

# SPRAWOZDANIA ARCHEOLOGICZNE

INSTYTUT ARCHEOLOGII I ETNOLOGII POLSKIEJ AKADEMII NAUK



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**SPRAWOZDANIA  
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INSTYTUT ARCHEOLOGII I ETNOLOGII  
POLSKIEJ AKADEMII NAUK

# SPRAWOZDANIA ARCHEOLOGICZNE



KRAKÓW 2020

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Dedicated to Professor Jan Machnik for His 90<sup>th</sup> Birthday



Weronika Skrzyniecka<sup>1</sup>

## TEXTILE IMPRESSIONS ON THE TRYPILLIA CULTURE POTTERY FROM OGRÓD AND VERTEBA CAVE SITES IN BILCZE ŻŁOTE

### ABSTRACT

Skrzyniecka W. 2020. Textile impressions on the Trypillia culture pottery from Ogród and Verteba Cave sites in Bilcze Żłote. *Sprawozdania Archeologiczne* 72/2, 231-258.

Due to the limited number of materials associated with textile production from the Neolithic and Eneolithic, especially in regard to Eastern Europe, its indirect remains present an important and valuable source of information. One of the materials that testifies to textile production is pottery with textile impressions. The aim of this article is to present and discuss the results of microscopic analyses of textile impressions, identified on selected sherds of ceramic vessels from the Trypillia culture sites in Bilcze Żłote, Ukraine. During the research, three basic categories of textile-related products were identified: pottery with intentional cord imprints, impressions of various types of non-woven textiles, as well as woven fabrics of varying thickness and density. This article also highlights the issue of using textiles in the technological process of pottery manufacturing. Microscopic analysis of textile impressions opens up new research possibilities in the recognition and reconstruction of the weaves and twists of particular types of fibres, and provides a solid foundation for comparative studies.

Keywords: textile impressions, Trypillia culture, textile production, weaving

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## INTRODUCTION

Textile goods constitute an integral part of the everyday life of human communities. As historical sources indicate, the production, distribution and usage of textiles had not only practical, but also social and even religious significance in ancient civilizations (Pipes *et al.* 2019, 5; Shishlina *et al.* 2000, 109). Textile production, which encompasses, according to the definition given in this article, various types of activities associated with processing and interconnecting plant- and animal-based fibres, resulting in the creation of woven and non-woven products, has been constantly gaining the interest of researchers in the last years (Gleba M. 2017; Gleba and Mannering 2012, 1-24; Good 2001, 209-226; Grömer 2016, 2-32; Chmielewski 2009, 9-13; Cybulska and Maik 2007, 185-198; Sikorski 2003, 123-141; Rast-Eicher and Dietrich 2015). Due to the perishable nature of organic materials, direct traces of textiles, especially those from older periods, are rarely discovered at archaeological sites. Only in specific conditions, *e.g.* anaerobic, alkaline, wet environments, do organic materials have a chance to preserve. Some of the most well-known examples come from circum-Alpine wetland settlements, where numerous Neolithic and Bronze Age textile finds were preserved within waterlogged contexts (Bazanella 2012, 203-214; Feldtkeller and Körber-Grohne 1998, 131-242; Grömer 2016, 2-32; Médard 2000; Rast-Eicher 2005, 117-132; Rast-Eicher and Dietrich 2015). However, in relation to Eastern Europe, interpretations regarding the standards of textile crafting are mainly based on the examination of indirect remains of the discussed type of production. This encompasses primarily analyses of production tools, *i.e.* spindle whorls and loom weights (Adovasio 1996, 526-534; Andersson 2003, 46-62; Grömer 2016, 32-33; Gleba 2008; Mårtensson *et al.* 2009; Pipes *et al.* 2019). Another, though often overlooked, category of material includes imprints of textiles pressed on clay products and hardened during the firing process. The impressions of simple textile structures made of plant-based materials are considered among the oldest traces of textile production in Europe, as their chronology dates back to the Upper Palaeolithic (Adovasio 1996, 526-534; Drooker 2000, 63; Gleba and Mannering 2012, 1-24; Mazare 2011a, 32; Soffer *et al.* 2000, 812-821). Textile imprints from the Neolithic are documented mainly on ceramics and, to a lesser degree, on clay tools and daub. Their appearance is associated with the use of various kinds of textile goods during the process of pottery production, *e.g.* pads used for forming or transport, materials for surface polishing or elements used to merge parts of the manufactured container. The other category includes intentional textile imprints, such as the so-called 'cord' ornament, as well as various types of activities related to preparation of the vessel's surface (textile ceramics). Despite limitations, resulting *i.a.* from deformations of the original texture during the pressing and firing process or traces of use-wear, such as surface abrasions, technological analyses of textile impressions represent a valuable source of information about textile production (Drooker 2000, 59-68; Makkay 2001; Mazare 2011a, 27-48; Podkańska 2012, 207-213; Richter 2010, 211-2016).

Previous examinations of textile imprints documented on clay products of the Trypillia culture communities indicate that different types of textile products were utilized. Among them are fabrics made in tabby (weft/warp-faced, *e.g.* kilim technique) and rep weave (possibly made on vertical looms as evidenced by the discovery of loom weights deposited in a row), cords and non-woven textiles made by looping or netting. Plant fibres (tree bast, flax and hemp) were used most frequently; however, the use of wool is also considered possible. All mentioned finds with textile impressions are dated to the Late period of the Trypillia culture (CI), *i.e.* the beginning of the 4<sup>th</sup> millennium BC (Burdo 2004, 516; Burdo *et al.* 2010; Chmielewski 2009, Tab. 14; Novitskaya 1960; Kordysh 1951; Kosakivskyi 1998; 2001; Kosakivskyi *et al.* 1998; Prokopowicz 2013, 99-100; Sikorski 2010, 49-56; 2017, 365-289).

