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TRACING THE MICRO PROCESSES OF THE PRODUCTION AND USE OF CERAMIC VESSELS AND TEXTILE PRODUCTS FROM THE CUCUTENI-TRYPILLIA SETTLEMENTS OF BILYI KAMIN AND KRYNYCHKY-FERMA (UKRAINE)

ABSTRACT

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The article presents an analysis of a collection of ceramic fragments with textile imprints from the Cucuteni-Trypillia settlements of Bilyi Kamin and Krynychky-Ferma, which are situated in modern Ukraine. The analysis involved macroscopic and microscopic examinations as well as use-wear studies, aimed at characterizing traces that provide insights into the production and utilization of ceramic vessels and textile products. A comparison of results with published data from the Trypillia settlements located mainly to the east of the Dnister River was carried out. A preliminary characterization of the shared and distinct characteristics in the development of the economic activities during the Trypillia CI and CII stages (*i.e.*, during 4th millennium BC), was completed.

Keywords: Cucuteni-Trypillia, ceramics, textile impressions, microscopic analysis, use-wear, ceramic and textile production
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1. INTRODUCTION

The process of producing ceramic vessels in the Neolithic societies of South-Eastern Europe has occasionally been connected with the use of a layer of textile placed (as a kind of separator or support) under the base of the vessels (*e.g.*, Mazăre 2011a; 2011b; Nincic 2016; Svilar 2016). Vessels produced by the Cucuteni-Trypillia (CT) societies who existed between the Carpathian Mountains and the Dnipro River in the territory of modern Romania, Moldova, and Ukraine during the 5th to 4th millennia BC were no exception to this practice. Archaeological sources from CT sites indicate that the supports were most often used during the working process with still-raw (unfired) clay, probably at the stage of shaping the vessel and possibly at the drying stage (*e.g.*, Novytska 1948; Kordysh 1951; Kosakivskyi *et al.* 1998; Ciobanu and Tencariu 2022). The use of a support provided ancient ceramists with a convenient way to manipulate the vessel, as the production was typically carried out on a stationary surface (Novytska 1948; Kordysh 1951). There is no undisputed evidence of a potter's wheel in the CT environment, although there are assumptions about the presence of some rotating devices (Markevich 1981, 120-130; Ellis 1984, 115-118; Ciobanu and Tencariu 2022). The utilization of these supports represents an evident innovation in the production of ceramic vessels (Novytska 1948; Kordysh 1951; Makarevych 1960). Spiral and perpendicular braided mats, as well as woven or other non-woven fabrics were most commonly used as supports (Markevich 1981, 113-117; Kosakivskyi 2003).

Clay is a very plastic material, and as a result, the use of textiles as supports leaves clear "documentation" in the form of impressions on the bottoms of vessels. Such discoveries have been documented since the initial investigations of the CT sites in the late 19th century (Skrzyniecka 2020). Textile imprints enable us to gain insights into the weave's characteristics, the fabric's density, the quality of the thread, and in some instances, even the direction in which the thread was twisted. These details have been discerned through the first pioneering professional studies of this artefact category (Novytska 1948; Kordysh 1951). Although such imprints are the main source for the study of CT textiles – which are not generally preserved in the archaeological record – a comprehensive study remains incomplete. There are some synthetic works on this topic that have described this artefact type at the regional level (Markevich 1981; Kosakivskyi 2006; Marian 2009; Mazăre 2011b) or at the level of some settlements (Novytska 1948; 1960; Kordysh 1951; Kosakivskyi 1998; Kosakivskyi *et al.* 1998; Sikorski 2016; Skrzyniecka 2020). These work are based on data that are derived either from the author's own field investigations or have been compiled through the analysis of published works and museum collections.

Microscopic studies remain very promising for the study of textile imprints on Trypillia vessels because they make it possible to examine the thread structure in more detail. This approach facilitates a comprehensive examination of thread structures, as well as more precise determination of their metric characteristics. The first application of this method to the investigation of textile imprints on vessels dates back to the early 1930s, when M. Novytska conducted research on materials recovered from the Stina 1/4 archaeological site, excavated in 1929. Photomicrographs and "micro-analysis" were carried out by that author during this study (Novytska 1933) and the results were published after the Second World War (Novytska 1948). Photomicrographs were also used during the investigation of textile imprints in the middle of the 20th century, for example from the Lomachyntsi-Plyta settlement (Passek 1951, 55-57). Recently, the microscopic method has been actively used to study imprints on CT vessels (Sikorski 2016; Skrzyniecka 2020).

However, during the processing of this category of artefacts, the majority of the studies mentioned above pay most attention to the reconstruction of the CT textile manufacturing. On the other hand, details concerning pottery production related to the utilization of textile supports have typically received less attention, with the exception of a few individual studies (*e.g.*, Markevych 1981, 120-130; Ciobanu and Tencariu 2022). In our opinion, the functional traces of textiles on the bottoms of vessels, although overlooked by researchers despite containing information about the process of how vessels with textile imprints functioned, are equally interesting. Therefore, the main objective of this article is to provide a comprehensive characterization of the technical use of textile in pottery making. As database for this paper the collection of ceramic fragments featuring textile imprints from Copper Age settlements, specifically Bilyi Kamin and Krynychky-Ferma, located within the territory of contemporary Ukraine, has been used. Two sites were also chosen to identify whether there were temporal differences in the ceramic and textile production as well. Additionally, we conducted a comparative analysis of our research findings with published data from settlements of the Trypillia culture, predominantly situated to the east of the Dnister River.

The analyzed collection was gathered during active field investigations conducted by Ukrainian researchers in the early 2010s (Rud *et al.* 2015), and also as a result of later large-scale expeditions during 2016-2021 (Rud *et al.* 2019; 2022; 2023). These expeditions were primarily conducted in collaboration between researchers from the Institute of Archaeology of the National Academy of Sciences of Ukraine in Kyiv and Kiel University in Germany, as part of the CRC1266 "Scales of Transformations". Unfortunately, the successful six-year field campaign of this international expedition was abruptly halted due to Russia's war against Ukraine, which escalated significantly on February 24, 2022.

2. MATERIALS AND METHODS

The textile impressions on the bottoms of ceramic vessels, under analysis in this article, originate from two Trypillia culture settlements dating to the 4th millennium BC. The settlements are situated in the southern part of the forest-steppe zone, located between the Dnister and Southern Buh Rivers, and fall administratively in the southern part of the Vin-

Fig. 1. Localization of the Bilyi Kamin and Krynychky-Ferma settlements and other Cucuteni-Trypillia settlements that are mentioned in the article. Prepared by V. Rud

nytsia oblast of Ukraine. They are identified as the Bilyi Kamin site, affiliated with the Chechelnyk group during the Trypillia CI stage, and the Krynychky-Ferma site (Fig. 1), which is part of the Brînzeni group at the onset of the Trypillia CII stage. Below, we provide a concise overview of these settlements, followed by a detailed description of the contextual information concerning the discovered artefacts.

2.1. Bilyi Kamin settlement

According to the results of the magnetic survey conducted in 2018, the Bilyi Kamin settlement encompasses an expansive area spanning 97 ha in a remarkable topographical situation. This settlement stretches from the lower terrace of the Rohizka River, part of the Southern Buh River system, up to the crest of an elongated promontory that extends in a south-east to north-west direction. Overall, the settlement conforms to the "classical" layout of Trypillia settlements with a concentric ring corridor. A rectangular square (the so-called "plaza") containing three large megastructures is situated on top of the promontory. To the south-east of the plaza, a fourth megastructure is also visible. Settlement activities in Bilyi Kamin took place with the "highest" dating probability mainly during the

39th century BC, which was determined using the radiocarbon dating method (Rud *et al.* 2019a; 2019b).

The first archaeological excavations at the settlement were conducted in 1928 (Makarevich 1940). During the 1980s and 1990s, V. Kosakivskyi repeatedly surveyed the settlement. During his investigations, ceramics with textile imprints were found (Kosakivskyi *et al.* 1998, fig. 4: 4). In this article, artefacts from field investigations conducted in 2010 and 2014 are analyzed (Kosakivskyi and Rud 2011; Rud *et al.* 2015, 19). At that time, we received information from local residents about large-scale looting of the settlement via illegal excavations. The site was immediately examined. Several damaged areas of the cultural layer were recorded in the north-eastern wooded part of the settlement. But the largest number was concentrated in the central part of the settlement, to the south of the megastructures, where numerous robber pits and hundreds of kilograms of ceramic vessel fragments have been discovered. Within this collection, there were 15 ceramic fragments originating from four different vessels (identified as find IDs 2, 3, 4 and 36) notable for the high quality of their textile impressions.

