



## Research Article

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# Innovations of the Beginning of the Sixth Millennium BC in the Northern Pontic Steppe

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**Abstract:** This study focuses on the pottery-bearing (“Neolithic”) sites of the northern Azov Sea region. The vessels ornamented with comb imprints appeared there in the sixth millennium BC. In the light of a recent re-dating of the Rakushechny Yar site sequence, the sites of the northern Azov region appeared to be the earliest evidence for this innovation. The innovation in the ceramic assemblage is accompanied by an innovative lithic tool set. The latter included macro-blades and fan-shaped end-scrapers, which were previously unknown in the studied region. Their reanalysis (including new field work at the single-layer site of Chapaevka) helped formulate a hypothesis of maritime transmission of comb-ornamented ceramics in the Black and Azov Sea. This hypothesis will stimulate further discussions regarding the ways of Neolithization in Eastern Europe. It underlines the connections between Balkan “classic” Neolithic and pottery-bearing sites of the Ukrainian Steppe. The impressed ware from Makri and other mainland Greek sites is treated as the closest analogy to the finds of the northern Azov Sea region.

**Keywords:** Neolithic, impressed pottery, comb imprints, migration, Ukraine

## 1 Introduction

The dawn of the sixth millennium BC saw a major shift in the material culture of populations of South and South-East Europe. In our study, we consider the adjacent regions of the north-western Azov Sea (Meotic) littoral and the Steppe Dnieper river valley (Southern Ukraine). There are indications of an early appearance of comb-ornamented pottery here. The aim of the study is to characterize the earliest complexes with comb-ornamented pottery in the region. Then, the authors proceed to suggest ways of diffusion as well as the destiny of this innovation.

The earliest ceramics with comb ornamentation were found in the lower layer of Semenovka 1 (Kotova & Tuboltsev, 1996), at the Babino 3 site (Kotova, 2003), at the Razdolnoe site (Kotova, Anthony, Brown, Degermendzhy, & Crabtree, 2017), and at the single-layer Chapaevka site (Kotova & Rassamakin, 2001) in the northern Azov Sea region (Figure 1). In this study, we give the label “Neolithic” to the sites with pottery, even if other parts of the Neolithic package are absent or not proven (e.g., agriculture or cattle breeding).

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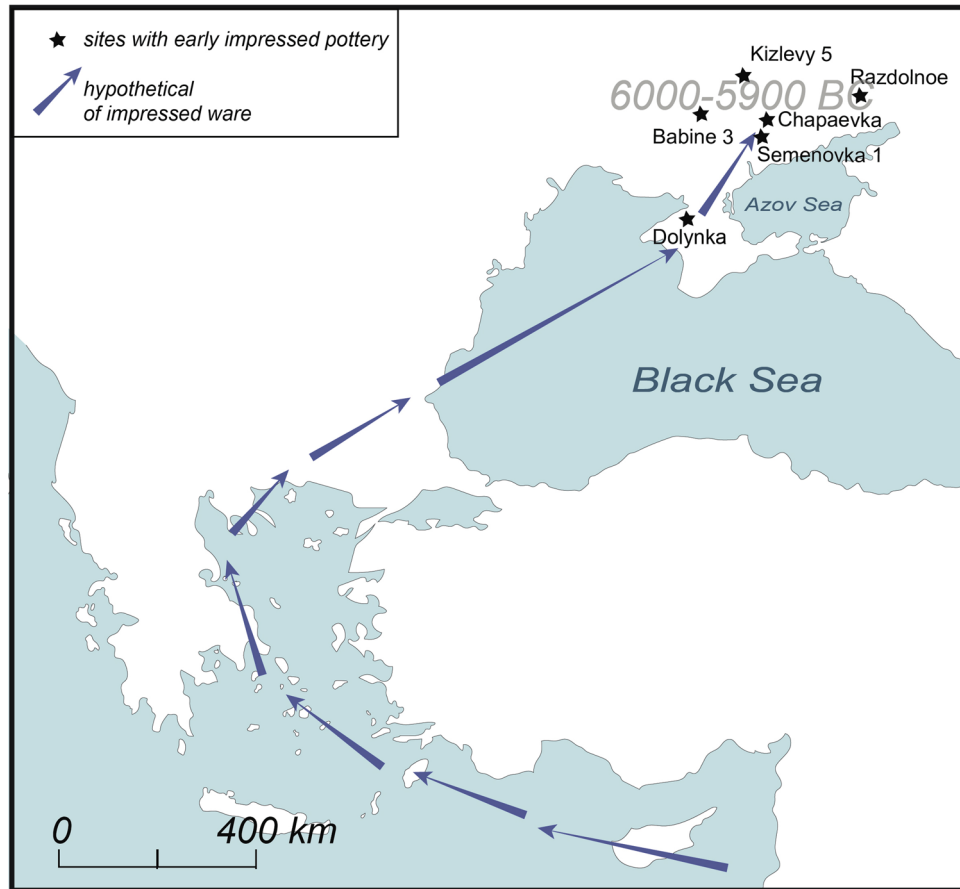
**Special Issue:** THE EARLY NEOLITHIC OF EUROPE, edited by F. Borrell, I. Clemente, M. Cubas, J. J. Ibáñez, N. Mazzucco, A. Nieto-Espinete, M. Portillo, S. Valenzuela-Lamas, & X. Terradas

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**Figure 1:** Distribution map of impressed pottery in region.

In this region, the preceding period of the late seventh – early sixth millennium BC was marked by the development of the Sursky culture. It is characterized by the notable set of bone tools including decorated pieces and grooved bone points (Figure 2(1–6)), polished stone tools (Figure 2 (7 and 8)), and stone vessels (Figure 2(9, 10, and 14)) (Kotova, 2003, 2011). Pottery was made from silt and had a natural temper of water plants (Vasil’eva, 2006) or crushed shells. Sursky pottery shapes included single high bowls and some types of pots and jars with a pointed bottom (Kotova, 2015, Figures 4–7). Pottery was decorated with lines, triangular or oval impressions, combinations of these elements, and – very rarely – imprints of two-teeth stamps (Figure 2(11–13 and 15–17)).

The region to the north of the Azov Sea saw the appearance of the comb-ornamented ceramics by the early sixth millennium BC. This innovation did not come alone but with new flint-knapping technologies and a new stone tool set. This new complex forms the first stage of the Azov-Dnieper culture (Kotova, 2003). The earliest comb-ornamented pottery was made of clay with a visible temper of shells with sand. The pottery was ornamented using comb imprints. Its peculiarity consists of the lack of a “collar” (a particular angular constructive element on the inner surface of the rim, probably a support for a cover) on the rim, which is typical for the later pottery of the Azov-Dnieper culture.

## 2 Materials and Methods

The study is based on the archaeological finds coming from a group of sites (see detailed description below) that is situated in southeastern Ukraine. The study utilizes an old-fashioned typological approach to meet its goals.

