can be found in pastes of pottery from sites located on the Sukhona River (*Ivanischeva 2009.278*). Grog temper was also used in pottery of the Elshanskaya-like culture in the Sura-Moksha basin (*Vasilieva, Vybornov 2014.38*) and in pottery from the Koshkinskaya site on the right bank of the Vyatka River (*Gusentsova 2014.91*). Pottery in the Dnepr-Dvina basin was made with another type of grog (crushed clay), which was first used in vessels from phase 'a-1'.

Some types of Elshanskaya culture are similar to pottery from Rakushechny Yar (form 2), made with the 'S' technique with an admixture of grog (only in this case, crushed pottery was used). Also, the straight walls and roundish or pointed rims of the earliest stage of Elshanskaya culture are similar to forms 1 and 5 from Rakushechny Yar (Pl. 1).

The distribution of sites with Early Neolithic pottery reveals particularities in the distribution of different types throughout Eastern Europe. The distribution map of sites where pottery appeared in the first half of the 7<sup>th</sup> millennium calBC shows a small number of such regions with the oldest dates (Map 1). We might suppose that such pottery would be typologically distinguishable from the later mixed pottery traditions of different regions. However, its quantity and the number of sites with these types of pottery would not be the same as in the following periods. A considerable increase in radiocarbon dates of Early Neolithic pottery can be seen in the period from 6500 to 5500/5300 calBC (Map 2). The absence of radiocarbon dates for certain types of pottery did not allow an analysis of their distribution into more narrow chronological periods within this long period. Also, we might suppose the co-existence of sites with pottery of different origin. For example, in the Upper Don basin, several groups of sites with different pottery types have been found: sites with Karamyshevo-type pottery, Upper Volga culture, Elshanskaya culture and Middle Don culture (*Smolianinov 2009*).

#### Could we estimate the speed of this process?

It is assumed that the process of Neolithisation was a single event. However, it is now clear that this process could have taken a long time, such as, for example, in north-western Turkey, where this process took 2000 years from when elements of the 'Neolithic package' first appeared. It might be proposed that different forms of Neolithisation occurred simultaneously in different parts of this region (*Özdoğan 2013.190–191*). An interesting scenario has been offered of the population of the coastal regions of north-western Turkey (*Özdoğan 2013.195*), where Mesolithic groups adopted major components of the 'Neolithic package' brought by newcomers: pottery, a productive economy and definite categories of goods with a prestigious and/or high-status role. However, the habitual way of life continued: they lived in huts covered with clay, had a complex economy with hunter-gathering activities, and different types of burial. The economy practised at some of the sites in Anatolia in the 7<sup>th</sup> millennium calBC was also complex, based on a combination of cattle husbandry, hunting, fishing and collecting shellfish (*Özdoğan 2013.174*). Shellfish occupied a considerable place in ancient diets at some sites, where specialised storage pits have been found (*Özdoğan 2013.182*). Similar accumulations and pits with shellfish were

also found at the Rakushechny Yar (*Belanovskaya 1995*) and Surskaya sites (*Telegin 1996.44*).

The distribution of pottery traditions from the three centres described above, according to <sup>14</sup>C dates (*Timofeev et al. 2004*), occurred in a short period along the main water routes of Eastern Europe flowing in a meridional direction, while at first, rivers flowing in latitudinal directions formed natural barriers to the distribution of these traditions. Small groups moved and settled in different areas, the traces of which are difficult to see archaeologically, bringing innovations into the Mesolithic milieu – parts of the ‘Neolithic package’ – of which pottery became one of the most frequent and well accepted.

According to ethnographic data, a widespread uniformity of pottery styles must exist in communities of hunters-gatherers due to the movement of individuals between groups (*Hodder 1982*). This process may be termed a ‘migration of ideas’ in cases when physical migration is virtually undetectable. Established in a new place, these ‘centres’ of innovation began to be ‘secondary’ centres from which ceramic traditions began to diffuse and develop gradually among people in the surrounding regions. Thus, in the Dnepr-Dvina region, this process is reflected in the appearance of Rakushechny Yar pottery traditions in the first stage, which did not continue and were not adopted by local populations. Triangular impressions as decorative traditions and techniques of coil modelling with the use of polishing and smoothing with a comb-like tool from the Lower Volga – North Caspian centre then appeared here. This tradition was conserved in the local cultural milieu and became widespread.

One of the factors that could have influenced the distribution of pottery traditions in specific regions might be climatic changes accompanied by climate cooling and aridisation, which occurred in the second half of the 7<sup>th</sup> millennium calBC over a wide area of Europe (*Weninger et al. 2009; Spiridonova, Aleshinskaya 1999*), including the steppe and forest-steppe of Eastern Europe. This could have led to the forest zone with its huge forests and rich food resources attracting people from more southern areas (*Arslanov et al. 2009; Mazurkevich 1995*).

The study of the morphology of the earliest pottery from Eastern Europe shows the existence of vessels with predominantly flat and round bases during the first stage in the Rakushechny Yar assemblage, as well as at sites in the Lower Volga, the first stage

of Upper Volga culture, and also, probably, in the materials from the Middle Volga River, north-eastern Lake Onega and the Dnepr-Dvina region. Vessels with a conical base spread later and were typical of the forest zone, but much less of forest-steppe and steppe zones. This testifies to the existence of various types of vessels among hunter-gatherer groups in Eastern Europe in the first stages. While richly decorated conical vessels, which are believed to accompany hunter-gatherer communities, were not predominant, they appeared much later in Eastern Europe (see for example, *Budja 2013; Piezonka 2014.272*). The oldest vessels were usually made from a clay paste without temper or from sandy paste without organic temper, which has also been described for some hunter-gatherers of other areas (*Skibo et al. 1989.140*). On the other hand, conical vessels that appeared in different parts of Europe are often supposed to be of Eastern European origin, such as in the formation of the Ertebølle complex in Northern Europe (*Gronenborn 2009.541*). However, based on our own observations of the earliest Eastern European pottery and the Ertebølle complex, and also based on publications (*i.e. Jennbert 2011; Glykou 2011*), we conclude that these complexes are not directly related, since there are great differences in pottery technologies and forms of the vessels from both these complexes. Conical bases were highly varied in terms of technology and morphology, and the problem of their appearance and development needs to be investigated.

We suppose that the appearance of the oldest pottery in Eastern Europe might have been a much more complicated process than simply some gradual distribution of conical vessels among communities of hunter-gatherers. Pottery was included in the cultural system of local societies from the very beginning, becoming a symbol/sign, where it could have played different roles.

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## Appendix

**Neolithic sites with Samchinskaya-type pottery: 1 Teteruka Noue XV; 2 Soroka I, layer 1, hor. 'a'; 3 Soroka V; 4 Cykynivka; 5 Girzheve; 6 Pechera I; 7 Korzhiv; 8 Samchinci I; 9 Samchinci II; 10 Shurivci-Porig; 11 Shimanov'ske II; 12 Sokil'ci I, II, VI; 13 Zyan'kivci II; 14 Glyns'ke I; 15 Ladyzhin II; 16 Ladyzhin I; 17 Myf'kiv Ostriv; 18 Baz'kiv Ostriv; 19 Zavallya; 20 Zhakchik; 21 Mel'nychna Krucha; 22 Savran'; 23 Pugach 2; 24 Pugach 1; 25 Gard 4; 26 Gard 3; 27 Korma 1B; 28 Krushnyky; 29 Gyrlo Gnylopyati; 30 Lazariivka; 31 Zavalivka; 32 Borodyanka 3V; 33 Hodosivka; 34 Romankiv; 35 Mutyhy; 36 Dobryanka 1; 37 Stril'cha Skelya; 38 Kizlevyi V; 39 Semenivka 1; 40 Zlyvki; 41 Zelena Gornycya 6; 42 Zelena Gornycya 5; 43 Tuba 2; 44 Starobil's'k.**

**Sites in the Lower Don and Northern Azov areas: 45 Matveev kurgan; 46 Rakushechny Yar.**

**Lower Volga River sites. Kairshak-tenteksorskaya group: 49, 51 Kugat IV, Kulagai-si (I stage); 50 Kairshak III (II etap); Dzhangaro-varfolomeevskaya group: 47 Tu-Buzgu-Huduk I (I stage); 48 Dzhangar (2, 3 layers), 52 Varfolomeevka (3 layer) (II stage).**

**Site of Strumel': 197 Gastyatin type.**

Sites in the Lower Dnepr basin (surskaya culture, I stage): 194 *Surskoi Island*; 195 *Kodachek Island*; 196 *Vinogradnyi Island*.

Sites in the Middle Volga basin (Elshanskaya culture, middle Volga culture), Suro-Moksha basin: 53 *Maksimovskaya*; 54 *Vilovatovskaya*; 55 *II Staro-Elshanskaya*; 56 *Ivanovskaya*; 57 *Krasnyi Yar VII*; 58 *Lebyazhinka I*; 59 *Lebyazhinka IV*; 60 *Il'inskaya*; 61 *Nizhnyaya Orlyanka II*; 62 *Chekalino IV*; 63 *Krasnyi Gorodok*; 64 *Lugovoe III*; 65 *Ozimenki I, II*; 66 *Imerka 8*; 67 *Utyuzh I*; 68 *Lake V'yunovo I*; 69 *Lesnoe-Nikol'skoe III*; 70 *IV Tetyushskaya*; 71 *II Sherbet'skaya*; 162 *Gorodok I*; 163 *Vadovskie selisha*; 164 *Starodevich'e I*; 165 *Russkoe Maskino I*; 166 *Mashkino 1, 3*; 167 *Kovylyai 1, 3*; 168 *Volgapino*; 169 *Andreevka 1*; 170 *Krasnyi Yar*; 171 *Potodeevo*; 172 *Ekaterinovka 2*; 173 *Bessonovka 3*; 174 *Grabovo 3*; 175 *Podlesnoe 3, 4, 5, 7, 8*; 176 *Penzenskie stoyanki (Ernya, Kalashnyi zaton, Belyi omut)*; 177 *Ust'-Kada-da 1*; 178 *Inderka*.

Sites of Volgo-Kama culture: 72 *Tarhan I*; 73 *Koshkinskaya*; 74 *Kyilud II*; 75 *Chernushka*; 76 *Chernushka*; 77 *Levshinskaya*; 78 *Chashkinskoe ozero VI, VIII*.

Sites of Khoper, Middle Don basin: 79 *Plautino 1,2,4*; 80 *Rusanovo*; 81 *Borisoglebskie 1-3, Lovchak 7-8, Strel'bishe 4-5, Stela*; 82 *Kozlinovskaya*; 83 *Staroanninskaya*; 84 *Kopanische 1, 2*; 86 *Monastyrskaya*; 87 *Droniha*; 88 *Cherkasskaya*; 89 *Inyasevo*; 90 *Shapkinskie stoyanki*; 91 *Uvarovo*; 92 *Mozharovka*; 93 *Kipec*.

Sites in the Upper Don basin: 85 *Yamnoe*; 94 *Ust'e reki Izlegoshi-2, 3*; 95 *Karamyshevo 1, 5, 9, 19, m. Krasnyi Bugor*; 96 *Yarlukovskaya protoka, Rybnoe ozero-2, 1, Punkt 207. site 'Natasha'*; 97 *Lake Lipeckoe*; 98 *Studenovka 3*; 99 *Kulikovka 2, Berezovka 4B, Monastyrshina 2A*; 100 *Vasil'evskii kordon-1,3,5,7, 16, Podzorovo-1,2*; 101 *Dobroe-1, site 87: Lake Bogorodickoe, Bogorodickoe 1*; 102 *site 1. Shlyuz 1, p.97 v urochishe Gorodishe, site 382, 380, 100, Sokol'skii most 8, 9, 11, 3, pos. u pamyatnika Narodovol'cam*; 103 *settlement 2 (site 105), 6 (site 109) near Gudovskogo kordona, site 8 in Malininovskiy district, site 1 near Pervomaiskoe lesnichestva, site 343, site 5, site 2 near village of Krutogor'e*; 104 *site 3 at the mouth of the Borovica River, site 259 (site 1 near Lake Krugloe), site 346 (site 6 near Lake Lyubovickogo), site 340 (site 7 near Barkovskii)*; 105 *Savickoe 1*; 106 *location near the village of Preobrazhenovka, Buhovoe 9, 10, Glinishe, Torbevo XV, XVII, Kriveckoe Lesnichestvo 1*; 107 *Kurino 1*; 108 *Universitetskaya 1, 3, Chertovickaya, Chernavskaya, st. Yaht-klub, Shilovskaya 1, Otrozhka*; 109 *Zamyatino 10*; 110 *Krivobor'e 2*; 111 *Ksizovo 6*.

Sites of Desninskaya culture: 112 *Zherenskaya protoka*; 113 *Zhereno III*; 114 *Vithovka I, III*; 115 *Chernetovo I*; 200 *Krasnoe V, VI, X*.

Sites in the Upper Dnepr: 116 *Romanovichi*; 117 *Strelice*; 118 *Borok*; 119 *Zaval'e*; 120 *Katyn' 2*; 121 *Katyn' 3*; 122 *Katyn' 1, st. 21, 6*; 198 *location at Kasplya lake*; 199 *Zaozer'e*; 201 *Lavki*.

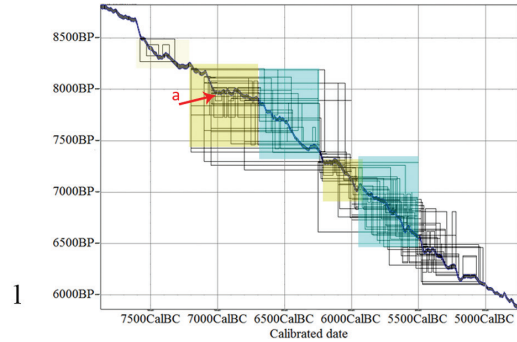
Sites of Dnepr-Dvina basin: 123 *sites in the Serteysky micro-region*; 124 *sites of the Usviatsky micro-region*; 125 *sites in the Sennitsky micro-region*.

Sites of the early stage of Upper Volga culture (including Volgo-Oka culture sites): 126 *Ozerki 5, sloi III*; 127 *Al'ba I, III*; 128 *Davydkovskaya*; 129 *Zamost'e 2*; 130 *Yazykovo I*; 131 *Kuhmar' 1*; 132 *Pol'co*; 133 *Belivo II*; 134 *Maslovo boloto 8*; 135 *Shadrino IV*; 136 *Alekseevskoe I*; 137 *Sahtysh I, II, VIII*; 138 *Ivanovskoe III, V, VII*; 139 *Okaemovo 3, 5, 18*; 140 *Varos*; 179 *Somino II*; 180 *Kosyachevo I, II*; 181 *Zav'yalka 1*; 182 *Bobrinka II*; 183 *Strelka I*; 184 *Malaya Lamna*; 185 *Volosovo*; 186 *Davydkovo*; 187 *Zhabki III*; 188 *Teren'kovo III*; 189 *Korenc 1*; 190 *Seima I*.