The aim of this article is to present and discuss the results of microscopic analyses of textile impressions, identified on selected sherds of ceramic vessels from the Trypillia culture sites in Bilcze Żłote. Moreover, it is intended as an introduction to further research on the still only partially recognized textile crafting of the Trypillia communities. The presented work continues previous research on traces of textile production from Bilcze Żłote assemblages, the results of which (mostly analyses of single sherds with textile negatives) were published in three papers – *Notes on weaving in the Trypillian Culture of the Ukraine* (1951), *North European Textiles until AD 1000* (1992) and in the volume from 2013 titled *Bilcze Żłote: materials of the Tripolye culture from the Werteba and the Ogród sites* (Kordysh 1951, 98-112; Bender Jørgensen 1992, 84, fig. 110; Prokopowicz 2013, 99-100).

## SITE

The Verteba Cave and Ogród sites are located near Bilcze Żłote, which lies on the eastern bank of the Seret river, in the Ternopil province of the Volhynian-Podolian Upland in Ukraine (Fig. 1). The Ogród site, discovered in the river valley zone, is interpreted as the remains of a Trypillia culture settlement. Verteba Cave, considered to be a place dedicated to ritual practices, is located in a gypsum cave and constitutes a part of an expansive Miocene gypsum karst (Kadrow *et al.* 2003; Nikitin *et al.* 2010; Kadrow 2013a, 23-28; Karsten *et al.* 2015, 121-144; Kadrow and Pokutta 2016, 3; Madden *et al.* 2018, 44-53; Ledogar *et al.* 2018). Excavations on both sites have been conducted (with breaks) since the end of the nineteenth century, *i.a.* by Gotfryd Ossowski and Włodzimierz Demetrykiewicz. Materials obtained during the fieldwork are part of a collection in the Archaeological Museum in Kraków. After World War II, archaeological excavation in Bilcze Żłote was resumed in 1996-1997 (and continues to the present), by a team led by Mykhailo Sokhatskiy of the Regional Museum in Borschiv, Ukraine. The collection of artefacts from the sites is considered one of the largest assemblages of Cucuteni-Trypillia complex materials documented so far (Rook and Trela 2001; Sokhatskiy 2001a; Kadrow *et al.* 2003; Nikitin *et al.* 2010;



Fig. 1. Location of Bilcze Żłote. Map by R. Skrzyniecki

Ledogar *et al.* 2018). In addition to a large amount of human skeletal remains in association with faunal bones, it consists of thousands of potsherds, whole vessels, numerous examples of anthropo- and zoomorphic figurines, flint and stone products, and objects made of bone and antler (*i.a.* a flattened plaque in the shape of a bull head), as well as other clay items of various functions, *e.g.* spindle whorls and loom weights (Rook and Trela 2001, 201-202; Nikitin *et al.* 2010, 9-18; Ledogar *et al.* 2018, 1-6).

A thorough chronological analysis of ceramic materials from the Ogród and Vertebe sites has been conducted by T. Tkachuk, who divided them into six chronological horizons (Kadrow *et al.* 2003). The first three categories are temporally related to the settlement activity on the Ogród site, associated with three local cultural groups: the oldest, labelled Zalishchyky (BZ OI), is dated to BI-BII stage of the Trypillia culture, the middle is the Mereshivka group (BZ OII, BII stage), and the latest is identified with the communities of the Shipentsy group (BZ OIII, the beginning of the CI stage). The remaining 3 chronological horizons fall into the period of habitation of Vertebe Cave, during which the succession of at least three local groups took place. It begins with the Shipentsy group (BZ WI, the end of CI stage), continues with the Koshilivtsy group (BZ WII, dated to the beginning of CII stage) and the Kasperivtsy group (BZ WIII), and ends with the younger phase of the CII stage of the Trypillia culture (Sokhatskiy 2001a, 207-227; 2001b, 115-126; Kadrow *et al.*

2003; Kadrow 2013b). The results of radiocarbon dating of the material from Vertebe Cave additionally corroborate this sequence, indicating that this site was inhabited by the Trypillia culture communities from the first centuries of the IV millennium BC to the beginning of the III millennium BC (Kadrow *et al.* 2003, 119-123; Nikitin *et al.* 2010; Ledogar *et al.* 2018, 141-158).

## MATERIALS AND METHODS

From the collection of clay artefacts, which were gathered during excavations in Bilecze Złote prior to WWII and are currently located in the Archaeological Museum in Kraków, a sample of ten pottery sherds with visible textile impressions was selected for the purpose of the presented research. Technological traits of these materials were analysed using the KEYENCE VHX-6000 digital microscope. Samples were also imprinted in self-hardening sculpting clay in order to make a positive mould form of the negative impressions of textiles, which are used to facilitate microscopic measurements and identification of textile type (Drooker 2000, 59). Among the ten fragments in question, one bore traces of black and red painted designs (sample 10), and another two were adorned with a corded ornament and a horizontal plastic band located below a thickened rim, cut off obliquely and slanting down toward the inside (samples 1 and 2). The remainder of fragments had no particular traces of ornamentation, and therefore can be included into the “kitchenware” category. Textile impressions in various states of preservation were documented on the bottom parts of the ceramic vessels. Among them, 3 impressions of fabrics and 4 non-woven textiles were identified. Apart from the above-mentioned ‘cord’ impressions located under the rim, one imprint of fabric inside the vessel wall has been identified (sample 10) (Table 1).

Three basic categories were introduced to classify textile products during the research: intentional ‘cord’ imprints, impressions of various types of non-woven textiles, as well as woven fabrics, varying in thickness and density.