Three more fragments of ceramics with textile imprints were found by the Ukrainian-German expedition in 2018. They all belong to one vessel (Find ID 4903), which was found in Building 7 (Rud *et al.* 2019a), a two-story structure with an area of 12.5 x 4.3 m. The collapsed segments of the vessel were found in a compact area on the first floor of the building near its southern corner in a 98 x 81 cm area (Fig. 2: 1, 2). This first floor seems to have had an economic purpose. It can be assumed that the entrance to the building was located in the southern wall of the building at the second floor level. It is possible that a first floor entrance to the building was also located in the same area, but no confirmation of this assumption has been found. With the highest probability, the use of Building 7 took place over a period of 35 years between 3910 and 3875 cal. BCE (Rud *et al.* 2019a, 51-53).

2.2. Krynychky-Ferma settlement

The settlement of Krynychky-Ferma occupies the flat part of a plateau above the valley of the stream that forms the left tributary of the Markivka River (Dnister River system). The magnetic map of the site produced in 2017 is difficult to interpret due to the arbitrary locations of the small anomalies that were identified. Therefore, the core of the settlement plan is interpreted to be the small number of buildings that together with sunken features form a central circular row with a few buildings situated outside it. Some kind of unoccupied circular corridor around the row is also documented. The area to the south of the central row is mostly occupied by small anomalies that could be pits or other small household features (Rud *et al.* 2024, forthcoming). In any case, the settlement structure of the Krynychky-Ferma site is not as regular as the structure of settlements in the preceding Trypillia period, starting from BI-BII till the CI (Hofmann *et al.* 2024, in print). Considering the topographical conditions of the settlement's location, its total area presumably was no larger than 14 ha.

In 2017, during the Ukrainian-German expedition at the Krynychky-Ferma settlement, six fragments bearing traces of textile imprints from various vessels were uncovered. Among these, four fragments (identified as find IDs 2079, 2157, 2216 and 2217) originated from test pit 2, which measured 1 x 2 m. The primary objective of this excavation was to investigate a rectangular anomaly located within the circular row of the settlement. Subsequently, it was determined that this anomaly was a sunken feature, with a depth of up to 0.7 meters during the Eneolithic period. The bottom of the pit was compactly filled with a significant quantity of artefacts, including fragments of animal bones and ceramic vessels, flint and antler tools, and tiny ceramic figurines. According to the radiocarbon dating, it is highly likely that the filling of the pit occurred between 3640 and 3530 cal. BCE (Rud *et al.* 2024, in print). Additionally, two more fragments bearing textile impressions on ceramic sherds (identified as find IDs 3002/1 and 3002/2) were discovered during a surface survey of the settlement area.

2.3. Sample examination methods

This study focuses on eleven pottery samples with textile impressions. In this article the fragments are presented using an abbreviation of the settlement name, specifically «BK» for Bilyi Kamin and «KF» for Krynychky-Ferma, followed by the respective field numbers of the finds. Therefore, samples originating from the first settlement are identified as BK4903, BK2, BK3, BK4 and BK36, while those from the second are denoted as KF2079, KF2157, KF2216, KF2217, KF3002/1 and KF3002/2.

Compiling the collection of pottery fragments with textile impressions used as a source for this work took place as a result of searching for and identifying samples at the stage of field investigations and additionally under laboratory conditions when working on the ceramic collections. In certain instances, ceramic vessel fragments were subjected to cleaning procedures using a citric acid solution to eliminate contaminants. However, in cases where the residue was tightly adhered and removing it might have caused further damage to the fragile surfaces of the sherds, some portions of the deposit were deliberately left intact.

For the purpose of this investigation, the processing of the collection was completed in several stages. These were planned based on repeatedly tested methodical steps used for processing such ceramic products with imprinted textiles (Skrzyniecka 2020; Skrzyniecka *et al.* 2022) and on the basis of personal experience.

During the initial stage, the ceramic vessel fragments were macroscopically examined both visually as well as with the aid of a magnifying glass. This examination aimed to identify and describe the traces associated with both the production and the use of the vessel and the textile. Through visual inspection, we were able to assess the state of preservation of the textile imprint and provide a general characterization of the imprinted textile fragment. Additionally, whenever feasible, we conducted an initial assessment of the yarns and fibres impressions. It is important to note that this aspect was applicable solely to finds featuring well-preserved sherd surfaces.

During the second stage, a microscopic analysis was conducted, primarily focusing on the detailed examination of imprinted fibres and yarns (see Table 1). This examination encompassed the determination of spinning and twisting directions (Z-twisted – clockwise direction, S-twisted – counterclockwise direction), measurement of twist angle (given in degrees °), which indicates the intensity of the yarn/thread twist, and width measurements (mm) of the imprints (Grömer and Kern 2010, 3136-3145; Gleba 2017, 1206, 1207; Skrzyniecka *et al.* 2022, 230-231). The possible type of raw material is determined based on the proven formula where plant – with sharp surfaces of fibres, and animal – with soft fibre surfaces (Grömer and Kern 2010: 3140-3144; Skrzyniecka 2020). To determine the yarn/thread size, the metric indicators of 10-15 threads from both directions of the weave were taken into account for each imprint, as is usually done when examining actual fabric (Gleba and Harris 2019). It is important to emphasize that the impressions on clay preserve the negative, therefore twisting direction of yarns observed on the imprint appears in the opposite direction to their actual twisting or spinning (Kordysh 1951, 100; Skrzyniecka 2020). This aspect was considered when describing the structure of the threads. For example, we report Z-plied if the original fabric was spun in the clockwise direction, although the imprint makes it appear as though it was spun to the counterclockwise direction. The investigation was carried out using the Keyence VHX-7000 digital microscope at the ArchaeoMicroLab of the Faculty of Archaeology at Adam Mickiewicz University in Poznań. The microscopic examination and photography were taken under 20x magnification.

The third stage involved creating positive casts of the impressions of textiles on the ceramic sherds. These casts were employed for visual examination, enabling the evaluation and testing of assumptions regarding the production and function of the textile, which had been formulated during the first two methodological stages.

Throughout all the aforementioned stages, high-resolution photo documentation of the artefacts was carried out using both a camera and a digital microscope. In the case of documenting textile imprints, the most optimal results were achieved when employing side lighting and altering contrast settings.

The images and preliminary visual examination description of samples BK2 and BK3 had been previously published (Kosakovsky and Rud 2012, fig. 1; Rud 2018, 153, 161, fig. 79). As part of the preparations for this article, additional cleaning of the surface of the mentioned samples was conducted, accompanied by a specialized microscopic analysis of the finds.

Several definitions to characterize the techniques of the investigated fabrics are used in our article. The first includes textiles made in a simple tabby or plain weave that is characterized by passing alternatively the weft thread over and under every single warp thread (Mazăre 2011b, 33). There is a variation of this technique called balanced tabby weave, in which there are the same number of threads per square centimetre in the warp and

Table 1. Technical data of the textile impressions on ceramic from the Bilyi Kamin and Krynychky-Ferma sites

Sample	Textile imprint dimensions	Vessel bottom diameter/ thickness (mm)	Weave	Thread count in threads per cm, warp/weft	Warp				Weft			
					Thread structure	Thread diameter/ average (mm)	Thread elements thickness (mm)	Raw material/ thickness (mm)	Thread structure	Thread diameter/ average (mm)	Thread elements thickness (mm)	Raw material/ thickness (mm)
BK4903	175x175	175/10	weft-faced tabby	5/8-9	S2z: 34-42°	0.90-1.10/1.00			Z	1.18-1.67/1.42		plant/ 0.036-0.064
BK2	198x191	198/14-18	weft-faced rep tabby	5-6/12-13	S2z: 21-32°	1.35-1.62/1.45	0.53-0.64	plant/ 0.031-0.055	S: <20°	1.06-1.42/1.32		
BK3	188x162	194/9-10	weft-faced rep tabby	6/13-14	S2z: 31-45°	1.13-1.54/1.31	0.62-0.85	plant 0.042-0.094	S2z: 23-37°	1.00-1.44/1.18	0.54-1.01	plant/ 0.036-0.058
BK4	50x36	230/12-15	twining ?	3/8-9						1.76-1.90/1.82		
BK36	88x47	138/12	weft-faced rep tabby	5-6/11-13					S: 20-21°	1.37-1.65/1.45		plant/ 0.029-0.064
KF2079	30x10	125/4-6	tabby	4-5/4-5		0.71-1.15/0.9				0.73-1.13/0.97		
KF2157	20x16	-/9	tabby	7-8/7-8		0.73-0.84/0.79				0.80-0.93/0.87		
KF2216	46x17	146/5-6	tabby	6/8-9	S: 5-23°	0.65-1.11/0.77		plant	S: 5-23°	0.76-0.98/0.88		plant
KF2217	87x44	125/9-12	tabby	6/7-8	S: 23-26°	0.99-1.26/1.14			S: 9-17°	0.77-1.20/1.06		
KF3002/1	55x40	128/10-13	tabby	6/7-8	S: 5-21°	0.79-1.34/1.12		plant/ 0.026-0.064	S: 5-21°	0.74-1.44/1.05		plant/ 0.048-0.072
KF3002/2	75x62	-/7-11	tabby	4-5/9								

