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Ilia Palaguta[1], Elena Starkova[2]

EASTERN LBK POTTERY: SOME OBSERVATIONS ON PRODUCTION TECHNIQUES AND THE SYMMETRICAL STRUCTURE OF ORNAMENTS (FLOREŞTI AND NIEZWISKA)

ABSTRACT

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There are two collections that are stored in Saint Petersburg originating from the first LBK sites (Floreşti I and Niezwiska) investigated in the USSR during the 1950-60s by Tatiana Passek and Katerina Chernysh. Despite the incompleteness of this material, it allows us to make several observations regarding technical aspects of pottery production and its ornamentation. The production of LBK vessels is based on a coiling with subsequent forming by the "paddle-and-anvil" technique. Principal distinctions between production techniques make it possible to exclude the idea of links between the LBK and the subsequent Precucuteni-Tripolye A culture. The specifics of the forms and techniques of LBK ornamentation allows to propose that such ornamentation originates from non-ceramic prototypes. Additionally, the symmetrical analysis of Eastern LBK ornamentation indicates differences in symmetry preferences between the LBK and Cucuteni-Tripolye populations. According to the hypothesis of D. K. Washburn (2018), such a difference may indicate distinctions in the social structures of these cultures.

Keywords: LBK pottery, pottery technology, ornament, symmetrical analysis
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1 Saint Petersburg Stieglitz State Academy of Art and Design, Solyanoy pereulok 13, 191028 St. Petersburg, Russia; ipalaguta@yandex.ru; ORCID: 0000-0003-2308-7586
2 State Hermitage, Dvortsovaya Naberezhnaya (Embankment) 34, 190000 St. Petersburg, Russia; astarkova2012@yandex.ru; ORCID: 0000-0002-1773-1737

INTRODUCTION: EASTERN LBK AND COLLECTIONS FROM FLOREŞTI AND NIEZWISKA IN SAINT PETERSBURG

The beginning of the study of the "Eastern" Linear Pottery culture (Linearbandkeramische Kultur, LBK) in the former USSR (specifically, what are now the Republic of Moldova and Ukraine) dates back to the second half of the 20th century. It is rightly associated with the name of Tatiana S. Passek (1908-1968), one of the largest figures in the history of studies on the Neolithic and Eneolithic of Eastern Europe, as well as with her student Ekaterina K. Chernysh (1924-2006).

The first Eastern LBK sites that were investigated since the 1950s were Floreşti in Moldova and Niezwiska in Ukraine. Interest in them was primarily due to the fact that, at these sites, a consistent pattern of LBK layers overlain with layers from the Tripolye culture was found, which may exemplify the stratigraphic column for the Neolithic in these territories. The question of the origin of the Tripolye culture was also actively discussed in post-war historiography. From the point of view of N. Ya. Marr's "stadial theory", which had dominated in the USSR since the 1930s, "new" archaeological cultures in a region were likely to have evolved through changes undergone by the previous ones that occupied the same territory (Klejn 1993, 21-22). According to Tatiana Passek, the "Tripolye culture is generally autochthonous in its origin and is associated with the early Neolithic LBK culture" (Passek 1949, 235). This intensive discussion was inspired by Sergey N. Bibikov's suggestion that the Tripolye-Cucuteni culture originated in the Balkan-Danubian area and spread through migrations of its carriers from this region (Passek 1954; Bibikov 1955). Echoes of these discussions continue to reverberate in the assertions of researchers regarding the "influences" of LBK traditions on Precucuteni-Tripolye ceramics – for example, in the idea that the Early Tripolye population that assimilated the "descendants of LBK tribes" might have "take[n] over the technology of tableware" (Zbenovich 1989, 177, 197), or other "certain characteristics" both of table and kitchen-ware (Burdo 2004, 111).

The materials from these settlements can be found in various museums, including the one in Saint Petersburg. The collection of ceramics from Floreşti is kept in the Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera) RAS. This is a selection of ceramics from the excavations of different years: 1956-1958 and 1960 (Inventory 6484). The majority of the materials are in The National Museum of History of Moldova in Chişinău. The examples from these collections have been repeatedly published in special and generalizing works (Passek and Chernysh 1963; Chernysh 1996; Larina and Dergachev 2017), but it is not clear which collection was used for statistics (Larina 1999, 58, fig. 48-55, 58).

The settlement of Floreşti I was situated on the bank of Răut River in Northern Moldova. The stratigraphic horizon of the LBK is "poor of finds," and covered by the Tripolye A – Precucuteni II level. During excavations of more than 2000 m² that took place there in

1955-58 and 1960-61, "the remains of eight big cellar dwellings" and eight "consumer pits" were found. As noted by the authors of the excavations, "almost all dwellings are arranged in rows, from east to west, forming a street," and the whole square of the village is around 120×120 meters (Passek and Chernysh 1963, 23).