The so-called ‘cord’ impressions were created intentionally to obtain a distinctive, decorative pattern on the vessels. According to the diameter of these textile products, three terms are distinguished in literature: thread – up to 2 mm in diameter, cord – between 2 and 8 mm and rope – more than 8 mm (Grömer and Kern 2010, 3136-3138; Rast-Eicher 1997, 305). Technological studies also indicate that different types of textile techniques could have been in use. Apart from the most common plied cord, these also include pressing of simple needlework and sewing stitches. More complex decorative motifs could be obtained by using stamps or textile templates with the previously applied cord pattern (Kaczmarek 2015; Sikorski 2010, 49-56; 2017, 365-380). For the purpose of this article, a microscopic analysis was conducted of the two fragments of ceramic vessels decorated with a ‘cord’ impression and a plastic band located under the thickened, oblique rim

Table 1. Textile impressed ceramics from Bilcze Złote

Sample no.	Artefact	Sample dimensions (cm)	Comment	Figure
1	Fragment of semispherical bowl	26 x 8 x 12,7	Horizontal rows of 'cord' ornament	2, 3
2	Fragment of a vessel	5,0 x 3,4	Horizontal rows of 'cord' ornament	4, 5
3	Bottom fragment of a vessel with preserved part of a body	27,8 x 15,9 Bottom thickness: 1,6 Bottom diameter: 19,8	Basketry impressions at the bottom of the vessel	6, 7
4	Bottom fragment of a vessel with preserved part of a body	14,7 x 10,5	Basketry impressions at the bottom of the vessel	8
5	Bottom fragment of a vessel with preserved part of a body	8 x 6,3 Bottom thickness: 0,9	Non-woven textile impressions at the bottom of the vessel	9,10
6	Bottom fragment of a vessel with preserved part of a body	14,5 x 6,2	Non-woven textile impressions at the bottom of the vessel	11, 12
7	Bottom fragment of a vessel	13 x 9,1 Bottom thickness: 1,1	Woven textile impression at the bottom of the vessel	13, 14
8	Bottom fragment of a vessel with preserved part of a body	13,8 x 9,0 Bottom thickness: 1,2	Woven textile impressions at the bottom of the vessel and spiral, cordage-like impressions under the fabric negative	15, 16
9	Bottom fragment of a vessel with preserved part of a body	11,7 x 15,3	Woven textile impression at the bottom of the vessel	17, 18
10	Fragment of painted ceramic	10,5 x 5	Woven textile impression and fingerprint inside and on the outer wall of the vessel	19, 20

(samples 1 and 2). This type of decorative pattern is connected with the Bilcze Złote Verte-ba III assemblage.

Imprints of non-woven textiles, *i.e.* different types of non-loom-based textiles, appear as a result of various vessel-making and decorating procedures. The earliest textile techniques were made by linking, looping or knotting strands or yarns by hand or with the use of simple tools such as sticks or needles. These include mesh-like structures, *e.g.* nets (sprang), mats, and products made by needle looping (nålebinding) or twining. The latter has many variants (*e.g.* closed, open, diagonal twining) and represents the most important textile technique in the Central European Neolithic. Twined textiles were created by the twisting of two or more active threads around passive ones, covering them entirely (Doumani and Frchetti 2012, 375; Gleba and Mannering 2012, 1-24; Grömer 2016, 2-32; Seiler-Baldinger 1994). Negatives of basketry are also included in this category of textile impressions. This refers to various types of three-dimensional containers, baskets or bags made of rigid or semi-rigid, mostly plant-derived raw material (Adovasio 1975, 223; 2016, 15; Marian and Bigbaev 2008, 43-49). There are different archaeological interpretations concerning the occurrence of textile imprints on the bases of vessels. Non-woven products

could have been used as a support for shaping (simple rotary tool) or for drying/moistening parts of clay products before firing or transportation (Mazāre 2011b, 33; Kosakivskiy 2004, 93-95; Sikorski 2018, 458-459). From the ceramic assemblage of Bilcze Żłote, four fragments of vessel bottoms with this type of textile imprint were selected for microscopic analysis (samples 3,4,5 and 6).

In contrast to non-woven goods made by hand or with the use of simple tools, weaving textiles requires the application of an additional device – the loom. The basic function of looms is to create a shed by tension and to separate passive yarns (warp) to facilitate the insertion of the active system of yarns (weft). The structure of weaving textiles is characterized by interlacing two systems of yarns in specific ways, which defines the weave type (Chmielewski 2009, 159-223; Grömer 2016, 2-32; Mazāre 2011a, 33-35). Negatives of fabrics left on clay products, most often as a result of production processes, allow for the identification of the weaving technique and the technical parameters of used threads. Four fragments of pottery from the Bilcze Żłote collection with impressions of woven textiles were selected for microscopic analysis (samples 7, 8, 9 and 10).

On the basis of commonly accepted and used research methods of textile impressions, as well as the previously mentioned limitations regarding this particular category of archaeological data, an analytical approach has been developed (Bender Jørgensen 1992, 13; Drooker 2000, 59-68; Gleba 2017, 1205-1207; Gleba and Mannering 2012, 1-24; Grömer and Kern 2010; 3136-3137; Podkańska 2012, 207-213; Sikorski 2010, 49-56; 2017, 365-380). The description of results obtained during the analysis is divided into four main categories. First, the technique of making a textile product (*e.g.* tabby weave, twining) is identified. Preparation of positive casts of post-textile imprints facilitate such interpretation. The second category covers technological parameters. Apart from the basic measurements of textile impressions, the spinning and twisting direction of yarn or cord is determined, and described as Z-twisted if it is spun to the right (clockwise) or S-twisted if spun to the left (counter-clockwise). When threads are plied of two or more yarns (to increase thickness and strength), twist direction is usually opposite to that of the original spinning. However, unlike draft-spun single yarns, plied yarns are one of the characteristic features of thread production with splicing, commonly used in the circum-Alpine Neolithic and ancient Egypt. In this technique, strips of plant fibre, *e.g.* flax, removed from their stalks, are joined together by overlapping and rolling only part of each fibre bundle, creating continuous thread. In the next step, previously prepared single thread is twisted with another one, forming stabilised plied yarn (Gleba and Harris 2018, 2329-2346; Grömer 2016, 74; Leuzinger and Rast-Eicher 2011; Rast-Eicher 2005, 117-132). It should be noted that the twisting direction observed on the impressions is a reversed image of the twist direction of the actual textile product.

The rest of the parameters include the twist angle (given in degrees °), which indicates the intensity (loose or tight) of the yarn or cord twist; width measurements (mm), including the width of the component threads/fibres in the case of multi-ply yarn or multi-

strand cord; and the density, measured in number of twists or interlaces per centimeter, indicating the fineness or coarseness of the products.