Sites of Valdaiskaya culture (with materials of Kotschischensky-type pottery): 141 *Kotchishe 1,2*; 142 *Shepochnik*; 143 *Dubovec (Peno 3)*; 161 *Zabel'e*; 191 *Zales'e I, II, Nizhnie Koticy 5, Zehnovo III, IV, Lanino I*; 192 *island Koshelev*; 193 *Zabolot'e II*.

Sites in north-east Europe (sites of the type Dutovo I, Chernaya Vad'ya, chernoborskaya group, Kama culture sites located in the basin of the Sukhona River and Lake Onega): 144 *Tudozero V*; 145 *Berezovaya slobodka II-III*; 146 *Prilukskaya*; 147 *Yavron'ga I*; 148 *Chernaya Vad'ya*; 149 *Chudgudor'yag, En'ty V*; 150 *Pezmog IV*; 151 *Seb'yag*; 152 *Ust'-Kulom I*; 153 *Kochmas B*; 154 *Niremka I, s.6*; 155 *group of Vis sites*; 156 *Dutovo I*; 157 *Chernoborskaya III*; 158 *Zubovo*; 159 *Koneshel'e*; 160 *Timoshel'e VI*.

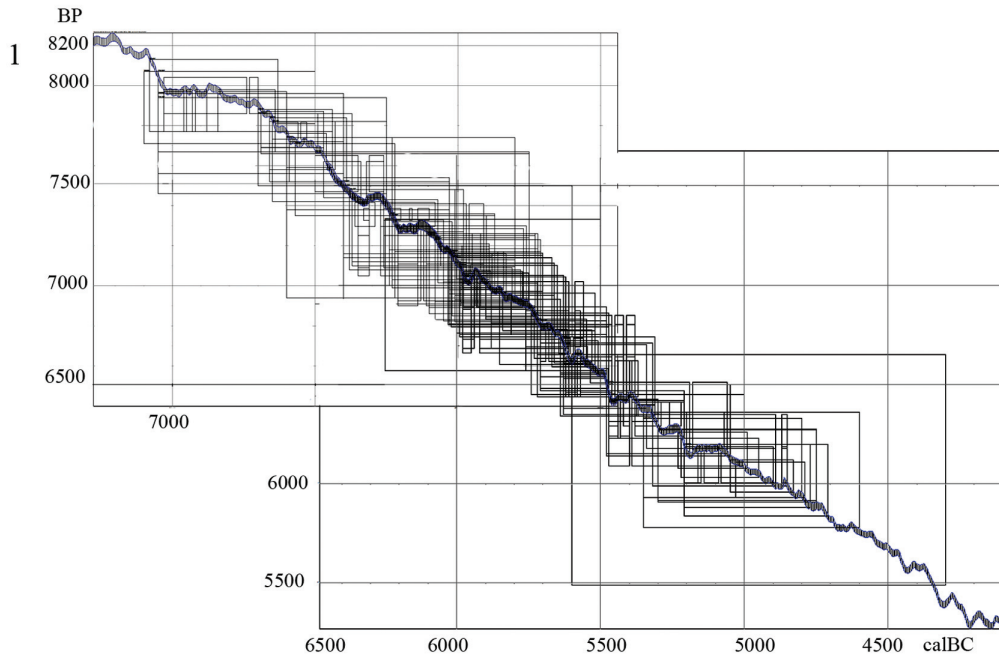
- \* - dates made on materials from the excavation I of the site Rakushechny Yar.
- \*\* - materials from excavation of 2013 of the site Rakushechny Yar.



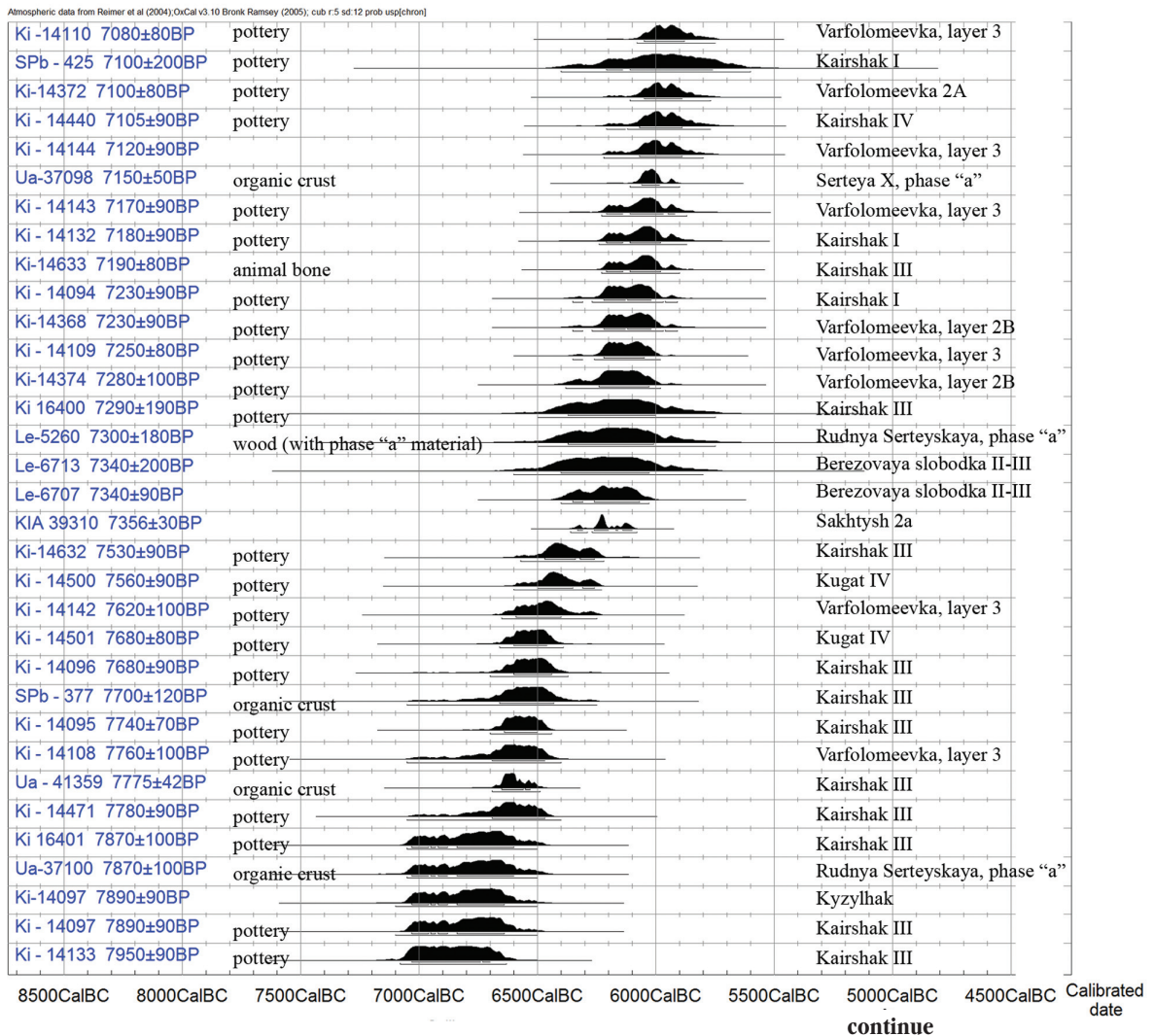
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Sample ID	Calibrated date	Material	Notes	Site
Ki-14586	6280±90BP			Krasny Yar VII
Ki-14441	6290±90BP			Molebnoe ozero I
Ki-14835	6310±90BP			Bol'sherakovskaya II
Poz-42052	6380±40BP			Ivnica 10
Ki-14411	6420±80BP			Maksimovka II
Ki-14412	6470±80BP			Maksimovka II
Ki-14570	6480±80BP			II Staroelshanskaya
Ki-14580	6540±80BP			Krasny Yar VII
Ki-14117	6550±130BP			Krasny Gorodok
Ki-14464	6640±100BP			Ilyinskaya
Ki-14113	6670±100BP			Ilyinskaya
Ki-14145	6680±70BP			Ilyinskaya
Ki 14584	6700±100BP	pottery		Lugovoe III
Poz-42053	6720±40BP			Ivnica 10
Ki-14078	6730±100BP			Krasny Gorodok
Ki-14111	6740±70BP			Ilyinskaya
Ki-14569	6760±80BP			II Staroelshanskaya
Ki-14619	6760±90BP			Ilyinskaya
Ki-14147	6770±90BP			Ilyinskaya
Ki-14413	6820±80BP			II Staroelshanskaya
Ki 15439	6820±90BP	pottery		Elshanskaya IX
Ki-14096	6940±90BP			Ilyinskaya
Poz-42054	6940±40BP			Ivnica 10
Ki-12168	6950±170BP			Ozimenki II
KiA 39308	7018±45BP			Sakhtysh 2a
Ki-6478	6930±100BP	organic crust		Rakushechny Yar, layer 15
Ki-6479	6950±100BP	organic crust		Rakushechny Yar, layer 15
Ki-6480	7040±100BP	organic crust		Rakushechny Yar, layer 15
Ua-48460	7554±169BP	charcoal		Rakushechny Yar, layer 17-19**
Ua-48461	7010±126BP	charcoal		Rakushechny Yar, layer 17-19**
Ua-41365	6841±40BP	organic crust	$\delta^{13}C -28,0$	Rakushechny Yar, layer 18
Ua-41364	7156±41BP	organic crust	$\delta^{13}C -28,0$	Rakushechny Yar, layer 19
Poz 47870	7160±40BP	pottery		Viunovo ozero I
AA 96017	7222±58BP	pottery		Viunovo ozero I
Poz-42051	7250±60BP	charcoal		Chekalino IV
SPb - 587	7560±70BP	pottery		Ivanovskaya
SPb - 424	7660±200BP	pottery		Chekalino IV
Ki-14567	7680±90BP			Ivanovskaya
Ki-12167	7680±190BP			Ust'-Tashelka
Ki-14631	7780±90BP			Ivanovskaya
SPb - 426	7790±200BP	pottery		Bol'sherakovskaya
Ki-12166	7810±190BP			Ust'-Tashelka
Ki-14568	7930±90BP			Ivanovskaya
Ua-37097	7290±50BP	organic crust	$\delta^{13}C -28,6$	Rakushechny Yar, layer 20
Ki-6475	7690±110BP	organic crust		Rakushechny Yar, layer 20
Ki-6477	7860±130BP	organic crust		Rakushechny Yar, layer 20
Ki-6476	7930±40BP	organic crust		Rakushechny Yar, layer 20*
SPb-729	7970±110BP	elk bone		Rakushechny Yar, layer 23-20**
Le 2343	8020±90BP	bone		Ivanovskaya
Ua-37099	8380±55BP	organic crust		Serteya XIV, "a-1"

Fig. 4. Histogram (1) and a list of calibrated values (2) (made in OxCal 3.10 (Bronk Ramsey 2005) of radiocarbon dates of sites with undecorated pottery (dates of figures 2, 4, 5 – after Vybornov 2008; Vybornov et al. 2008; 2012; 2013; Ivanisheva 2009; Hartz et al. 2012; Smol'yaninov, Surkov 2014; Tovkailo 2010; Gaskevich 2010; Karmanov 2008; Zaiceva et al. 2014; Tsybriy et al. 2014) and indication of a 'calibration plateau' 8000–7500 BP (1a).



2



2

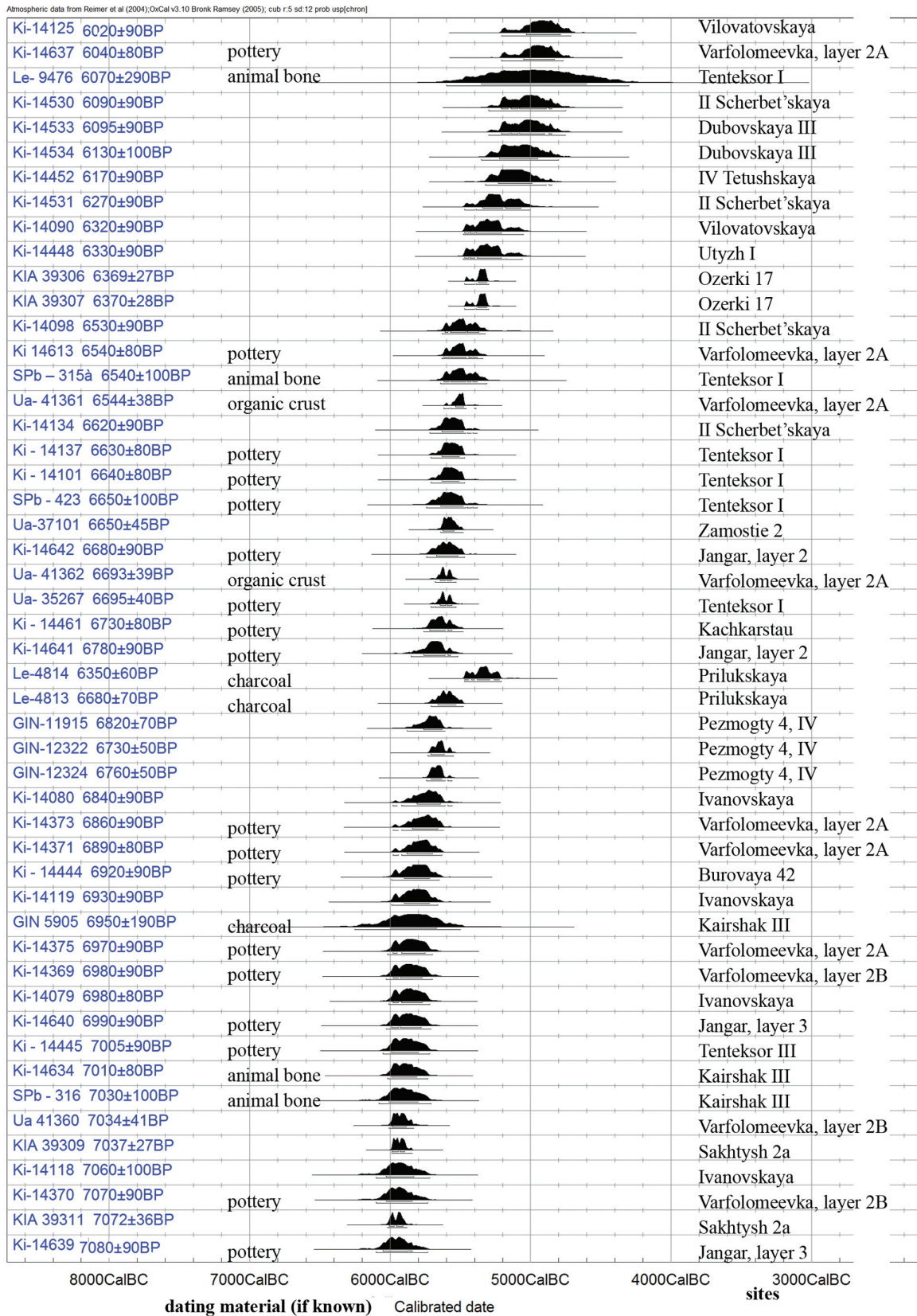
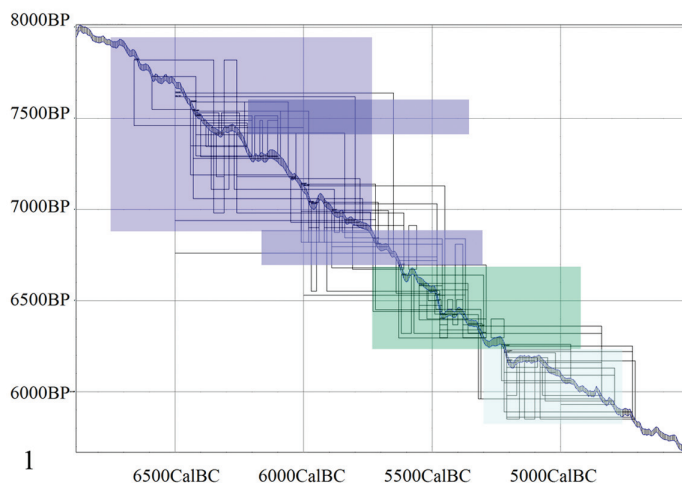


Fig. 5. Histogram (1) and calibrated values (2) of radiocarbon dates (made in OxCal 3.10 (Bronk Ramsey 2005)) from sites with pottery decorated by triangular impressions, drawn and oval impressions.