As can be seen in the published drawing, the pits were arranged linearly, stretching from north to south, with a distance of 6-8 m between them. Based on analogies with the LBK settlements in Central Europe, we may be dealing with not only with pit-huts, but also with elongated pits, usually located along the edges of the frame-and-pole "long houses" that were typical of this culture. The fills of the pits, which included layers of ash and coal, saturated with animal bones and fragments of ceramics, does not contradict this. It is quite difficult to trace the pillars of the house frames in the "yellowish loams" that underly the chernozem soil. Various authors (Lenneis 2005, 57, fig. 5; Saile *et al.* 2016, 9-11, Abb. 6) have already proposed reconstructions of the locations of these houses.

The total size of the collection stored in the MAE RAS is relatively small, consisting of about 1150 fragments. Calculations show a predominance of coarse pottery (kitchenware) with rough surfaces (80%), as well as the almost absolute dominance of spherical vessels in both categories of fine (tableware) and coarse ware.

The majority of materials from the site at Niezwiska, which were excavated between 1951 and 1957, are stored in the Ivano-Frankivsk local history museum. There are only 18 vessels from a burial found in 1953, that storied in State Hermitage museum, St. Petersburg (Inventory 2171). The materials were published by E. Chernysh (Chernysh 1962). It is obvious here that the pit near the longitudinal edge of the LBK "long-house" was interpreted as a "pit-hut". The mentioned burial was near its edge.

Thus, the material available to the authors is fragmentary, and in both cases, it does not constitute a complete archaeological assemblage. There is no sense in republishing it; however, these ceramics are excellent material for making observations on the technique of pottery manufacture and ornamentation, as well as for the study of the principles of organization of ornamental compositions.

LBK POTTERY TECHNIQUES

Based on the ceramics from Floreşti and Niezwiska, several observations on the technologies of the vessels' manufacture and decoration were made (Kozhin and Palaguta 2016). Recent studies allow us to supplement some of the conclusions.

The study of the composition of the raw materials of LBK ceramics has been greatly expanded in recent years thanks to the research of A. Rauba-Bukowska and S. Kadrow (Czekaj-Zastawny *et al.* 2017; Kadrow and Rauba-Bukowska 2017a; Kadrow and Rauba-Bukowska 2017b; Kadrow *et al.* 2017; Kadrow *et al.* 2018). Without questioning the conclusions of the authors, who revealed the differences in ceramic materials and re-