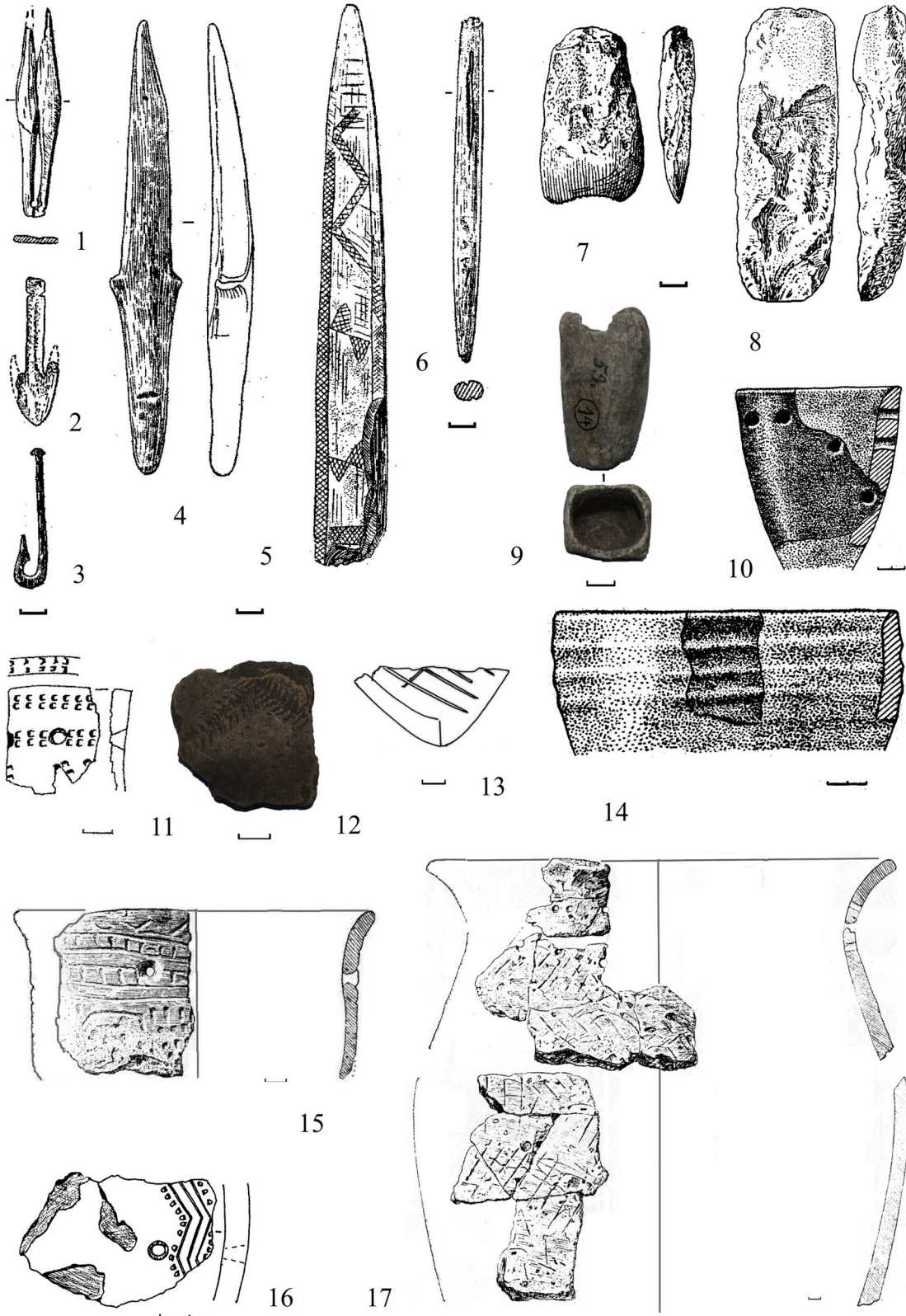


Figure 2: Materials of the Sursky culture.

Lithic assemblages were organized according to a standardized typological list proposed by D. Telegin in 1976 for the study of Mesolithic and Neolithic Ukraine (Telegin, 1976). Some important changes were applied to his scheme to account for advances in the technological understanding of lithic industries (Stanko, 1982). In particular, they were related to the description of technological flakes, which is based on the terminology proposed by Inizan, Reduron-Ballinger, Roche, and Tixier (1995). This approach supports both a detailed description of a given assemblage and enables comparisons with the previously analyzed and published Mesolithic and Neolithic assemblages from the adjacent regions.

Pottery was classified according to the typology for the Ukrainian Neolithic ceramics (Kotova, 2015). We used a visual determination for the clay paste composition. The studied collections include 38 potsherds from Chapaevka, 93 – from Razdolnoe, 230 – from Semenovka 1, 73 – from Strilcha Skelia, and 85 – from Kizlevy 5. The informativeness of a sample is not necessarily connected to its size. The state of fragmentation, variability, and preservation differs from site to site. The potsherds from Semenovka 1, Strilcha Skelia, and Kizlevy 5 came either from contexts with finds of other cultures or from contexts, which were not documented sufficiently. In this sense, the single-layered Chapaevka and the well-stratified Razdolnoe site are the most informative.

The chronology of the discussed sites is defined by the calibration of the available dataset. The radiocarbon dates can be subdivided into two groups: conventional dates and AMS (accelerated mass-spectrometry) dates. Conventional dates were obtained in Kyiv radiocarbon facility on several occasions. The Kyiv dates were doubted by some researchers due to evident discrepancies with dates from other laboratories from sites situated to the west of the region of the study, namely from the Buh-Dniester (Haskevych, Endo, Kunikita, & Yanevich, 2019) and the Trypillia (Rassamakin, 2012) cultures. However, in the region of the study, there are several Neolithic cemeteries dated both by Kyiv and Oxford laboratories with an overall good correspondence between them (cf. Table 1, Lillie, 1998; Lillie, Budd, Potekhina, & Hedges, 2009; Kotova, 2018). The Kyiv dates were verified by dating in another laboratory (Uppsala) for the Razdolnoe site (Kotova *et al.*, 2017) with a reasonable correspondence between the results. The chronology of Chapaevka is based solely on two conventional Kyiv dates. The samples selected for dating Chapaevka and Razdolnoe are animal bones. In Razdolnoe's case, the bones of cattle were used for some dates, thus excluding a possibility of the reservoir effect. The dates were calibrated in OxCal 4.4 (Bronk Ramsey & Lee, 2013; Bronk Ramsey, 1995, 2009) with curve IntCal20 (Reimer *et al.*, 2020).

## 2.1 Sites

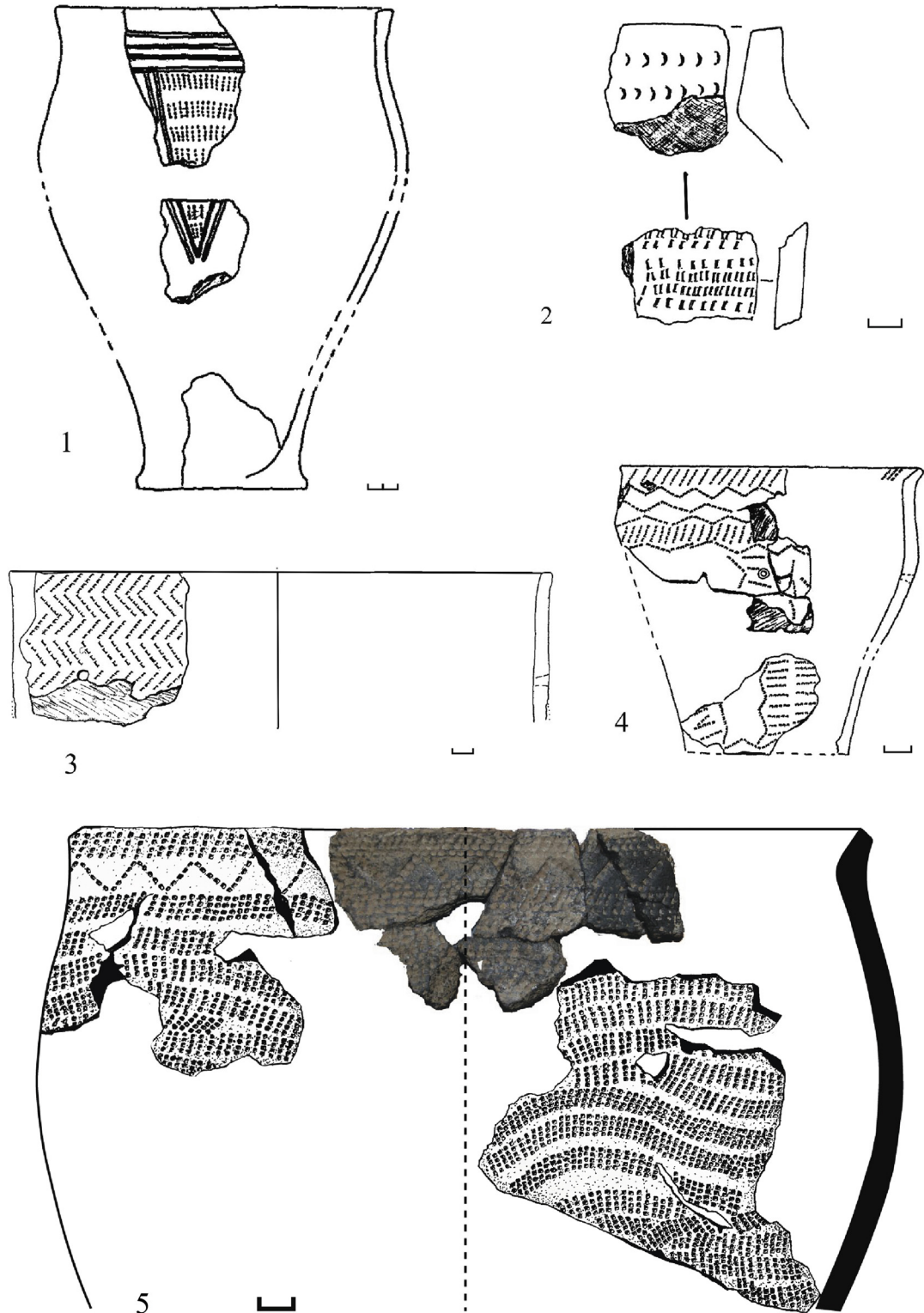
### 2.1.1 The Chapaevka Site

It is located near the village of Blagodatne (formerly Chapaevka), Tokmak district, Zaporizhja region, on the first fluvial terrace of the right bank of the Molochnaya river. The first excavations took place in 1990–1991 (Kotova & Rassamakin, 2001). In 2019 we started a new excavation at this site, which can be interpreted as a small seasonal camp. The excavated area is 120 m<sup>2</sup>. The stratigraphy of soil deposits is as follows: a chernozem layer of about 20 cm overlaps a dark brown loam of 20 cm or more, under which there was a layer of brown loam. It was underlain by a light brown loam. The Neolithic layer is located in the upper part of the brown loam. The finds are represented by ceramic shards (including those with the comb ornamentation), animal bones, flint and stone tools, shells (complete or fragmented *Unio* and *Helix*), charcoals, and small pieces of ochre.