Atmospheric data from Reimer et al (2004); OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]

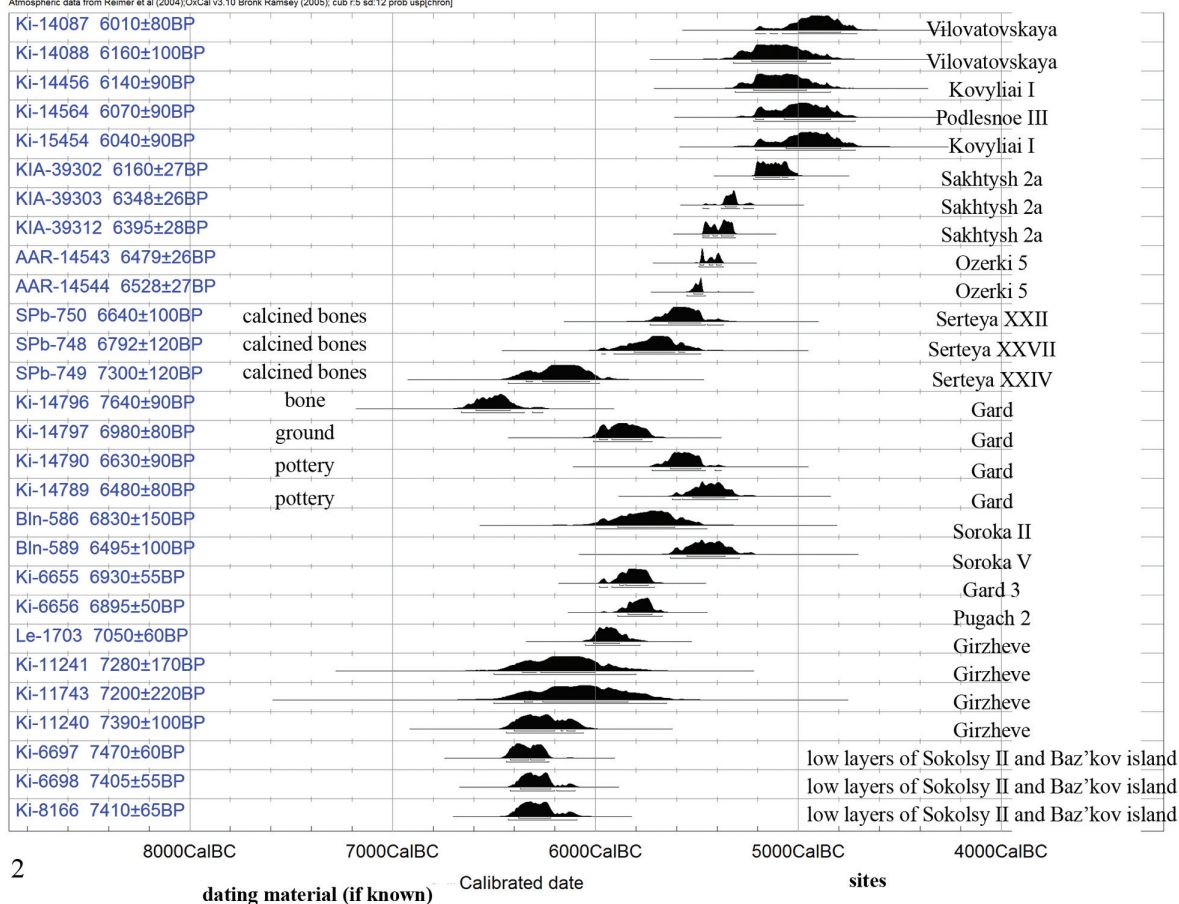
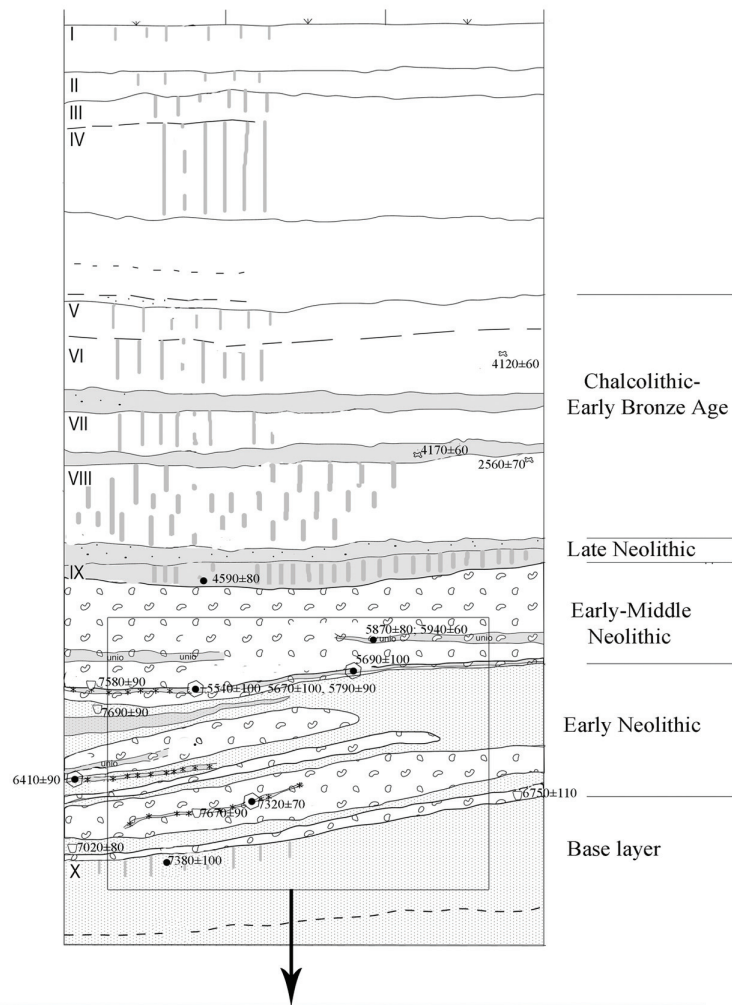
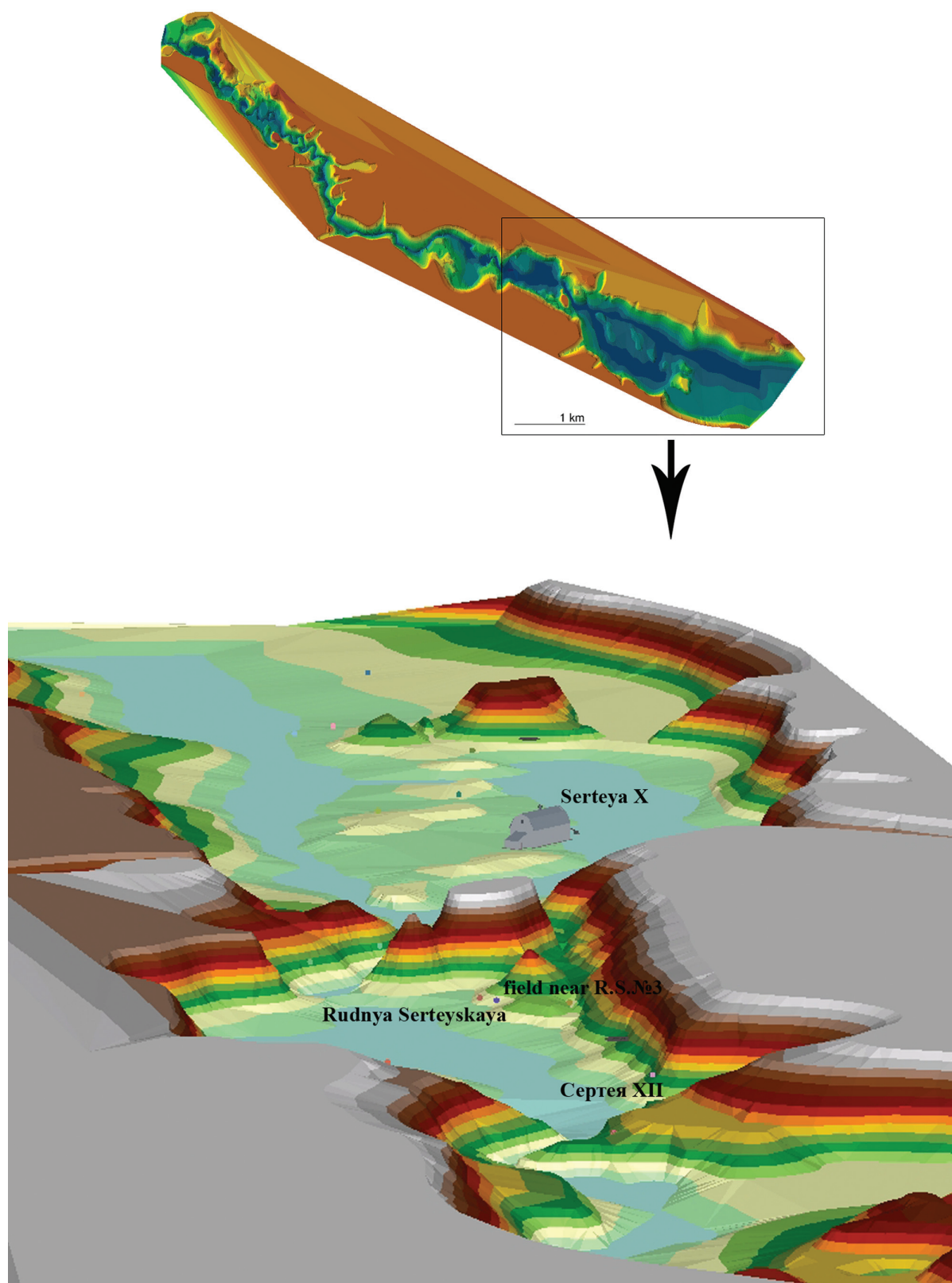


Fig. 6. Histogram (1) and calibrated values (2) of radiocarbon dates (made in OxCal 3.10 (Bronk Ramsey 2005)) from sites with pottery decorated with impressions made by various comb-tools.