weft. And the second variation is a weft-faced tabby – when the weft covers the warp threads and there are more weft threads than warp threads (Mårtensson 2009, 376). The scheme of this technique is well illustrated by the fig. 2 in the following publication (Gleba 2020). The next variation includes textiles made in a weft-faced rep tabby, that also called as rep, gobelin (tapestry) or kilim weave in the preliminary publications of the Trypillia textiles (*e.g.*, Kordysh 1951; Novytska 1948; 1960; Kosakivskyi 1998; Uhl 2016). It is a simple weave structure in which the densely arranged weft threads entirely cover the warp (Uhl 2016, 40-41). It worth emphasizing that in case of textile impressions, usually only a fragment of textile product without selvedges or starting borders is visible, which makes it difficult to distinguish and trace the arrangement of warp and weft threads (Skrzyniecka 2020, 248). But the documented turn of threads on one of the textile samples from the Stina 1/4 settlement (Novytska 1960, 34, 35, fig. 2) confirms the existence of weft-faced textiles in the Trypillia culture territory east of the Dnister River. Although we do not reject the existence of warp-faced textiles. The existence of the twining technique, using two active twisted threads, in the specified territories (Mazăre 2011b, 31-33; Skrzyniecka 2023, 12) has not yet been sufficiently described. According to W. Skrzyniecka (2023), it is possible that sometimes this type of textile is described in literature by mistake as kilim or rep techniques.

3. CERAMIC WITH TEXTILE IMPRINTS FROM THE BILYI KAMIN SITE

Sample BK4903

The textile impression (Fig. 2: 3, 4) has been preserved on the base of a pear-shaped vessel. The upper part of the vessel is decorated with a black painted ornament. The diameter of the base is 175 mm and it is approximately 10 mm thick. The walls of the vessel were fired at a sufficiently high temperature, but the bottom was fired at a lower temperature. As a result, the state of preservation of the bottom is unsatisfactory, as it is covered with numerous cracks and the inner and outer surfaces of the bottom are often peeled off. Moreover, the textile imprints are also damaged. No traces of the use of the vessel were found. Instead, we have traces of non-purposeful smoothing of the edge of the basal surface at the stage when the unfired clay was worked. The imprint of the textile on the largest fragment is better preserved than on the two other fragments. All further observations are made on the basis of the study of this particular fragment.

A torn piece of fabric was utilized, which is notably visible in the central part of the fragment. Deep impressions of at least 12 nearly parallel warp threads, measuring 32-45 mm in length, and not interconnected by other threads, have been preserved. However, in the remaining parts of the imprints, numerous yarns from both the warp and weft in the characteristic over-and-under thread interlacing is observed. These imprints indicate a disorderly arrangement of threads in the central part of the vessel base. Therefore, we suggest that this textile was created using a weft-faced tabby weave pattern, characterized by a tightly spaced arrangement of weft threads, with a density of 8-9 threads per 1 cm in the weft yarn structure, and 5 threads per 1 cm in the warp.

In the upper part of the fragment (Fig. 2: 4), three weft threads placed adjacent to each other are discernible, possibly indicating the presence of a pattern on the fabric. The length of the preserved part of the pattern segment is approximately 57 mm, which encompasses the entire width of the preserved impression. At a distance of 23 weft threads, two weft threads positioned side by side can be observed. These threads are traced over the entire expanse of the imprint, except for the central torn section of the fabric. Consequently, the total length within the imprint could exceed 150 mm. A similar pattern was noted five threads below, but in this instance, three threads are observed together in the area to the left of the central torn portion of the fabric, while only two threads are present to the right. The absence of the third thread may be due to loss during use or its initial absence. Again, the total length within the imprint exceeds 150 mm.

In the weaving process, threads within a wide thickness ranging from 0.90 to 1.67 mm, were utilized. It is worth noting that the warp threads, in comparison, are noticeably thinner (see Table 1). A majority of the warp threads are twisted with two strands of fibres with an angle measurement falling within the range of 34-42° and an S-plied direction. In contrast, the weft threads demonstrate a Z-plied structure. Most likely the plant-derived fibres were used in this piece of textile range in thickness from 0.036 to 0.064 mm.

Sample BK2

The textile impression (Fig. 3) has been preserved on the basal part, having a diameter of approximately 198 mm and a thickness range of 14-18 mm. It was a rather large table vessel of a closed form. The vessel was fired at a high temperature and the surface of the sherd is solid. Notably, some parts of the base were broken from the walls of the vessel along the technological seam. This makes it possible to partially reconstruct the process by which the lower part of the vessel was formed. Initially, the vessel's bottom was shaped as a disk, with the walls subsequently attached. Both the interior and exterior juncture of the two vessel parts were covered with an additional layer of clay. The surface of the basal part contains numerous linear traces associated with its smoothing, as well as numerous pieces of small lumps of clay that cover the textile impressions. No traces of the use of the vessel were found. Instead, traces of non-purposeful smoothing of the surface of the basal edge at the stage when the unfired vessel was being worked are visible. Such areas have preserved the characteristic gloss of the surface.

Shallow impressions of textile are preserved across nearly the entire expanse of the vessel's bottom. They are clearly visible on the basal edges and are less visible on its central part. Most likely, these imprints provide evidence of a worn textile being used as a support, as indicated by the imprints of several seemingly torn threads, some up to 13 mm in length,

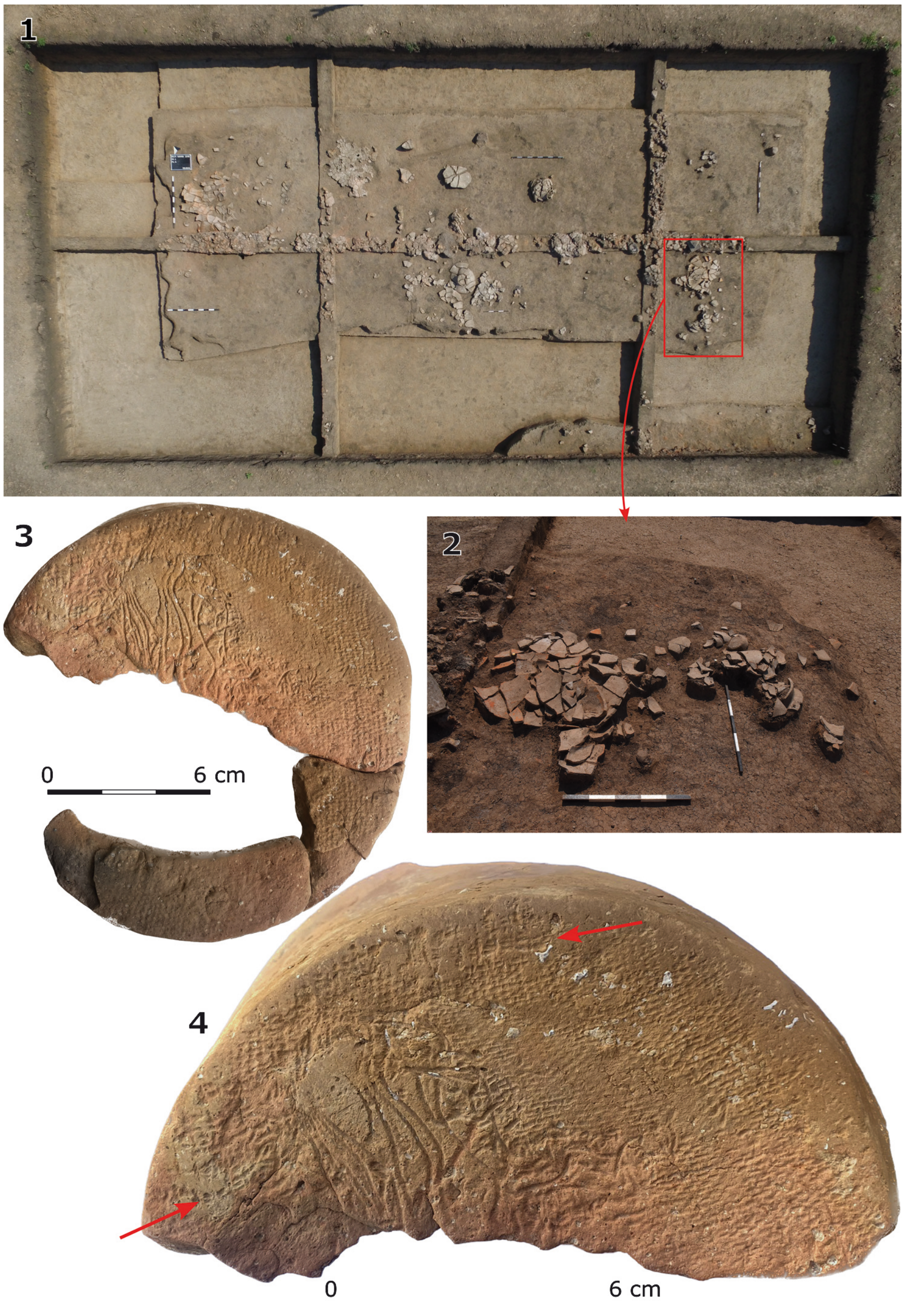

Fig. 2. Bilyi Kamin. (1) Aerial picture of Trench 4 that displays features on the ground floor of House 7; (2) the picture of the collapsed vessel BK4903 on the ground floor of House 7; (3, 4) sample BK4903 with weft-faced tabby weave textile impression with patterned segments. Prepared by V. Rud