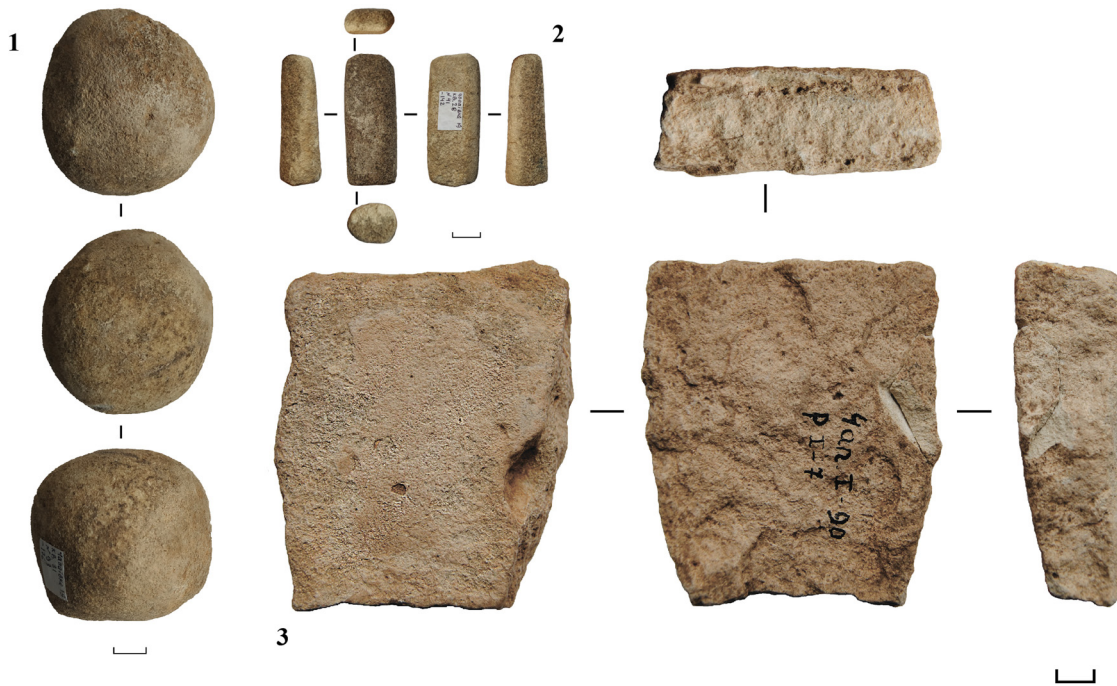
Only one high bowl with the imprints of a short comb stamp was found at Chapaevka (Figure 3((5)). The collection includes sandstone implements: a round hammerstone (∅ 54–56 mm; Figure 4(1)), a grindstone that is rectangular in cross-section (50 × 18 × 10 mm; Figure 4(2)), and a big piece of coquina with traces of trituration (Figure 4(3)). At the level of the cultural horizon, an accumulation of burnt grains was revealed, but their deposition does not allow us to draw any conclusion at this point.

Table 1: Relevant radiocarbon dates

Site name	Provenience	Aspect/phase	Lab. N	Date BP	SD	Material	calBC (1 s)	calBC (2 s)	Reference
Basic sites									
Chapaevka	Sq. 3, -64 cm	ADK/I	Ki-7671	7030	70	Animal bone	5985-5840	6021-5745	Kotova, 2015
Chapaevka	Sq. 6, -62 cm	ADK/I	Ki-7670	6910	60	Animal bone	5875-5726	5972-5668	Kotova, 2015
Razdolnoe	2010, tr. 1, -280 cm	ADK/I	Ua-42031	6609	49	Mandible of cattle	5615-5481	5620-5478	Kotova et al., 2017
Razdolnoe	1991, tr. 2, sq. 1, -120 to 140 cm	SDK/II	Ki-8002	6550	80	Animal bone	5615-5407	5629-5335	Kotova et al., 2017
Razdolnoe	1991, tr. 2, sq. 1, -120 to 140 cm	SDK/II	Ki-8001	6490	80	Animal bone	5527-5365	5616-5310	Kotova et al., 2017
Razdolnoe	1991, tr. 2, sq. 1, -120 to 140 cm	SDK/II	Ki-8000	6475	80	Animal bone	5516-5335	5614-5228	Kotova et al., 2017
Razdolnoe	2000, tr. 5, sq. 6B, -174	SDK/II	Ua-41433	6428	37	Mandible of cattle	5471-5368	5473-5325	Kotova et al., 2017
Razdolnoe	2000, tr. 5, sq. 6B, -174	SDK/II	Ua-41434	6310	38	Mandible of cattle	5318-5216	5363-5211	Kotova et al., 2017
Additional sites									
Semenovka I	Lower layer	ADK/I	Ki-6688	6980	65	Animal bone	5972-5790	5984-5732	Kotova & Tuboltsev, 1996
Semenovka I	Lower layer	ADK/I	Ki-7678	6850	70	Animal bone	5780-5660	5886-5625	Kotova & Tuboltsev, 1996
Kizlevy V		SDK/II	Ki-7999	6740	90	Bone tool	5726-5561	5794-5479	Kotova, 2018
Stritcha	Sq. 8, cut 9	SDK/II	Ki-8174	6290	65	Bone tool	5359-5208	5466-5053	Kotova, 2018
Skelia									



**Figure 3:** Earliest comb-ornamented pottery from Babino 3 (1), Semenovka 1 (2–4), and Chapaevka (5).

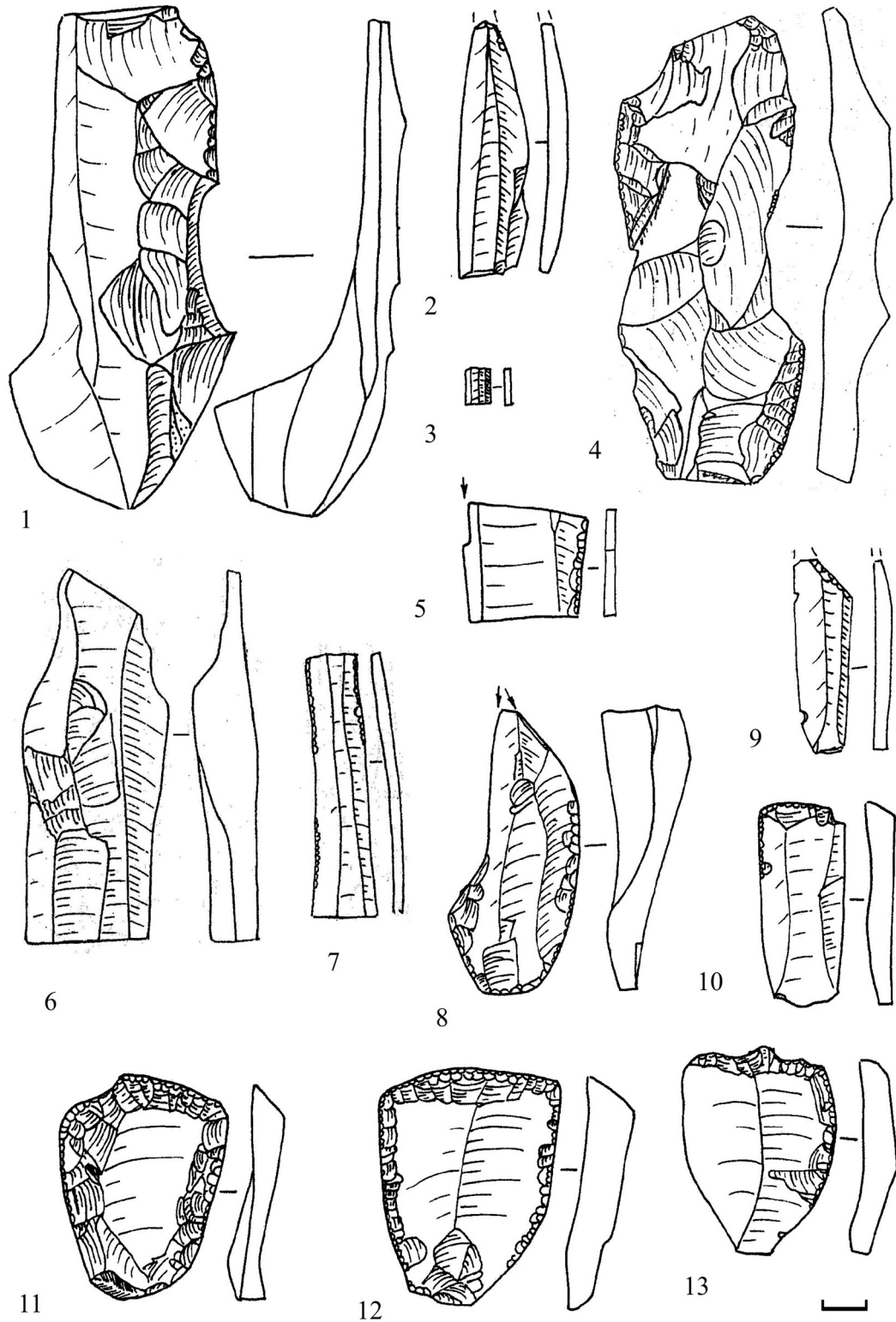


**Figure 4:** Sandstone items from Chapaevka. 1 – a round hammerstone ( $\varnothing$  54–56 mm), 2 – a grindstone (50 × 18 × 10 mm), 3 – a big piece of coquina with traces of trituration.

