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TEXTILE-IMPRESSED POTTERY FROM THE BRONZE AGE SETTLEMENT IN SZCZEPIDŁO, POLAND

ABSTRACT

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The practice of using textiles during the process of pottery manufacturing provides a unique insight into the technological aspect of prehistoric craft, the actual products of which are very rarely preserved to our times. In this study, microscopic analysis of ceramics fragments with textile or textile-like imprints was carried out in order to determine the type and structural features of textile products that were used by the inhabitants of the Bronze Age settlement in Szczepidło, Central Poland. In addition, issues related to the function of textile patterns on ceramics were discussed. Measurements made during the research were used to prepare a dataset of technical parameters of identified impressions, which, apart from being itself a valuable source of information, could be implemented in future comparative studies.

Keywords: Middle and Late Bronze Age, textile-impressed pottery, Szczepidło, microscopic analysis, textile production

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INTRODUCTION

Due to the perishable nature of organic materials, direct traces of textiles are rarely documented at archaeological sites. The earliest preserved textile finds from Poland are dated back to the Hallstatt period and for this reason, our knowledge of Bronze Age textile techniques in this region is still rather limited (Maik 2012; 293-303; Schaefer-Di Maida and Kneisel 2019, 204). One of the important categories of materials related to this issue, though often overlooked by researchers, are imprints of textiles impressed on pottery. Their appearance is associated with use of various kinds of products made of plant or animal-based fibres, during the process of pottery manufacturing, *e.g.* as pads used for building, polishing or transportation. This category also includes intentional textile imprints made for decorative purposes, such as the so-called 'cord' ornament, as well as various types of activities related to the preparation of the vessel's surface – textile ceramics or textile-impressed ceramics (Lavento 2001, 20, 21; Lopatina 2017a; Schaefer-Di Maida and Kneisel 2019, 197; Silska 2012, 101-103; Skrzyniecka 2020).

The latter is widely represented in pottery assemblages from North-Eastern Europe, dated from the Late Neolithic to the Iron Age and is interpreted as a separate ceramic category (Lang 2007; Lavento 2001; Lavento and Patrushev 2015; Lopatina 2017a). In Central Europe, especially in the Carpathian Basin, textile ceramics appear in materials of the Hatvan, Otomani-Füzesabony and Wietenberg cultures (Lasak and Lemańska-Czarniak 2013; Lasak 2014; Kopacz 2001, 18-29) among others. In Poland textile impressions on pottery were considered as a specific marker of the Vorlaunitzer ('pre-Lusatian') culture (Kostrzewski 1926; Kowiańska-Piaszykowa 1966, Map 1; Dąbrowski 1972; 2004; Gedl 1975, 62-71), however, as more recent studies show, they are also associated with other taxonomic units such as the Mierzanowice culture, late phase of Trzciniec Cultural Circle and Lusatian culture (Lasak and Lemańska-Czarniak 2013; Lasak 2014; Kadrow and Machnik 1997; Makarowicz 2017). In addition, large number of textile and textile-like ceramics (approx. 600 sherds) was extracted from layers dated to the Early Bronze Age horizons of the Bruszczevo settlement (1700-1650 BC) of the Únětice culture (Silska 2012, 101-103; Schaefer-Di Maida and Kneisel 2019, 201).

The aim of this study is to analyze the structural features of textile imprints visible on pottery, and identify what kind and what quality of products were used to create them by the Szczepidło settlement community. We also propose a new interpretation of a previously examined set of ceramics with textile imprints from this site (Sikorski 2016, 503-519). In addition, this paper is intended to discuss whether impressions were made only for decorative purposes or rather served a practical function during the process of pottery manufacturing.

Textiles in this case are considered in broad sense, as all products associated with processing and interconnecting plant- and animal based fibres, resulting in the creation of woven and non-woven products (Gleba and Mannering 2012, 1-24; Good 2001, 209-226;



Fig. 1. Location of the Szczepidło archaeological site

Seiler Baldinger 1994, 5; Skrzyniecka 2020, 232). Despite some limitations, emerging from the deformations or shrinkage (10-20%) of the original products during the pressing and firing process as well as other factors, specialistic analyses of textile impressions represent a valuable source of information about traces of Bronze Age handicrafts that in most areas are absent in the archeological record (Drooker 2000, 59-68; Mazāre 2011, 27-48; Podkańska 2012, 207-213; Schaefer-Di Maida and Kneisel 2019).

SITE

The site is located in the eastern part of the Konin Valley (Kondracki 1994: 107f), which is a part of the Middle Warta Valley (Bartkowski 1978:13). It is located above the fluvial terrace of the Warta, 300 m east of the Brzeźno – Szczepidło road and placed on a parabolic windblown dune (partly in a blowout) stretching for 2 km along the E-W axis and 1 km along the N-S axis (Fig. 1). The largest and most spectacular habitation phase has been associated with the Middle and Late Bronze Ages societies representing the transition stage from the Trzciniec Cultural Circle to the Lusatian culture (Makarowicz 2016, 9-14).

Szczepidło was a long-term inhabited settlement in the second half of the 2nd millennium BC. In its development it is possible to distinguish two main phases divided by over a one-hundred-year hiatus. The first phase lasted for about 50 years (1500-1450 BC) or what is more probable even less (perhaps one generation only). The second phase, which is the crucial one, lasted for at least 100 years (1330-1230 BC). On the basis of the artefact analysis and chronometry it is possible to assume that the occupation of the younger phase was permanent.

Spatial analysis of the excavated part of the site has revealed the presence of at least five (I-V) living-activity zones of various sizes (from 400 to 1000 square metres). In those areas over a dozen farmsteads (houses with yards) were detected. Only in two cases was it possible to distinguish the shape of buildings (rectangular and on-ground constructions in zone I and a central production-living feature – the metallurgical workshop – in zone III). In other examples, only storage features were preserved (cellars) with a stratified rectangular, U-sectioned or trapezoidal-sectioned fillings (Makarowicz 2016, 273-277).

The stylistics of the pottery and metal artefacts exhibit the wide contacts of the settlement's society and reception of material culture patterns and tendencies specific for the second half of the 2nd millennium BC. The closest analogies to the analyzed set of patterns come from the Middle and Late Bronze Age sites from the Polish Lowlands, however some of them also have analogies in the upland zone of the Oder and Vistula basins.

MATERIALS AND METHODS

Within the excavated area, more than one hundred pottery fragments reveal textile and textile-like patterns (Fig. 2). The first examination of this type of pottery was published in a monograph of the Szczepidło site, where the results of analysis of 48 pottery fragments with textile or textile-like imprints were included (Sikorski 2016, 503-519). For the purpose of this research, 44 new samples (Tab. 1, samples no. 21-64) have been selected and chosen for specialist analysis. In addition, 20 previously published textile-impressed pottery fragments were re-examined (Tab. 1, samples no. 1-20). The study was carried out on the basis of commonly accepted and used methods of analysis of archaeological textiles and textile impressions (Doumani and Frachetti 2012, 368-382; Drooker 2000, 59-68; Gleba 2017, 1206, 1207; Grömer and Kern 2010; 3136, 3137). They include detailed measurements and visual examination by digital microscope and photographic documentation. Samples were chosen for microscopic observation using a Keyence VHX-6000 digital microscope with up to 100× magnification. The categories of data required to obtain information of structural features contain: spinning and twisting direction (Z-twisted if spun to the right or S-twisted if spun to the left); width measurements (mm) of the yarn imprints; twist angle (given in degrees °), which indicates the intensity (loose or tight) of the yarn or cord twist and the density, measured in number of twists per centime-