Fig. 3. Bilyi Kamin. (1) Vessel base of sample BK2 with weft-faced rep tabby weave textile impression and (2) details of fabric structure, microscopic photography under 20x magnification. Prepared by O. Zaitseva and W. Skrzyniecka

positioned near the centre of the vessel's bottom. Furthermore, there are additional indications of wear, such as three segments measuring 25-40 mm in length, which suggest the loss of several weft threads as well as an irregular density of interlacing. The original textile displayed a high density, featuring a weft-faced rep tabby weave with 5-6 warp threads and 12-13 weft threads per 1 cm. However, due to a reduction in density, certain areas now reveal the warp threads (Fig. 3: 2). This erroneously makes it seem as though the textile was made in a weft-faced tabby weave.

Within an area measuring 8 x 14 mm, located adjacent to the central part of the bottom, an additional textile impression was observed. The orientation of the threads in this imprint is perpendicular to the direction of the textile threads encompassing the entire impression area. This, too, constitutes an impression of a weft-faced rep tabby weave, characterized by a dense arrangement of weft threads that fully covered the warp threads. We have identified a thread count of 5 threads per centimetre in the warp of the fabric and 12 threads per 1 cm in the weft.

Considering the identical thread density in both impressions, it is reasonable to conclude that the same piece of textile was used. In other words, it appears that, during certain vessel production manipulations, it was placed on a piece of the same textile twice.

The potter's work surface on which the textile was laid also contained a number of small objects, possibly lumps of clay left over from the correction of vessel surfaces. Accordingly, the imprint is characterized by deep and well-defined thread impressions (Fig. 3: 2). In specific areas, it is observed that the warp threads comprise two strands between 0.53 and 0.64 mm thick that were twisted (S2z) at an angle of 21-32°. Most likely plant-derived fibres employed in this context display a thickness spectrum spanning from 0.031 to 0.055 mm. The remaining threads are slightly S-plied with an angle of up to 20°. The warp threads measure 1.35-1.62 mm in thickness, while the weft threads range from 1.06 to 1.42 mm.

We assume that the formation of the vessel's bottom did not occur directly on the textile support, as there are no deeply embedded textile impressions across the entire area of the base. The vessel was shaped on the support, albeit with minimal pressure exerted on both the bottom and the support. Subsequently, the vessel was removed from its original support, presumably for the purpose of applying a light slip to its surface, as evidenced by the presence of slip within the textile impressions. In the process of this movement, a second impression was formed, which was also covered with slip. After slipping, the vessel was placed on a surface that contained significant lumps of clay. Such lumps are usually left on the work surface after vessel surfaces were corrected by cutting off excess clay. These pieces of clay overlap the textile impressions and slipped areas in many places. At the final stage of work on the still unfired vessel, numerous traces of mechanical damage to the basal surface occurred, which seem to be related to correcting and possibly smoothing the surface of the central part of the base. In such areas, clay may have been removed with the help of some kind of tool, and along with this, the imprints of the textile were deformed or destroyed. During these manipulations of the vessel, especially at the final stages, a characteristic flattening of the basal edges occurred.

Sample BK3

The textile impression (Fig. 4) has been preserved on the base of a large tableware vessel of closed shape. The diameter of the base is 194 mm and it is 9-10 mm thick. The vessel was fired at a high temperature and so the surface of the sherd is solid. The peculiarities of the production technology of the lower part of the vessel are evident in several areas. We have traces of the seam where the walls were joined to the disk-shaped workpiece of the base. In one case, the walls were joined from the top of the edge of the disk, and in the other case they were joined from the end. Traces of smoothing clay onto the edge of the basal surface and traces of cutting the corner between the edge of the base and the walls were noted. Additionally, certain sections of the textile impression are covered by small, unprocessed clay lumps that were in a raw state when they became integrated into the vessel's bottom. This indicates that a textile support was not used in the final stages of vessel production in this case.

The textile imprint on the bottom part of the vessel is quite evident, as the fabric is evenly impressed across the entire preserved area of the base. This probably indicates the formation of the basal disk directly on the support. The support was placed on a flat surface with individual small objects on it, possibly pieces of clay. The used textile support was a weft-faced rep tabby weave textile with a relatively high weft thread density, measuring 13-14 threads per 1 cm, and a warp density of 6 threads per 1 cm. However, in certain areas, the density decreases, revealing the warp threads. In these areas, the weft density is 9-10 threads per 1 cm, and the warp is 5 threads per 1 cm. The weft threads have been lost in several areas (Fig. 4: 2, 3), resulting in reduced density and the formation of open spaces ranging from 5 mm to 170 mm in length. The disordered arrangement of thread imprints in the central part of the fragment also indicates damage to the warp threads.

The warp threads (Fig. 4: 2, 3) exhibit a thickness ranging from 1.13 mm to 1.54 mm. The majority of these warp threads are twisted at an angle of 31-45°, plied of two strands (S2z), with each strand measuring 0.62 mm to 0.85 mm in thickness. The plant-derived threads have fibres ranging from 0.042 mm to 0.094 mm in thickness.

Weft threads, on the other hand, have a thickness range of 1.00 mm to 1.44 mm. Similar to the warp threads, the weft threads are predominantly twisted from two strands (S2z), with each strand measuring 0.54 mm to 1.01 mm and twisted at an angle of 23-37°. The plant-derived fibres have a thickness ranging from 0.036 mm to 0.058 mm.

Sample BK4

The textile impression (Fig. 5: 3) has been preserved on the base of a closed-shaped tableware vessel. The diameter of the base is approximately 230 mm. The thickness of the base is 12-15 mm. The firing of the base of the vessel seems to have been conducted without access to oxygen, as evidenced by a black-grey stain on its lower surface.