The early comb-ornamented pottery from Semenovka 1 and Babine 3 cannot be linked to a flint complex of a certain type due to taphonomic reasons. Thus, the single layer of the Chapaevka site is the only possibility to link the earliest comb-decorated ceramics and flint and stone tool sets (Kotova & Rassamakin, 2001).

The Chapaevka lithic complex (Figure 5) differs from other Neolithic and Mesolithic sites in the western Azov Sea area and the Dnieper valley, and it rather resembles complexes of the sixth millennium BC from the Neolithic sites of the Balkans (as will be demonstrated below). Chapaevka yielded a relatively small number of chipped stone artifacts (187 items). The artifacts were made from the flint of several varieties: (1) UA-F-Chap1 – dark gray to black, nontransparent flint with white chalky spots and small grayish inclusions; (2) UA-F-Chap2 – very fine-grained, transparent when thin, with chalky primary cortex flint of excellent quality for knapping; (3) UA-F-Chap3 – spotty gray-greenish flint of “cacao” color and texture, nontransparent, medium-grained; (4) UA-F-Chap4 – yellow-reddish flint coming from small pebbles; and (5) UA-F-Chap5 – yellow wax, nontransparent flint resembling Dobrogean cherts (but obviously not of Dobrogean origin). The classification was done according to the characteristics visible to the naked eye. The denominations come from a code suggested by Pawlikowski (1992) in order to avoid a hasty “geographical” naming. Based on macroscopic characteristics, the second variety resembles flints of Cretaceous sediments. They are numerous to the east and northeast of the site of Chapaevka. The closest described outcrops are situated in some 100–120 km distance – Otrishky (Dnipro region) and Volcha river valley, while modern-day industrial exploitation of deep flint-containing sediments occurs in 70 km to the north of Chapaevka (Mokriansky quarry). Alluvial flints can be found in the valleys of small rivers and streams flowing down to the Azov Sea (Petrougne, 1995). A petrographic study is required to assign the defined lithogroups to the known outcrops.

The main groups of artifacts are a fragment of a pebble, three chunks, 60 flakes (including 22 chips smaller than 1 cm in diameter), 59 laminar products, eight technical flakes, and 56 *outils façonnés*. There is not a single core in the collection. Technical flakes and chips are far too few to account for the number of retouched tools and regular blades. So, we must conclude that serial knapping for blank production took place elsewhere.



**Figure 5:** Flint complex from Chapaevka. 1 – distal part of overshoot blade; 2, 6–7 – blades; 3 – bladelet; 4 – technical flake with retouch; 5 – simple burin; 8 – transversal burin; 9 – truncated blade; 10–13 – end-scrapers.

Technical flakes retained some information on the reduction of cores. There is a distal part of a massive overshoot blade in the collection (Figure 5(1)). It removed a lower part of a conical core, at least 12 cm long.



Every negative is parallel and elongated (of the blades), and they are quite wide – over 22 mm. There are remains of *neo-crête* done on the flank of this core. There are rejuvenation flakes of platforms of cores with a regular lamellar negative pattern, also with a circular platform.

Flakes are as numerous as blades are. However, this group also includes small chips. The latter comprise by-products of retouching thick supports. These *débris* are indicative for the retouching of end-scrapers and, probably, other tools produced *in situ*.

Nonmodified laminar products comprise 5 microblades (less than 7 mm wide), 11 bladelets (7–12 mm wide), and 7 blades (over 12 mm wide). Microblades are in fact elongated chips from retouching and have no independent significance in the flint-knapping sequences of the site. Bladelets were systematically knapped off (Figure 5(3)). They usually have very parallel edges and a regular outline. Their morphology is consistent with the hypothesis that at least some of them were produced by application of pressure: they are thin, with a “light” section in sense of Gallet (1998), with very regular dorsal scarring, parallel sides with little undulations, and geometrical distal ends (Inizian & Pelegrin, 2002). In contrast, there is a notable macro-blade component in the assemblage, namely laminar products with a width of over 20 mm – comprising 10 unretouched items (Figure 5(2, 6, and 8)). Some blades were evidently knapped off by a direct blow due to visible ring-cracks on their butts. Others show traces of more complex preparation for detachment. Around 60% of proximal parts bear faceted butts. Sometimes it is evident that the aim of faceting was an isolation of the portion of the butt by creating some depressions around it. The impulse was applied to this higher portion of butt’s relief rather than to a ridge, even when the butt has a dihedral appearance.

Blanks modified by retouching, trimming, and burin removals are quite numerous in collection (almost 30%). They include blades, bladelets, flakes, and technical flakes. Laminar products outnumber any other type of blank.

The retouched blades (26 it.) are the largest group, but they are heterogeneous. Some retouches could in fact be traces of use. There are some heavily retouched items resembling “knife-like” blades of D. Ja. Telegin (Telegin, 1976). A single piece has both edges retouched to a rounded end (scraper-like head (Telegin, 1976)). There are two items with a retouch and a linear gloss along the sides. They are markedly different from polished blade fragments of early farming cultures. The latter usually have an angular shiny cereal polish (Mazzucco et al., 2020). The end-scrapers (18 it.) are made mostly on ends of blades, sometimes retouched. A particular subgroup is represented by end-scrapers *à éventail* (six items, Figure 5(11–13)). They are quite massive and are usually made on blades and blade-like flakes at least 2 cm wide. Other tools include burins (transversal and simple, Figure 5(5 and 8)), a side-scraper, truncated blades (Figure 5(9)), and two *pièces écaillées*.

The general composition of the assemblage is peculiar. It is not a production context. Serial knapping of blanks occurred elsewhere. Numerous retouching chips suggest that the modification of blanks and tools was carried out on the site. So, lithic tools were involved in some kind of production activity (-ies) at the excavated part of Chapaevka. They were produced by *façonnage* and rejuvenated there. An important innovation was the introduction of macro-blade production. An exact technique that was applied for this process is yet difficult to suggest. Likely it was not a pressure technique, or at least, not only pressure, because some sections of blades are quite thick and the blades themselves are not as regular as one would expect in the case of pressure-aided knapping (Inizian, 2012; Pelegrin, 2012a, 2012b).

Assemblages with a large proportion of modified pieces and notable laminar components are typical for early farming cultures of southeastern Europe (Kaczanowska, 1980; Kozłowski, 1989; Kozłowski, Kozłowski, & Radovanović, 1994; Mateiciucova, 2008). There are also complexes with numerous cores and knapping debris. However, the latter usually lack significant series of imported blades and tools. Kozłowski and coauthors proposed to treat them as different models of production. The former reflects a developed logistic system of raw material acquisition and tool production typical for sedentary agricultural communities of the Balkans, while the latter appears in times of weak intercommunal relationships and a shortage of high-quality imported products (Domboroczki, Kaczanowska, & Kozłowski, 2010).

Lithic assemblages of the northern Pontic region of the late seventh–sixth millennium BC mostly belonged to the second model of production (with numerous debris from a production “on site”; Gaskevych, 2003, 2005; Govedarica, Kiosak, & Manzura, 2017; Kiosak & Salavert, 2018; Kotova & Tuboltsev, 2013; Kotova, 2003). The general composition of the Chapaevka complex is atypical for the region and

period. In this sense, the Chapaevka assemblage is a precursor of the Eneolithic lithic assemblages of the Seredny Stog culture (Kotova, 2008), with massive end-scrapers on blades, long “knife-like” retouched blades, also with “scraper-like” heads.