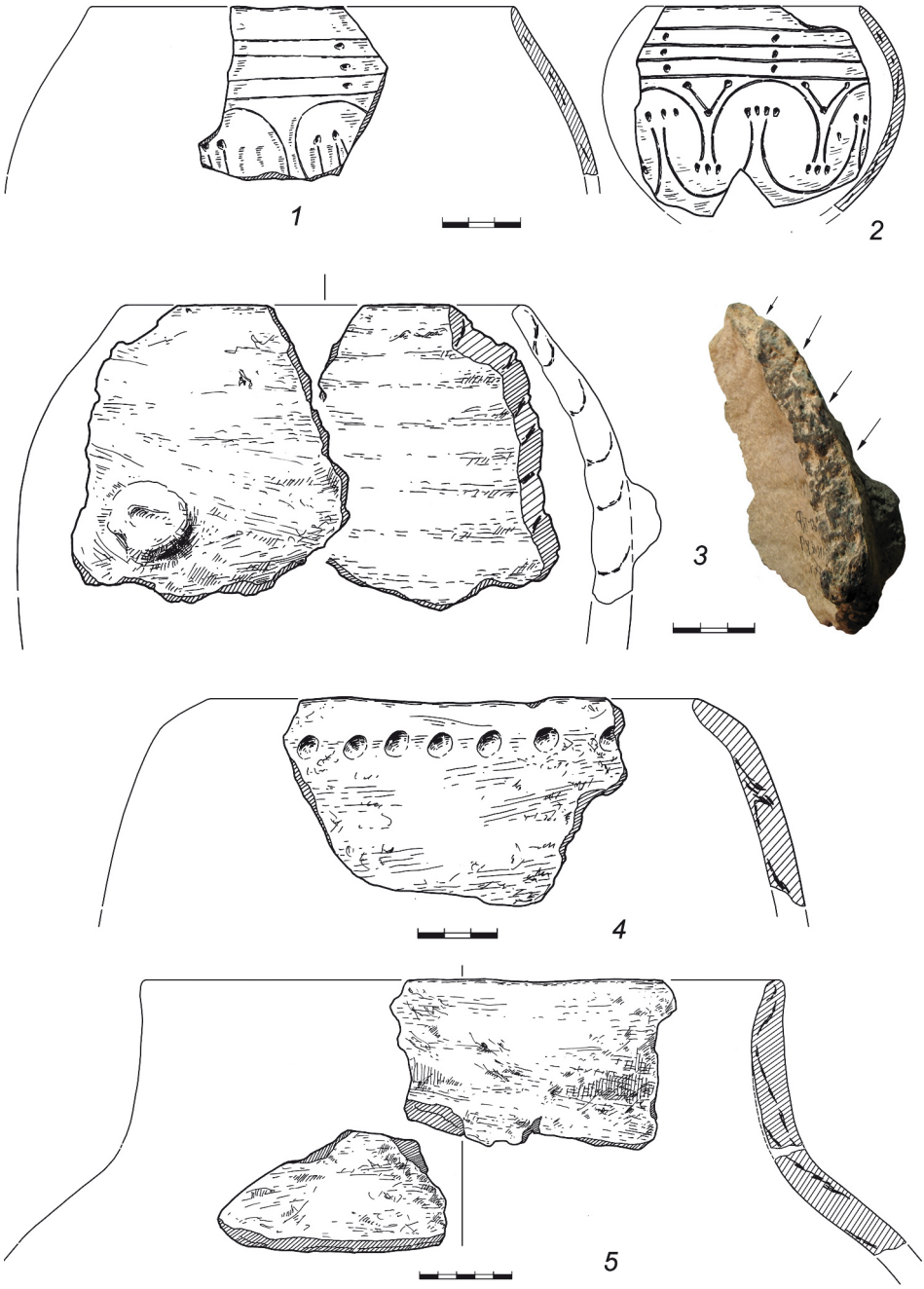

Fig. 1. Floreşti I: LBK pottery from excavations by T. Passek. Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera) RAS, St. Petersburg

constructed the possible paths of migration of LBK groups, it should be noted that the particular selection of ceramic raw materials is also influenced by the properties of local clays, to which the population needed to adapt when occupying new territories.

The general characteristics of the raw materials of LBK ceramics are largely determined by the entire technological chain, where the "paddle-and-anvil" technique is used as the main *modus operandi* in the formation of the vessels in both the Western and in the Eastern areas of this archaeological culture (Gomart 2011; Gomart 2014; Kozhin and Palaguta 2016). This necessitates the exclusion of large solid impurities (crushed screes or fireclay) in the material, which would damage the vessel walls during the use of this technique. Therefore, in the manufacture of Linear Pottery, finely crushed non-organic impurities, such as sand and powdered chamotte, or organic substances (chaff, or perhaps dried manure) were used. When moving to new territories, the choice of admixtures to the raw clay material was determined both by the already established skills (as indicated by the differences in impurities), and by the characteristics of local raw materials.

Vessels' blanks were assembled from coils or narrow strips. There is an example of a "kitchen" vessel in Floreşti, the walls of which, after coiling, were not hardly modified by secondary forming operations. The oval coils can be clearly seen at fractures (Fig. 1: 3). The walls of the vessel turned out to be thick, but its surface was smoothed out, so that the irregularities are visible only from the inside. However, this is an exception to the rule. Most of the vessel walls bear the traces of extensive transformations as a result of beating (Fig. 1: 4). The walls of the tableware vessels made of fine-structured clay are especially transformed by the "paddle-and-anvil" technique (Fig. 1: 1-2). The use of coils rather than strips in several cases is indicated by the disorder of their joints (Fig. 1: 1, 5).

Indicators of the use of the paddle-and-anvil technique are:

– coils are largely strained, joints between coils or strips are also stretched and deformed (Fig. 2: 1);

– the structure of sherds is layered; the orientation of inclusions that are visible in the cross-sections of sherds is preferably along the surface (Fig. 2: 4);

– use of paddle-and-anvil technique requires the use of finely granulated impurities that do not damaged the walls of the vessels: sand (crushed, powdered gruss or chamotte) or organics (chaff or, perhaps, dried manure) (Kozhin 1964; Rye 1981);

– flat traces of a paddle on the upper surfaces, and corresponding traces of an anvil on the inner surfaces of vessels;

– these features are consistent with the predominantly spheroidal shapes of vessels that usually do not have explicit ribs (This quite eloquently demonstrates the closeness of the LBK forms to the spherical amphoras of the Corded Ware cultures of Europe, the Karasuk culture of Southern Siberia, and the ceramics of Melanesia, where the paddle-and-anvil technique was also used (Kozhin 1964; Kozhin and Ivanova 1974). It is obvious that there is no need to talk about any genetic continuity between these cultures; the morphological similarity of their ceramics is due only to the use of similar techniques).