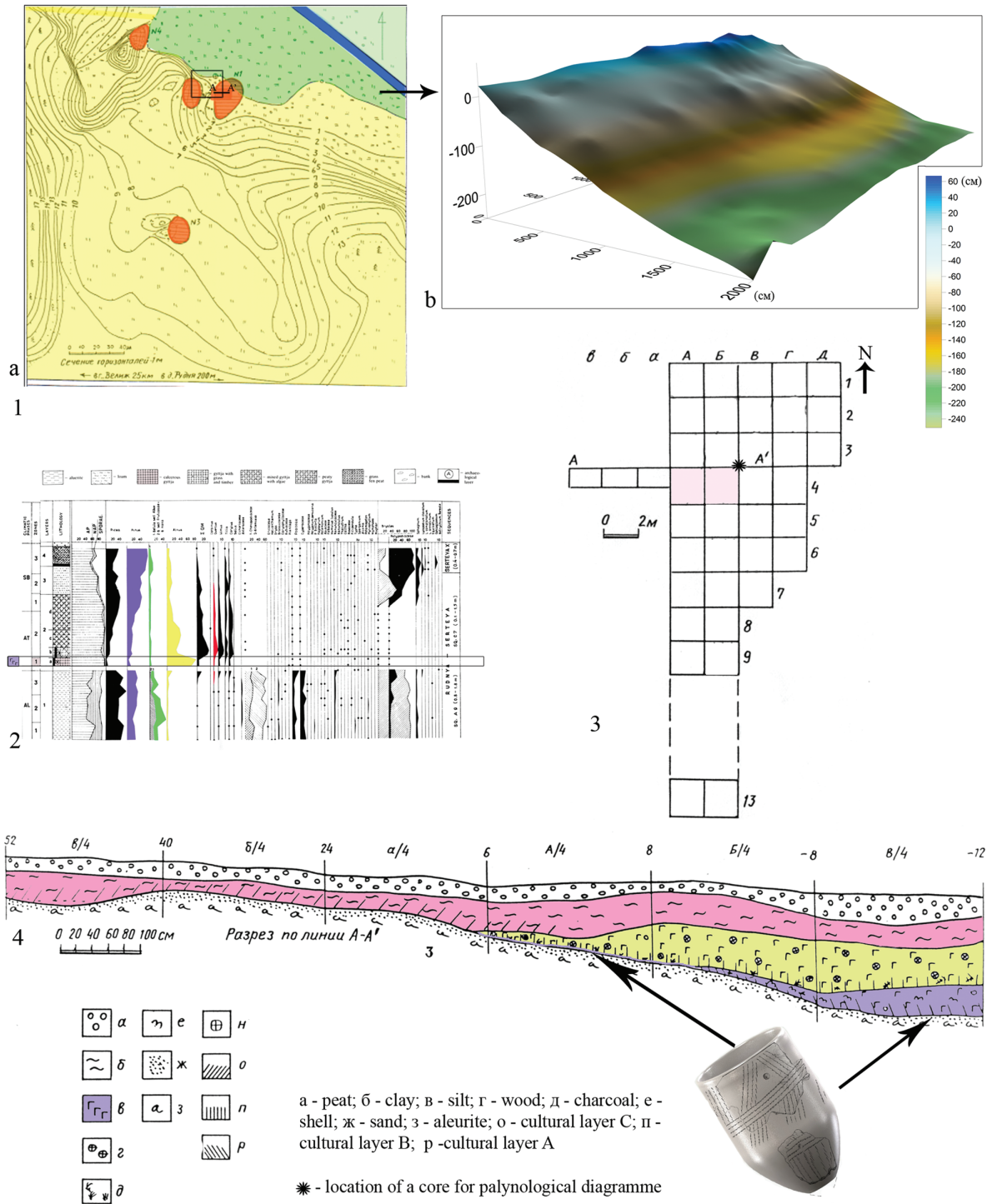




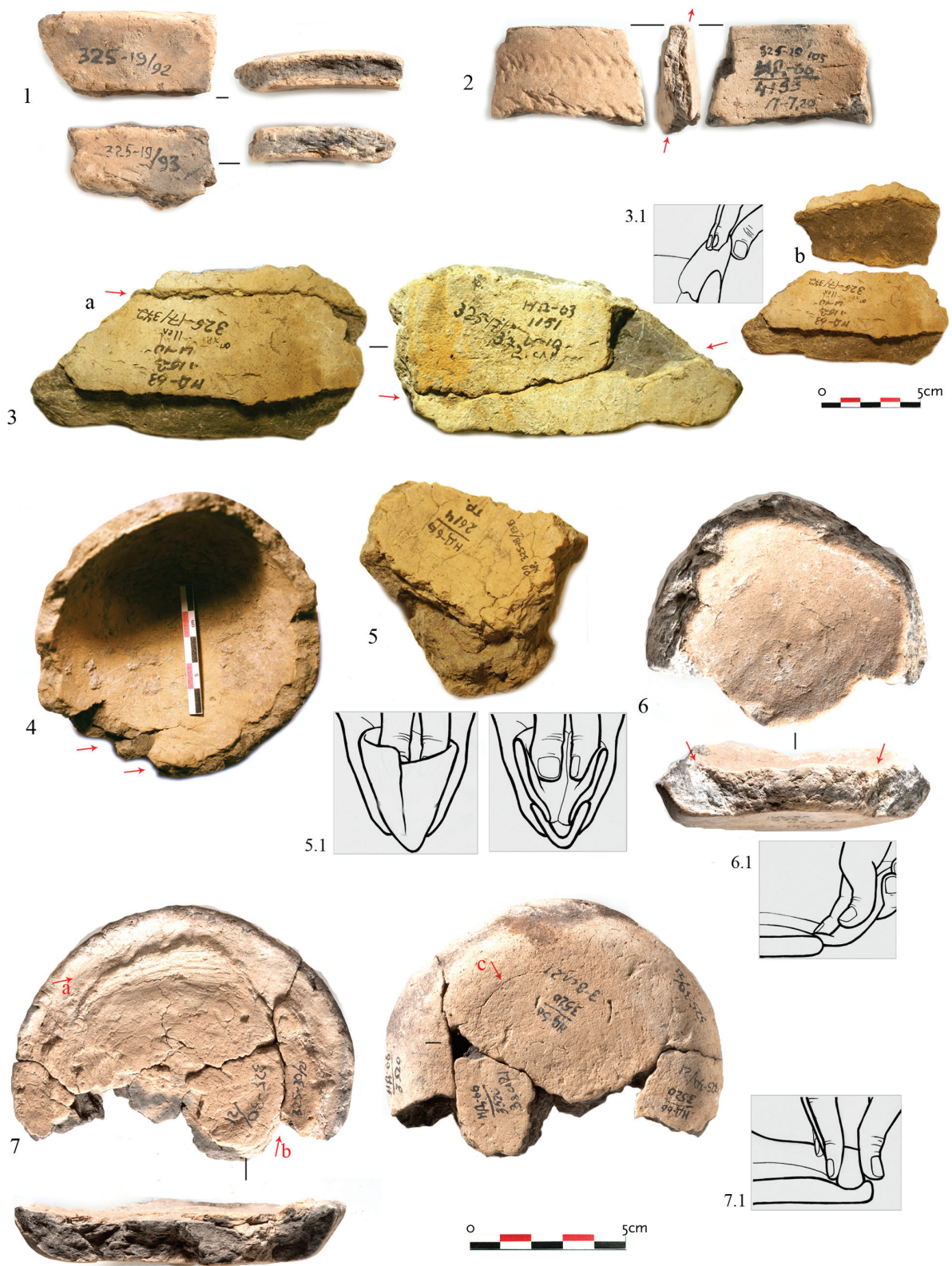
**Fig. 7. Stratigraphy of the 2008 test-pit (after Aleksandrovsy et al. 2009, Fig. 3) with date distributions in the layers, and photograph of the low part of the 2008 test-pit (photo: A. Mazurkevich).**



*Fig. 8. Early Neolithic sites' distribution in the southern part of Serteysky microregion.*



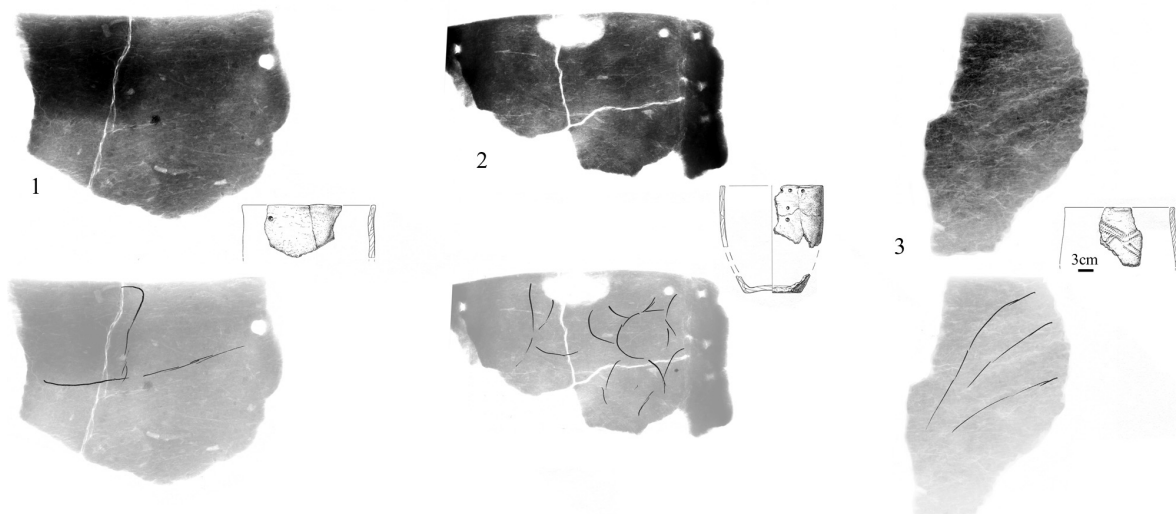
**Fig. 9. Rudnya Serteyskaya. 1a location of the site and field near Rudnya Serteyskaya 2-4 in the Dnepr-Dvina region (after Mazurkovich, Miklyaev 1998.Fig. 2, 1); 1b relief reconstruction; 3 plan of the excavated part with indication of position of phase 'a' vessels; 2 stratigraphy with indication of vessel fragments of phase 'a' position and palynological diagram with indication of layer that covered the layer containing Early Neolithic pottery (after Dolukhanov et al. 1989.Fig. 1).**



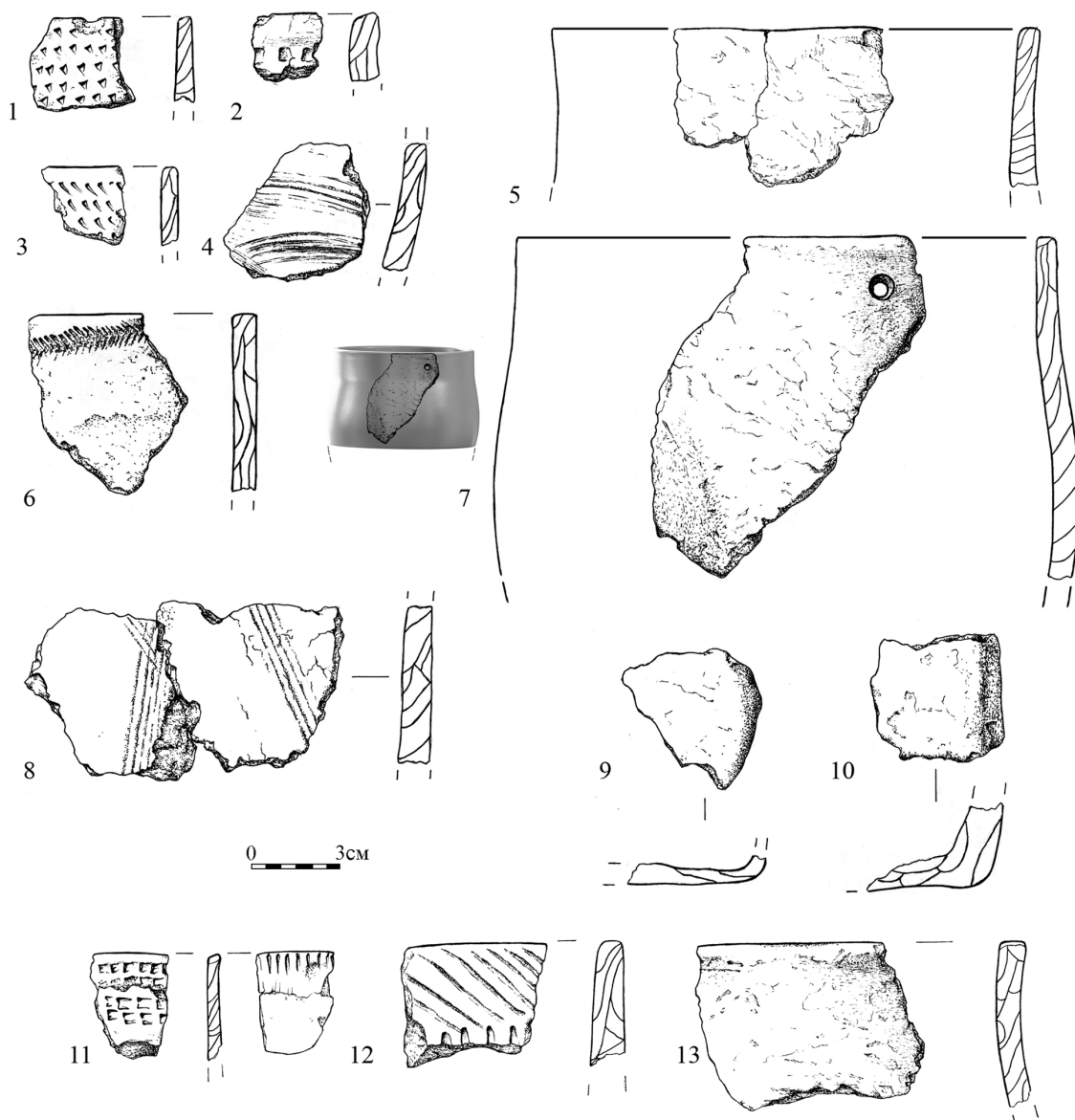
**Tab. 1. Rakushechny Yar. Macro-traces on vessel surfaces. 1 U-junction of coils; 2 N-junction with slight stretching; 3a junction of coils greatly stretched, 3b part of the coils (3.1 reconstruction of vessel modelling); 4 traces of coils and modelling of the walls on a conical base; 5 traces of slabs joining conical bases (5.1 reconstructed modelling of conical base); 6 places where coils join while the flat base was modelled with coils (6.1 reconstruction); 7 'groove' left on the perimeter of the flat base (a), fractures left where coils were joined (b), curved fracture, which marks the junction of coils (c) (7.1 reconstructed base).**



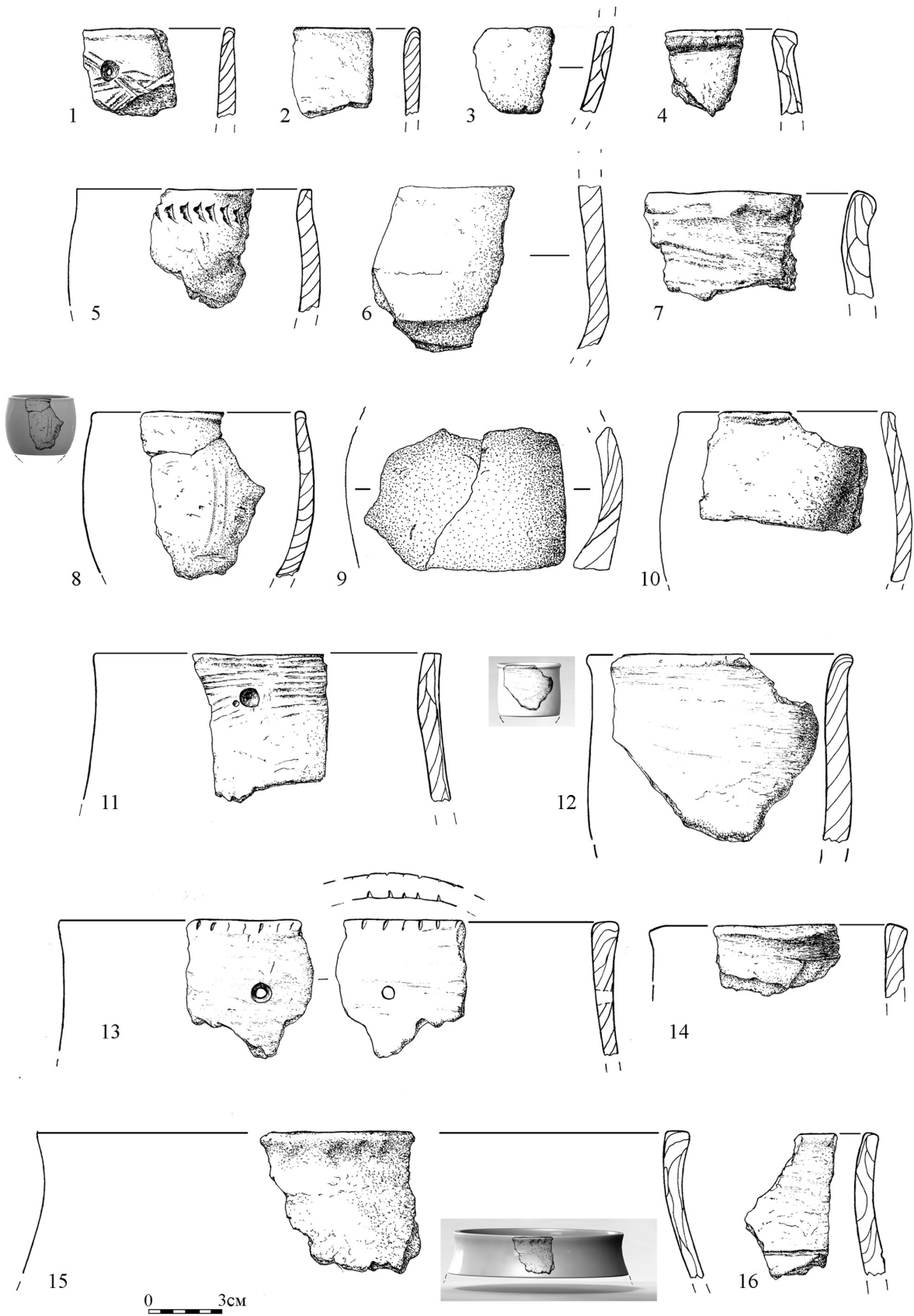
**Tab. 2. Rakushechny Yar. Macro-traces on vessel surfaces. 1 traces left by a comb-like tool on the inner side of the base; 2, 3a, 4a, b, 5b smoothed surface; 3b traces left after inner surface treatment; 3c oblique direction of coils' in profile; 4b two slabs/fragments of coils; 4c vertical fracture marking two slabs/coils; 5a coils on flat base; 6 traces left after smoothing with pebble; 7 imprint on outer side of flat base.**