The particular structure of Chapaevka’s assemblage (absence of cores, high percentage of tools) is typical for sites of “consumers,” where tools were utilized, not produced (Domboroczki *et al.*, 2010). It can be interpreted along several (nonexclusive) lines of argument: (1) a specialization of the Chapaevka camp on some short-term activity including production and utilization of end-scrapers; (2) blades and tools formed a part of a portable tool kit (tool kits) brought to the site with a residential movement of tool makers; and (3) an import of blanks produced elsewhere as a result of division of labour. The first explanation is not sufficient because it fails to account for the dimensions of blanks in Chapaevka. We need to consider that most tools in Chapaevka were made from high-quality raw material, while the closest outcrop of flint of similar quality is situated over 100 km away from the site. The blanks and tools are notably large. The second hypothesis is also less likely, as it seems that there was little if any reduction of most blanks before their arrival at the site. There is no evidence of extensive reduction or economy of raw material that would result in microlithization of the assemblage. Thus, blanks and tools of Chapaevka were brought to the site being produced recently, avoiding a long process of reduction. Their appearance on the banks of the Molochna river can be characterized with the term “import.” The single site (Chapaevka) is obviously not enough for a reconstruction of a developed logistic system of raw material acquisition. In contrast, a combination of macro-blade technology and a “consumer’s” structure of lithic assemblage are indicative of a complicated way of procurement of raw materials for the dwellers of Chapaevka.

Chapaevka is of particular interest for the study of cultural changes in the Early Neolithic of the northern Pontic region, since the materials found there reflect the initial stages of the appearance of comb-ornamented pottery in the region and link it with a particular lithic complex. The Chapaevka site yielded a single layer of the Azov-Dnieper culture, covered by over a meter of sterile deposits. This fact *a priori* makes Chapaevka a reference site for further research and excludes any possibility of cultural admixtures from other periods.

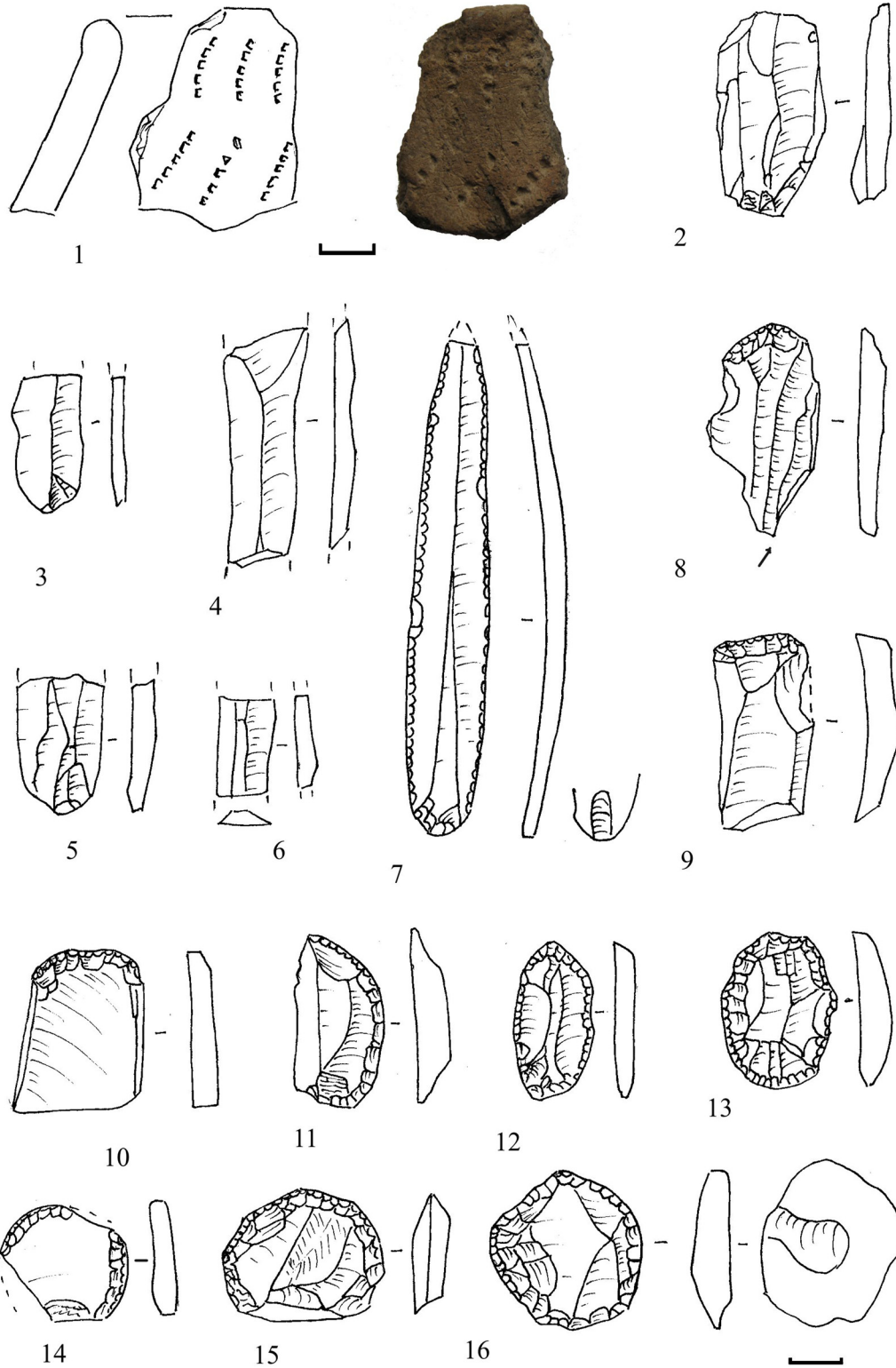
Radiocarbon dates for animal bones from Chapaevka ( $6910 \pm 60$  BP, Ki-7670 and  $7030 \pm 70$  BP, Ki-7671, Table 1) are calibrated to the timeslot 6022–5668 calBC ( $2\sigma$ ). They can be combined (X2-Test:  $df = 1$   $T = 1.7$  (5% 3.8)) with a resulting date of 5976–5736 calBC ( $2\sigma$ ). However, all these dates were produced in the Kyiv Laboratory, which has sometimes given earlier results than other laboratories, and they need verification.

Additional indirect arguments for such an early date of Chapaevka can be drawn from the Semenovka 1 site, situated at the same Molochna river, some 30 km downstream. In its lower layer, there were comb-ornamented potsherds, which are very similar to Chapaevka finds. However, this layer also contained materials of the earlier Sursky culture. The animal bones from the lower layer of Semenovka 1 were dated in the Kyiv radiocarbon facility. It is possible that two later dates from this series ( $6980 \pm 65$  BP, Ki-6688 and  $6850 \pm 70$  BP, Ki-7678; Table 1) are connected with early comb-ornamented vessels from this site.

### 2.1.2 The Razdolnoe Site

This site yielded several interesting Neolithic complexes (Kotova *et al.*, 2017). They characterize the further development of the early comb-ornamented ceramic traditions in the western Meotic region. The site is located on the banks of the Kalmius river. This terrace abuts the high plateau. The general area of the site is about 5,000 m<sup>2</sup>. It was excavated in 1963–1965, 1991, 1998–2000, and 2010. Up to this moment, the Neolithic layers have been excavated on an area of about 400 m<sup>2</sup>. The following stratigraphy was recorded: 1 – turf layer 0–20 cm; 2 – dark gray chernozem layer 20–90 cm; 3 – gray-brown loamy soil 90–154 cm; 4 – brown loam soil with lime inclusions 154–220 cm; and 5 – bright brown loam soil over 220 cm.

The early complexes of Razdolnoe (sixth–fourth millennium BC) are represented by some small, short-lived camps. One such camp was excavated in 2010. It consisted of an accumulation of *Unio*, some flint tools, animal bones, and a fragment of a comb-ornamented ceramic (Figure 6(1)). The radiocarbon date for the domestic cow mandible defines the date of this camp at 5620–5478 calBC,  $2\sigma$  ( $6609 \pm 49$  BP; Ua-42031,



**Figure 6:** Finds from Razdolnoe (middle seventh millennium BCE). 1 – a shard with comb decoration; 2-4, 5-6 – laminar products; 7 – blade with convergent retouch; 8-16 – end-scrapers.

Table 1). The paste of the Neolithic potsherd was tempered with sand. It was decorated using diagonal comb imprints creating horizontal rows.

The lithic complex of Razdolnoe (camp of 2010) is small (17 items) while being evidently microlithic in contrast to the Chapaevka assemblage. A high percentage of retouched tools indicate that final stages of flint-working are overrepresented in the collection, as is the case in the Chapaevka complex. Artifacts include a knife-like blade (over 10 cm long) with a fractured distal end and regularly retouched sides and five fragments of blades (Figure 6(2–7)), a flake, a fragment of a blade core, an end-scraper with a burin detachment (Figure 6(8)), and end-scrappers on flakes and blades (Figure 6(9–11, 13, and 14)). There are some particular end-scrappers: on a side of a flake with a convex front (of the “Oskol type”), circular, and subcircular varieties (Figure 6(11 and 12)). Three scrapers were found in a single accumulation with a cow’s mandible (Figure 6(12, 15, and 16)). The differences to Chapaevka are not only in the size of the tools (Razdolnoe implements are much smaller) but also in the set of types for end-scrappers.