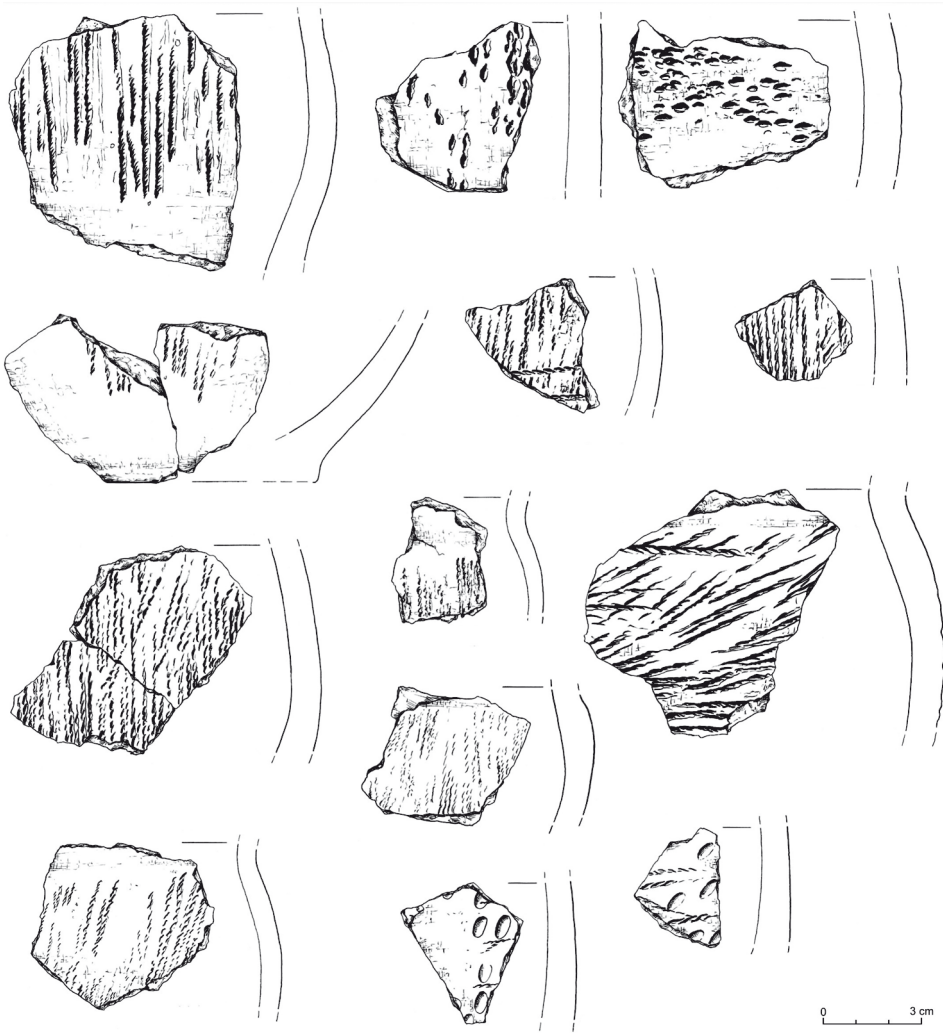


Fig. 2. Selected samples of textile-impressed pottery from Szczepidło (Makarowicz 2016, 201)

ter, indicating the fineness or coarseness of products. Results of the measurements were recorded in a table (Tab. 1) and used to identify technical parameters and most likely the technique of making an impression and textile products itself. In addition, selected samples were imprinted in sculpting clay in order to make a positive mould form of the negative of textile imprints, which were used to facilitate microscopic measurements and identification of textile structure.

Table 1. Textile impressions: technical data

Sample no. (inv. no.)	Textile structure	Twist direction imprint	Twist angle	Width of cord/ thread (mm)	Number of twists/threads per 1 cm
1 (14310)	thread/cord impressions in oblique, V-shaped arrangement; imprints of knots	Z	20-35°	0.5-2.4	-
2 (14112)	parallel thread impressions	S2z	20-30°	0.9-1.8	2
3 (14112)	parallel thread impressions	S2z	20-30°	0.7-1.2	-
4 (14006)	impressions in the form of oval and oblong recesses	Z	30-35°	2-3.2	2
5 (13972)	parallel thread impressions	Z	30-45°	1.3-2	-
6 (13966)	impressions in the form of oval and oblong recesses	S2z?	-	1.4-2.9	1
7 (14077)	textile-like impressions in irregular arrangement	-	-	1-1.7	-
8 (13909)	parallel thread impressions	Z	30°	1.7-1.9	-
9 (14413)	textile-like impressions in oblique, irregular, possibly layered arrangement	Z	25°	0.8-1.7	-
10 (14397)	parallel thread impressions	Z	20-25°	1.4	-
11 (14167)	textile-like impressions in irregular arrangement	-	-	0.5-1	-
12 (14434)	thread impressions in oblique, V-shaped arrangement	S2z?	35-40°	1.8-2	3
13 (14401)	impressions in the form of oval and oblong recesses or parallel imprints of coarser threads/cords	Z?	-	1.4-2.2	2
14 (14397)	parallel impressions of coarse threads	S2z	35-40°	1.6-2	2
15 (14192)	parallel thread/cord impressions	Z	20-30°	2-2.5	-
16 (14420)	parallel thread/cord impressions	S	-	0.9-1.8	-
17 (14538)	textile-like impressions in irregular arrangement	Z	30-35°	1.2-1.5	-
18 (14393)	parallel thread/cord impressions	S	35-40°	2-2.5	2
19 (14531)	parallel impressions of fine threads	Z	35-40°	0.5-0.8	-
20 (14186)	parallel impressions of fine threads	Z	35-40°	ca. 0.5	-
21 (13909)	thread impressions in parallel and V-shaped arrangement	Z2s	20-25°	0.5-1.4	4
22 (14401)	impressions in the form of oval and oblong recesses or parallel imprints of coarser threads	Z	40-45°	1.4-1.8	2
23 (14170)	thread impressions in close and parallel arrangement, in some parts overlapping	Z	25-35°	0.8-1.2	-
24 (14170)	thread impressions in close and parallel arrangement, in some parts overlapping (continuation of sample 23)	Z	25-30°	0.8-1.2	-
25 (14391b)	three strand cord impression under ornamented part	-	-	2-2.3 (each strand 0.9-1.2)	4.5

26 (14229)	thread impressions in parallel arrangement, in some parts overlapping	Z	30-35°	1.2-1.4	-
27 (14229)	slightly visible parallel impressions of fine threads	-	-	ca. 0.6-0.7	-
28 (14076)	thread impressions in separated and parallel arrangement	Z	25-35°	1.1-1.5	-
29 (14063)	shallow thread impressions in parallel arrangement	Z	30-35°	1.2-1.4	-
30 (14063)	parallel thread impressions	Z	30-40°	0.9-1.3	-
31 (14063)	thread impressions in parallel arrangement, in some parts overlapping	Z	20-25°	0.9-1.2	-
32 (14063)	parallel and separated impressions of coarse threads	Z	30-35°	1.7-2	-
33 (14063)	parallel thread impressions	Z	20-25°	0.9-1.2	-
34 (14063)	parallel thread impressions	Z	20-25°	1-1.3	-
35 (14078)	parallel thread impressions intersected by imprints applied in crosswise direction	S2z	25-35°	1.3-2	3
36 (14103)	parallel thread impressions	S2z	25-35°	1.3-2	2.5
37 (14101)	parallel thread impressions	Z	30-35°	1.4	-
38 (14050)	thread impressions in parallel and V-shaped arrangement	Z	25-35°	1.2-1.5	-
39 (14036)	shallow thread impressions in parallel arrangement	Z	-	1-1.2	-
40 (feature no. 7)	thread impressions in V-shaped and irregular arrangement	Z	ca. 30°	1.2-1.8	-
41 (14232)	parallel thread impressions, in some parts overlapping	S2z	20-25°	1.2-1.4	2
42 (14121)	irregular thread impressions	Z	25-30°	1.3-1.5	-
43 (14141)	parallel thread impressions	Z	30-40°	0.6-1.3	-
44 (13885)	parallel thread impressions	Z	30-35°	1-1.2	-
45 (14237)	parallel cord impressions in close arrangement???	Z	25-35°	3.8-5	-
46 (14223)	parallel thread impressions	Z	ca. 35°	1.2-1.3	3
47 (14049)	thread impressions in V-shaped arrangement	Z	25-35°	1.4-1.9	-
48 (14061)	parallel thread impressions in close arrangement, intersected by separated imprints applied in crosswise direction	Z	25-35°	0.9-1.8	2
49 (14061)	parallel thread impressions	Z	-	0.8-1.3	-
50 (14217)	textile-like impressions in parallel arrangement	-	-	0.7-1.2	-
51 (14217)	thread impressions in V-shaped arrangement	Z	20-25°	0.7-1.2	-
52 (14225)	parallel thread impressions in close arrangement	Z	25-35°	0.7-1	-
53 (14230)	parallel thread impressions	Z	25-30°	0.9-1.1	-
54 (14226)	parallel thread impressions	Z	25-30°	0.8-1	-