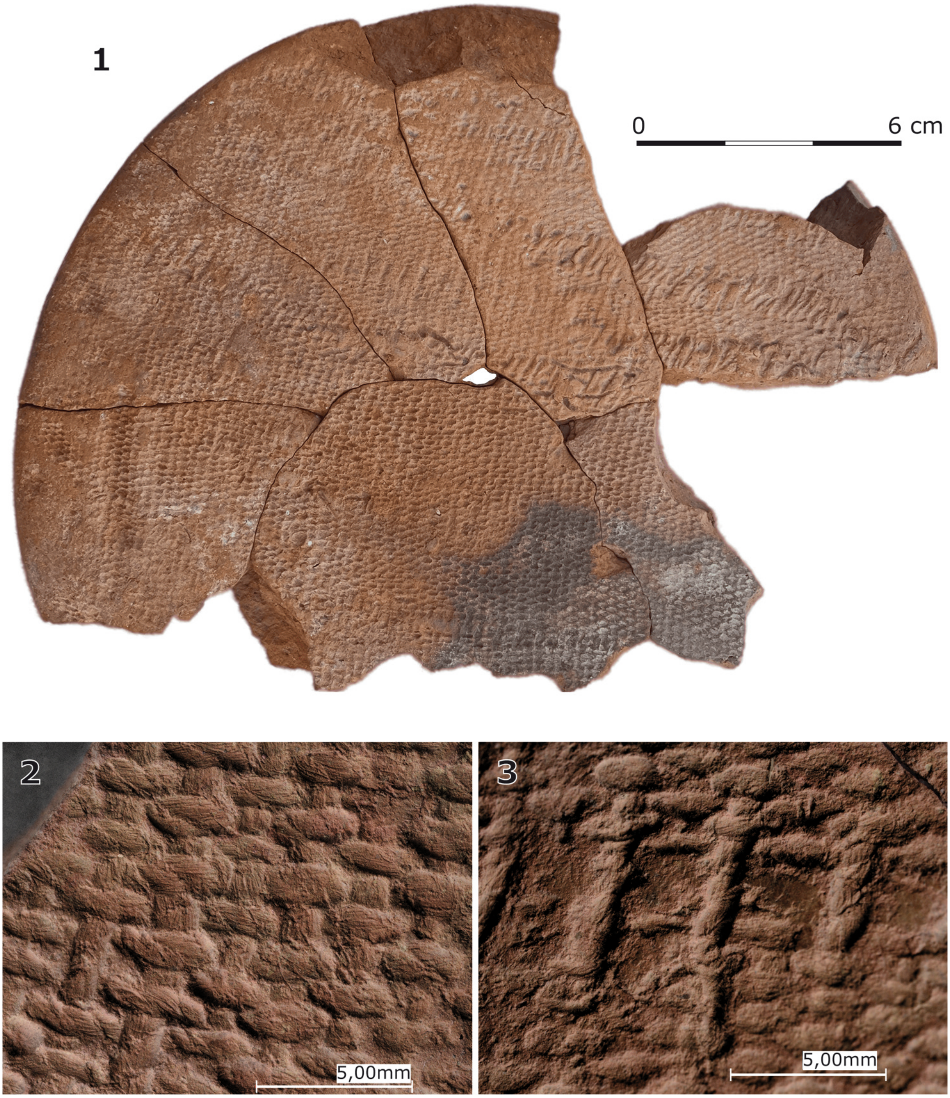

Fig. 4. Bilyi Kamin. (1) Vessel base of sample BK3 with weft-faced rep tabby weave textile impression and (2, 3) details of fabric structure, microscopic photography under 20x magnification. Prepared by O. Zaitseva and W. Skrzyniecka

The textile imprint closer to the centre part of the bottom is better preserved. The area closer to the edge of the bottom exhibits slightly deformed and smoothed imprints, probably a result of manipulations with the unfired vessel. This might have occurred immediately after the bottom disc was formed, and the shaping of the vessel's walls had already

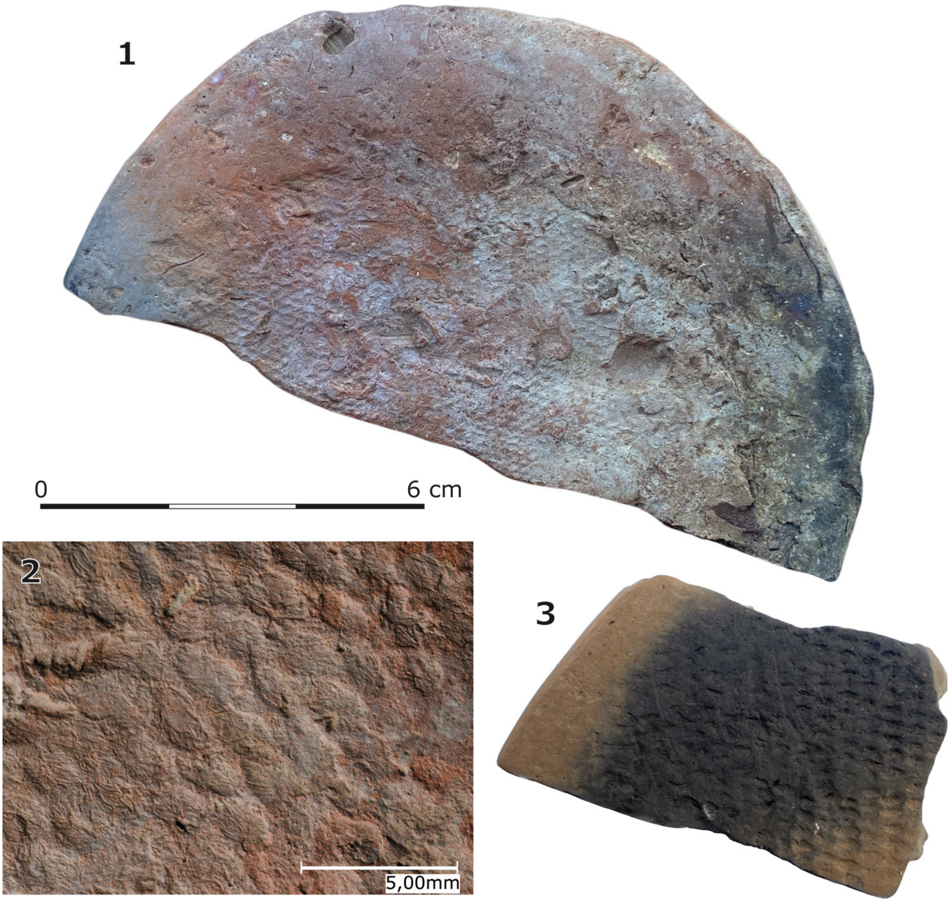

Fig. 5. Bilyi Kamin. (1) Vessel base of sample BK36 with weft-faced rep tabby weave textile impression and (2) details of fabric structure, microscopic photography under20x magnification; (3) vessel base of sample BK4 with twining (?) impression. Prepared by V. Rud and O. Zaitseva

taken place without the use of a textile support. There are no imprints directly on the edge of the bottom, and numerous traces of mechanical damage are visible across the entire imprint area. On the edge of the base, there is also a slight smoothing of the surface, which can be seen in the gloss of the surface. On the other hand, this gloss also indicates the absence of traces of characteristic surface polishing, which is a consequence of the long use of the vessel.

As a support, a high-density probably twined textile was employed. In this case, only the imprints of the weft threads are discernible, as they are closely packed together. The weft threads are at a slight angle to the direction of warp threads, which, in our opinion, indicates the use of the twining technique. Textile fragments made in such technique are known, for example, from the materials of the Bronze Age of modern Ukraine (Gleba and Krupa 2012; fig. 20.1). The threads of the warp are not visible. Simultaneously, the density of the warp threads is approximately 3 per 1 cm, while that of the weft threads is between 8 and 9 per 1 cm. The weft threads have a thickness within the range of 1.76 and 1.90 mm. Impressions of the fibres are not preserved.

Sample BK36

The textile impression (Fig. 5: 1, 2) has been preserved on the bottom part of a closed-shape tableware vessel with a diameter of 138 mm. The thickness of the base is 12 mm. Traces of how the walls were attached to the basal disk were identified. Additional smoothing of the edges of the base after the formation of the walls was not conducted. As a result, the corner between the base and the walls contains deformations from pressure placed on the basal disk when the walls were attached. The surface of the base, primarily its central part, exhibits a significant amount of mechanical damage, which, among other things, spoilt the textile imprint. The surface of the base is partially covered with slip.

The textile imprint is well-preserved in the central part of the base. In some areas on the edges of the base, faint traces of an imprint were also noted. A dense textile of weft-faced rep tabby weave was used as a support. It consists of 5-6 warp threads and 11-13 weft threads per 1 cm. The thickness of the weft threads ranges from 1.37 to 1.65 mm. They were spun at an angle of 20-21° in the S-direction, using plant-derived fibres with a thickness of 0.029-0.064 mm (Fig. 5: 2).

We could assume that the basal disk was formed on a piece of textile, but the walls were attached after the base was removed from the support, since the textile imprints on the edges of the basal surface were destroyed before the vessel was fired. Numerous traces of mechanical damage, including damage to the textile, additionally confirm that the support was not used in the final stages of the vessel's production.

4. CERAMICS WITH TEXTILE IMPRINTS FROM THE KRYNYCHKY-FERMA SITE

Sample KF2079

The textile impression (Fig. 6: 1) has been preserved on a basal fragment from a tableware plate. The diameter of the base is about 125 mm and the thickness is 4-6 mm. There is no technological seam between the base and the walls.

At the edge of the base, there are hardly noticeable imprints of some threads. It seems that the textile imprints on these areas were worn away during the use of the vessel. The clearest part of the imprint has been preserved closer to the middle of the base covering an area of approximately 30 x 10 mm in size. In this case, a textile made in a balanced tabby weave was used as a support during the production of the vessel. We counted 4-5 threads per 1 cm in both the warp and weft. Therefore, we are dealing with an imprint from a less dense textile, probably resulting from active use and possibly damage to some areas of this product. Threads with a thickness in the range of 0.71-1.15 mm were used for weaving. No microscopic characteristics related to the structure of the threads were observed.

