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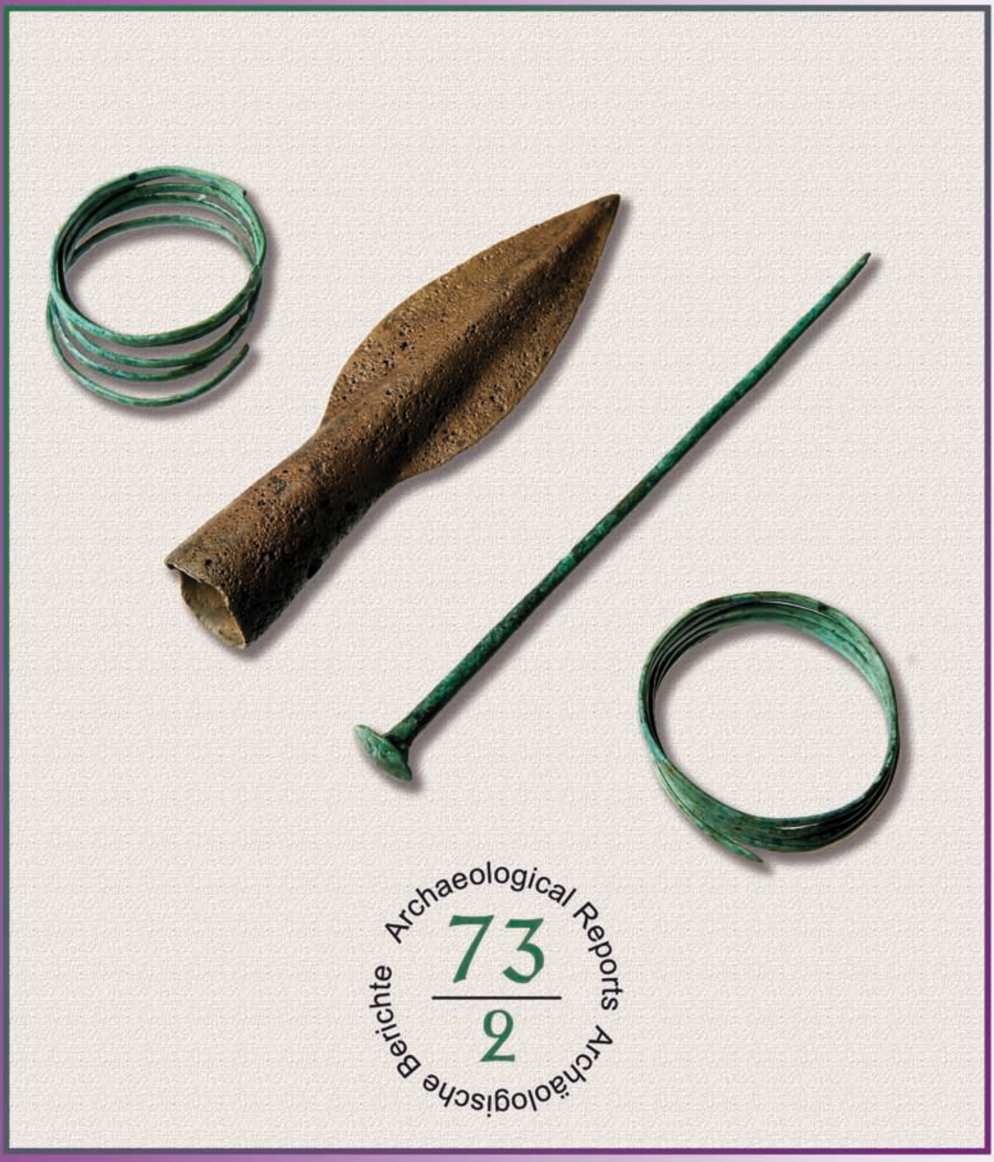

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Cover
Bronze artifacts from Nieciecz Włościańska, site 11, Grave 2
Photo by P. KOBEK, modified by J. Kulczyńska-Kruk

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A R T I C L E S

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BARK PITCH IN THE EARLY NEOLITHIC OF CENTRAL EUROPE

ABSTRACT

Kotova N., Stadler P. and Goslar T. 2021. Bark pitch in the Early Neolithic of Central Europe. *Sprawozdania Archeologiczne* 73/2, 9-23.