Sample no. (inv. no.)	Textile structure	Twist direction imprint	Twist angle	Width of cord/ thread (mm)	Number of twists/threads per 1 cm
55 (14226)	parallel thread impressions	Z	20-25°	0,9-1,1	-
56 (14233)	parallel thread impressions	Z	20-25°	0,9-1,7	-
57 (14267)	shallow thread impressions in irregular arrangement	Z	-	0,8-1,5	-
58 (13962)	parallel thread impressions	Z	25-35°	0,8-1,5	-
59 (13998)	parallel thread impressions	Z	ca. 30°	ca. 1,3	-
60 (14074)	shallow thread impressions in parallel arrangement	Z	20-25°	1,2-1,4	3?
61 (14163)	parallel thread impressions	Z	25-30°	1-1,2	-
62 (14165)	parallel thread impressions in some parts overlapping	Z	25-30°	0,7-1,1	-
63 (14165)	parallel thread impressions	Z	30-40°	1-1,5	-
64 (14511)	parallel impressions of fine threads	Z	25-30°	0,4-0,7	-

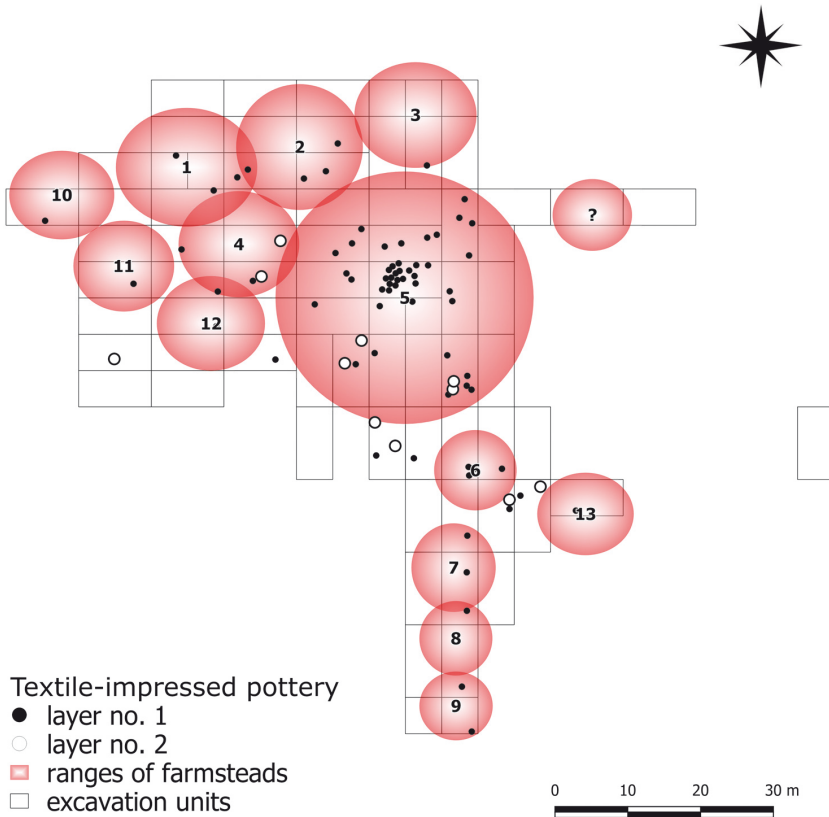


Fig. 3. Distribution of textile-impressed pottery and the approximate range of farmsteads

According to the diameter of the basic elements of the textiles, three terms are distinguished in literature and for classification purposes were employed in this paper: 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).

Impressions on pottery, identified as made by using textile products of various structure and thickness, represent 6.6% of the total ceramics collection from the Szczepidło settlement. The range of distribution of pottery fragments with this type of ‘decorative motif’ covers almost the entire area of the studied settlement space, with a concentration in its middle and eastern parts (Fig. 3). They appeared both in layers (68 fragments) and settlement features (10 fragments, separately and with other decorative patterns). For five of the above-mentioned features (16, 165, 170, 194 and 234) the chronology using the ^{14}C method was established. The chronological range of the discussed classification group covers the time span of 1280-1224 BC, however with a high degree of probability (68.2%) textile motifs on ceramics were used in the period 1271-1243 BC (Makarowicz 2016, 240-272). The distribution patterns showed no separate clusters of this type of ceramics. In addition, analysis using manual XRF spectrometer, did not point to any differences between the elemental composition of textile-impressed ceramics and other pottery fragments. It can be assumed that they were used as typical household ceramics.

Traces of textiles covered the outer walls of the vessels’ body parts. They began below the neck, occasionally going down to the bottom parts, but there are no discernible impressions on the bases. The majority of imprints are visible only in the form of fragmentary and shallow impressions, in some cases fully or partially obliterated, which is indicated by the presence of smooth surfaces between each imprint, and covered with an additional layer of clay (angobe, rugged pottery) (Sikorski 2016, 503-507). The remainder of the potsherds bear traces of regular patterns resembling textile structures, but could have been made with different tools as well, *e.g.* comb, bunch of twigs, wooden or clay smoothing tool (Lopatina 2017b, 287-296; Rammo 2017, 111-119). This type of imprints might be referred to as ‘pseudo-textile ornament’ (*cf.* Lasak and Lemańska-Czarniak 2013; Lasak 2014, 127-157, fig. 18; Sikorski 2016, 503).

RESULTS AND DISCUSSION

Due to the state of preservation of textile impression and the presence of a fibrous pattern, a total of 64 ceramic fragments were selected for detailed microscopic observations. Structural features of identified textile imprints are diversified, however all of them might be considered as made by non-woven products. It means that no interlacing of two systems of yarns – warp and weft were identified on the impressions. Visible negatives of twisted fibrous structures suggest that the products used were made of spun or plied yarns. Therefore, it can be assumed that impressions were created using elastic materials, which

could adjust to the shape of a vessel. The lack of textile imprints on the bases also disproves the use of rigid products, *e.g.* wicker baskets, during the pottery making process (Schaefer-Di Maida and Kneisel 2019, 204).

Most of the analyzed impressions (53) are discernible in the form of repeated rows of textile products resembling cords or threads. They appear in parallel or oblique and V-shaped arrangements (Fig. 4). The majority of the imprints are loosely placed, though some of them appear in close arrangements. Overlapping and intersecting parallel imprints by cord/thread impression applied in crosswise direction are also observed. The negatives of knots were recorded on one of the samples (Fig. 5, 6). Four ceramic fragments bear traces of less regular imprints, consisting of oval and oblong recesses, possibly made of coarser yarns (Fig. 7). A shallow imprint of a three-ply cord was recorded on one fragment of pottery and on the last six samples, fragments of textile/textile-like impressions in a disorganized and irregular arrangement were identified (Fig. 8).