Sample KF2157

The textile impression (Fig. 6: 2) has been preserved on a fragment of the basal edge of a tableware vessel, possibly open-shaped, as the inner surface was carefully processed. The thickness of the base is 9 mm. The textile imprint is preserved closer to the central part of the base. There are no traces of imprints on the edge of the base, as its surface was polished during the use of the vessel. Textile traces are hardly notable on most of the specified area, as they have also been practically erased. The textile impression was best preserved in a 9 x 5 mm depression.

In this case, a high dense textile made in a balanced tabby weave was used as a support during the production of the vessel. We counted approximately 7-8 threads per 1 cm in the warp and weft. Threads with a thickness in the range of 0.73-0.93 mm were used for weaving. Microscopic characteristics related to the structure of the threads were not recorded.

Sample KF2216

The textile impression (Fig. 6: 4, 5) has been preserved on a fragment of the base of a closed-shaped tableware vessel. The diameter of the base is 146 mm and its thickness is 5-6 mm. There is a technological seam between the base and the wall of the vessel.

The textile imprints are best preserved closer to the central part of the base. There are no imprints on the basal edges, as its surface was polished during the life-use of the vessel. The textile was made in a simple tabby weave. The density of the warp is 6 threads and that of the weft is 8-9 threads per 1 cm. Threads with a thickness in the range of 0.65-1.11 mm were used for weaving. The S-ply of the fibres is characteristic of both the warp and the weft threads. The twist angle of most threads is up to 10°, while the fibres of individual threads were spun at an angle between 15 and 23°. The shape and microstructure of the fibres suggest the use of a plant-derived raw material (Fig. 6: 5).

Sample KF2217

The textile impression (Fig. 7) has been preserved on a basal fragment of a closed-shaped vessel with a diameter of 125 mm and thickness of 9-12 mm. A crack was found on the outer side of the vessel, indicating where the walls and the base were joined.

There are no indications of textile imprints along the edge of the bottom part, as the surface has been notably polished during the vessel's functional use. In the section of the bottom closest to its centre, traces of the textile imprint appear somewhat distorted, potentially preserving even the impressions of the craftsman's papillary lines. Consequently, it is apparent that the use of a textile support was omitted during the final stages of vessel

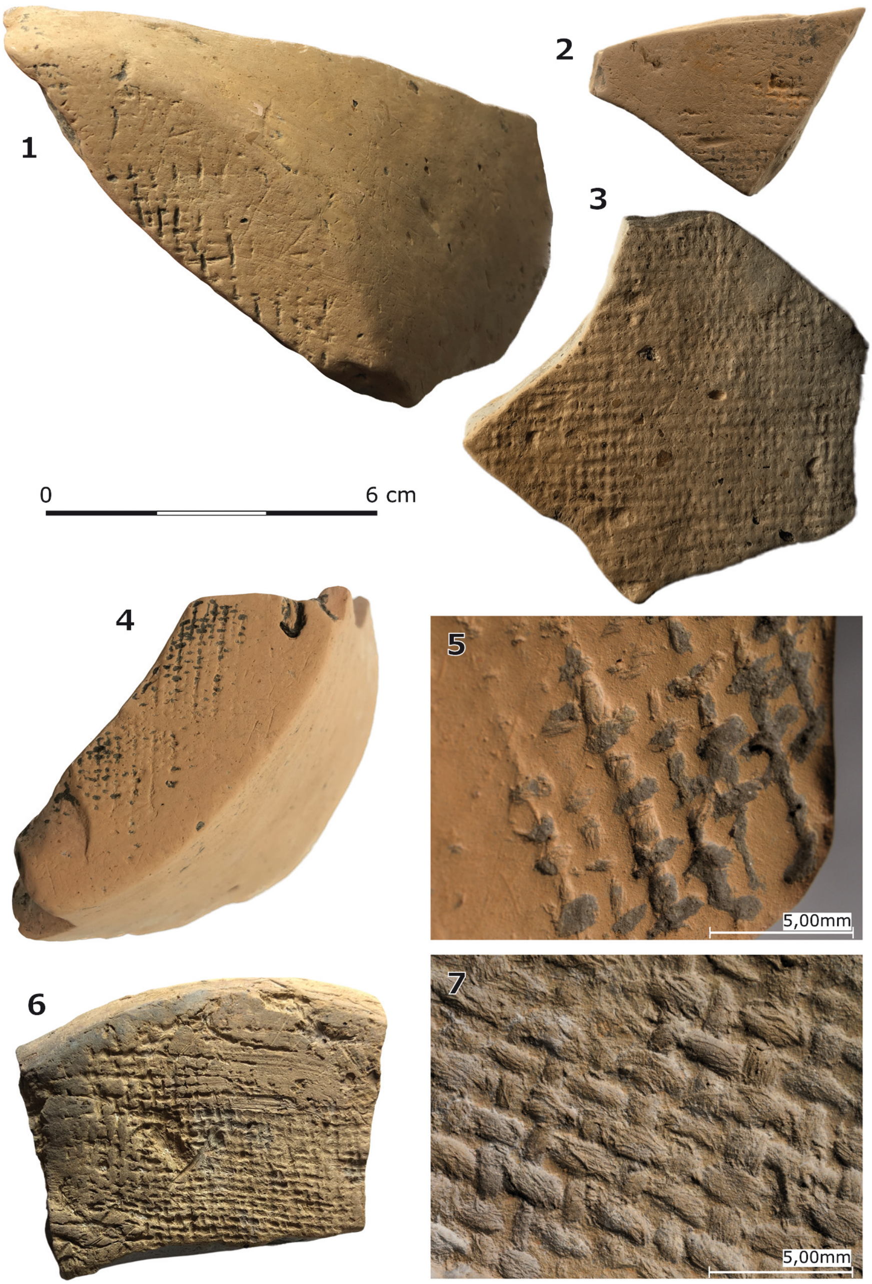

Fig. 6. Krynychky-Ferma. Vessel bases of samples (1) KF2079, (2) KF2157, (3) KF3002/2, (4) KF2216, (6) KF3002/1 with tabby weaves textile impressions and details of fabric structure (microscopic photography under 20x magnification) of samples (5) KF2216 and (7) KF3002/1.
Prepared by O. Zaitseva, W. Skrzyniecka and V. Rud

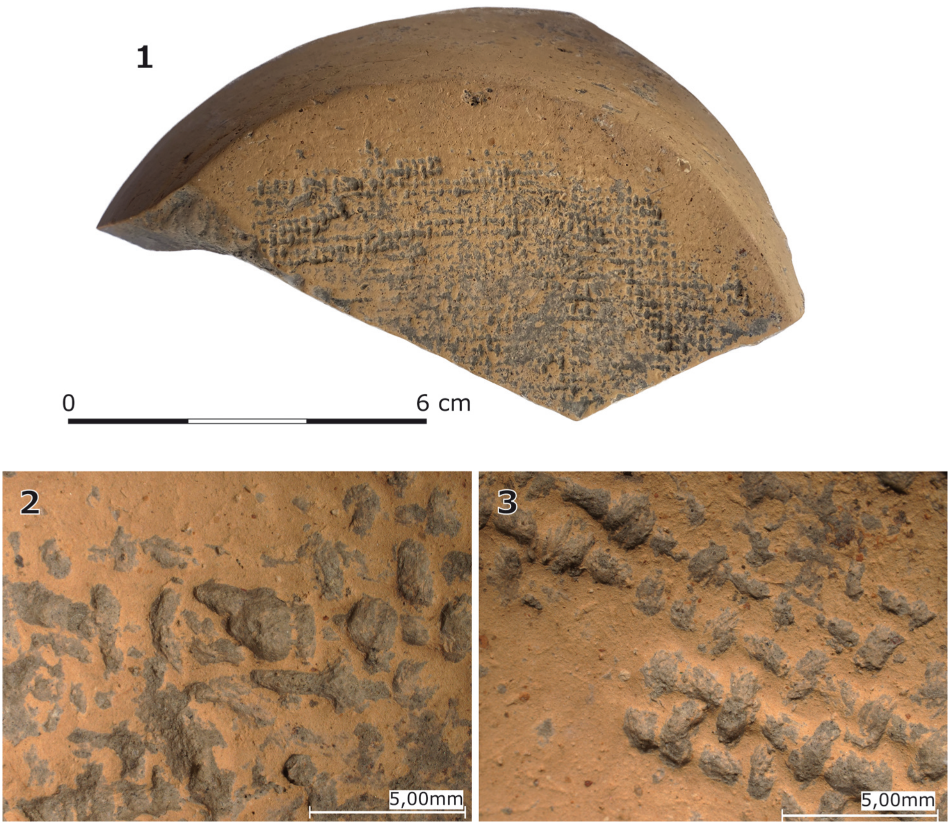

Fig. 7. Krynychky-Ferma. (1) Vessel base of sample KF2217 with simple tabby weave textile impression and (2, 3) details of fabric structure, microscopic photography under 20x magnification. Prepared by O. Zaitseva, W. Skrzyniecka and V. Rud

production. In general, the bottom's surface exhibits irregularities, featuring multiple recessed areas with depths of up to 2.0 mm, where the textile imprints are better visible. The rationale behind this uneven bottom surface can be attributed to various factors. Firstly, inherent surface irregularities probably contributed to this phenomenon, as previously elucidated while characterizing samples BK2 and BK3. Secondly, it seems that the textile may have been unevenly spread across the working surface or became creased during the formation of the bottom disc. Consequently, imprints of these folds were transferred onto the bottom, manifesting as sunken areas with linear characteristics. These depressed areas are interpreted as the placement of an elevating element under the textile pad, which could have facilitated lifting and transporting the formed vessel (Skrzyniecka 2020, 248). Still, this idea is not supported by the sample from our collection, as the textile support was not employed during the concluding stages of vessel production.