Fig. 2. Floreşti I: LBK pottery from excavations by T. Passek. Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera) RAS, St. Petersburg

The unity of the ceramic assemblage of the LBK, despite the differences in the ceramic raw materials between "kitchen" and "table" ware, confirms the use of the paddle-and-anvil technique for both categories of pottery. "Kitchen" vessels can be quite large: the diameter of the rim of one sample from Floreşti, which is represented in numerous, loosely connected fragments, is over 34 cm, and the height of the vessel height could exceed 70 cm (Fig. 1: 5). There is a typical admixture of chaff in the paste of this vessel. Both the walls and the rim are formed by beating, which is visible in the traces of the paddle on the upper surface, and by the strained joints between the coils or strips. The surface is smoothed after beating. The bottom of this vessel is rounded. The firing is uneven: the upper part of the vessel is yellowish, but there are also large, gray-colored spots on the walls that occurred because of an inability to form a homogeneous firing environment.

LBK pottery belongs to the round-bottom tradition that is based on the use of blanks shaped as semi-spherical bowls, which are flattened later on in the pot-making process. The body/bottom passage is smooth. As can be seen in several fragments, the line between the walls and the bottom is formed by a series of paddle blows (Fig. 2: 2), and only one case in the Floreşti collection demonstrates the use of scraping for modification after beating (Fig. 2: 5).

There is a completely different set of technological operations in the Tripolye-Cucuteni ware, which formed another "operational chain". The paddle-and-anvil technique is not used either in the early period Precucuteni-Tripolye A or later, even when a number of vessels of "Steppe" origin created by this technique appeared in the Tripolye assemblages (Palaguta 2007, 67-72). Tripolye vessels are constructed from wide clay bands with subsequent scraping and trimming. These techniques allow the use of large fractions of chamotte as admixture.

The only evidence of possible connections between the LBK and Precucuteni-Tripolye A ceramics are the finds from the LBK level at the site of Tîrpeşti, located in Subcarpathian Moldova, where some LBK vessels were decorated with carved decorations like the earliest Precucuteni pottery (Marinescu-Bîlcu 1971). These fragments obviously represent an attempt to decorate an LBK vessel with an ornament inherent to another tradition, but the same ornamental techniques are more typical for the pottery of the Boian-Giuleşti culture, which predates the Precucuteni culture, and is conventionally synchronous to the LBK. That is why the role of LBK culture in the genesis of the Precucuteni-Tripolye culture can be excluded.

The lines of pottery decoration in Floreşti, just as in Niezwiska, are mostly cut with a sharp instrument on clay that is in the nearly 'leather-hard' condition. The depth of the lines is 1.5-2 mm, cutting the wall by almost half of its thickness (Fig. 2: 6). The 'dots' were made after the lines, and their inner surface is rough, as can be expected when working with a dried preform (Fig. 2: 1-3, 5).

The smoothing and polishing of the surface of the tableware was made after the completion of its ornamentation. There are some cases in Floreşti in which the ornamental

lines were erased during the polishing process (Fig. 2: 3). Thus, the use of the paddle-and-anvil technique and surface polishing obviated the need to use engobe for surface smoothing, unlike the ceramic processes of the most Balkan cultures, included the Cucuteni-Tripolye culture.

The manner of decoration, which resembles a woodcarving, as well as the "free" manner of early LBK ornaments, which are not related to the tectonic of the vessel's shape, may provide evidence of the influence of the processing of non-ceramic items (Schuchhardt 1909; Kozhin and Palaguta 2016, 248).

In Floreşti, traces of red paint are revealed on separate fragments of the "table" ware, and one of the "kitchen" vessels is painted with broad black lines (Fig. 2: 7). LBK paints have not been analyzed. It can be only assumed that the paint was applied after firing, as in the Tripolye and other Balkan cultures (Podvigina *et al*. 1999).

The question of LBK origins remains an important problem. One of the keys to answering this question is the genesis of the LBK ceramic complex and its connection with the traditions of the earliest Balkan-Carpathian Neolithic Starčevo-Körös-Criş culture. This problem has been the subject of a recent collective work that is devoted to comparing the pottery techniques of the LBK, the Alföld Linear Pottery culture and the Körös culture (Gomart *et al*. 2020). However, the question of whether a complete technological chain was borrowed, or of whether a more or less independent development of techniques by the LBK complex took shape with only the idea of ceramic production borrowed – further developing independently via inspirations from the treatment of other materials – requires further study, taking into account not only the manufacturing technique, but also the decoration of the vessels.