Next, the possible type of raw material (plant – with sharp edges of fibres in the negative, animal – with soft fibre edges) used to produce a textile is suggested. However, it must be emphasized that such interpretations should be supplemented with comparative and experimental studies in the future (*cf.* Grömer and Kern 2010; 3140-3144; Rast-Eicher 2016). Textile finds from Neolithic wetland settlements indicate that the most important fibres at that time were tree bast and, to a lesser degree, flax. Such materials are elastic and soft, and therefore constitute an easy-to-use material for making threads or cords (by hand or using spinning tools) with different intensities of twist (Grömer and Kern 2010, 3136-3137; Rast-Eicher 2005, 117-132).

The last stage of the description of microscopic observations is aimed at the identification of methods of application or appearance of textile impressions; in the case of cord ornaments: *e.g.* manually, roulette, stamp; in the case of woven and non-woven textile impressions: *e.g.* textile support for drying/moistening or transporting the vessels, cloth for smoothing the surface.

## RESULTS OF MICROSCOPIC ANALYSIS

### Sample 1

Large fragment of semispherical bowl, reconstructed from 7 smaller parts with thickened, obliquely cut rim (slanting inward), and ornamented with three horizontal rows of 'cord' impressions (inner imprint 26 × 1 cm), divided with two vertical rows of incisions. Under the rim is a plastic, encircling band with nail impressions and three dual, horizontal rows of 'cord' impressions (6 rows in total), located below the band (outer imprint 26,5 × 3,2 cm). Surfaces carefully smoothed. 'Cord' ornament created with precision and distributed evenly with the use of fine, tightly Z-ply thread (S-ply impression), regular in depth (Table 2). Visible and sharp edges of component fibres suggest that the thread was made from raw material of plant origin (Figs 2 and 3). Relatively equal distances between cord impressions (2-3,6 mm) and dual sequences of impressions (5,2-7 mm) on the outer wall of the vessel might indicate that the ornament was prepared with the use of an additional tool, for example thread-wrapped rod, roulette or textile template wound around a cylindrical object (*cf.* Dumpe 2006, 71-84; Soper 1985, 29-51; Koško *et al.* 2010, 13-48; Sikorski 2018, 453-467).

### Sample 2

Fragment of a vessel decorated with six horizontal rows of 'cord' impressions (five full imprints and one fragmentarily preserved), in two sequences of 3 impressions each (2,7 × 5 cm), placed under the rim of the vessel. Surface probably smoothed before the impres-

Table 2. Textile impressions: technical data

Sample no.	Textile structure	Twist direction	Width of cord/strand/yarn (mm) active/passive	Number of twists/threads per 1 cm active/passive
1 (outer imprint)	thread	Z (31-37°)	1,1-1,7	6
1 (inner imprint)	thread	Z (26-30°)	1,4-1,7	6
2	thread/cord	Z2s? (36-48°)	1,3-2,2	3,5-4
3	coiling	-	2-5	1,5
4	three-dimensional twining?	-	1,8-2,3	-
5	coiling or twining	-	1,6-2,5	-
6	twining or needle looping	S	2-2,9 (in stretched part)	3-4
7	balanced tabby weave	S2*?	0,9-1,1/0,8-1,0	8/8
8	weft/warp-faced tabby weave	indiscernible	1,3-1,5/1,5-1,9	5/6
9	tabby weave	S2*?	0,8/0,6	7-8/8-9
10	tabby weave, netting?	S2*(z)?	1,3-1,5/1,2-1,5	6/6

\* – an asterisk is inserted when annotating a spliced thread structure (see also Gleba and Harris 2018, 2330; Rast-Eicher and Dietrich 2015, 36)

sion was made. ‘Cord’ ornament made with coarse, tightly but irregularly Z-plied thread/cord (probably made by hand), regular in depth (Table 2). There is a possibility that each strand of thread/cord was plied of two components twisted in the opposite direction (Z/2s). Coarse microstructure and visible, irregular edges of component fibres suggest the use of plant-derived raw material, *e.g.* bast (Figure 4, 5). Distances between particular rows of textile impressions are between 2,7 to 3,7 mm (between sequences 8,5 mm), which also indicates the possible use of a certain type of rotary tool.

### Sample 3

Bottom fragment of a big vessel (reconstructed from three sherds) with preserved portion of the smoothed surfaces of its outer wall. The base of the vessel was completely covered with shallow basketry impressions in circular arrangements, partially smoothed (with visible traces of smoothing tool), and had a thin layer of clay added in the center. The container was probably made in the spiral-coiling technique, where the single vertical stitches wrap horizontal elements (foundation), holding the working end against the previous row (Adovasio 2016, 99). The width of individual strands ranged from 2 (close to the center) to 5 millimeters at the edge (Table 2). No discernible fibre twist was identified. Visible edges of component fibres suggest that plant-derived raw material, *e.g.* roots, straw



Fig. 2. Fragment of vessel with cord ornament from Bilcze Złote (sample 1). Photo by P. Silska



Fig. 3. Details of cord impressions on the obliquely cut, inwardly slanting rim of the vessel from Bilcze Złote (sample 1)

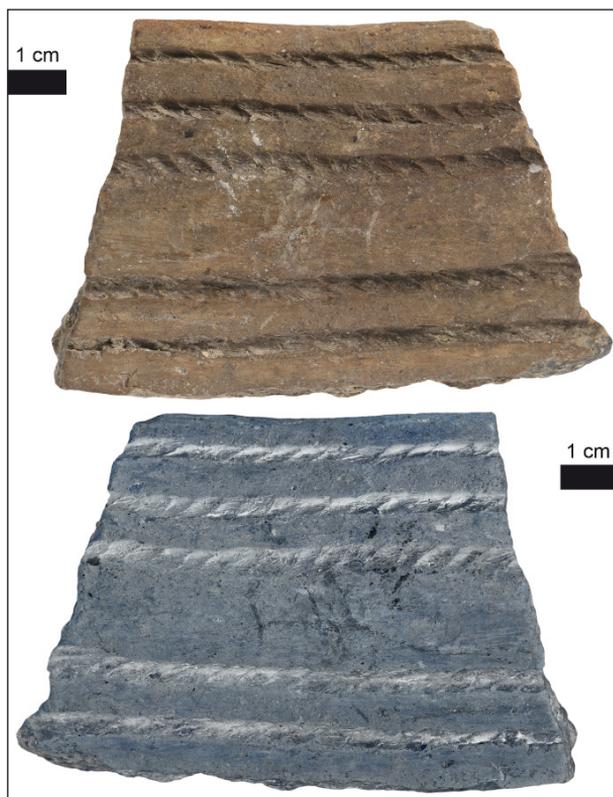


Fig. 4. Fragment of vessel with cord ornament from Bilcze Złote (sample 2). Photo by P. Silska