From the whole set of the textile-impressed ceramics, traces of finely spun and plied yarns, as well as coarser products were identified (Figs 9, 10). The width of a single imprint on the analyzed samples ranged from 0.4-2 mm, with the dominance of 1.5 mm or thinner threads (Fig. 11). The coarser impressions left on the four samples (Fig. 12) were made of cords with a thickness of 2-5 mm. Some fragments bear traces of different yarn widths within one sherd. The analyzed impressions were made of both S-twisted (49 samples) and Z-twisted (10 samples) yarns. Among them, traces where each strand of yarn was plied of two components twisted in the opposite direction (to increase thickness and strength) – Z2s (7 samples) and S2z (1 sample), were also recorded (Fig. 13). It should be noted that the twisting direction observed on the impressions, given in the table 1, is a reversed image of the twist direction of the actual textile product. Twist angle ranged from 20° to 45°, which indicates that yarns were quite tightly spun and plied. The number of yarn twists per cm was discernible in case of 17 samples and measured from 1 to 4.5 twists (Tab. 1).

The identification of raw material on the basis of textile imprints is problematic. In this case, experimental research might prove useful, as it allows comparison of the microstructure of different types of fibres. The presence of fine, sharp and not always regular impressions of individual fibres might suggest that plant-derived raw material could have been chosen by the manufacturers from Szczepidło (*cf.* Grömer and Kern 2010; 3140-3144; Grömer *et al.* 2018, 275-284; Sikorski 2016, 503-519). During the Bronze Age in Central Europe, different plant fibres were used for textile production. The most common were flax, hemp, nettle, as well as bast and grass. In this period, the first animal materials, like wool or horsehair also appeared (Bender Jørgensen and Rast-Eicher 2018, 25).

As was discovered in the previous research, the arrangement of impressions and wide spectrum of technical parameters of imprinted products suggest that different types of non-woven textiles could have been utilized (Sikorski 2016, 505-509). However, the state of preservation, size of samples, almost complete lack of textile tools (only one large cylindrical loom weight was found on the Szczepidło settlement) and consequently the absence