The second problem is the influence of the LBK on the formation process of subsequent cultures of the Late Neolithic and Eneolithic that emerged on the same territories. This includes the question of the role of the LBK in the genesis of the Cucuteni-Tripolye ceramic complex that was mentioned above. In this case, we believe, the symmetrical analysis of ornaments is quite productive, allowing for the comparison of large 'layers' of material at the level of archaeological cultures through the principles of symmetry used in ceramic ornaments.

LBK ORNAMENTS: SYMMETRICAL ANALYSIS

Studies on the decoration of LBK pottery have an extensive historiography that includes the description and analysis of ornamental compositions and their elements in multiple local groups and separate sites, which allows local and chronological characteristics and the directions of influences and migrations to be distinguished.

The method that is based on the analysis of the principles of symmetry, which were used for the compounding of ornamental compositions, is relatively rarely applied for

studies on pottery ornaments. It is based on work on the symmetry of crystals and its mathematical theoretical background (Shubnikov and Kopcik 1974; Jablan 2002). The principles of symmetry have been taken into consideration in the description of ethnographic materials, objects of applied art of the Scythian-Siberian "animal style," and pottery of the Turkmen Copper Age and the Andronovo culture of the Steppe Bronze Age (Kircho 1999; Rudkovskiy 2013 *etc.*). The analysis of symmetry has also been tested on the materials of the Tripolye culture (Starkova 2020).

The starting point for using symmetry analysis to study ornaments of prehistoric ceramics is the work of Anne O. Shepard (Shepard 1948), and the most fruitful developments in this direction are seen in research on the decoration of ceramics and textiles of Native American cultures. Dorothy K. Washburn and Donald W. Crowe found that a change in the ratio of symmetry types is associated with the movement of population groups, and, accordingly, with a change in the social, economic, and cultural structures of societies. Thus, the choice of definite types of symmetry is an important element of cultural identity (Crowe 2004; Washburn 2018).

From a formal point of view, any ornamental composition is a curvilinear/rectilinear geometric pattern consisting of repeating elements and motifs. The focal point of a composition may be either the patterns themselves or the background spaces between them. This phenomenon is referred to as the "reversibility" of the ornament (Kozhin 1981, 136; Palaguta 2009). The motif is repeated in the composition according to certain rules of symmetry, and the number of repetitions is limited. This makes it possible to consider any ornament within a rigid, limited framework of a set of symmetry methods.

The main types of symmetry are:

– mirror reflection (the simplest), in which elements are mirrored about an axis or plane;

– rotation, in which the figure (element or motif) can be rotated several times about the rotational center. Particular cases of rotation symmetry are central when elements or motifs rotate 180 degrees relative to the center; glide reflection refers to when the rotation is made relative to an infinitely remote center;

– similarity, in which all figures of the same shape are considered equal, regardless of their size;

All planar symmetry constructions are limited by four options: movement, double rotation, mirror reflection, and glide reflection. On this basis, only 7 types of one-dimensional ornaments (borders) can be created. The ornament on LBK ceramics is located mainly in the horizontal zones, so we restrict ourselves to considering exclusively linear patterns. A border is a linear pattern obtained by the parallel translation of a motif or element of an ornament. A motif is a repeating set of elements in the composition. Symmetries of borders are usually denoted by alphanumeric indices originally adopted in crystallography: pm11, pmm2, p112, pmg2, p111, p1g1, p1m1,1 (fig. 1, *1*) where:

– p – primitive (or elementary) cell in crystallography, which is an equivalent of a motif in ornamental composition;

– 1 – no changes;
– m – mirror reflection;
– g – glide reflection, which is an offset of the repeating region relative to the axis;
– 2 – rotation around the center of rotation by 180 degrees

This system of symbols for borders was developed by the German crystallographer Carl Hermann in 1928 and modified by the French mineralogist Charles Victor Mauguin in 1931. Hermann-Mauguin symbols are also called international symbols because they are used in the International Tables for Crystallography. The international system is different from the A.V. Shubnikov system (Shubnikov and Koptsik 1974); however, as experience has shown, it is more suitable for describing the symmetry of ornaments.

With regard to the analysis of the symmetry of ornaments on LBK ceramics, we are faced with certain difficulties associated with the extreme fragmentation of the ceramic material, which complicates the reconstruction of the patterns and the full ornamental compositions, which is required for this study.

The Eastern LBK materials used for this study come from the sites of the Prut-Dniester interfluve (the territory of the contemporary Republic of Moldova), and were published in a monograph by Dr. Olga Larina (Larina and Dergachev 2017): Floreşti I, Gura Camencii IV, Dănceni, Sîngerei I, Rogojeni II. The examples belong to a group of sites that are close in time and territory, and that are relatively well represented and illustrated, which allows us not only to distinguish separate elements, but also to reconstruct the complete ornamental compositions.