A fabric of a simple tabby weave was used as a support during the production of the vessel. The density of the warp is 6 threads, and that of the weft is 7-8 threads per 1 cm. An area was identified where two weft threads were lost. In another case, there is a visible knot (Fig. 7: 2) on the warp thread, which indicates that it was tied (repaired) during the weaving process. A similar feature was also documented on material from the Stina 1/4 settlement (Novytska 1948, 46, 47, figs 5 and 6). Threads with a thickness in the range of 0.77-1.20 mm were used for weaving. The S-ply of the fibres is typical for both the warp and the weft threads. The spinning angle of some warp threads is up to 23-26°, and the weft threads were spun at an angle of 9-17° (Fig. 7: 3).

Sample KF3002/1

The textile impression (Fig. 6: 6, 7) has been preserved on a basal fragment from a closed-shaped tableware vessel. The diameter of the bottom is 128 mm and the thickness is 10-13 mm. It was noted that the base was broken from the walls of the vessel along the technological seam, which was covered on the inside with an additional layer of clay 1-4 mm thick.

On the basal edge, the imprints of the fabric threads are slightly deformed and erased as a result of manipulations while the vessel was still unfired. Several parallel fine lines on the edge of the fragment are possibly impressions of the potter's hand's papillary lines. On two sections of the fragment, long primarily weft threads from the torn edge of the textile are visible. Closer to the middle of the vessel base, the textile imprint is better preserved. This shows that we are dealing with a textile made in a simple tabby weave.

The density of the warp is characterized by 6 threads, while the weft features 7-8 threads per 1 cm. The threads employed for weaving exhibit a thickness ranging from 0.74 to 1.44 mm. An irregular S-ply of the fibres is typical for both the warp and the weft threads. The spinning angle of most threads is up to 10°, while the fibres of individual threads were spun at an angle of 15-21°. The fibres are of plant-derived raw material and their thickness is 0.026-0.072 mm (Fig. 6: 7).

So, the potter firmly integrated the disc-shaped base of the bottom with the textile, facilitating the creation of a high-quality impression. Nevertheless, this impression had partial damage during the handling of the still raw vessel. It is worth noting that the exceptional preservation of fibre imprints can be attributed to the elevated temperature levels during firing of the vessel. This heightened temperature regime effectively strengthened the vessel's surface and ensured its preservation. Traces of the use of this vessel, often indicated by characteristic smoothing of the bottom, remain absent in this case. It is plausible that this vessel became unsuitable for use following the breach of proper firing conditions.

Sample KF3002/2

The textile impression (Fig. 6: 3) has been preserved on a fragment of the central part of the base of a closed-shaped tableware vessel. The thickness of the bottom part is 7-11 mm. Unfortunately, the characteristic bottom edge, which aids in determining the diameter, is absent. Furthermore, it's worth noting that the surface of the ceramic sherd is in a fragile condition.

The surface of the base is uneven, with numerous depressed areas up to 1.5 mm in depth. The traces of textiles on the not depressed areas were erased during the use of the vessel. Traces of textile were better preserved in the depressions, although the general preservation of the imprint is defined as satisfactory. The reason for such relief on the bottom surface is irregularities on the working surface itself. This was described above during the characterization of, for example, samples BK2, BK3 and KF2217.

A textile with a simple tabby weave pattern was employed as a support. The warp exhibits a density of 4-5 threads, while the weft consists of 9 threads per 1 cm. In one section of the imprint, a combination of two weft threads was observed, which could be attributed to a technological defect or possibly the result of thread loss due to wear and tear. However, the presence of this specific thread arrangement in other parts of the sample remains uncertain due to the poor preservation of the imprint.

5. DISCUSSION

Based on the analyzed collection of ceramic fragments with textile imprints, we are able to reconstruct the processes related to the production and use of ceramic vessels and textile products within the Bilyi Kamin and Krynychky-Ferma settlements of different chronological periods of Trypillia culture. Textiles were used as supports in the production of vessels with basal diameters exceeding 125 mm. The specified diameter is noticed for the KF samples, and the maximum diameter of vessels from this settlement does not exceed 146 mm. Although the minimum diameter of the sampled BK vessels is close to the metric characteristics of the KF vessels, the maximum diameter reaches 230 mm. These findings suggest that textile supports were primarily utilized for vessels of medium to large sizes. A similar conclusion was drawn by V. Kosakivskyi based on materials from the Yaltushkiv settlement (Trypillia CI), where textile supports were used for vessels with bottom diameters ranging from 130 to 180 mm (Kosakivskyi 1998, 36-38).

The data derived from the analysis of most processed samples (BK2, BK3, BK4, BK36, KF2217 and KF3002/1) suggest that the textile support was not utilized during the final stages of vessel production. In these instances, it appears plausible to assert that the supports were not employed during the drying stage of the vessel but rather during preceding phases. In certain cases (BK4 and BK36), the textile support was exclusively employed in the creation of the bottom disc, preventing it from adhering to the work surface. It indicates the absence of clear rules in the use of supports in the technological chain of ceramic manufacture before drying. So, the use of supports in combination with rotary mechanisms (Markevich 1981; 120-130; Ciobanu and Tencariu 2022) is also possible.

In the process of making the vessel, fixing the walls to the disk-shaped basal blank was accompanied by an increased level of pressure on its edge, especially in thin bases and this deformed them. It was precisely these lowered areas of the base that were often in contact with various surfaces during the use-life of the vessels. This led to the destruction of the textile imprints on the basal edges. The absence of textile imprints on the specified areas is documented on most of the KF samples (with the exception of KF3002/1). This indicates that the inhabitants of the settlement intensively used the vessels. In contrast, there is an absence of evidence indicating the use of vessels among the BK samples.

However, we suggest that the functionality of these large, enclosed vessels was not centred around frequent movement, particularly if they served a storage purpose. For instance, the pear-shaped vessel BK4903 has a volumetric capacity of approximately 44 litres. As previously mentioned, it was discovered near the building's corner. Other collapsed large vessels within Building 7 at the ground floor level of the Bilyi Kamin site are positioned adjacent to the building's corners and walls, while in the central section of the building, the vessels are situated near the grain grinding area (Fig. 2: 1; Rud *et al.* 2019a, fig. 13). So, they mark the initial functional placement of storage vessels in the house.

Preliminary observations regarding the frequency at which supports were used in pottery production are important. In 2018, within a 136 m^2 excavated area at the chronologically earlier Bilyi Kamin settlement (Rud *et al.* 2019a), one textile-imprinted vessel base was found, whereas in a much smaller area of 8 m^2 at the later Krynychky-Ferma site (Rud *et al.* 2024 , forthcoming), six such artefacts have been found. Although detailed statistical data on the frequency of such imprints are still lacking, these immense differences might in our opinion indicate an increase in the popularity of the use of textile underlays in pottery production from the CI stage to the beginning of the CII stage of the Trypillia culture. This preliminary conclusion seems to be supported by the increasing popularity of this process that is documented in the Usatove materials dating to the second half of the 4^{th} millennium BC (chronology according to: Kaiser 2019). According to various sources, it is estimated that between 10% and 90% of the bottom parts of vessels from both burial and settlement sites exhibit imprints of textile supports, which were created using textile of simple tabby weave or mats plaited using various techniques (Boltenko 1926, 11; Zbenovych 1974, 81, 82; Patokova 1979, 32, fig. 11; Patokova and Petrenko 1989; Burdo 2004, 421).