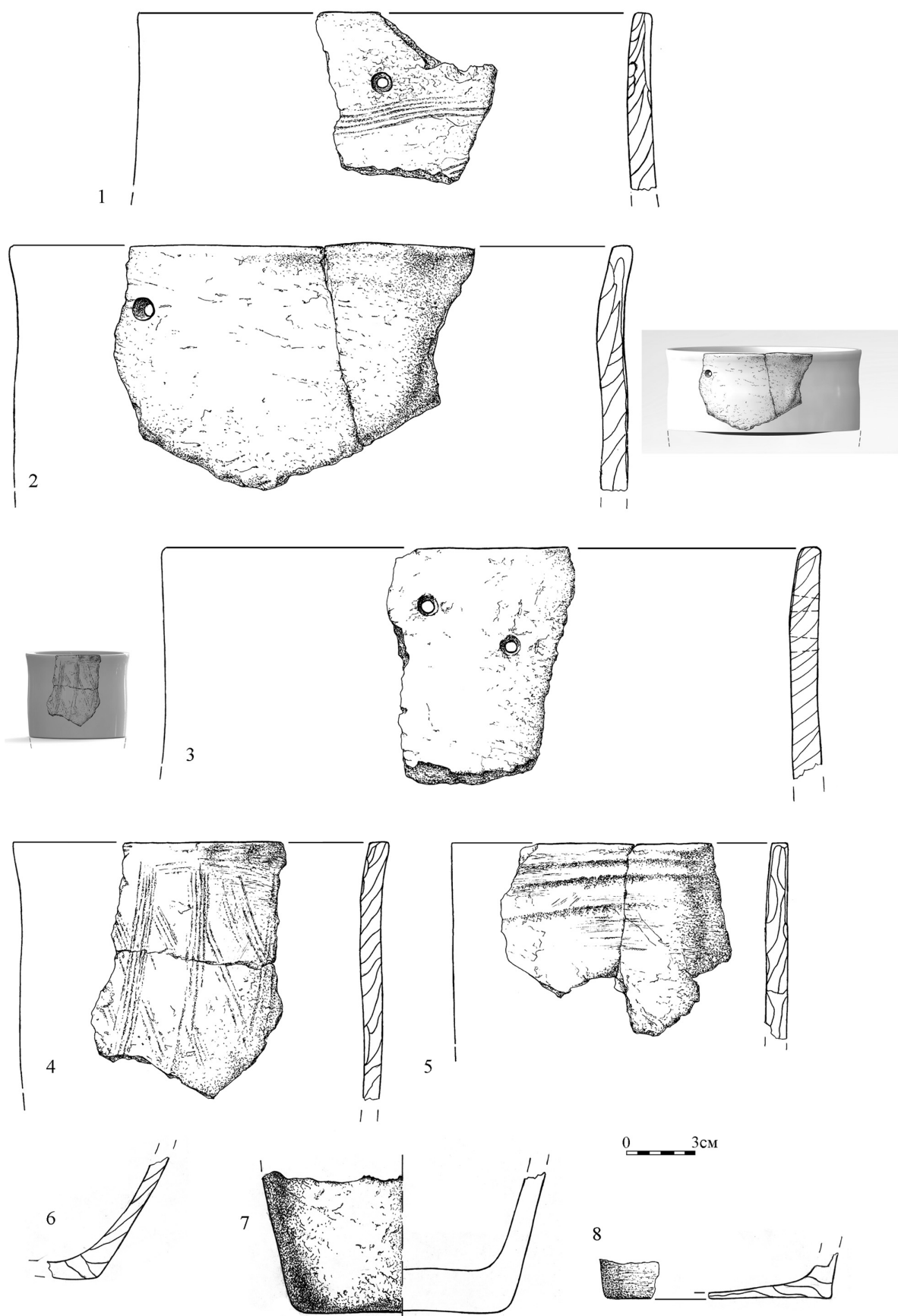
**Tab. 3. Rakushechny Yar. Radiography of the vessel fragments, with indication of different technological traces.**



**Tab. 4. Rakushechny Yar. Pottery. 1-10 layer 23; 11-13 layer 22.**

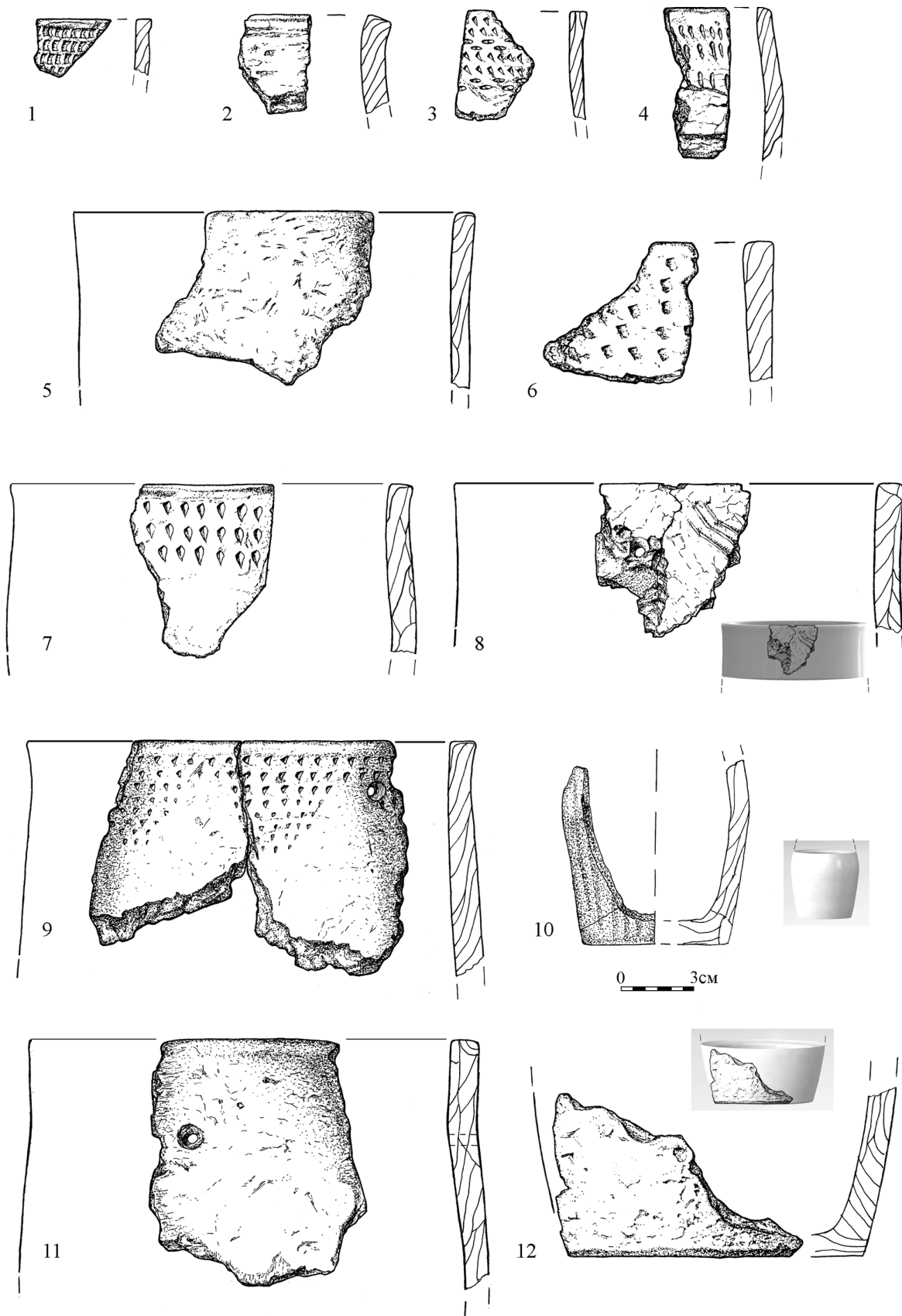


Tab. 5. Rakushechny Yar. Pottery from layer 20.

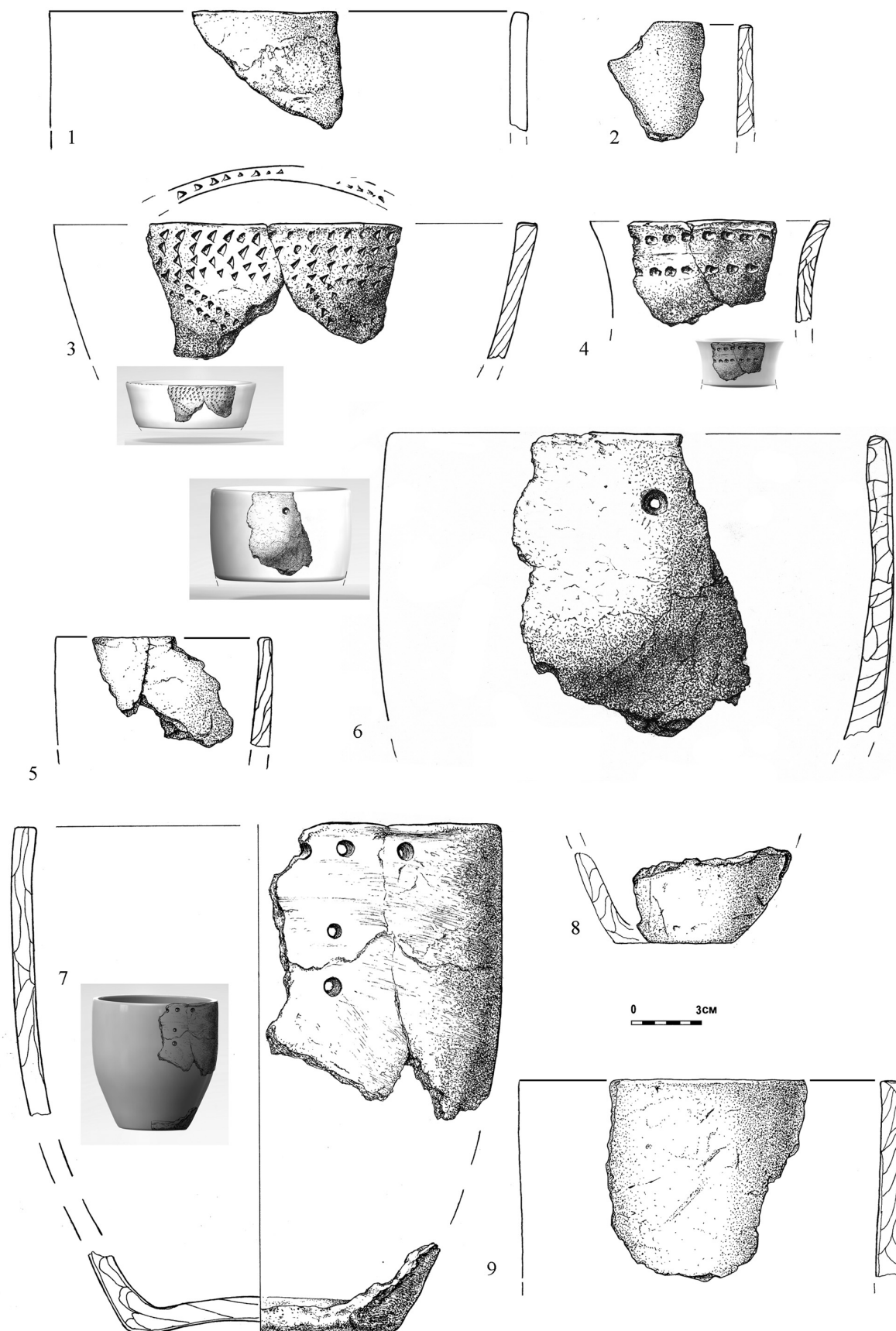


Tab. 6. Rakushechny Yar. Pottery from layer 20.