Resettlement of the LBK population to these Eastern territories took place at an early "note" phase, and later, the contacts between the periphery and the central part of the area were interrupted, which is evidenced by the absence of ceramics of the later Želiezovce phase (Kadrow and Zakościelna 1999, 190, 191). Thus, on this territory, we find only the pottery of the "note" phase, which developed independently without any influences from the western region. Besides the Moldavian sites, some compositions on pots from the contemporaneous Niezwiska burial, where complete vessels are preserved, are also included in the analysis (Passek and Chernysh 1963, fig. 25, 12, 15, 16, 23).

As has been observed (Starkova 2020), it is more expedient to carry out a symmetric analysis on the materials from a group of relatively synchronous sites of the same region, since this obscures the local characteristics of individual settlements. In addition, the information from any one site is not enough to obtain informative results.

Obviously, any irregularities in the lines, which often break the symmetry of elements and motifs, are a direct product of the skills of a particular master, so here we are employing an "ideal" scheme, without consideration of such errors. Many ornamental schemes were initially created with a violation of symmetry, and it was the basic structure that was violated, although the basis of the composition of the border followed the rules of symmetry. This can be compared with Tripolye-Cucuteni ornaments, where the symmetry of the main construction was often broken by additional details (Starkova 2020). Also, symmetry

was generally absent in some of the LBK decorations, but because of the small size of the fragments, and the inability to determine the amount of such decorations, this category of ornaments is not included in the statistics of the study.

Five out of seven possible types of border symmetry were identified in Eastern LBK ornaments: pm11, pmm2, p112, pmg2, p111.

The simplest compositions, both visually and in terms of their production, are those of the pm11 type, formed by the parallel transfer of the motif and its reflection about the vertical axis (Fig. 3: 1-3). Such compositions are formed by rows of horseshoe-shaped figures, arched lines, or triangles. The majority of pm11 schemes were produced without distortion or any additional elements breaking the symmetry.

The next type of symmetry, known as pmm2, presents a vertical and horizontal reflection of the motif, as well as a 180-degree rotation. There are significantly fewer borders with vertical and horizontal symmetry. These can be parallel lines separated by paired or single depressions or compositions of rows of broken lines forming rhombuses (Fig. 3: 4, 5). In some cases, geometric figures are rather sloppily executed, with uneven lines, which breaks the pmm2 symmetry (Fig. 3: 6).

A more complicated type of p112 symmetry is formed by a parallel translation and rotation of the motif by 180 degrees. These are ornaments in the form of rows of horizontal, S-shaped figures, formed by one to three parallel lines or a continuous S-shaped spiral (Fig. 3: 7, 8, 11). Compositions based on the p112 type of symmetry can also consist of inclined semicircles, formed by 1-3 parallel lines, or by oblique parallel lines (Fig. 3: 9, 10). In ornaments formed by this type of symmetry, violations often occur, such as different numbers of lines forming the semicircles, or even a significant deformation of the basic structure, such as when parts of the spirals overlap and are not drawn completely (Fig. 3: 11).

Compositions of the pmg2 type are formed by a parallel translation, a mirror reflection of the motif and its gliding about the horizontal axis with rotation by 180 degrees. Ornaments with this type of symmetry are most common on Eastern LBK ceramics. Such borders are formed by wave-like or broken bands, rounded depressions, or rows of semicircles, which consist of one to four lines (Fig. 3: 13-16). Variants with additional elements that differ in the upper and lower parts of the border, and which therefore break the symmetry of the final composition, are quite common among this type of ornamental scheme (Fig. 3: 16, 17, 19). Sometimes the number of lines forming the motives can be different between the upper and lower rows, but the basic structure of the border is not broken in this case (Fig. 3, 18).

However, there are compositions where the pmg2 symmetry is clearly visible, but the basic structure is strongly distorted – for example, a broken line with discontinuities, a different number of lines in a band, or additional elements with significantly different locations (Fig. 3: 20). In another example, the center line of the border is an element of both the lower and upper parts of the composition, thereby violating the basic structure formed by the rows of sliding semicircles (Fig. 3: 21).