After analyzing the BK and KF sample collections, it was determined that textiles woven in a simple tabby weave, weft-faced tabby and weft-faced rep tabby weave were utilized as supports during the vessel production process. These correspond to the characteristic Trypillia weaving techniques that have been repeatedly documented on materials from other settlements, primarily of the CI stage, such as Yaltushkiv, Bernashivka, Stina 1/4, and Chechelnyk (Novytska 1948; 1960; Kordysh 1951; Kosakivskyi 1998; Kosakivskyi *et al.* 1998). We assume with caution that the BK4 sample fabric was made using a twining technique, the existence of which was previously indicated by W. Skrzyniecka (2023). It is worth noting that the BK samples have impressions of dense textiles made using a weft-faced tabby and mainly weft-faced rep tabby weave, and the KF samples are exclusively of a lower density simple tabby weave. In general, at the Trypillia CI stage, in addition to the specified weaving techniques, non-woven textiles made with netting or needle looping techniques are also available in the artefacts from, for example, the settlements of Yaltushkiv, Bernashivka, and Stina 1/4 (Novytska 1948; 1960; Kordysh 1951; Kosakivskyi 1998; Kosakivskyi *et al.* 1998). To date, descriptions of a small number of artefacts from the Trypillia CII stage (the end of the first half of the 4^{th} millennium BC to the beginning of the 3^{rd} millennium BC; chronology based on the dating of the Krynychky-Ferma settlement and according to: Diachenko, Harper 2016) have been published. These imprints are similar to samples from Krynychka-Ferma that are, for example, known from the Vovchynets, Zhvanets-Lysa Hora, and Sharyn 3 settlements (Passek 1953, 59; Burdo 2004, 515; Kushtan 2016). Based on these data, we assume that a simple tabby weave were the most common during the CII stage of the Trypillia culture.

A distinct pattern is observed across all samples in the collection, where the number of warp threads per 1 cm is consistently fewer than the weft threads. In the case of weft-faced rep tabby samples, the number of weft threads (ranging from 11 to 14) is more than twice that of the warp threads (ranging from 5 to 6). In contrast, for simple and weft-faced tabby weaves, the weft threads are slightly greater in number (ranging from 4 to 9) than the warp threads (ranging from 4 to 8), or there is an equal number of threads in both directions (4-5 or 7-8). It has been repeatedly observed that old, worn textiles were used as supports during the production of vessels (*e.g.*, Novytska 1948; Kordysh 1951). This is confirmed by the results of our investigation, and therefore the initial density of the textiles may have been somewhat higher. For instance, sample K2079 has an atypically low weft density of 4-5 threads per 1 cm.

More than half a century ago, samples featuring imprints of decorated fabrics on Trypillia culture ceramics were documented. It is possible to infer the existence of two distinct methods for producing decorative patterns on fabrics, as indicated by materials recovered from the Stina 1/4 settlement of the CI stage. The first method involves weaving, where three or four weft threads are thrown simultaneously (Novitskaya 1960), while the second method employs an embroidery technique (Makarevich 1960, 31). In both cases, it is presumed that coloured threads were utilized to create patterns (Novitskaya 1960). An important result of our research is the identification in the collection of a sample (BK4903) that most likely confirms the existence of patterned textured fabrics in the Trypillia environment in the CI stage. In this case, the texture is created by three weft threads. The formation of texture with two threads is doubtful, but also possible.

In the BK and KF samples, the thickness of the thread impressions range from 0.65 to 1.90 mm. Moreover, the data differ depending on the settlement. In the case of the earlier BK samples, the threads are thicker and most are over 1.00 mm, with an average thread thickness of 1.37 mm. Even if we consider only the results for woven products, the average thread thickness are high — 1.30 mm. For most samples, along with the use of single-thread elements, the use of plied yarns is also typical. Conversely, on the later KF samples, the threads are somewhat thinner ranging from 0.65 to 1.44 mm thick, with an average thickness of 0.95 mm. Only single-thread elements were used. Perhaps, the difference in the thickness of the threads is a chronological feature.

Currently there exists no large database against which the stated assumption can be verified. The metric characteristics of the threads from textile imprints on ceramics are, however, known to us from several settlements located in the area east of the Dnister River. For example, at the settlement of Stina 1/4 of the Trypillia CI stage, threads with thicknesses close to the range of the BK samples, from 0.7 to 2.0 mm, were used, although the approximate average thickness of the threads is 1.14 mm (Novytska 1948; 1960; Makarevych 1960). That is, this value is intermediate between the data obtained from the samples that come from the Bilyi Kamin and Krynychky-Ferma sites. The thickness of the threads from the settlement of Petreni (Trypillia CI) on the right bank of the Dnister River varies in the range of 0.7-1.9 mm, with an estimated average value of 1.33 mm (Kordysh archive; 1951). Plied yarns were sometimes used at these CI stage settlements (Novytska 1948; 1960; Kordysh 1951; Makarevych 1960). Data on the thickness of the threads from the CII stage of the Trypillia culture are known only from the sites of Romanivka and Kolodyste. For the Romanivka site, the thickness of the threads ranges from only 0.5 to 0.7 mm, and the range for the Kolodyste site is between 0.8 and 1.6 mm (Kordysh 1951). The metric characteristics of the threads imprinted on materials from the settlements of Bilyi Potik and Bilcze Zlote (Sikorski 2016; Skrzyniecka 2020) are not taken into account, since they come from multi-layered sites and it is not possible to determine to which chronological horizon the artefacts belong.

However, it must be emphasized that drying and firing of clay is accompanied by shrinkage of the material, and therefore the actual thicknesses of the threads that were used to produce the textile imprints were larger than those given above.

As for thread structure, the spinning angle of single yarns does not exceed 17-26° for samples from the investigated collection. The maximum spinning angle of double-strand thread, which, as it was mentioned, is typical only for individual BK samples, reaches 32-45°. These data are generally correlated with available information of a similar nature (Sikorski 2016).

We have determined that plant-derived raw material was used to make the investigated threads that were imprinted on BK and KF samples, which correlates with the majority of existing data (*e.g.*, Novytska 1948; 1960; Kordysh 1951; Sikorski 2016; Skrzyniecka 2020). However, researchers assume that some samples exhibit imprints of threads made of animal-derived raw materials, namely yarn made of wool (Kordysh 1951, 104; Makarevich 1960, 29; Kosakivskyi *et al.* 1998, 38). However, BK and KF samples visually demonstrate, in our opinion, a different quality of raw material prepared for spinning. The former show a much higher level, resulting in well-processed plant fibres (for example sample BK36, see Fig. 5: 2).

6. CONCLUSIONS

This research shows that, starting from the CI stage (the beginning of the 4^{th} millennium BC), textiles from the Trypillia culture were integrated into the recycling process, enabling the utilization of worn fabrics as supports during vessel production. The analyzed collection from the Bilyi Kamin and Krynychky-Ferma settlements suggests that these supports were employed at various stages associated with vessel formation, primarily during the creation of the disc-shaped base of the bottom part. Notably, during the drying phase preceding firing, these supports were not utilized. Supports were used for the rotating of the vessel during manufacture or possibly in association with a rotating device.

At the Bilyi Kamin settlement, these supports were primarily employed in the production of large, closed-form vessels that show no signs of extensive use, implying a probable storage function. The most prevalent fabric type at this settlement consisted of dense weft-faced rep tabby weave, crafted using thick threads made from carefully prepared plant-derived fibres. Frequently, threads spun from two yarns were employed, imparting the required thickness and thereby enhancing strength. The presence of patterned fabrics during the CI stage of the Trypillia culture has been verified. Furthermore, at this chronological stage, fabrics woven on a loom in different variations of a tabby weave and produced using non-woven techniques were also frequently encountered.

At the Krynychky-Ferma settlement, textile supports were employed for vessels with smaller volumes but greater functional variability. This is evident in vessels that served both storage and consumption purposes, indicating the increasing popularity of support usage in pottery production. Furthermore, materials from other settlements of the Trypillia CII stage demonstrate the emergence and widespread adoption of specialized mats as supports during this chronological stage. Concurrently, the variety of textile production techniques decreases. During this period, the prevalent type of textile, both at the Krynychky-Ferma settlement and throughout the Trypillia CII stage, consists of less dense fabrics produced on a loom in a simple tabby weave. This technique was, perhaps, the most practical method for fabric production, utilizing thin threads derived from poorly processed plant fibers.

The observed differences in textile production between the settlements of the two successive stages in the development of the Trypillia culture can be correlated with broader trends in the evolution of the economy, social structures, and political organization. These trends, characterized by active development and refinement during the stages of Trypillia BI-BII, BII, and CI (late 5^{th} to early 4^{th} millennia BC), transition into a phase of decline, primarily with the onset of the CII stage of the Trypillia culture or undergo significant transformations (*e.g.*, Hofmann *et al.* 2019; Kirleis *et al.* 2023). There is also a degradation in pottery production during this stage (Ryzhov 2002). However, certain practical aspects of pottery production are experiencing increased popularity, as evidenced by our research.

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