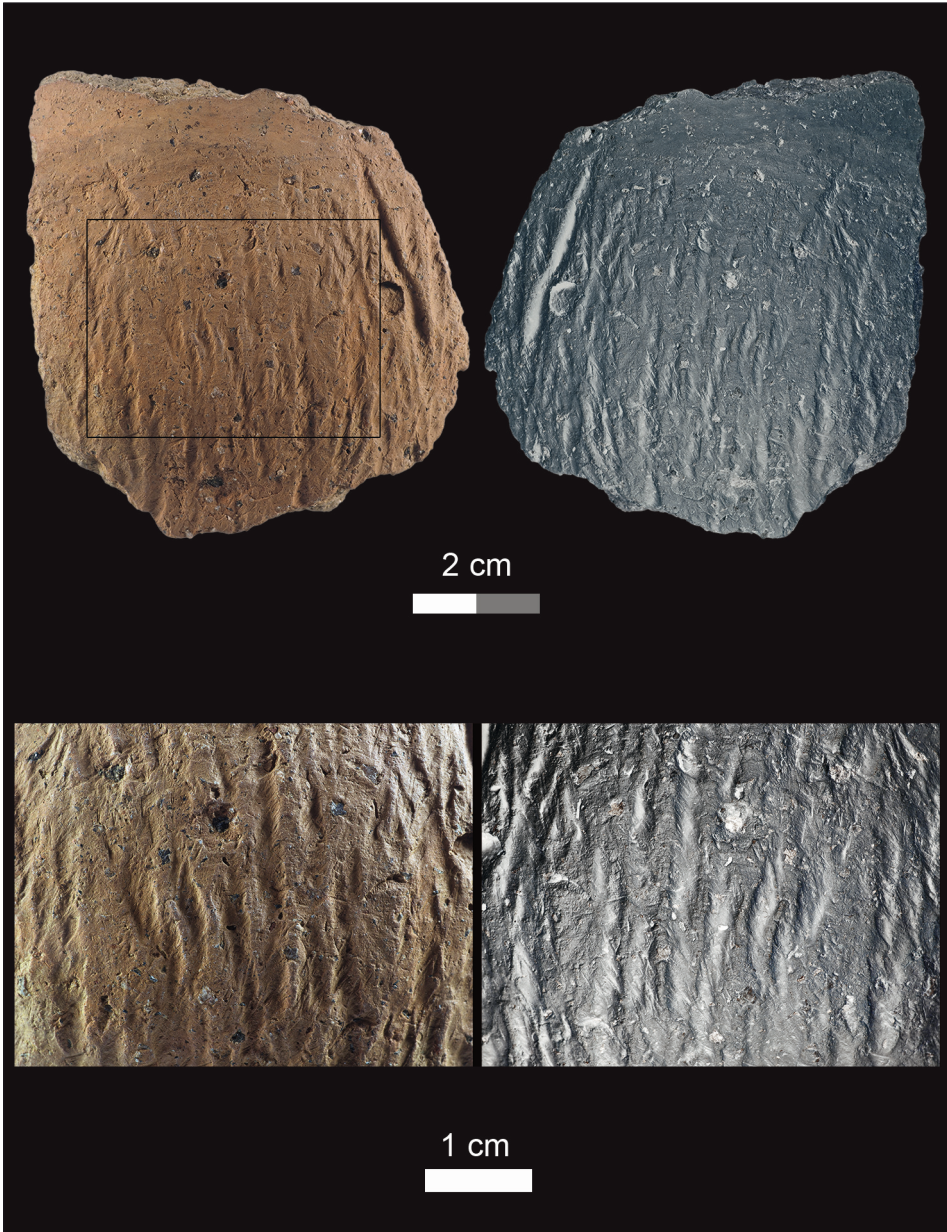


Fig. 4. Pottery fragment with oblique textile imprints, Szczepidło

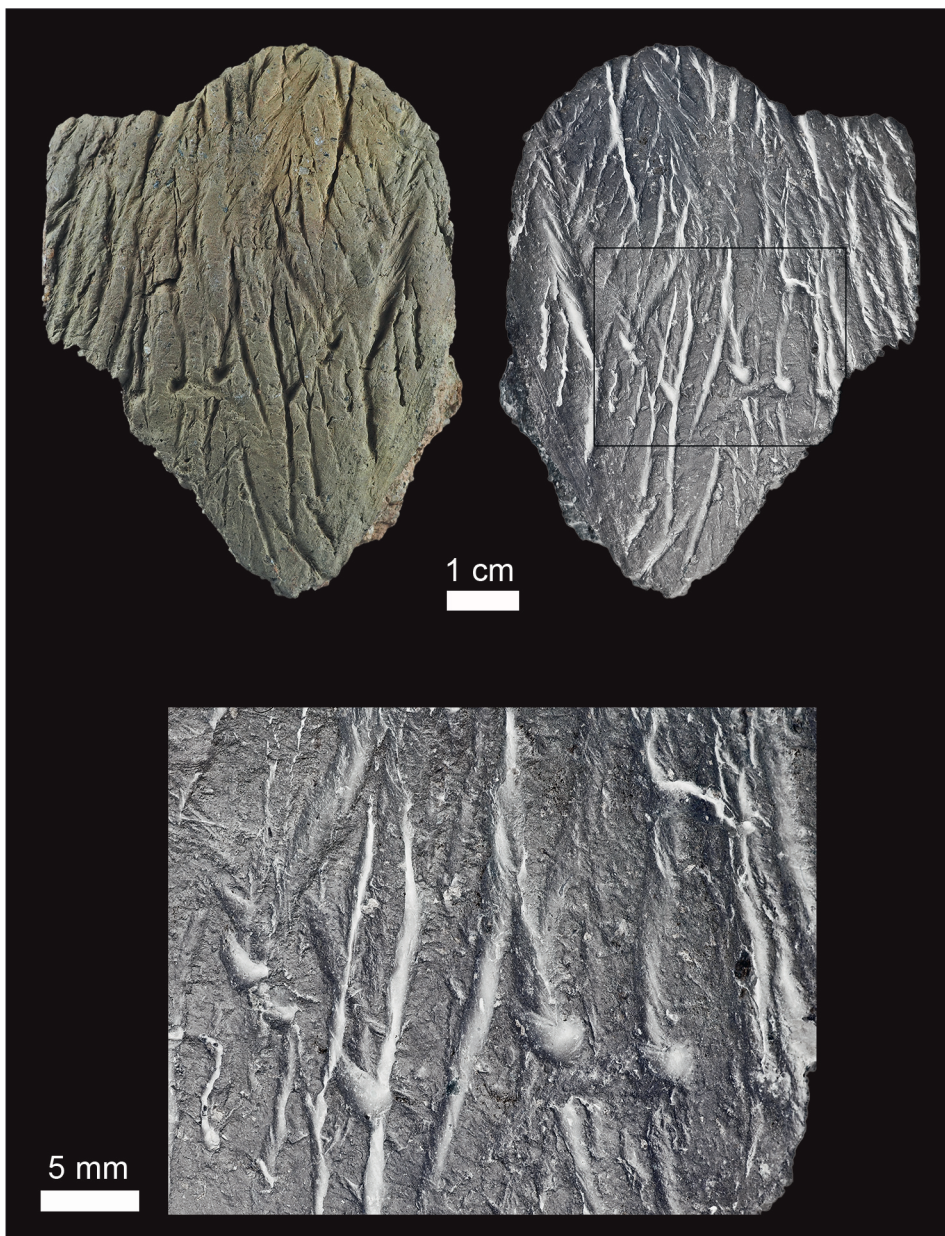


Fig. 5. Textile imprints with traces of knots visible on pottery fragment, Szczepidło

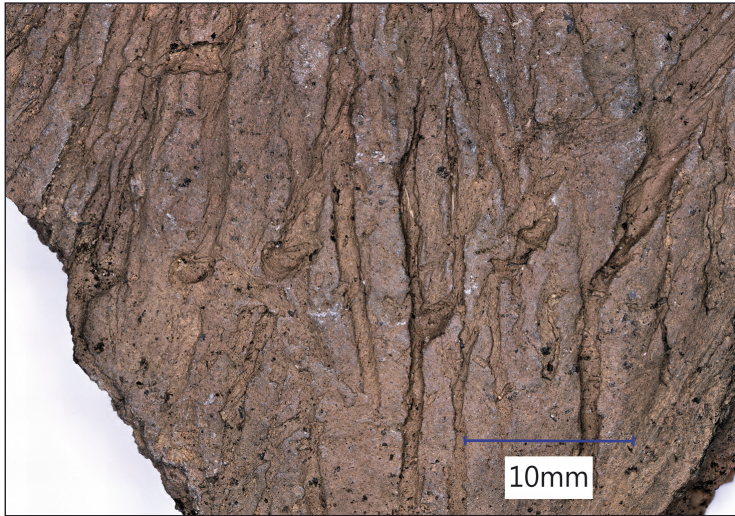


Fig. 6. Details of imprinted knotted threads on pottery fragment, Szczepidło



Fig. 7. Pottery fragment with textile imprints of coarser yarns, Szczepidło

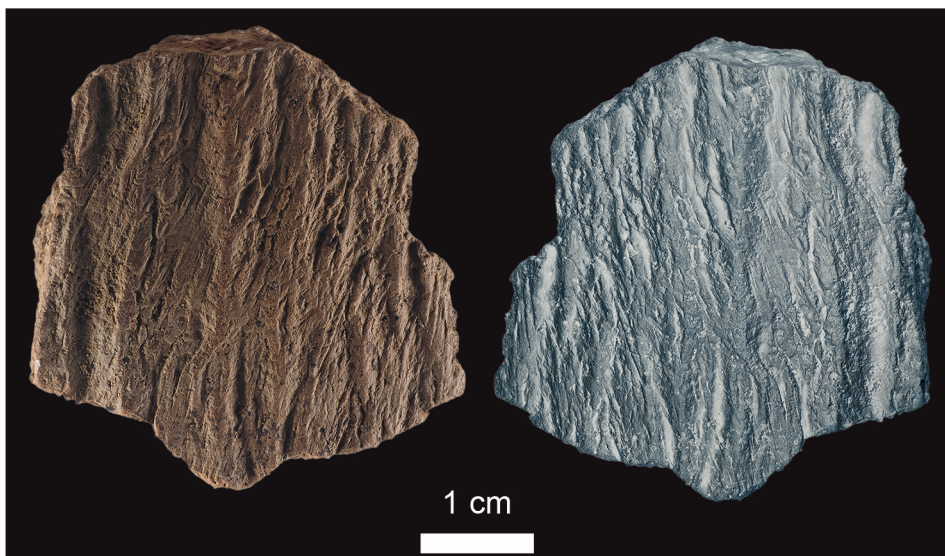


Fig. 8. Pottery fragment with textile or textile-like imprints, Szczepidło

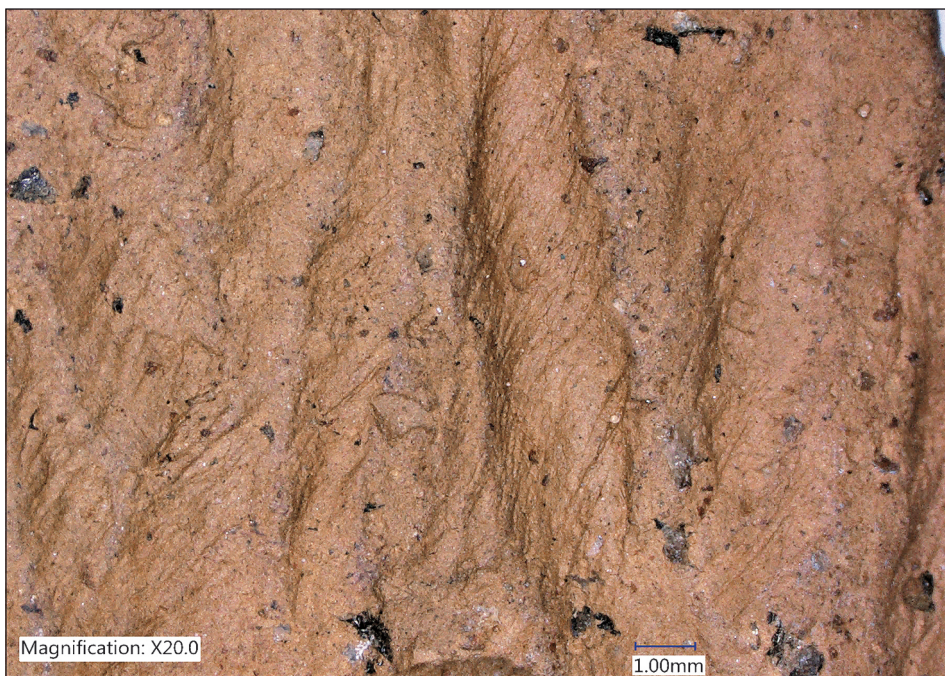


Fig. 9. Details of single yarn structural features imprinted on pottery fragment, Szczepidło