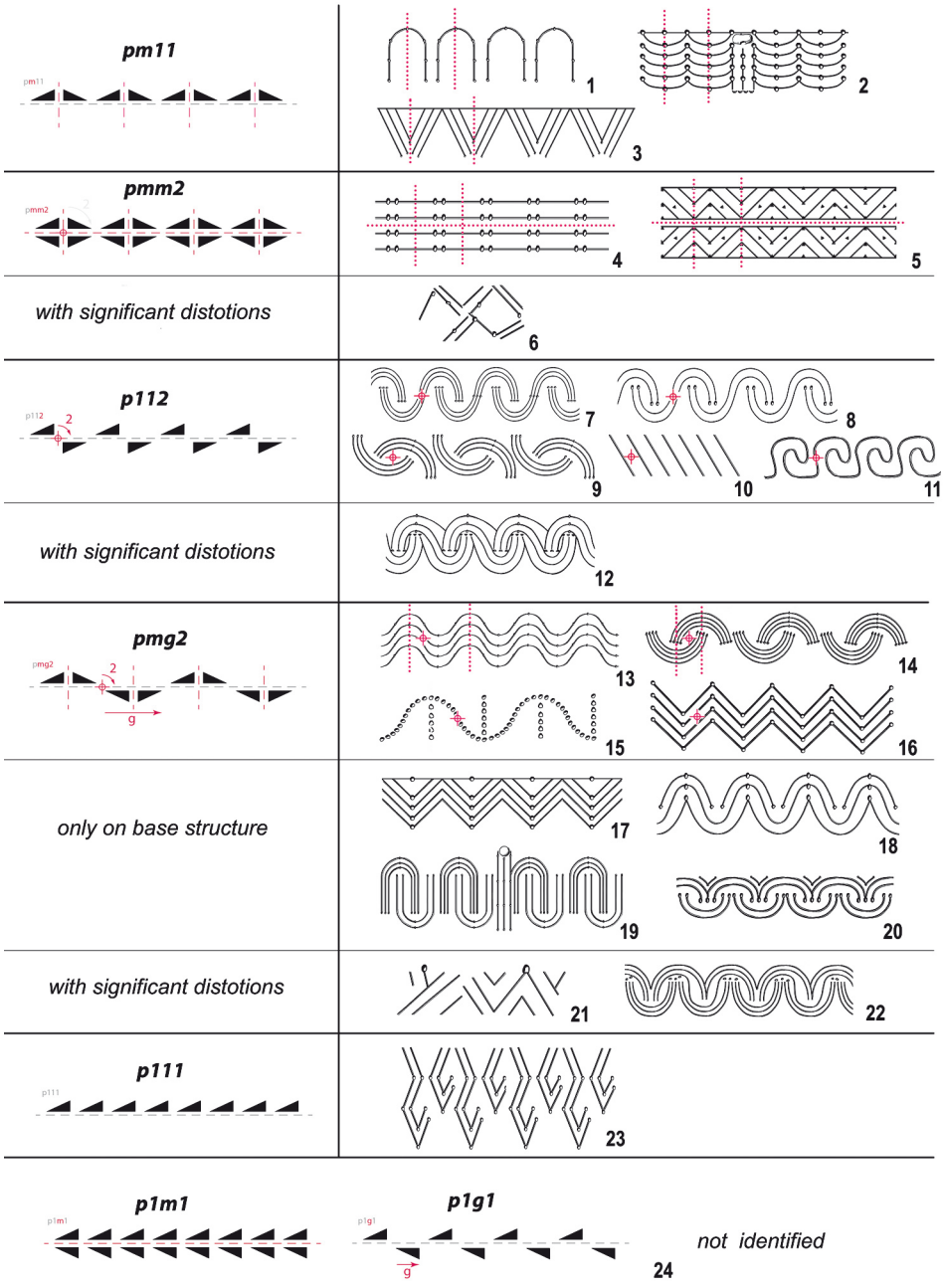

Fig. 3. Symmetry types of Eastern LBK ceramic ornaments

The p111 symmetry is a simple parallel translation of the motif in the horizontal direction. It would seem that compositions with repeating motifs without horizontal and vertical symmetry are the most simple, but such schemes are quite rare in LBK ceramic ornaments. This type, which is composed of vertical rows of broken lines, is present on one vessel from Niezwiska (Fig. 3: 23). On the other hand, compositions following a basic p112 symmetry are common in Tripolye ornaments; however, they are broken by additional asymmetrically located elements, thus, in the final scheme, they turn into compositions with a simple p111 repetition of the motif. In LBK ceramics, additional details are absent from p112 compositions as a rule, and all distortions follow the basic structure.

Compositions of the p1m1 type, which denotes a parallel transfer of the motif with its reflection relative to the horizontal axis, and the p1g1 type, which is formed by the reflection and gliding along the horizontal axis, are not identified in the decoration of Eastern LBK ceramics (Fig. 3: 24).