The second early complex of Razdolnoe was located at a distance about 100 m from the first one (Kotova *et al.*, 2017). The collection of this small camp contained ceramics with comb imprints and band ornamentation (Figure 7(2, 3, and 5)); a shard with oval impressions (Figure 7(4)); a pot with a low neck with a complex composition of “walking comb imprints,” incised lines and oval pin impressions (Figure 7(1)). Flint tools and a fragment of an axe of the local raw material were found in this stratigraphical unit (Figure 7(6–13)).

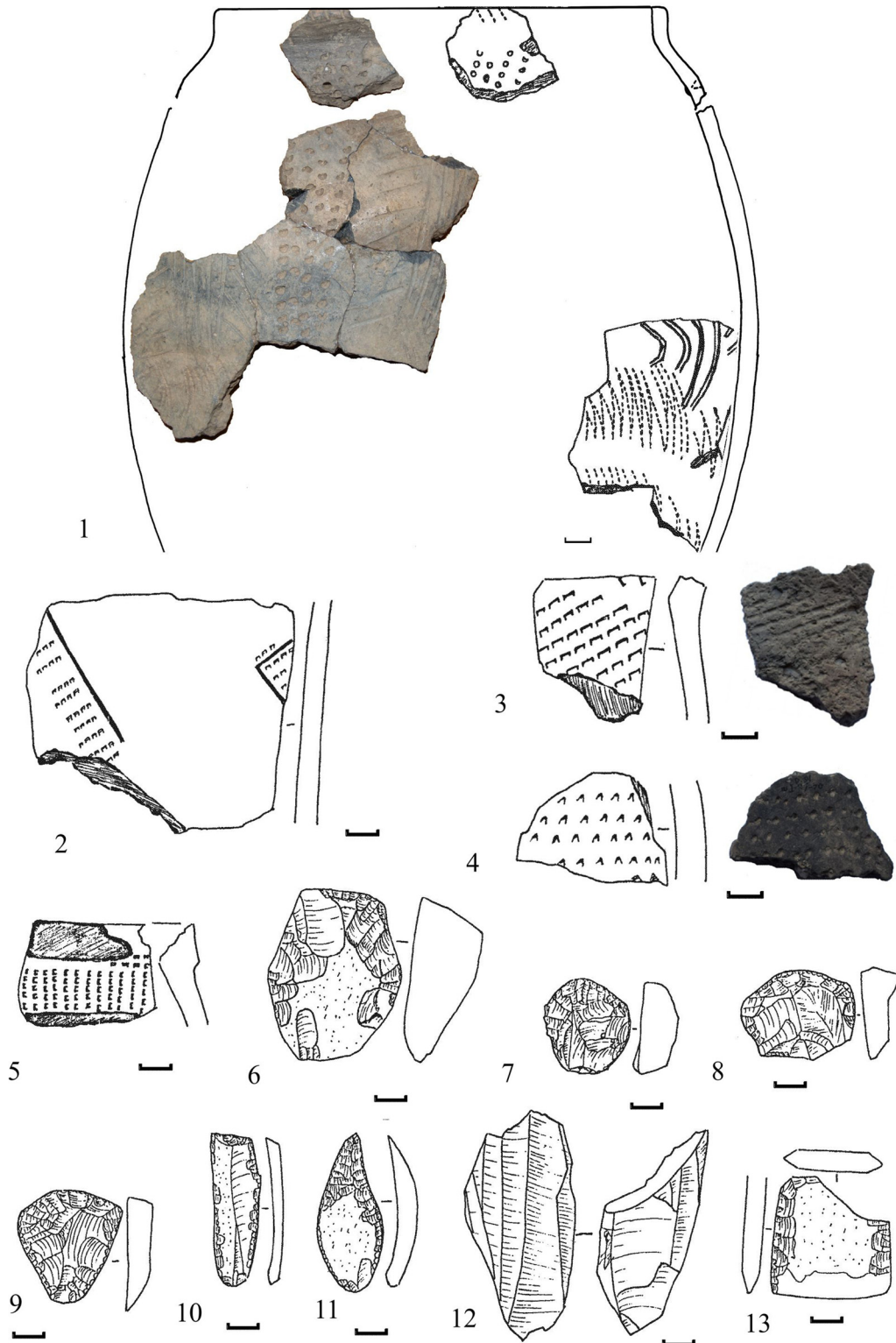
Some radiocarbon dates for animal bones from the layer are given (Kotova *et al.*, 2017): 6550 ± 80 BP (Ki-8002); 6490 ± 80 BP (Ki-8001); and 6475 ± 80 BP (Ki-8000). These defined the date of this Neolithic camp at 5460–5430 calBC. It is interesting that the fragments of the cow jaw gave two rather different dates in the laboratory of Uppsala (Sweden): 6428 ± 37 BP (Ua-41433) and 6310 ± 38 BP (Ua-41434). They can be combined in an interval of 5371–5313 calBC (X2-test:  $df = 1$   $T = 4.9$  (5% 3.8); OxCal v4.4 (Bronk Ramsey, 2009)).

### 3 Discussion

Single vessels with short comb imprints (two-teeth) are known in this area from an earlier period, in the context of the Sursky culture (Figure 2(11)). The materials of Chapaevka and Razdolnoe have shown that in the sixth millennium BC new shapes of vessels (flat-bottom vessels with a concave near-bottom part instead of point-bottom pots) appeared with longer comb imprints and a new manner of application (“walking way,” Figure 3(2)). As was mentioned above, similar pottery was found at Semenovka 1 (Kotova & Tuboltsev, 1996, Figures 10: 1; 11) with a probable equally early dating (Table 1). The lithic industry included an innovative macro-blade technology for the first time (cf. Telegin, 1976).

The reasons and timing of diffusion of comb decoration in Ukraine were disputable for a long time. V. Danilenko decided that first comb-ornamented pottery appeared among the Dnieper-Donets culture population under an influence from the forest regions of Russia. He assumed that with the Dnieper-Donets impact, comb decoration spread among the Buh-Dniester and Balkan population (Danilenko, 1962, p. 24; 1969, p. 156). That idea was supported by other archaeologists (Telegin, 1969, pp. 170, 191; Markevich, 1974 and others), but at the beginning of the 1990s, it became clear that the comb imprints appeared in the steppe area earlier than further to the north. They were disseminated among the Buh-Dniester people and later, together with the first pottery and agriculture among the Mesolithic population of the forest zone of Ukraine (Gaskevich, 2010; Gaskevych, 2001; Kotova, 2003; Zaliznyak, 2005 and others).

In the Lower Don region, single vessels with short comb imprints (two to four-teeth) occurred in the Early Neolithic Rakushechny Yar culture (Mazurkevich & Dolbunova, 2012, Figures 2(11) and 3(5)). This fact allowed an assumption that the domination of comb decoration could be explained via a development of the local tradition in the northern Azov Sea area (Belanovskaya, 1995). However, a recent dating programme has demonstrated that the layers 15–17 of Rakushechny Yar were dated to “an interval spanning no more than a few decades, centered around c. 5600 calBC” (Dolbunova *et al.*, 2020, p. 119, Figure 7), defining a *terminus post quem* for the fifth layer of Rakushechny Yar containing early comb-ornamented pottery. Thus,



**Figure 7:** Finds from Razdolnoe (5360–5310 calBCE). 1–5 – potsherds; 6, 12 – knapped objects; 7–9 – end-scrapers; 10 retouched and truncated blade; 11 – point; 13 – adze-like tool.

Lower Don sites could not have been a source of innovative comb ornamentation for the sites of the northern Azov region.

Another point of view linked the appearance of comb pottery in the Lower Don with an influence of Ural people on the basis of great similarities of shapes and ornamental compositions of vessels from both areas (Danilenko, 1969, p. 39; Kotova, 1994, 2003). However, the recent research has shown that the pottery with comb decoration in the northern Black Sea area was older than in the South Ural region. D. Gaskevich revived Danilenko's idea about the similarity of Dnieper-Donets and Buh-Dniester comb-ornamented pottery with the *Cardium* ceramics of the Mediterranean (Danilenko, 1969, p. 203) and assumed the marine migrations from the west to the North Pontic steppe around the middle of the seventh millennium calBC (Gaskevich, 2010, p. 247). He concludes that the Ukrainian comb-ornamented pottery was older than or contemporaneous with the similar ceramics from the eastern Adriatic. According to his hypothesis, both could have originated from the same source, located in the Near East or North Africa, where early traditions of comb decoration existed.