Fig. 5. Details of cord impressions on vessel fragment from Bilcze Złote (sample 2)



Fig. 6. Bottom fragment of a vessel with basketry impressions from Bilcze Żłote (sample 3).  
Photo by P. Silska

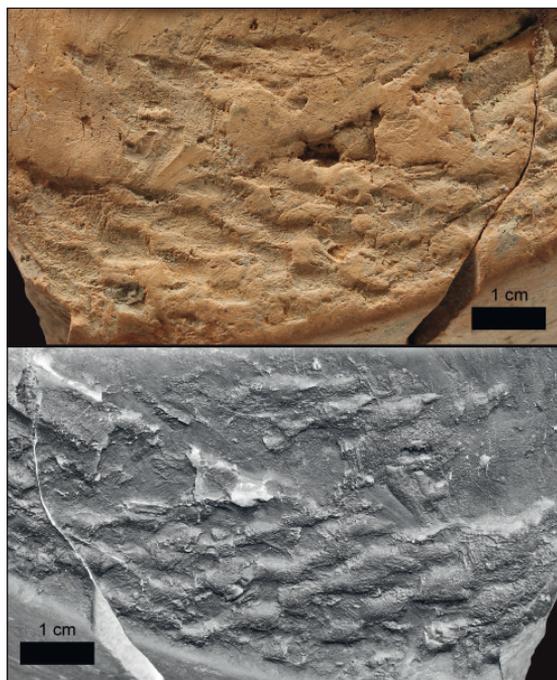


Fig. 7. Details of basketry impressions on bottom fragment of a vessel from Bilcze Żłote (sample 3).  
Photo by P. Silska

or reed, could have been chosen (Figure 6, 7). As indicated above, this type of textile impression occurred as a result of using non-woven products in the pottery manufacturing process.

#### Sample 4

Bottom fragment of a vessel with a preserved portion of its body. The outer wall was smoothed, the inner bottom part rugged. The surface of the outer bottom was partially damaged and covered with a thin layer of clay (Figure 8). Negatives of spiral basketry visible at the base. The container was probably made in three-dimensional twining; however, due to the state of preservation of the imprint, it is difficult to classify (Rast-Eicher 2005, 118-123). The circular rows of plant strands (1,8-2,3 mm wide, with visible edges of

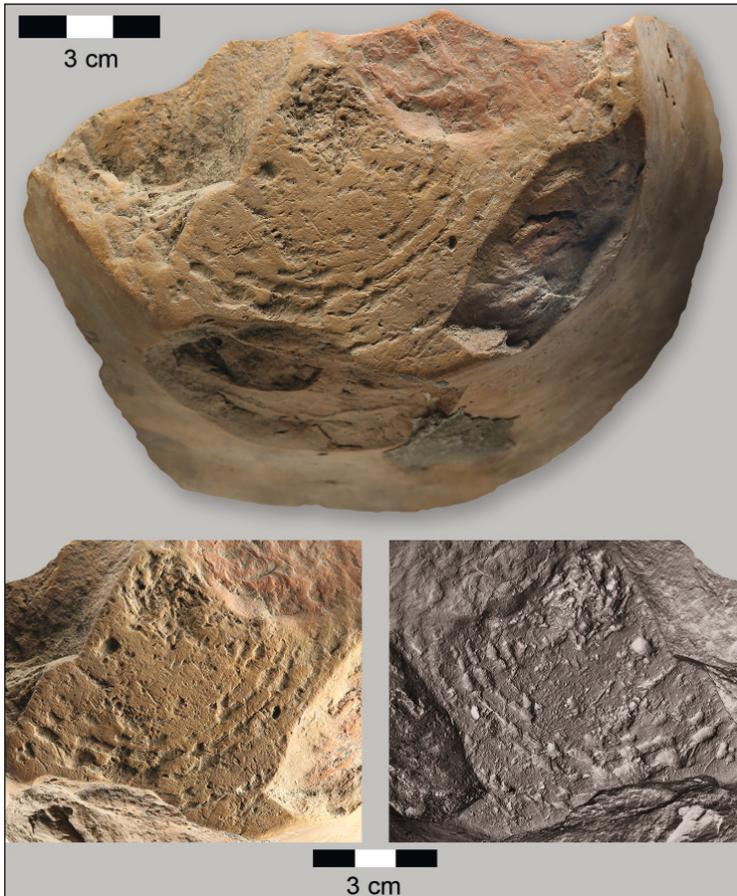


Fig. 8. Bottom fragment of a vessel with basketry impressions from Bilcze Żłote (sample 4).  
Photo by P. Silska

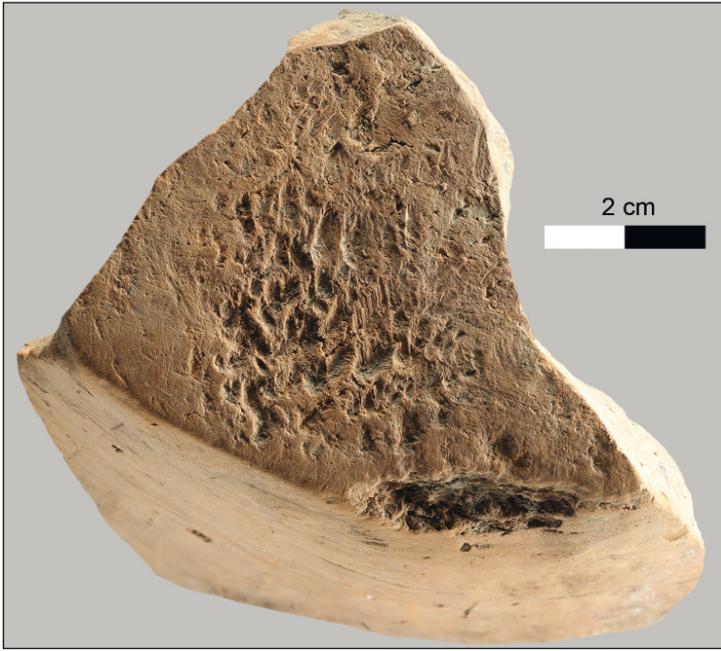


Fig. 9. Bottom fragment of a vessel with plaiting impressions from Bilcze Żłote (sample 5). Photo by P. Silska