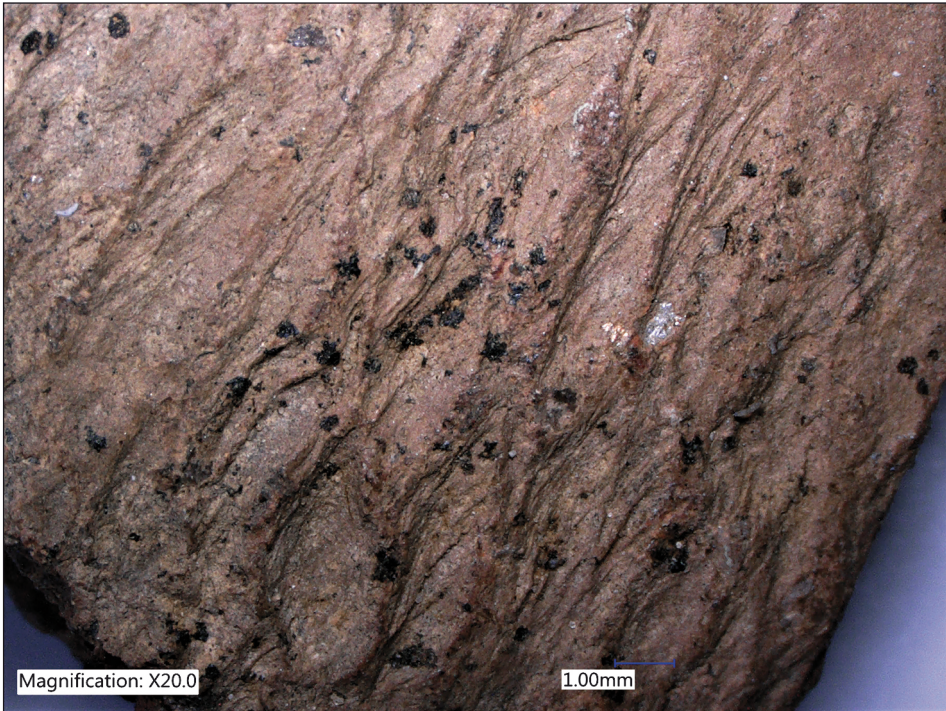


Fig. 10. Details of plied yarn structural features imprinted on pottery fragment, Szczepidło



Fig. 11. Pottery fragment with parallel textile imprints of fine threads, Szczepidło