The above example of symmetry analysis, due to practical constraints, was conducted on an extremely small amount of material from the peripheral sites. However, even in this case study, we can find some regularities. In particular, the greatest number of compositions with broken symmetry was found among the ceramics of the Floreşti I settlement. So far, due to the lack of information, it is not entirely clear how to interpret this. The p1g1 symmetry type, which is absent among ceramics of the Eastern LBK sites considered here, is found on ceramics of the same phase in the central part of the area, for example, in the LBK burial ground in Nitra (Pavúk 1972, Abb. 29, 7, 11). This can be explained, as noted above, by the long-term isolation of the Eastern region of the LBK area, and, accordingly, by the differences in the composition and structure of the population compared to its central part.

The calculations of the percentage of symmetry types can be carried out in a very approximate manner using a small amount of data from the above-mentioned sites of the Middle Dniester region using summary tables by Olga Larina (Larina and Dergachev 2017, fig. 51-54), in which the different types of ornaments are presented. Estimating from the total number of published varieties, the most common types of ornaments in the Eastern LBK are those with pmg2 symmetry (38%), followed by pm11 (28.2%), p112 (19.7%), and pmm2 symmetry (12.7%), with the least common being the p111 type (1.4%) (Fig. 4).

For comparison, the symmetries of ornaments of the BII-CI stage of the Tripolye culture (Popudnya, Shipintsi), as well as those of its finale stage from the cemetery at Vykhvatintsy, are presented in Figure 4, alongside the LBK data (regrettably, the data for the Tripolye A and BI periods are not sufficiently presented in publications, but this does not affect the general comparison between the cultures). There is a significant difference in the ratio of symmetry types between the chronological stages, which confirms the dramatic changes in Tripolye-Cucuteni society just before its decline (Starkova 2020). Thus, with such a comparison, it can be seen that completely different ideas about symmetry are embodied in the ceramic ornaments of three different cultures: the LBK, the Tripolye BII-CI and the later Tripolye CII (which, in fact, is a separate culture of the Early Bronze Age).

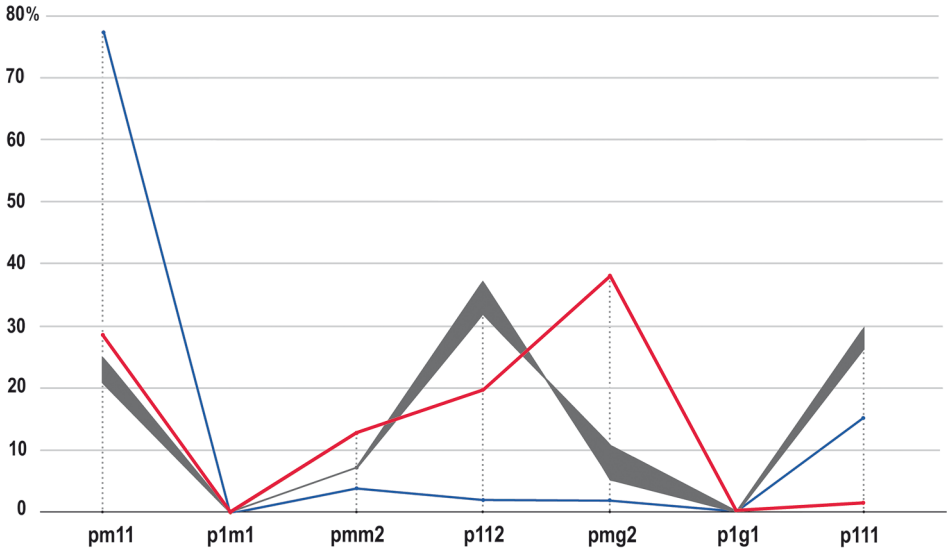

Fig. 4. The frequency of symmetry types: Eastern LBK (red), Tripolye BII-CI (gray), and in the Vykhvatintsy cemetery of the Tripolye CII period (blue)

The possibility of developing this topic at the level of one culture is still limited by the fact that the analysis of symmetry has not been carried out for individual sites. As for the symmetries in LBK ornaments, it would be appropriate to compare their ratio in the center of the territory to the periphery, as well as in different phases of culture development, when the difference in the set of symmetries, in contrast to the style of ornamental compositions, may not be so significant.

CONCLUSIONS

The analysis of pottery forming and ornamentation techniques shows the basic differences between the ceramics of the Late Neolithic and Early Eneolithic cultures of the Carpathian-Balkan circle – in particular, the Tripolye-Cucuteni culture, which replaces the LBK in the territories East of the Carpathians. The analysis of the symmetric structure of LBK ornaments yields the same results. The use of this method is needed for more detailed studies of the series of reconstructed pottery, but even an approximate comparison revealed the different types of symmetries that were chosen by different populations. It can be assumed that the change of the population in this region took place without any visible contacts between the archaeological cultures.

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