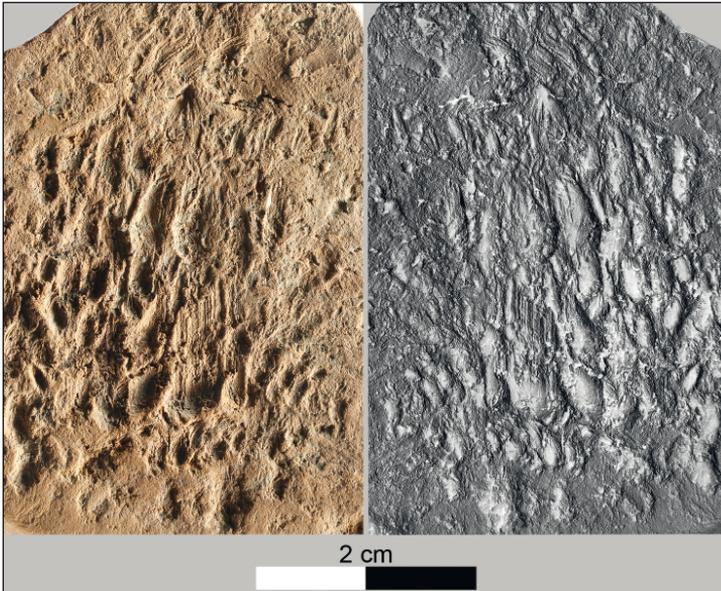


Fig. 10. Details of plaiting impressions on bottom fragment of a vessel from Bilcze Żłote (sample 5). Photo by P. Silska

component fibres) were separated from each other by a distance of approx. 2,2 mm (Table 2). No discernible fibre twist was identified.

### Sample 5

Fragment of the bottom and part of the body of a vessel with smoothed wall surfaces. An irregular coiling or twining? impression (3,5 × 4 cm) was identified on the vessel base (Figures 9, 10). No discernible twist angle of the strands. Visible negatives of component fibres, approximately 0,06 mm wide, suggest the use of a raw material of plant origin, possibly bast or grass (Table 2).

### Sample 6

Bottom fragment of a vessel with a preserved portion of its wall, showing traces of a smoothing tool. Impression of presumably non-woven textiles on the entire bottom, resembling linked, partly stretched, horizontal rows of cord-like impressions with dense structure (Table 2). The textile product was possibly made with a twining or simple needle-looping technique (nålebinding/knotless netting), with the use of S-plyed yarn. Nålebinding textiles were produced with one needle, “where the thread of the new stitch is passed arbitrarily through at least two unfinished thread-loops of arbitrary size” (Hansen 1990, 21-27; Mazăre 2011a, 29). This technique preceded knitting and is sometimes difficult to distinguish. It is worth remarking that nålebinding textile impressions were also identified on the bases of Cucuteni pottery, as a result of using “technical” fabrics (Marian 2008, 327-334; 2009). Visible edges of the component fibres of the yarn indicate the use of a raw material of plant origin (Figs 11 and 12).

### Sample 7

Bottom fragment and portion of the body of a medium-sized vessel with smoothed outer wall and uneven bottom surface with traces of oval scratches. Small impressions of woven textile (aprox. 1,1 × 1,2 cm) visible on several parts of the base, intentionally covered with an additional layer of clay. The fabric was made of the simplest form of weaving: medium-dense, balanced tabby weave, where the weft threads were interlacing over and under the warp (Table 2). This type of weave can be identified by its checkerboard-like appearance (Gleba and Mannering 2012, 1-24; Mazăre 2011a, 33-36). Yarns were most likely S-plyed (visible as Z-plyed on the imprint), and no discernible twist of single-thread elements was identified, which suggests thread production with splicing (Gleba and Harris 2018, 2329-2346). Due to the sharp edges of the yarn and the visible negatives of component fibres, it can be assumed that the textile pad was made of plant-derived raw material (Figures 13, 14).

### Sample 8

Bottom fragment and portion of the body of a large vessel with smoothed surfaces (clear traces of horizontal smoothing on the outer wall). Visible impression of a partially



Fig. 11. Bottom fragment of a vessel with non-woven textile impressions from Bilcze Złote (sample 6). Photo by P. Silska

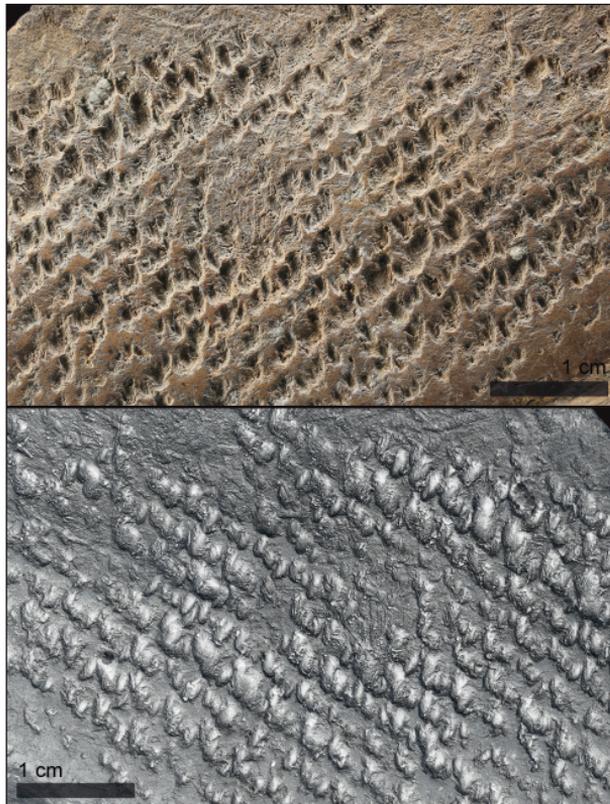


Fig. 12. Details of non-woven textile impressions on bottom fragment of a vessel from Bilcze Złote (sample 6). Photo by P. Silska