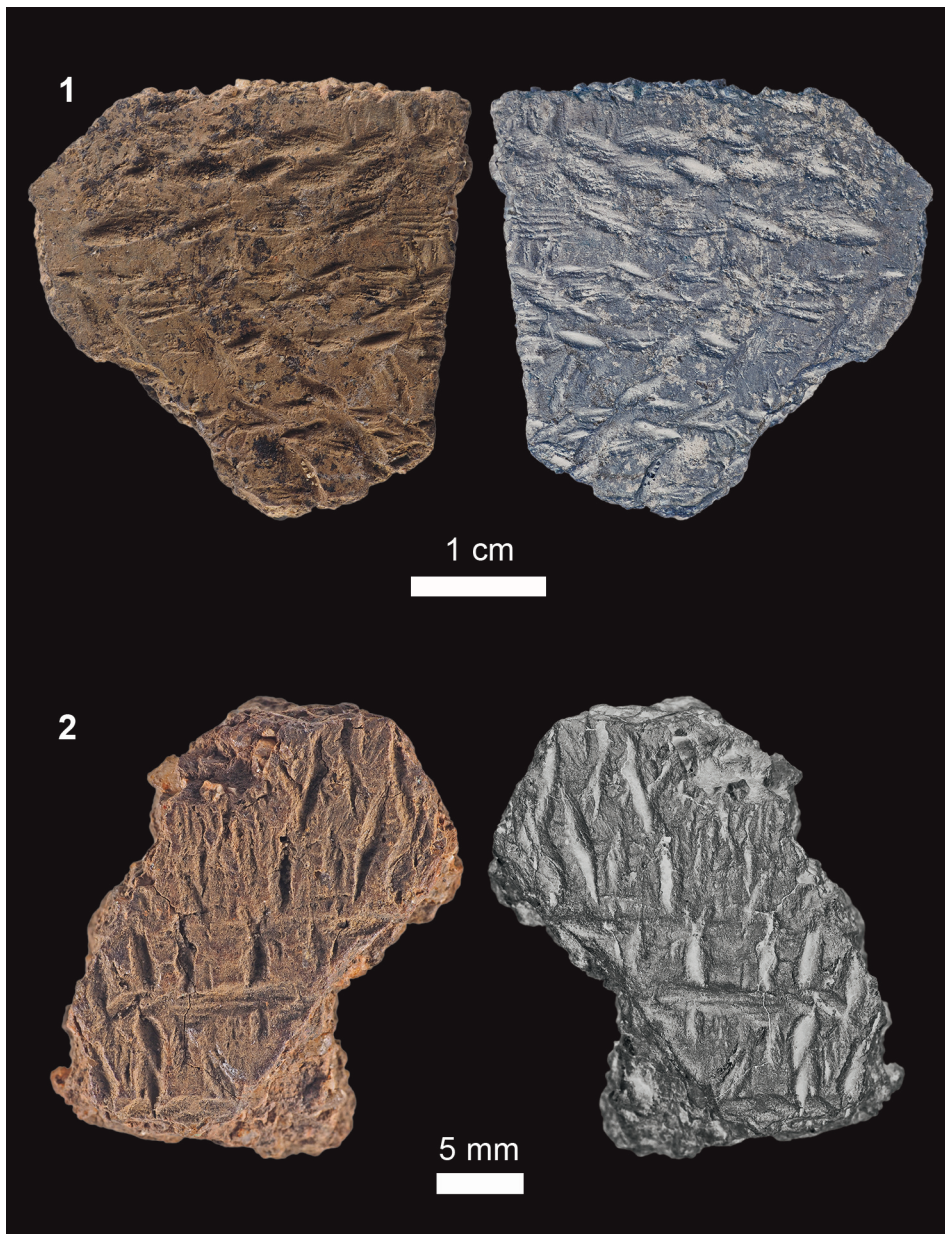


Fig. 12. Examples of pottery fragments with coarser textile imprints, Szczepidło

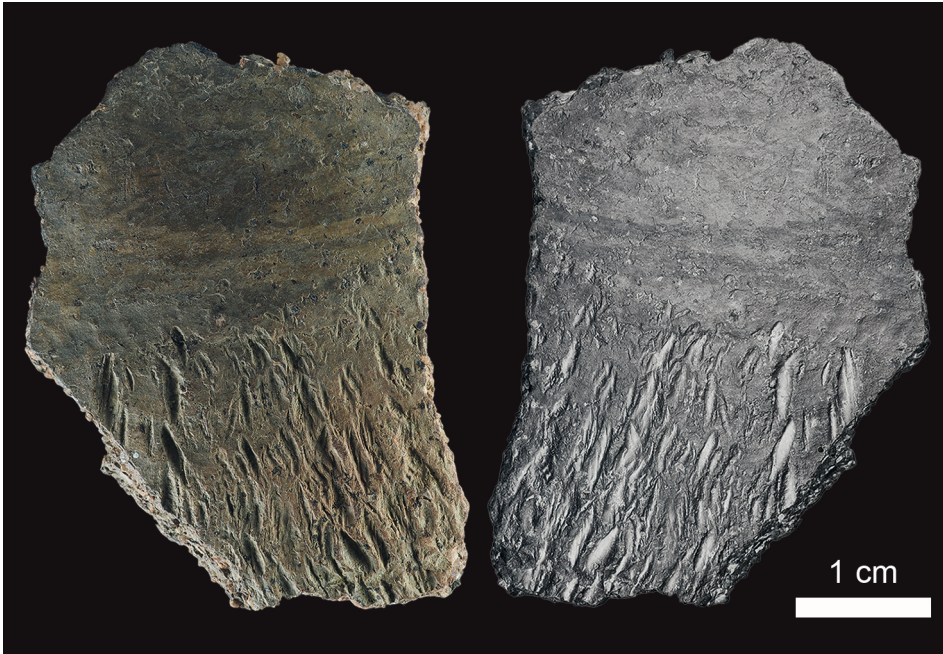


Fig. 13. Pottery fragment with textile imprint of plied yarns, Szczepińsko

of clear imprints of interlacing or looped structures, makes it much more difficult to recognize techniques and implements that leave textile or textile-like pattern on the surface of vessels. It must be emphasized that variability represented *e.g.* by the difference in yarn width within one sherd with textile pattern or imprints in “intersecting” arrangement are often the result of using products with different technical parameters that were pressed on top of each other, creating a layered impression. In addition, imprints resembling ‘textile’ structures with no discernible fibrous pattern, distinctive for spun yarns, could arise with the use of varied types of tools for finishing the vessels surfaces (*cf.* Lasak and Lemańska-Czarniak 2013, figs 1, 2; Rammo 2017, 111-119).

Microscopic observations of pottery fragments and positive moulds led to the conclusion that the patterns resembling imprints of parallel yarn rows – the most numerous in the studied assemblage, were most likely produced by rolling cord or thread wrapped around an implement, such as a stick, rod, or folded cords over the wet surface of a pot. The coarser and less regular imprints, in the form of oval and oblong recesses, could have resulted from using the above-mentioned techniques, but with an application of coarser yarns. The observed characteristic features of this type of surface treatment are: overlapping of parts of imprints with others, shifting of the pattern direction, repeatability of structures and the presence of relatively long fragments of separated threads/cords

imprints which are not dependent on the shape of the vessel. The oblique and V-shaped arrangement of impressions (identified on eight pottery fragments), might also result from 'rouletting' and alternating the direction of the rolled tool. In these cases, different kinds of plaited and knotted structures, for example netting, or knotted cords, which is additionally indicated by the negatives of knots, might have been used.

It is worth mentioning that a similar method of applying textile patterns was identified on the Late Neolithic and Bronze Age pottery from north-eastern Europe. This practice, additionally, has been confirmed by experimental research. Their results showed that the different textures of imprints can be obtained by diversifying the cord/thread raw material and its thickness, soft or hard based tool as well as wrapping density and regularity (*cf.* Dumpe 2006, 71-84; Doumani and Frachetti 2012, 368-382; Lopatina 2017b, 287-296, Fig. 2, 3; Rammo 2017, 111-119).

The arrangement of imprinted textile patterns and overall appearance of the pottery fragments indicate that making an impression was one of the final steps of the pottery preparation before the firing process and thus could be considered as one of the methods of surface finishing. The practice of using textiles during the process of pottery manufacturing could have functional or decorative purposes. It is considered that "technical" textiles were used as a support for shaping or drying/moistening parts of clay products before firing or transportation. The use of various types of rotary tools could provide better merging and levelling the surface of moist clay. A practical function might also have been involved, by increasing the comfort of direct use, especially in case of large vessels, by roughening the surfaces for more firm hold (Dumpe 2006, 71-84; Kłosińska 1997, 40; Lasak 2014, 147; Schaefer-Di Maida and Kneisel 2019, 207; Silska 2012, 101-103; Sørensen *et al.* 2017, 8). Selected fragments of textile-impressed pottery bear traces of smoothing or covering with an additional layer of clay, but only in the chosen parts of vessels, *e.g.* on the necks, leaving the rest of the textile imprint unchanged (*cf.* Makarowicz 2017, 152, fig. 18). The presence of the discussed practice might support the idea that using textiles for decorative purposes was also intentional and thus represented a specific cultural marker. Particular textile patterns on vessels surfaces could be interpreted in terms of skeuomorphs, which means that an ornament or object produced in one material is made to imitate another. This custom may indirectly indicate the growing social and economic importance of textiles during the Bronze Age.

CONCLUSIONS

Despite the lack of actual textile finds, the results of microscopic analyses of textile-impressed ceramics provide insight into technological aspects of Bronze Age textile production in Poland. The largest pool of data in this case is related to the basic elements that form textiles – yarns. Traces of single and plied yarns were recorded. The majority of single

threads used were S-twisted, which is visible as a Z-twisted imprint and most of the analyzed examples of plied yarns were twisted in the opposite directions. The width and twist angle of yarn imprints indicate that both finely spun and coarser materials were in use. Regarding the yarn's quality, two basic categories of imprints can be distinguished: those made relatively precisely, with the use of finely prepared threads and less careful impressions, created using coarser and uneven yarns or cords. Structural features of imprinted threads and cords from the Szczepidło pottery show similarity to textile production patterns from the Bronze Age in other areas of Central Europe. They usually have a diameter of quite fine threads around 0.6-1.2 mm and coarser yarns measuring 1.2-2.5 mm (Grömer 2012, 30, 31; Belanová-Štolcová 2012, 309, 310). It can be stated that inhabitants of Szczepidło settlement had knowledge and skills to manufacture textiles of varying thickness and quality.

Using textile products for finishing the surface of the vessels proves not only the practical skills of the manufacturers but also offers better understanding of the aesthetic categories which they followed. Moreover, the fact that textiles were widely used in different utilitarian contexts makes it possible to trace how various crafts were combined. This study indicates that the geographically and chronologically broad tradition of making textile-impressed pottery was also cultivated by Middle and Late Bronze Age societies from the Szczepidło settlement. We argue that detailed analysis of textile imprints is a significant complement for comparative studies focused on textiles and pottery-making technologies as well as on interactions between social groups.

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References

- Bartkowski T. 1978. Środowisko przyrodnicze grodu wczesnośredniowiecznego w Łądzie nad Wartą Środkową. In W. Błaszczuk (ed.), *Gród wczesnośredniowieczny w Łądzie nad środkową Wartą*. Poznań: Muzeum Archeologiczne w Poznaniu, 13-31.
- Belanová-Štolcová, T. 2012. Slovak and Czech Republics. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe from Prehistory to AD 400 (= Ancient Textiles Series 11)*. Oxford: Oxbow Books, 306-331.
- Bender Jørgensen L. 1992. *North European Textile until AD 1000*. Aarhus: Aarhus University Press.
- Bender Jørgensen L. and Rast-Eicher A. Data Fibres for Bronze Age Textiles. In L. Bender Jørgensen, J. Sofaer and M. L. Stig Sørensen (eds), *Creativity in the Bronze Age. Understanding Innovation in Pottery, Textile, and Metalwork Production*. Cambridge: University Press.