It is not possible to agree with the seventh millennium BC as a date of appearance of comb decoration in the south of Ukraine. Every C14 date (though some “direct” dates on potsherds had a questionable methodology of extracting organic compounds for dating; cf. Haskevych *et al.*, 2019; Kotova, 2015) indicated that the comb decoration became widespread simultaneously on a territory from the Middle Dniester to the Lower Don only in the beginning of the sixth millennium BC (Kotova, 2015). In the Azov Sea area and the steppe Dnieper valley, it was connected to a formation of the Azov-Dnieper culture. Its pottery had strong similarities with Impressed Ware pottery in the decoration and shapes of vessels (Kotova, 2015). However, the early potsherds decorated with comb imprints are represented by single specimens in the Early Sursky cultures (6200–6000 BC). These vessels were decorated mainly with two-teeth stamps, and the typical *Impressed Ware culture* round-shaped vessels were absent, while in the sixth millennium BC, comb decorations and shapes of vessels similar to those of the impressed pottery dominated in the Azov-Dnieper sites.

The Azov-Dnieper pottery was made with sand temper in the clay, which was similar to the Impressed pottery. It included vessels with a rounded body without a neck and with a flat bottom and a slantwise-cut rim. The ceramics set included two types of pots with a neck (with an S-type profile, Figure 3(1) and with a vertical neck, Figure 3(2)) and two types of high bowls (with an S-type profile of an upper part (Figure 3(4 and 5)) and with a vertical wall (Figure 3(3))). It is interesting that the site of Chapaevka demonstrated a unique flint complex with tools made on the wide and middle blades, with fan-shaped end-scrapers, which differed from the previous Sursky flint set dominated by bladelets and microblades, and microscrapers of circular, oval, and pointed shapes. However, there was also a site of the Azov-Dnieper culture (Razdolnoe) with a microlithic chipped stone inventory dating to the middle of the sixth millennium BC (Kotova *et al.*, 2017). Thus, in early and middle the sixth millennium BC, sites of the Azov-Dnieper region demonstrated a “dualism” of lithic industries similar to those recorded in the agricultural communities of the Balkans and Central Europe. The interpretation of this situation is far from being clear. One option is a hypothesis of interaction with the local population transferring some microlithic technologies to them (cf. Gronenborn, 2017). Another possibility is a difference in functions of the sites. Some were consumers' sites and were dependent on exchange networks in order to obtain their blades, while others tried to produce the required amount of sharp cutting edges by themselves. The latter implied an increased need for an economy of raw material and, thus, also an application of techniques resulting in a microlithic appearance of a complete assemblage (cf. Govedarica *et al.*, 2017).

## 4 Diffusion of Innovations

It is interesting to compare the time of domination of comb decoration in Eastern Europe and the Mediterranean. It was established in the Levantine – North Syrian sites about 6100–5950 calBC, – a little later (after 6000 calBC) – in the Aegean (Çilingiroğlu, 2010, p. 15). It was the beginning of the Middle Neolithic in the Aegean. The horizon of cultures with comb-ornamented pottery in the south of Eastern Europe (the Lower Don, Azov-Dnieper cultures) belonged to the Middle Neolithic too (Kotova, 2015). The closest regions for Ukraine, where the spread of the impressed pottery is recorded, are the western (Greece)

and eastern (northwest Anatolia) coasts of the Aegean Sea, as well as the Thrace region (Bulgaria and the Sea of Marmara region). Impressed ware appeared here almost simultaneously – about 6100–6000 BC (Reingruber, 2008; Winn & Shimabuku, 1989, p. 92). But despite the almost simultaneous appearance of impression products in the Aegean Sea, western and eastern parts of the region have significant differences, both in the technology for making pottery and in other areas of material culture. Among other things, an important difference is the presence of comb impressions in mainland Greece and Bulgaria and their almost complete absence in the Aegean coast of Anatolia and the Marmara region (Çilingiroğlu, 2016, p. 83).

An explanation for this difference can be found in the materials of the Levantine region, where the first stage of existence of impressed ware was associated with finger pinches, nail impressions, and prints of small sharp tools. They were separate elements that were repeated throughout the vessel body. There are also typical cases where tools with two or more teeth, such as a comb or a fork, were used. However, even in this case, in the most ancient phases, such an instrument was individually reflected several times throughout the body without creating complex compositions. At a later stage, important changes in the decorative style can be noted. First, the comb ornamentation became popular. Second, instead of covering ceramic bodies with the same single element (point, comb, nail, finger pinch, etc.), they are combined and arranged in a certain order, thus forming the composition in the form of stripes, zigzags, horizontal or diagonal lines. Another innovation of the later stages is the appearance of an impression pivotante (“walking” comb ornaments) (Balossi & Frangipane, 2002, p. 8).

Thus, it can be assumed that the first wave of migration of the bearers of the impressed pottery from the Levantine region was associated with the first period of its existence and reached the north-west Anatolian coast and the Marmara region at the very end of the seventh – the outset of the sixth millennium BC. Then, after the appearance of comb impressions in the Levantine region, the next wave of migrants also went to the Aegean region but in a different direction. To answer the questions “Why was the trajectory of the population changed?” and “why did both waves of migration reach the coast of the Aegean almost simultaneously” is quite difficult. Nevertheless, from the perspective of our study, it becomes obvious that if the population of the northern Pontic region was related to the bearers of the impressed ware tradition, then it happened through the territory of mainland Greece and Bulgaria and not through the Anatolia and Marmara regions.

At the same time, the advancement of the population over such a long distance (even considering the possibility of rapid marine advancement) is possible only in the case of large-scale migration. It is understood that the number of people in migrant groups should be sufficient to maintain identity. An interesting feature of the impressed ware distribution is that its rapid spread coincides with the foundation of new settlements. Places such as Nea Nikomedeia, Yannitsa B, and Anzabegova in the northern Aegean Sea and Polyanitsa-Platoto and Koprivets in Bulgaria produced their first layers with impressed pottery (Alram-Stern, 1996; Stefanova, 1996; Todorova, 1990). Presumably, the continuous nature of marine activities led to the creation of new villages on advantageous positions along these routes or on alluvial coastal plains that were optimal for early farmers. Therefore, it is assumed that it was human mobility, and not just the promotion of ideas, that played a key role in the spread of impressed ware over long distances (Çilingiroğlu, 2016, p. 89).

The absence of the sites with impressed ware between Bulgaria and the Azov-Dnieper culture region can be explained by changes in the Black Sea basin. At the beginning of the sixth century BC, the level of the Black Sea was much lower than it is today and the coastline directly connected the coast of Bulgaria to the Crimea (Yanko, Mudie, Kadurin, & Larchenkov, 2014), where undated sites of the Azov-Dnieper culture were also recorded (the Dolyinka burial ground, the Frontovoe site).

It is important that the Balkan-Meotic region connection functioned only for a short period. It is possible that the rather abrupt disappearance of contact is due to changes in the level of the Black Sea. In another scenario, the emergence of a new population with a different direction of advancement could have blocked the previous communication road. Such a course of events could be another confirmation of the existence of a separate monochrome horizon in the Balkans and southeastern Europe. The rupture of stable contact of migrants with Southeast Europe and the Balkans also resulted in the gradual

transformation of the material culture of the population, who left sites of the Chapaevka type. In contrast to the earliest sites, the Azov-Dnieper culture already inherited some local traditions.

It is interesting that the appearance of a large number of flint blades in Greece (Argissa-Magoula) could be due to the emergence of a new population although according to A. Reingruber their appearance does not have to be explained only by migrating populations but also just by replacing actions and tasks (plant cultivation instead of hunting) (Reingruber, 2011). Nevertheless, the flint industry of Chapaevka is fundamentally different from the local cultures. This difference reflects the profound division of labour when large blanks were produced and transported in order to be retouched into tools. The population that left this settlement was one of newcomers. Only after several generations, as a result of mixing with the local population, the second stage of the Azov-Dnieper culture follows, where elements of the local (Sursky) population's technocomplex are already present.

Thus, the appearance of impressed ware in the northern Pontic and the Azov Sea regions was impossible earlier than in these regions, due to lack of other territorial connections with the Levant region, where the earliest dates of impressiono ceramics are known. In general, such a chronology completely coincides with the radiocarbon dates of Ukrainian archaeological sites that contained new types of pottery – early Azov-Dnieper. A few radiocarbon dates suggest their appearance at the same time with the Greek Impressed Ware Culture horizon or a little later as a part of marine migrations of its population.