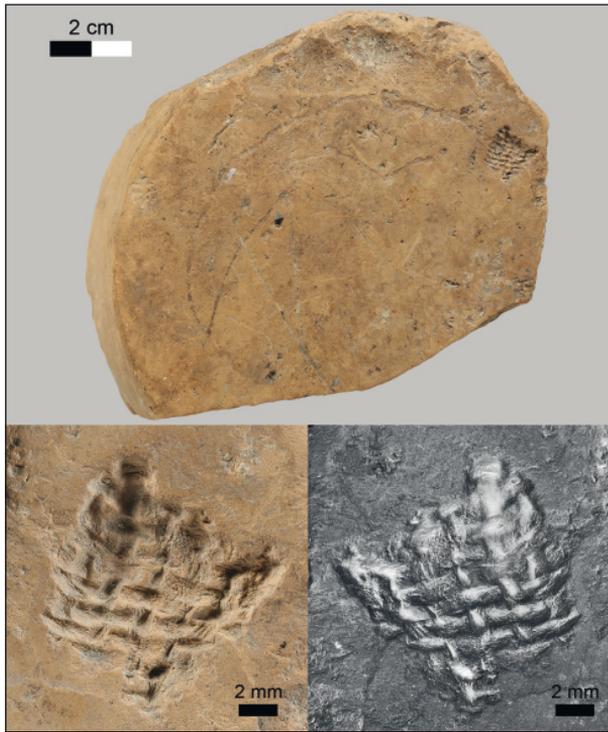


Fig. 13. Bottom fragment of a vessel with tabby weave textile impressions from Bilcze Złote (sample 7).  
Photo by P. Silska



Fig. 14. Details of tabby weave textile impressions on bottom fragment of a vessel from Bilcze Złote (sample 7)

stretched fabric on the entire bottom part (Figures 15, 16). Cloth made of coarse and dense, weft/warp-faced tabby weave (Table 2). Weft/warp weave textiles have one yarn structure covered by the greater density of the opposing one (Doumani and Frachetti 2012, 370; Emery 1966, 76-77). It should be emphasized that in case of textile impressions, usually only a fragment of textile product without selvages or starting borders is visible, which makes it difficult to distinguish and trace the arrangement of warp and weft threads (Podkańska 2012, 207-2013). The direction of yarn twisting is indiscernible. Under the impression of the textile pad, a deeper, cordage-like negative, arranged in a spiral shape, has been identified (4,5-5 mm wide). Placing the elevating element under the textile pad could have facilitated the lifting and transportation of the formed vessel.

### Sample 9

Fragment of a large vessel with preserved bottom and portion of the body. Carefully smoothed outer wall with traces of tool use. The inner surface of the vessel was rugged in the bottom part. Clear impression of a fine and medium-dense tabby weave on the entire base fragment (Figure 17, 18). The fabric was made of fine, most likely spliced and S-plyed yarns (Table 2). Missing threads may indicate the use of partially damaged cloths for pottery manufacturing. No traces of covering or smoothing of the imprint were recognized. Individual recesses were identified at the bottom, possibly formed while lifting the vessel. This type of textile impression was created as a result of using a textile “production” pad.

### Sample 10

Body fragment of painted pottery. The wall surface was carefully polished, covered with a thin layer of engobe, and painted with black and red horizontal lines. The textile impression (4,5 × 0,8cm) was made of tabby weave with the use of coarse, S-plyed (and possibly z-spliced) yarn, of plant origin (Table 2). The location of the imprint is unique in this case. Negatives of fabric were identified inside the wall of the vessel, which indicates a specific function of textiles in the process of pottery manufacture (Figures 19, 20). The analyzed fragment of the vessel was shaped by junctures of clay strips (Starkova and Zakościelna 2018, 67-85). Merging all parts (*e.g.* a moist clay surface with partially dried ones) requires special preparation of the clay to avoid separation of individual elements of the vessel during drying or firing. Uneven and intentionally grooved surfaces, created with the use of textiles, provide better adhesion and bonding of individual parts. There is also a possibility that wet textiles were used to maintain the necessary degree of moisture of the individual parts of the vessel before joining. The appearance of textile impressions inside the walls of ceramic vessels may have been the result of the aforementioned procedures (*cf.* Chmielewski 2009, 229-232; Grygiel 2008, ryc. 1028: 3; Kaczanowska 2006; Mazāre 2011b, 28-33). Apart from fabric negatives, under the separated top layer of engobe covering the wall surface, a possible fingerprint (8,5 × 5,5 mm) was identified. However, the chequered structure in the lower part of the imprint and relatively regular, vertical “lines”



Fig. 15. Bottom fragment of a vessel with tabby weave textile impressions and cordage-like imprint from Bilcze Złote (sample 8). Photo by P. Silska