- Dąbrowski J. 1972. *Powiązanie ziem polskich z terenami wschodnimi w epoce brązu*. Wrocław, Warszawa, Kraków, Gdańsk: Zakład Narodowy im. Ossolińskich, Wydawnictwo Polskiej Akademii Nauk.
- Dąbrowski J. 2004. *Ältere Bronzezeit in Polen*. Warszawa: Instytut Archeologii i Etnologii Polskiej Akademii Nauk.
- Doumani P. N. and Frachetti M. D. 2012. Bronze Age textile evidence in ceramic impressions: weaving and pottery technology among mobile pastoralists of central Eurasia. *Antiquity* 86, 368-382.
- Drooker P. 2000. Approaching Fabrics Through Impressions on Pottery. *Textile Society of America Symposium Proceedings* 773, 59-68.
- Dumpe B. 2006. Agrārs Tekstilās Keramikas Faktūru Veidošanas Īpatnības. *Arheologija un Etnografija* 23, 71-84.
- Gedl M. 1975. *Kultura przedłużycka*. Kraków: Ossolineum.
- Gleba M. and Mannering U. 2012. *Textiles and Textile Production in Europe from Prehistory to AD 400* (= *Ancient Textiles Series* 11). Oxford: Oxbow Books.
- Gleba M. 2017. Tracing textile cultures of Italy and Greece in the early first millennium BC. *Antiquity*, 91(359), 1205-1222. doi:10.15184/aqy.2017.144
- Grömer K. 2012. Austria. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe from Prehistory to AD 400* (= *Ancient Textiles Series* 11). Oxford: Oxbow Books, 27-64.
- Grömer K. 2016. *The Art of Prehistoric Textile making*. Vienna: Natural History Museum.
- Grömer K. and Kern D. 2010. Technical data and experiments on corded ware. *Journal of Archaeological Science* 37, 3136-3145.
- Grömer K., Miheliä S., Sofaer J., and Coxon S. 2017. Creating Effects in Lützenkeramik. In L. Bender Jørgensen, J. Sofaer and M. L. Stig Sørensen (eds), *Creativity in the Bronze Age. Understanding Innovation in Pottery, Textile, and Metalwork Production*. Cambridge: Cambridge University Press.
- Kadrow S. and Machnik J. 1997. *Kultura mierzanowicka. Chronologia, taksonomia i rozwój przestrzenny*. Kraków: Wydawnictwo Instytutu Archeologii i Etnologii PAN.
- Kondracki J. 1994. *Geografia Polski. Mezoregiony fizyczno-geograficzne*. Warszawa: Wydawnictwo Naukowe PWN.
- Kopacz J. 2001. *Początki epoki brązu w strefie karpackiej w świetle materiałów kamiennych*, Kraków: Wydawnictwo Instytutu Archeologii i Etnologii PAN.
- Kostrzewski J. 1926. Materiały do pradziejów Górnego Śląska. *Przegląd Archeologiczny* 3, 209-213.
- Kowiańska-Piaszykowska A. 1966. Cmentarzysko z II okresu epoki brązu w Pudliszkach w pow. gostyńskim. *Przegląd Archeologiczny* 18, 86-119.
- Lang V. 2007. The Bronze and Early Iron Ages in Estonia. *Estonian Archaeology* 3, 126-136.
- Lasak I. 2014. Materiał ruchomy z osady kultury łużyckiej. In M. Masojć (ed.), *Obozowiska, osady, usie. Wrocław – Widawa 17*. Wrocław: Instytut Archeologii Uniwersytetu Wrocławskiego, 89-158.
- Lasak I. and Lemańska-Czarniak K. 2013. Tak zwana ceramika tekstylna i pseudotekstylna jako wyznacznik chronologiczno-kulturowy. In J. Kolenda, A. Mierzwiński, S. Moździoch and L. Żygadło (eds), *Z badań nad kulturą społeczeństw pradziejowych i wczesnośredniowiecznych. Księga*

- jubileuszowa dedykowana Profesorowi Bogusławowi Gedidze, w osiemdziesiątą rocznicę urodzin przez przyjaciół, kolegów i uczniów*. Wrocław: Instytut Archeologii i Etnologii Polskiej Akademii Nauk, Ośrodek Badań nad Kulturą Późnego Antyku i Wczesnego Średniowiecza.
- Lavento M. 2001. *Textile Ceramics in Finland and on the Karelian Isthmus (= Suomen Muinaismuistoyhdistyksen Aikakauskirja 109)*. Helsinki: Suomen Muinaismuistoyhdistys.
- Lavento M. and Patrushev V. S. 2015. Appearance and chronology of textile ceramics in the middle and upper Volga region. Critical comparison of conventional ¹⁴C-, AMS- and typological chronologies. *Povolzhskaya Arkheologiya* 2/12, 160-188.
- Lopatina O. R. 2017a. Tekstilnye otpechatki na drevney keramike: problemy nterpretatsii (Textile imprints on early pottery: issues of interpretation). *Rossiyskaya Arkheologiya* 1, 168-179.
- Lopatina O. R. 2017b. Relefnoe prokатыvanie poverkhnosti kak priemsozdaniya tak nazyvaemykh "tekstilnykh" optechatkovna drevney keramike (The Typology of Textile Prints and the Chronological Distribution of the Individual Types of Textile Patterns. Supplemented with Drafts). Materialy III mezhdunarodnoy nauchnoy konferentsii "Ananinskiymir: kulturnoe prostranstvo, svyazi, traditsii i novatsii", *Archaeology of the Eurasian steppes (Arkheologiya Evraziyskikh stepey 4)*. Kazan: State institution "Tatarstan Academy of Sciences", 287-296.
- Maik J. 2012. Poland. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe: from Prehistory to AD 400 (= Ancient Textiles Series 11)*. Oxford: Oxbow Books, 293-305.
- Makarowicz P. 2016. *Szczepidło. Osada metalurgów kultury mogiłowej nad Wartą (= Archaeologia Bimaris. Monografie 9)*. Poznań: Archaeologia Bimaris, Uniwersytet im. Adama Mickiewicza w Poznaniu, Wydział Historyczny, Instytut Archeologii, Zakład Prahistorii Europy Środkowo-Wschodniej.
- Makarowicz P. 2017. The birth of a new world. Barrows, warriors, and metallurgists (1600-1200/1100 BC). In P. Urbańczyk and U. Bugaj (eds), *The Past Societies. Polish Lands from the first Evidence of Human Presence to the Early Middle Ages*. Vol. 3. 3 2000-500 BC, chapter 5. Warszawa: Institute of Archaeology and Ethnology, Polish Academy of Sciences, 128-186.
- Mazăre P. 2011. Textile Structures and Techniques Identified in Neolithic and Copper Age Sites from Romania. *Marisia* 31, 27-48.
- Podkańska M. 2012. Odciski tekstylne na ceramice. In P. Silska (ed.), *Wczesnobrązowa osada obronna w Bruszczewie. Badania w latach 1964-1968*. Poznań: Muzeum Archeologiczne, 207-213.
- Rammo R. 2017. Textile-impressed Pottery Revisited: Its Usefulness for Studying Bronze Age Textile Craft in Estonia. *Światowit* 56, 111-119.
- Schaefer-Di Maida S. and Kneisel J. 2019. Textile ceramics as complement to textile research. In S. Sabatini and S. Bergerbrandt (eds), *The Textile Revolution in Bronze Age Europe*. Cambridge: Cambridge University Press, 197-216.
- Schlabow K. 1960. Abdrücke von Textilien an Tongefäßen der Jungsteinzeit. *Jahresschrift für mittel-deutsche Vorgeschichte* 44, 51-56.
- Sikorski A. 2016. Odciski tekstylne na ceramice z epoki brązu ze Szczepidła, gm. Krzymów, woj. wielkopolskie, stan. 17. In P. Makarowicz (ed.), *Szczepidło. Osada metalurgów kultury mogiłowej nad Wartą (= Archaeologia Bimaris. Monografie 9)*. Poznań: Archaeologia Bimaris, Uniwersytet

im. Adama Mickiewicza w Poznaniu, Wydział Historyczny, Instytut Archeologii, Zakład Prahistorii Europy Środkowo-Wschodniej, 503-519.

Silka P. 2012. *Wczesnobrązowa osada obronna w Bruszczewie. Badania 1964-1968*. Poznań: Muzeum Archeologiczne.

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

Sørensen M. L. S., Sofer J. and Bender Jørgensen L. 2017. Introduction. In L. Bender Jørgensen, J. Sofer and M. L. Stig Sørensen (eds), *Creativity in the Bronze Age. Understanding Innovation in Pottery, Textile, and Metalwork Production*. Cambridge: Cambridge University Press, 1-17.