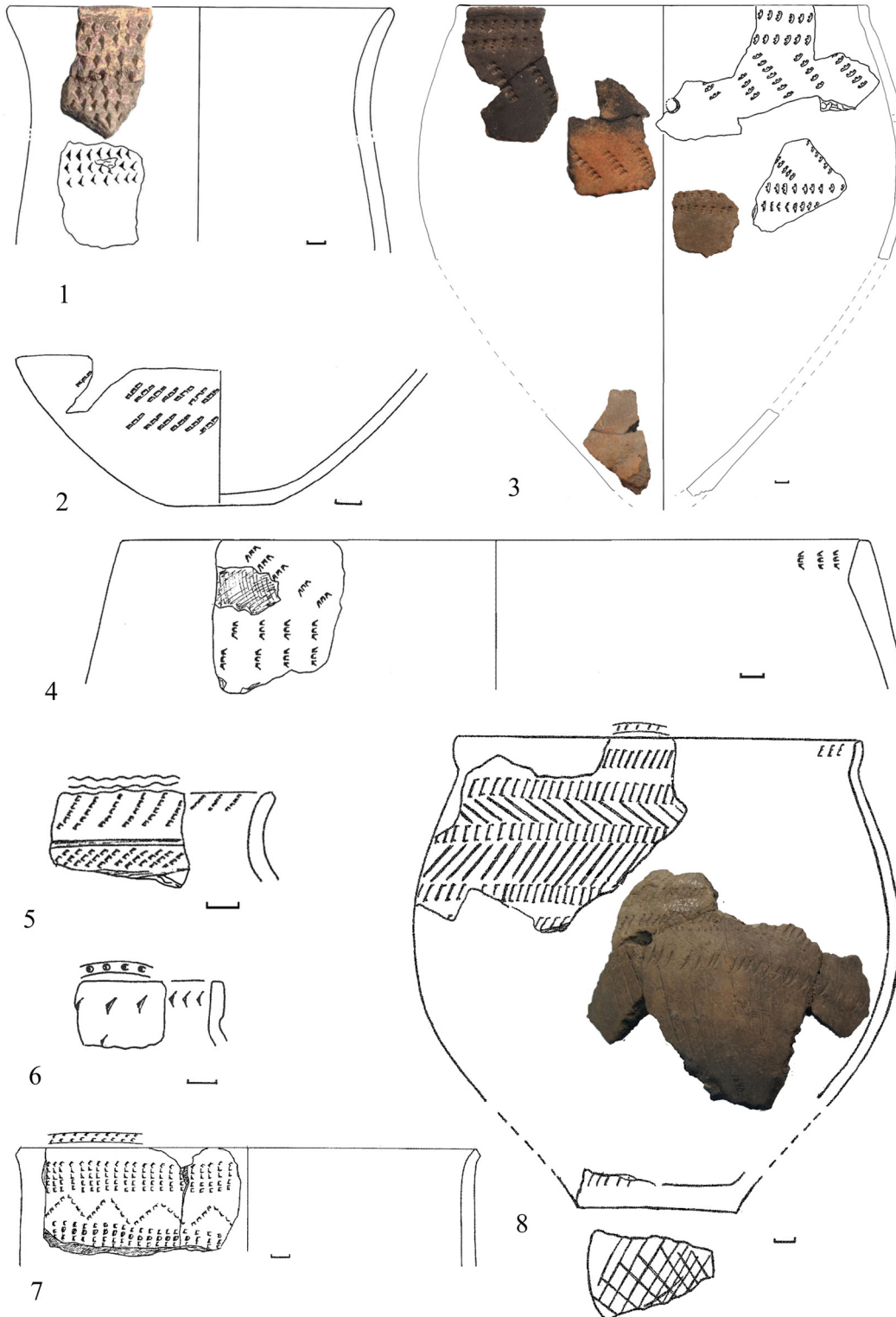
## 5 Destiny of Innovations

In southern Ukraine, we can reconstruct a variant of an evolution of the innovations, where the Impressed Ware culture migrants created the new culture (Azov-Dnieper), which co-existed with the previous Sursky culture in different ecological niches. The period around 6300–6000 BC is associated with the strongest aridisation that has been recorded for the entire territory of Europe (Budja, 2007; Weninger *et al.*, 2005). Due to aridisation, the population of the Sursky culture, which occupied the steppe zone, went to the northern regions (first of all to the Dnieper Rapids region). This is proven by the absence of sites of this culture during this period in the Azov Sea region and their sharp increase in the northern part of the steppe zone. As a result, a relatively empty territory was formed, which became attractive for migrants during the period of improving conditions. It is possible that the relative desolation of Azov Sea and Crimea regions during the preceding aridisation contributed to the migration of a new population to this region.

Probably, peaceful relationships between the Azov-Dnieper and Sursky people caused some Azov-Dnieper elements, which appeared in the Sursky pottery (a collar on a rim, comb decoration, a flat bottom (Figure 8(2–8)) and were used together with typical Sursky vessels (Figure 8(1)). This influence is most visible in the collections of the Kizlevy 5 site (Kotova & Tuboltsev, 2013), the lower layer of the Strilcha Skelja site (Kotova, 2002), and at the Kamyana Mohyla 1 site (Kotova *et al.*, 2017). One radiocarbon date obtained from a bone tool at Kizlevy 5 ( $6740 \pm 90$  BP; Ki-7999, Table 1) places the site between 5800 and 5500 calBC. The radiocarbon date for a bone tool from Strilcha Skelja shows a date of  $6290 \pm 65$  BP (Ki-8174, Table 1) or 5330–5170 calBC (Kotova, 2018).

Contacts between the Azov-Dnieper and Sursky people could have caused the migrants to adopt the local flint-knapping tradition. By the middle of the sixth millennium BC (according to so far available dates), the Azov-Dnieper people used mostly bladelets and made numerous end-scrapers from flakes as evidenced by the first complex of Razdolnoe. This situation (“Chapaevka – Razdolnoe dualism”) can also be interpreted in terms of raw material economy, leaving aside the cultural-historical explanation. If it ever happened, this transformation of the newcomers' culture can be detected in the Kalmius basin around 5604–5514 calBC. The second Middle Neolithic complex of Razdolnoe shows that the appearance of a collar on a rim and a band of lines and comb impressions as new elements of decoration on comb ceramics in this region can be dated as early as 5460–5430 calBC.





**Figure 8:** Vessels of Late Sursky culture under a pronounced Azov-Dnieper influence. 1, 4, 7 – Kizlevy 5; 2, 5, 6, 8 – Strilcha Skelia; 3 – Kamyana Mohyla 1.

We do not currently have radiocarbon dates for the synchronous Azov-Dnieper sites with the same new elements in the Dnieper valley. However, using the Sursky materials of the Kizlevy 5 and Strilcha Skelja sites, we can assume that the collar on the rim was typical for the Azov-Dnieper pottery by the middle of the sixth millennium BC and borrowed, together with comb decoration, by the Sursky people as a result of close contacts with the Azov-Dnieper population.

When pottery with comb decoration became common in the middle of the sixth millennium BC, large blades disappeared in the western Azov Sea area and in the steppe of the Dnieper valley. They returned to this region only in the Early Eneolithic at the beginning of the fifth millennium BC with the Seredny Stog population (Kotova, 2008). However, flat-bottom vessels and comb decoration were kept in this region till the Bronze Age.

## 6 Conclusion

Evidence of the Chapaevka site, which are supported with less clear finds from the Babino-3 and Semenovka 1, testified an appearance in South Ukraine of the earliest comb-ornamented pottery in the sixth millennium BC. Pottery with flat bottoms and a comb decoration did not have roots in the preceding Neolithic sites of the Sursky culture. The latter are characterized by vessels with pointed bottom and with linear and impressed ornamentation. We assume that the new sites were connected with penetration of a group of population carrying traditions of the Impressed Ware culture. They could settle in a relatively empty area of southern steppe. The sites of new type are defined via the concept of the Azov-Dnieper culture. Coexistence of the newcomers and local population during the sixth millennium BC caused dissemination of pots with flat bottoms sometimes with comb decoration in the Sursky sites (Kizlevy 5, Strilcha Skelia).

The lithic complexes of the sites with the earliest comb-ornamented pottery differ drastically. The Chapaevka assemblage stands out as an extremely early manifestation of macro-blade technology. The latter will become common in the region only by the fifth millennium BC (the Early Eneolithic period). Other sites (both Azov-Dnieper and Sursky) yielded microlithic chipped stone inventories.

At the moment, the data on the economy of the sites with earliest comb-ornamented pottery are very limited. The Chapaevka collection contains bones of unidentifiable till species horse, bison, saiga, wild pig, and fox, which were killed during the warm season of year. The Azov-Dnieper complex of Razdolnoe (5600–5500 BC) includes bones of cattle (Kotova *et al.*, 2017). The later complex of the same site (5400–5300 BC) represents unidentifiable horse, cattle, sheep, and pig (Zhuravlev & Kotova, 2003).

The final solution to the possible connection of the Neolithic population of the Northern Pontic steppe with the Impressed ware culture will be possible only after more extensive excavations and archaeological reconnaissance in the region, as well as a more detailed comparison of all materials.

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