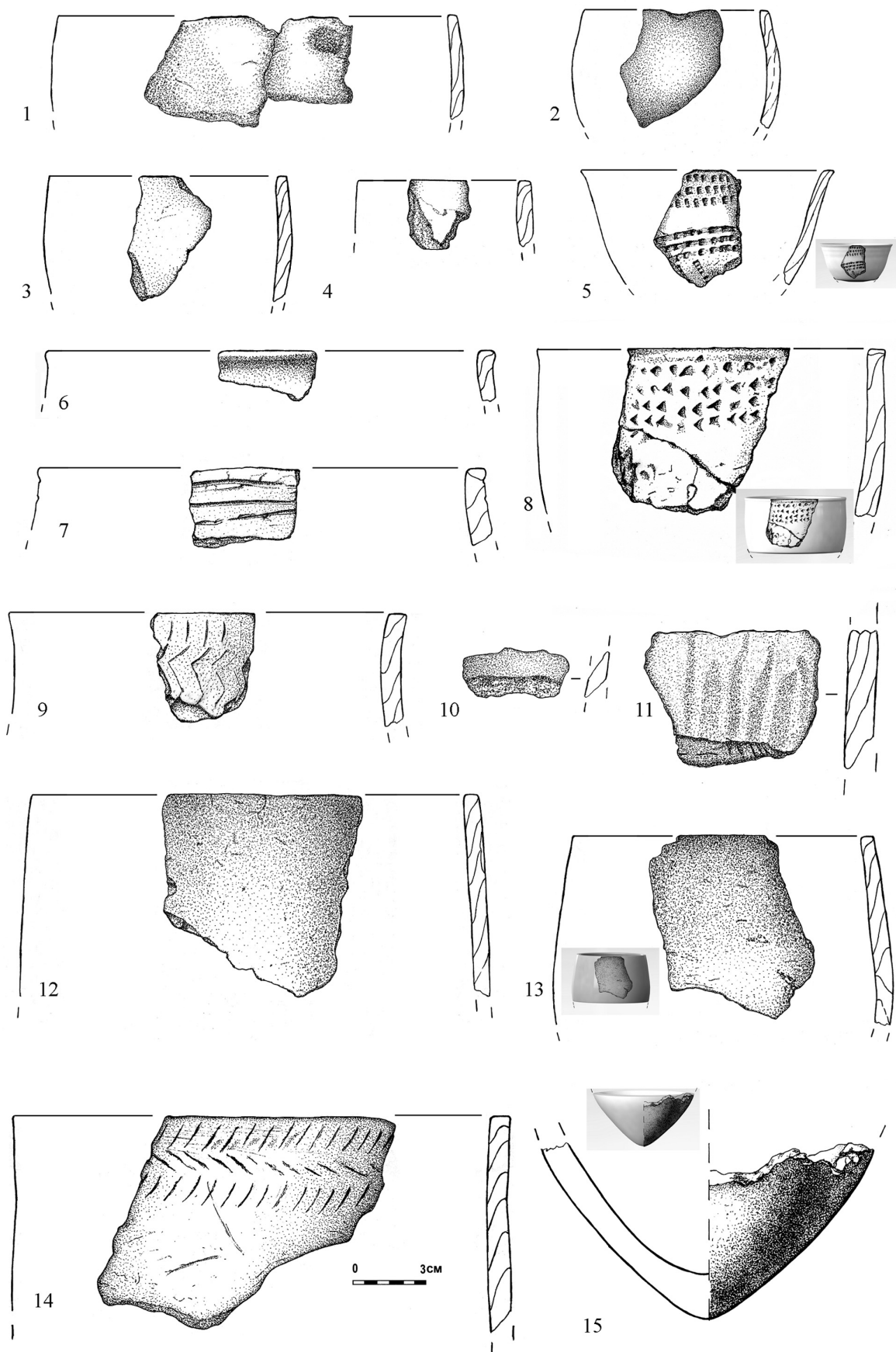




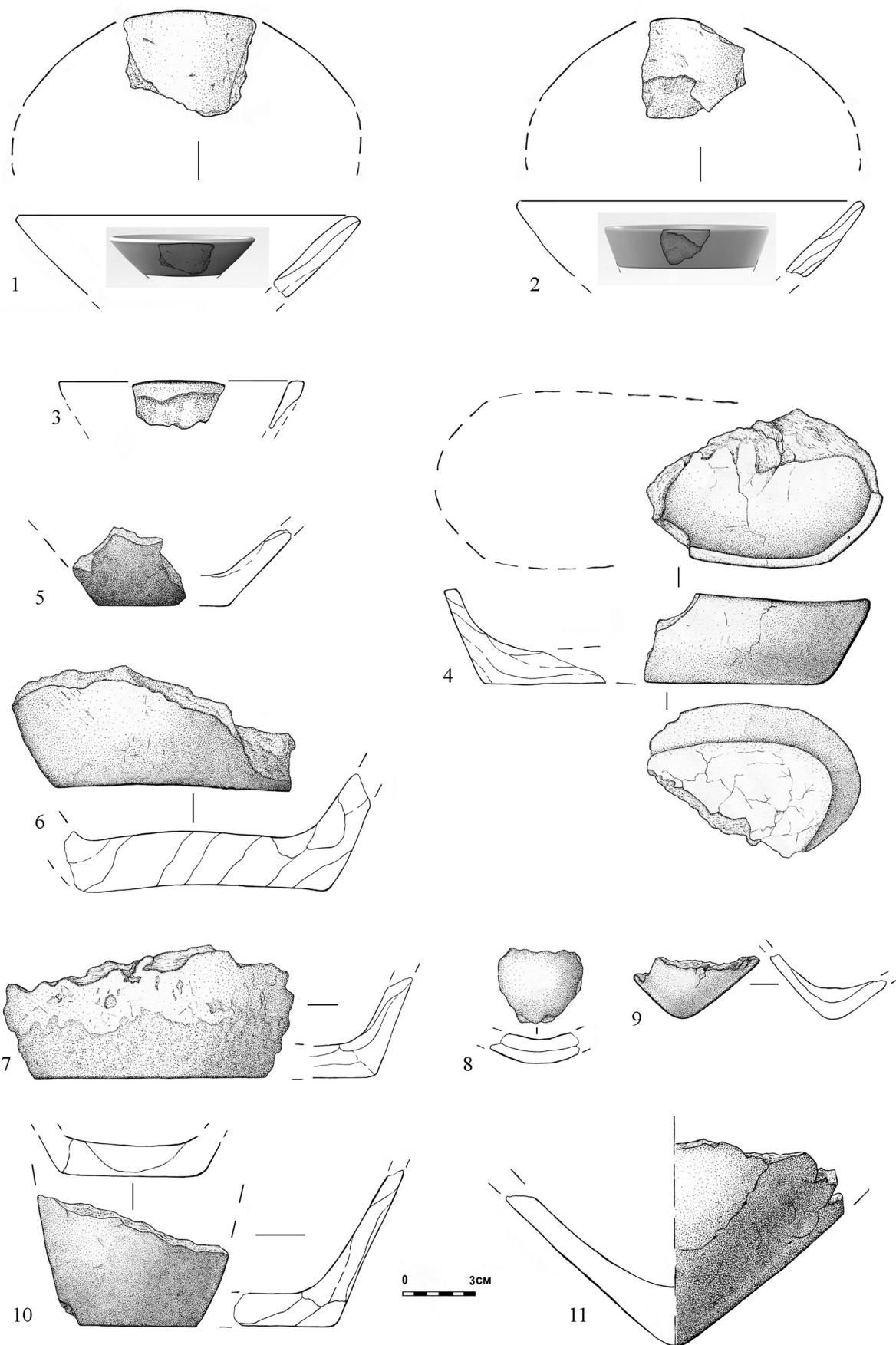
Tab. 7. Rakushechny Yar. Pottery from layer 19.



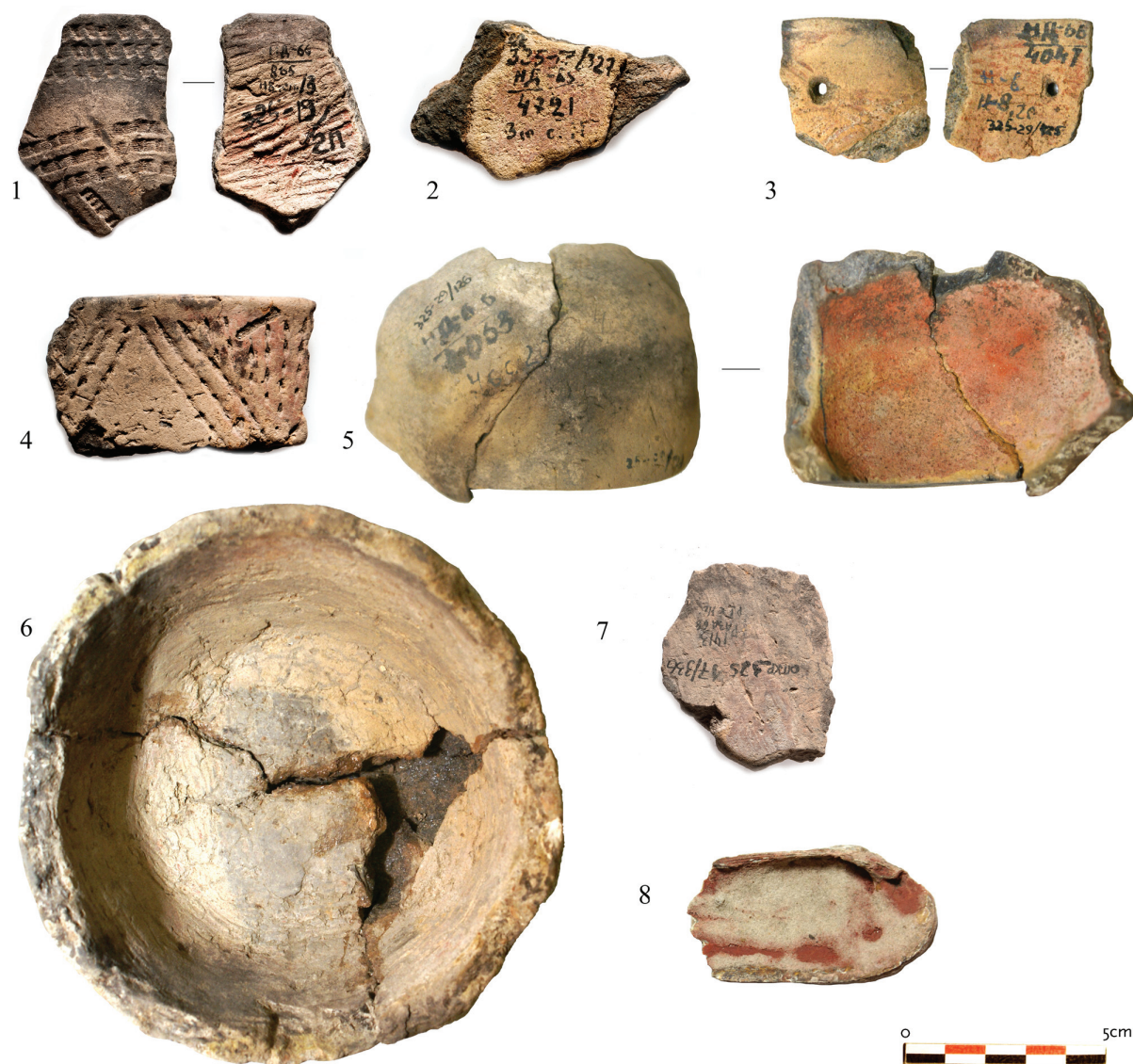
**Tab. 8. Rakushechny Yar. 1-6, 8-9 pottery from layer 14; 7 reconstructed vessel from layer 15.**



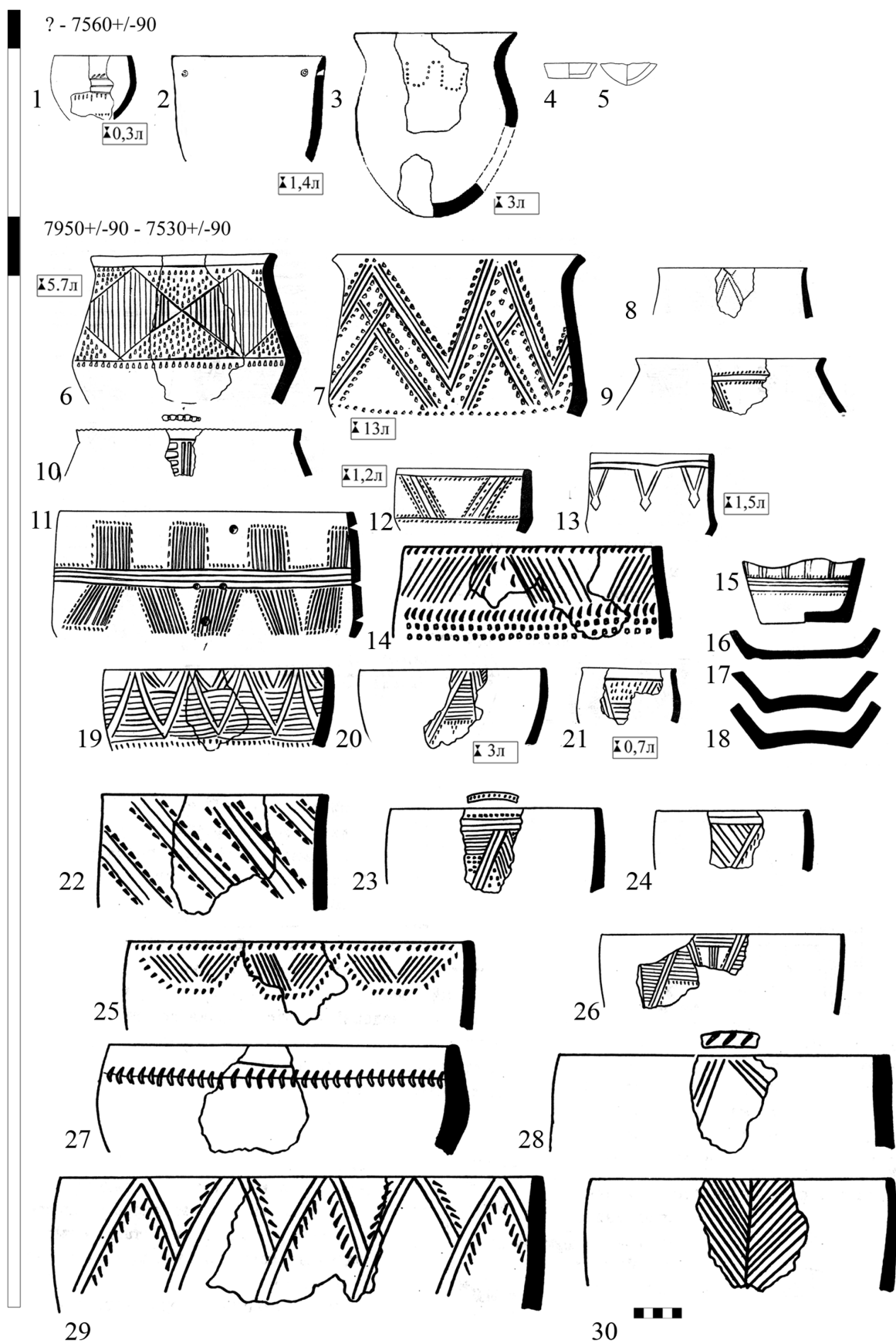
Tab. 9. Rakushechny Yar. Pottery from layer 13.