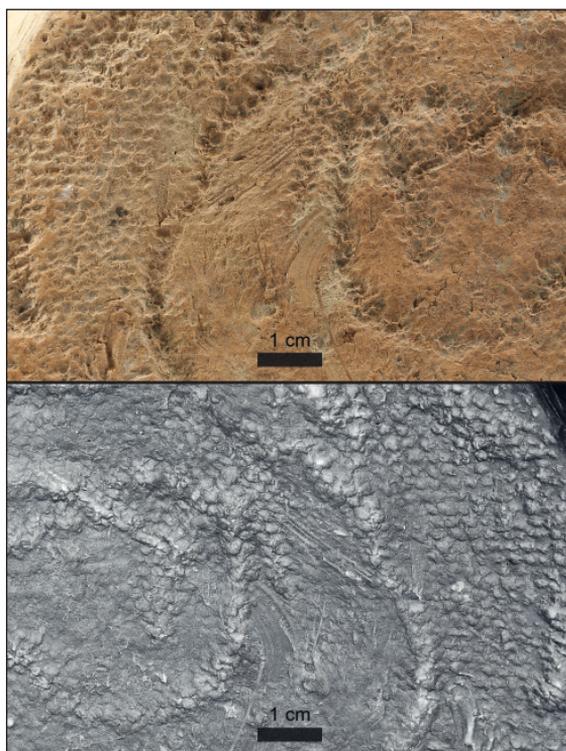


Fig. 16. Details of tabby weave textile impressions on bottom fragment of a vessel from Bilcze Złote (sample 8). Photo by P. Silska



Fig. 17. Bottom fragment of a vessel with tabby weave textile impressions from Bilcze Złote (sample 9). Photo by P. Silska

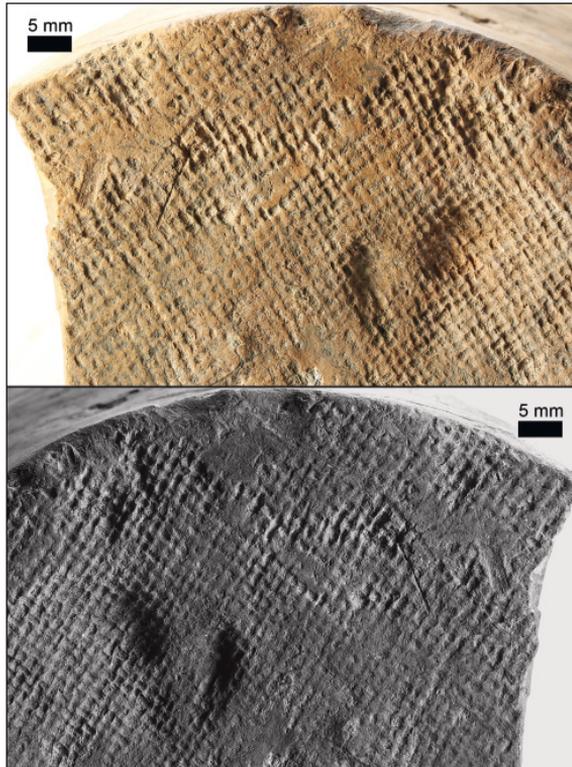


Fig. 18. Details of tabby weave textile impressions on bottom fragment of a vessel from Bilcze Złote (sample 9). Photo by P. Silska



Fig. 19. Tabby weave textile impressions inside the wall of painted ceramic from Bilcze Złote (sample 10). Photo by P. Silska



Fig. 20. Details of tabby weave textile impressions and fingerprint on the vessel from Bilcze Złote (sample 10)

might indicate the occurrence of a very fine textile impression (threads width: 0,3-0,5 mm?) made with the netting technique.

## CONCLUSIONS

The presented results of the analysis of textile impressions from the Bilcze Żłote pottery assemblages, as well as the current state of research on this issue, indicate that Trypillia communities had the ability to produce textile goods using various techniques. In addition to different types of non-woven products (such as cords, baskets, plaitings and twined textiles), woven fabrics constitute a large group of finds (*cf.* Chmielewski 2009, 233-235; tab. 14, 272-276). Variety in this category occurs both in relation to the density (quality) of the fabric itself and the type of yarn used. Types of fabrics recognized so far were made in tabby (balanced, weft/warp-faced tabby) and rep weave. Number of yarn interlaces per 1 cm in active and passive systems ranges from 3 to 12 threads (Chmielewski 2009, tab. 14, 272-276). On the bottom part of one of the vessels from the Bilcze Żłote collection, imprints of fine, balanced tabby weave, with 11 threads per 1 cm were identified (Prokopowicz 2013, 99; Figure 21). The diversity of most likely spliced and plied yarns, with a width between 0,5 and 1,9 mm, indicates that Trypillia communities had knowledge and skills with regard



Fig. 21. Balanced tabby weave textile impression on bottom fragment of the vessel from Bilcze Żłote. Photo by P. Silska (see Prokopowicz 2013, 99)

to the selection of technical characteristics of thread for making fabrics of the desired thickness and density. The possible use of splicing supports the hypothesis that the mentioned technique was commonly used for thread production from plant-derived raw material in the European Neolithic and Eneolithic traditions, instead of the previously believed draft-spinning technique (Gleba and Harris 2018, 2329-2346; Leuzinger and Rast-Eicher 2011; Rast-Eicher 2005, 117-132).

The relatively high frequency of textile impressions visible on Trypillia culture pottery indicates that textiles were important elements of the technological process associated with pottery manufacture (Zbenovich 1974, 80-81, Kosakivskyi 2004, 94; Chmielewski 2009, 226-233). The largest number of textile imprints is recorded at the bases of the vessels, which suggests the use of various kinds of textiles as supporting pads prior to firing. A characteristic feature of most impressions of this type is their intentional masking by smoothing and by covering them with an additional layer of clay. Another possibility is that some textile imprints were planned and intentional. The occurrence of textile impressions on the inside of a vessel wall (sample 10, Figure 19, 20), may indicate their application for the better adhesion and merging of individual elements used for pottery-making. Therefore, it can be assumed that textiles, including woven fabrics, were quite commonly used among Trypillia communities, and thus available for pottery manufacture (Mazäre 2011a, 27-48; 2011b, 28-33).

Due to the limited number of sources associated with textile production in Neolithic and Eneolithic communities, especially those from Eastern Europe, examinations of their indirect remains could produce valuable sources of information. Analysis of the technology of textile production opens up new possibilities in the recognition and reconstruction of production processes and the use of particular weaves and twists of fibre. Increasing the database of available clay materials with visible textile imprints offers a more solid foundation for comparative studies focused on the interactions between culturally diversified, periodically co-existing social groups. Furthermore, identification of the degree of technological advancement of textile production provides a basis for new interpretations regarding regional specialization, both in terms of cultivation and craft, which represents an important part of socio-economic organization.

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