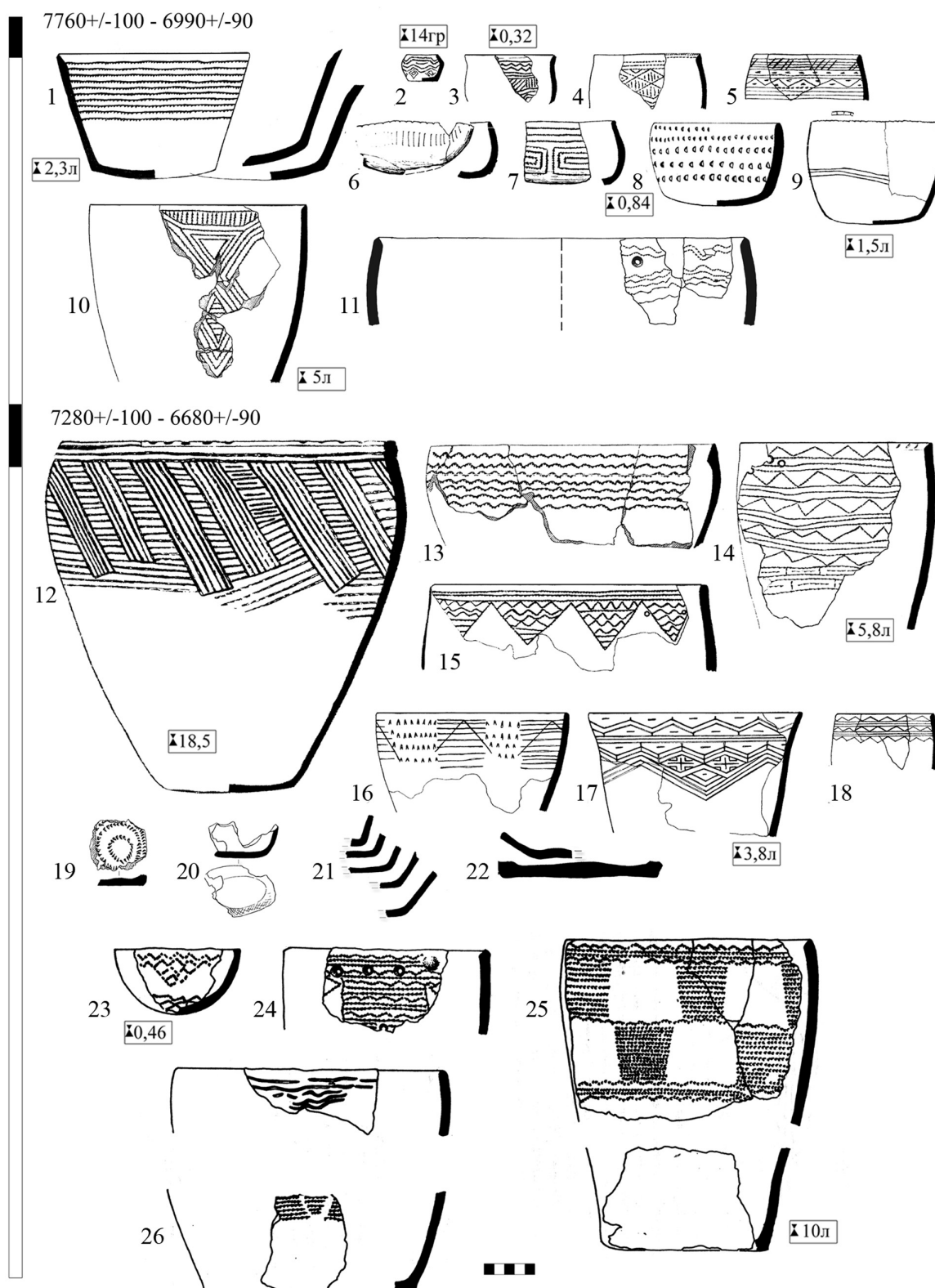
**Tab. 10. Rakushechny Yar. Pottery from layer 11.**



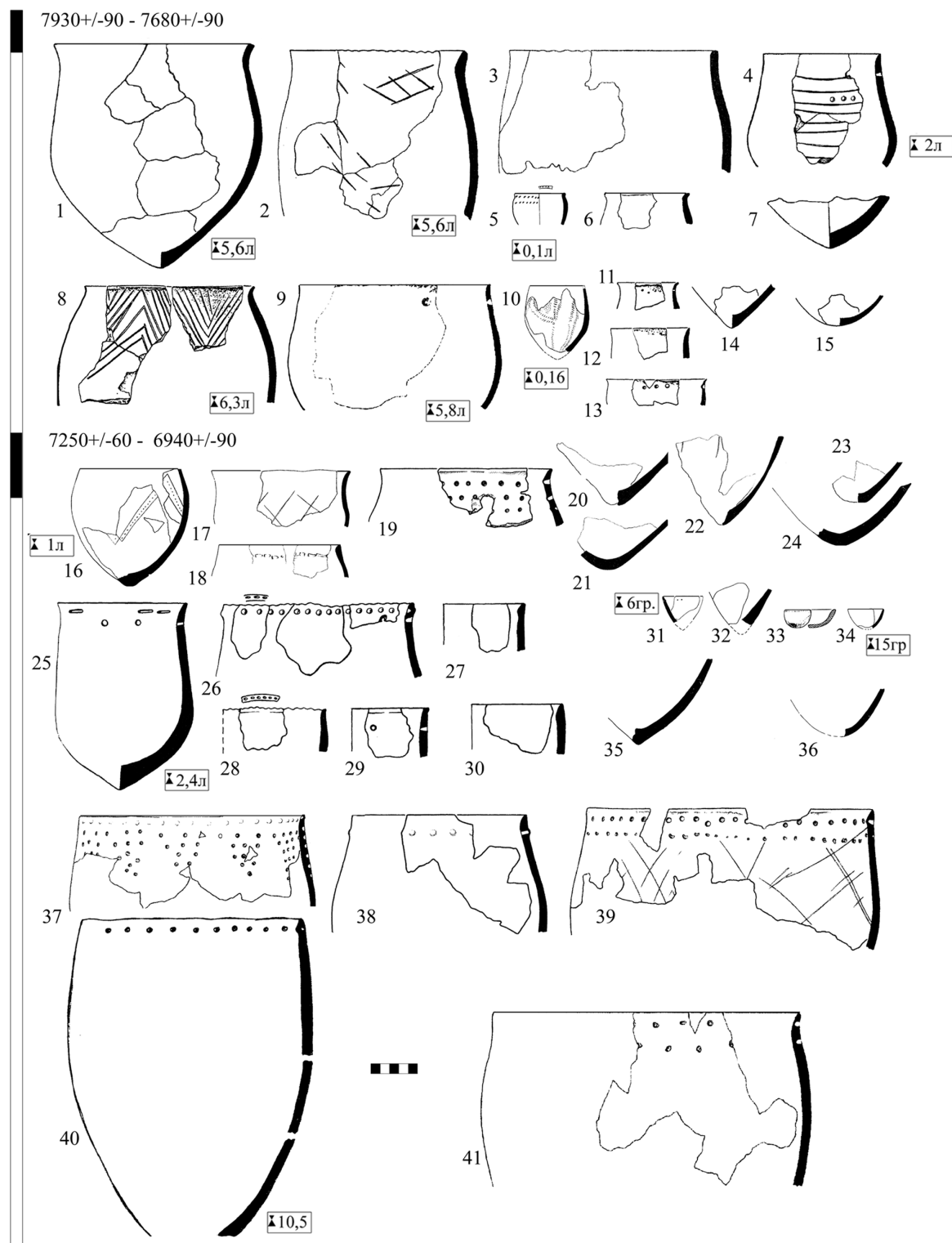
**Tab. 11. Rakushechny Yar. Vessels covered with ochre (1 – layer 13; 2, 4, 7– layer 11; 3, 5–6, 7 – layer 20) and *Unio* shell with ochre (8).**



Tab. 12. Pottery of Low Volga basin. 1-2 Kugat IV; 3 Kulagaisi; 4-5 Tu-Buzgu-Huduk I; 6-30 Kairshak III (1-3 after Vybornov 2008.Fig. 3; 4-5 after Vybornov 2008.Fig. 23; 6-30 after Vasiliev et al. 1989.Fig. 2-6).

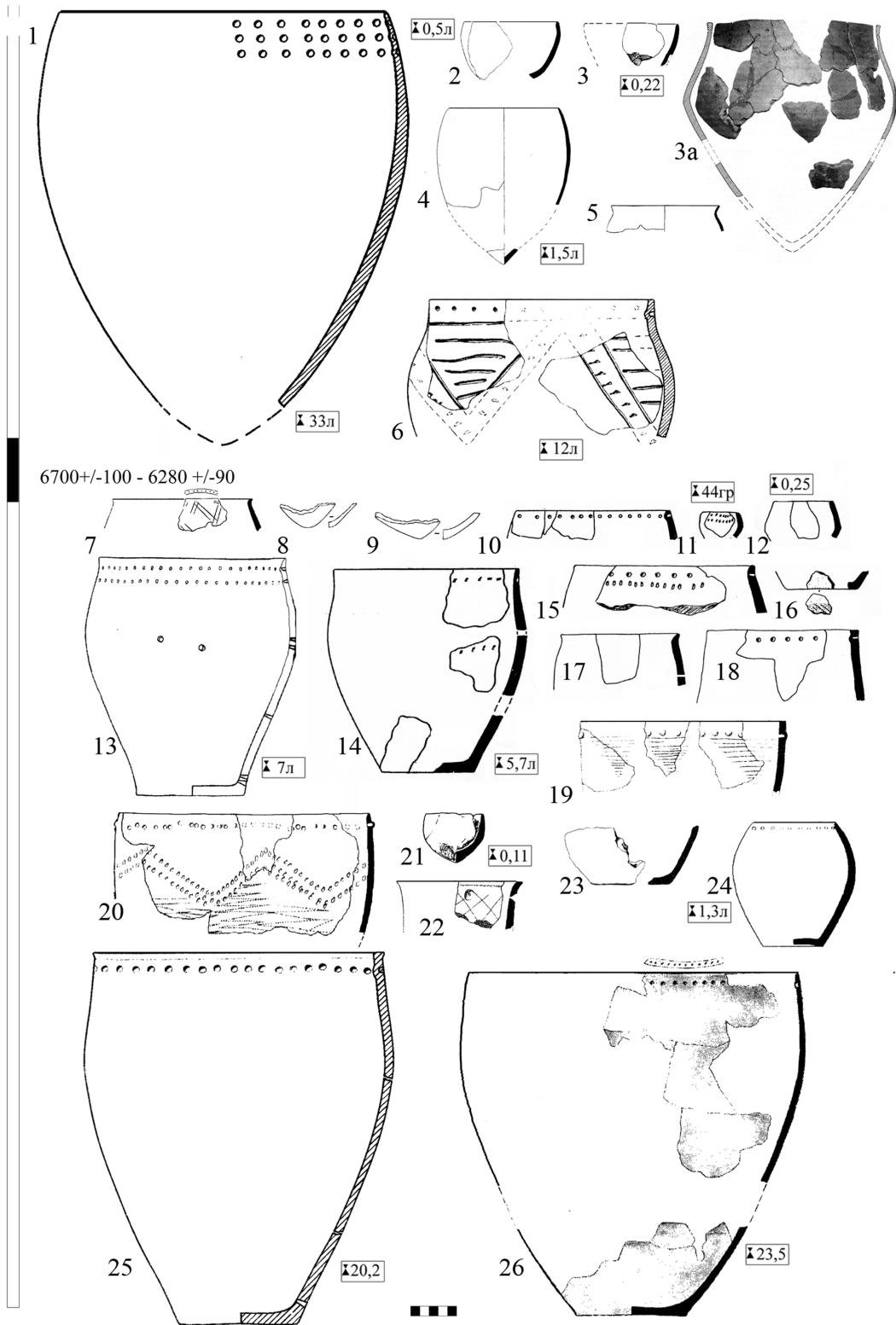


Tab. 13. Pottery of Low Volga basin. 1-10 Varfolomeevka, layer 3; 11 Jangar, layer 3; 12-22 Varfolomeevka, layer 2B; 23-26 Jangar, layer 2 (1-2, 6-7, 9 after Yudin 2004.Fig. 8; 3-5, 8, 10 after Yudin 2004. Fig. 12; 11 after Kolcov 1988.Fig. 15; 23-26 after Kolcov 1988.Fig. 12).

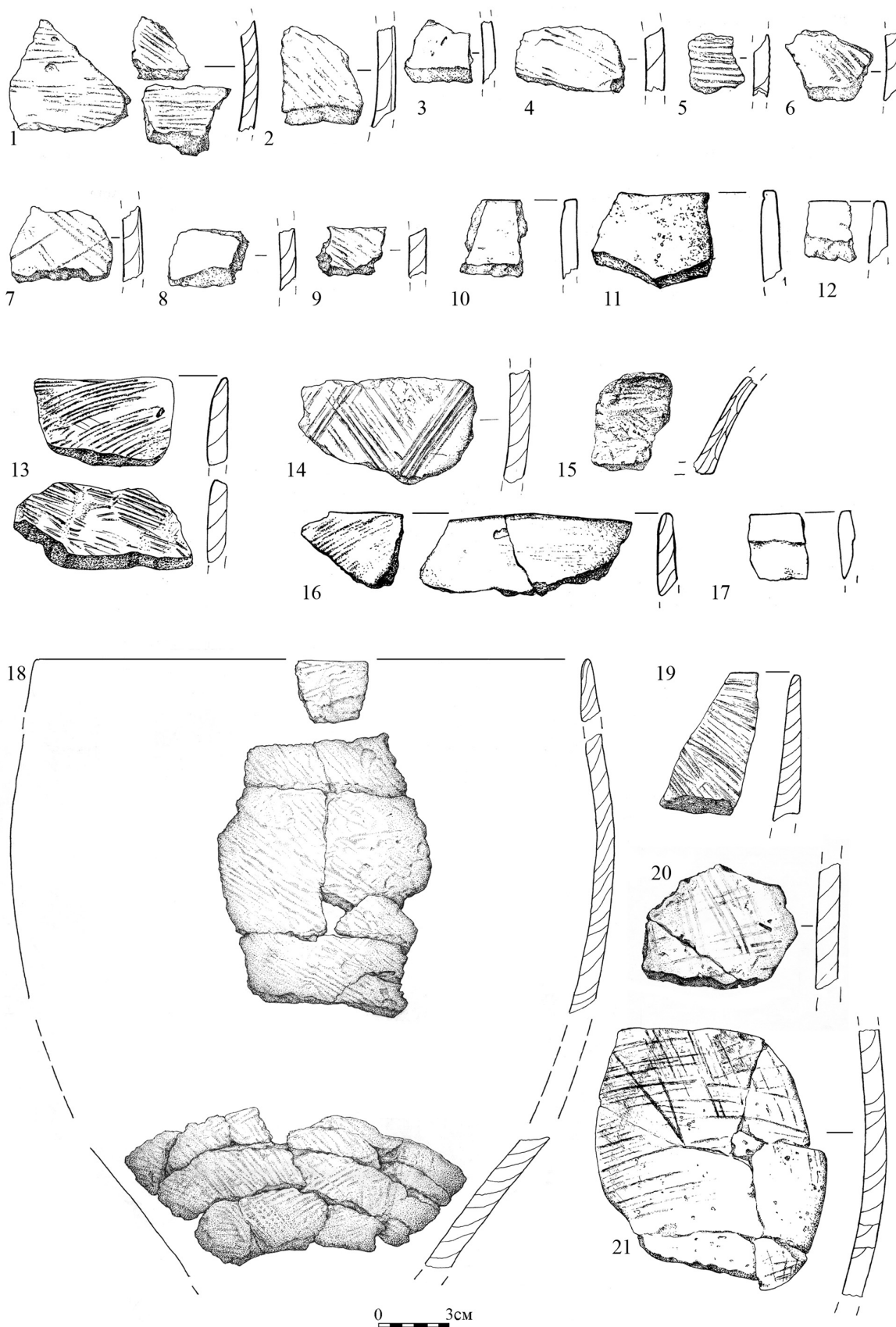


**Tab. 14. Elshanskaya culture pottery from the Middle Volga. 1–7 Ivanovskaya; 8–13 Chekalino IV; 16–24, 35–36, 37–39, 41 Nizhnjaya Orljanka II; 25–30 Staroelshanskaya II; 31–34 Ozimenki 2; 40 Maksimovskaya (1, 3 after Vybornov 2008.Fig. 46; 2, 4, 7 after Vybornov 2008.Fig. 47; 5 after Morgunova 1995.Fig. 5; 6 after Morgunova 1995.Fig. 4; 8, 11–15 after Vybornov 2008.Fig. 49; 9 after Vybornov et al. 2000.Fig. 2; 10 after Vybornov et al. 2000.Fig. 7; 16–18, 20–23 after Vybornov 2008.Fig. 52; 19 after Vybornov 2008.Fig. 53; 24 after Morgunova 1995.Fig. 25; 25–30 after Vybornov 2008.Fig. 45; 31–32, 34 after Vybornov et al. 2000.Fig. 33; 33 after Vybornov 2008.Fig. 168; 37–38 after Vybornov 2008.Fig. 53; 39 after Vybornov et al. 2000.Fig. 4; 41 after Vybornov et al. 2000.Fig. 5; 40 after Morgunova 1995.Fig. 13).**





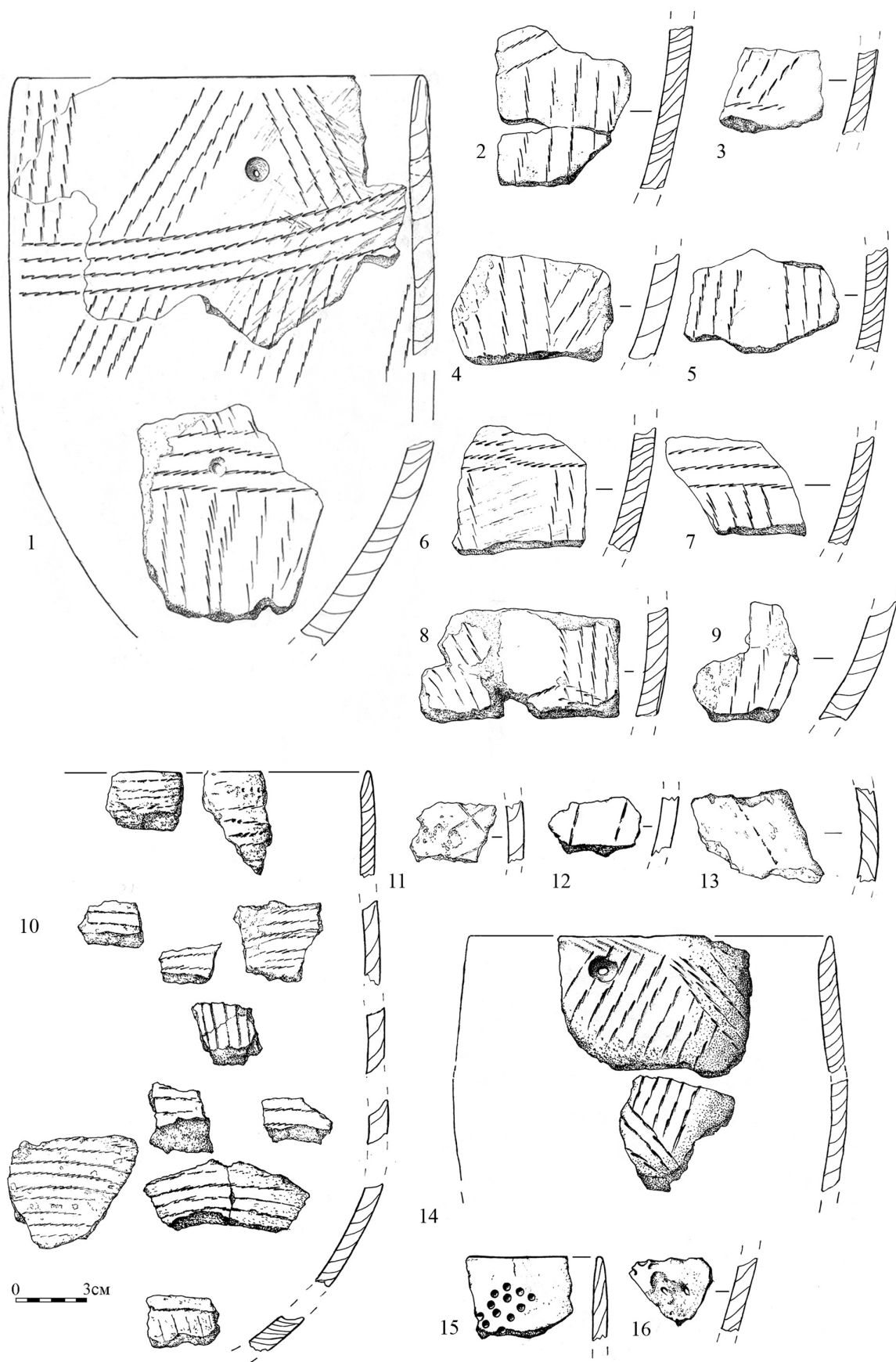
**Tab. 15. Elshanskaya culture pottery of the Middle Volga. 1, 23–24 Iljinka; 2–5 Imerka 8; 3a Viunovo lake I; 6, 19, 25 Bol'shaya Rakovka II; 7–9, 13 Krasny gorodok; 10–12, 14–18 Lugovoe III; 20 Lebjazhinka I; 21–22, 26 Lebjazhinka IV (1 after Vybornov et al. 2000.Fig. 3; 2–3 after Arheologiya Mordovskogo kraja 2008.Fig. 32; 3a after Berezina et al. 2013.Fig. 4, 5; 4–5 after Vybornov 2008.Fig. 181; 7 after Vybornov et al. 2000.Fig. 6; 8–9,13 after Vybornov 2008.Fig. 59; 10–12, 14–18 after Vybornov et al. 2012.Fig.10; 19 after Vybornov et al. 2000.Fig. 5; 20 after Vybornov et al. 2000.Fig. 11; 21 after Vybornov et al. 2000.Fig. 3; 22 after Vybornov et al. 2000.Fig. 4; 23 after Vybornov 2008.Fig. 62; 23 after Vybornov et al. 2000.Fig. 3; 25 after Vybornov et al. 2000.Fig. 18; 26 after Vybornov et al. 2000.Fig. 2).**



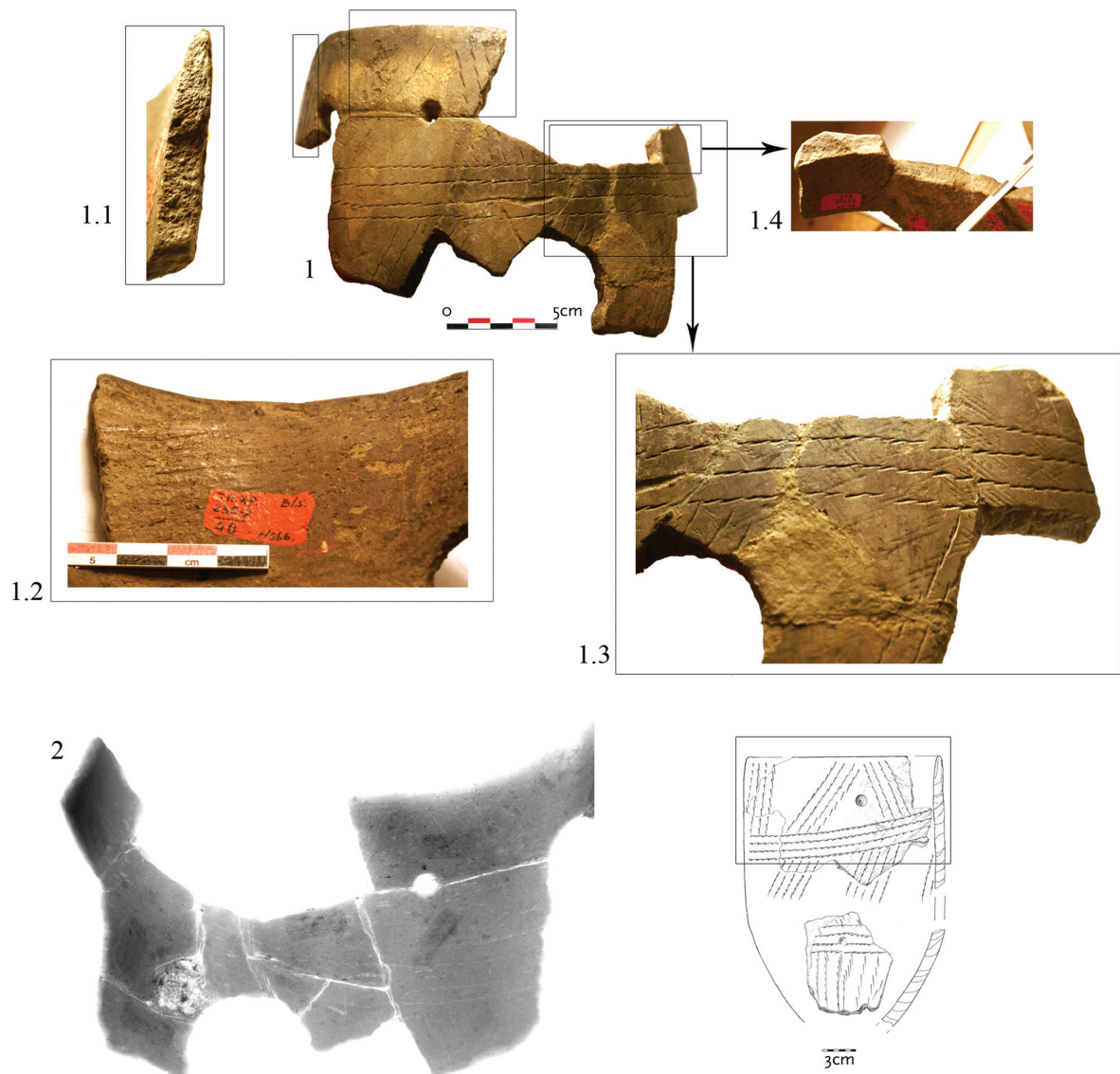
**Tab. 16. Early Neolithic pottery of phase 'a-1' in the Dnepr-Dvina region.**



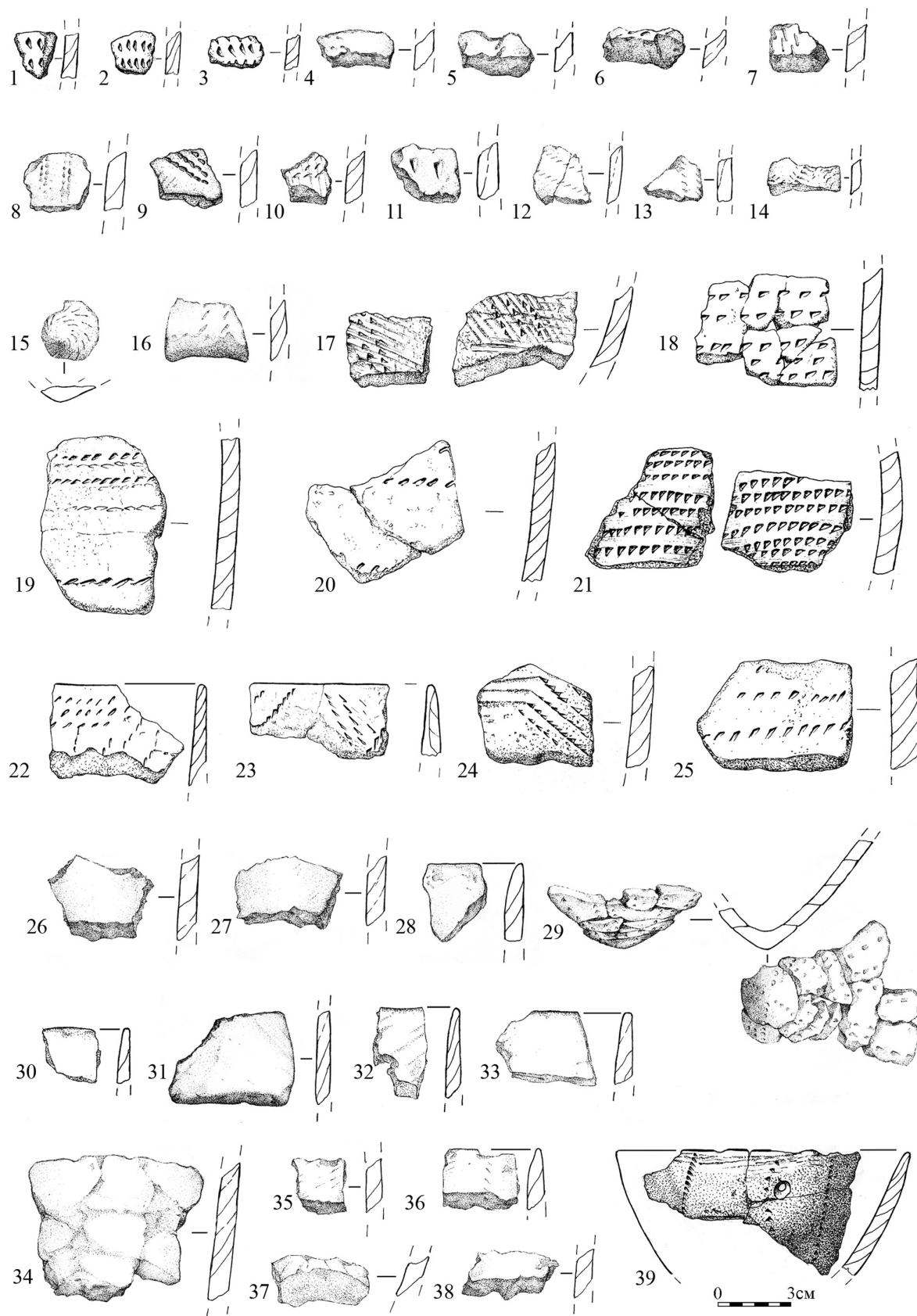
**Tab. 17. Macro-traces on a vessel of phase 'a-1' in Dnepr-Dvina region: 1.1, 3, 4 fractures where coils join; 1.2, 3, 6 horizontal / slightly oblique porous structure and fractures, marking coil junctions; 2, 4, 5 horizontal fractures at coil junctions.**



**Tab. 18. Early Neolithic pottery of phase 'a' in the Dnepr-Dvina region.**



**Tab. 19. Macro-traces (1) and radiograph (2) of the vessel of phase 'a' in the Dnepr-Dvina region. 1.1, 1.4 horizontal / slightly oblique porous structure and fractures, marking coil junction; 1.2 traces of surface roughening left by a comb-like tool; 1.3 traces of surface roughening left by a comb-like tool and further polishing of the surface.**



**Tab. 20. Early Neolithic pottery of phase 'b' in the Dnepr-Dvina region.**