The Linear Pottery people in 5670-5000 BC at the Brunn sites in Austria produced birch and beech bark pitches. Big globular vessels and closed high bowls could have been containers for the production and storage of this substance. Miniature vessels with a handle for hanging had contained small portions. Bark pitch as an adhesive for the repair of pottery and in the construction of big idols is also testified, as is the application of this material in decoration of vessels and idols, where bark pitch was a matrix for inlaying with grains or stones and creation of a contrasting black colour in linear ornamentation. Radiocarbon dating of bark pitch now is one of the most reliable materials for age determination of the Neolithic objects.

Keywords: Linear Pottery culture, Central Europe, using of bark pitch in the Neolithic, radiocarbon dates
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INTRODUCTION

Bark pitch was widely used in the Palaeolithic, Mesolithic and Neolithic periods. It can be considered as a substance that in prehistoric times was a real “multifunctional“ one: it is known to have been frequently used for a variety of purposes, *e.g.*, as coating of pottery, as an adhesive for ancient repair work, and in the construction of weapons (*e.g.* fixing flint arrowheads to their handles or shafts), and even as a gift offered in ancient rites (Sauter

Fig. 1. Location of the Brunn sites

et al. 2019). Data have been collected (Hansen 2019) about the use of pitch and bitumen for the decoration of the Prehistoric idols in the Near East (as imitation of hair) and on European Neolithic pots (Geometric patterns were formed with straw pieces inserted into bitumen in the Tisza culture, ornamental patterns in birch pitch coatings to Cortaillod vessels). Small lumps of this organic material are found on archaeological sites with tooth imprints, indicating that they were chewed. Ethnographic evidence suggests that birch pitch was used as a natural antiseptic for preventing and treating dental ailments and other medical conditions, because of the presence of botulin, which is one of the main constituents of birch pitch (Jensen *et al.* 2019).

MATERIALS

A collection of ceramics with bark pitch has been studied at the sites of the Linear Pottery culture in Lower Austria (Sauter *et al.* 2019). In 1989-2005 P. Stadler excavated six sites of the Linear Pottery culture (Brunn 1-6, see Fig. 1) near the village Brunn am Gebirge, 1 km from the southern outskirts of Vienna. These sites demonstrate a development of the local Linear Pottery culture from the Formative phase (Brunn 2 site, 5660-5350 calBC) till the Note phase (the Brunn 6 site, 5050 calBC). Three sites (Brunn 1, 2 and 3) contain sherds with bark pitch. These sherds belong to seven vessels from the Brunn 1 site (the Flomborn phase), two vessels from the Brunn 3 site (the Milanovce phase); six vessels and an idol from Brunn 2 (the Formative phase). Only in one feature we have found three vessels with black spots (Feature 2111 in House 67 at Brunn 1, Fig. 2: 1-3) and in two other features – two vessels (Feature 2107 in House 68 and Feature 88 in House 7 at Brunn 2). Other vessels have been found in different houses and features.

RESULTS

Chemical analysis was conducted for eight samples of vessels (Fig. 2: 5, 6; 3; 4; 5: 2; Puchinger *et al.* 2019) and for an idol (Fig. 6; Sauter *et al.* 2019). Most of these vessels have spots of pitch made from the bark of the birch (*Betula pendula*) and Sample 7 (Fig. 4: 3) was prepared from the European beech (*Fagus sylvatica*).

DISCUSSION

The location of the bark pitch spots serves as a basis for reconstruction the usage of this material. We can divide the examined ceramics with bark pitch into three groups: pottery with amorphous spots and ceramics with bark pitch as a part of the decoration and using of this material as adhesive.

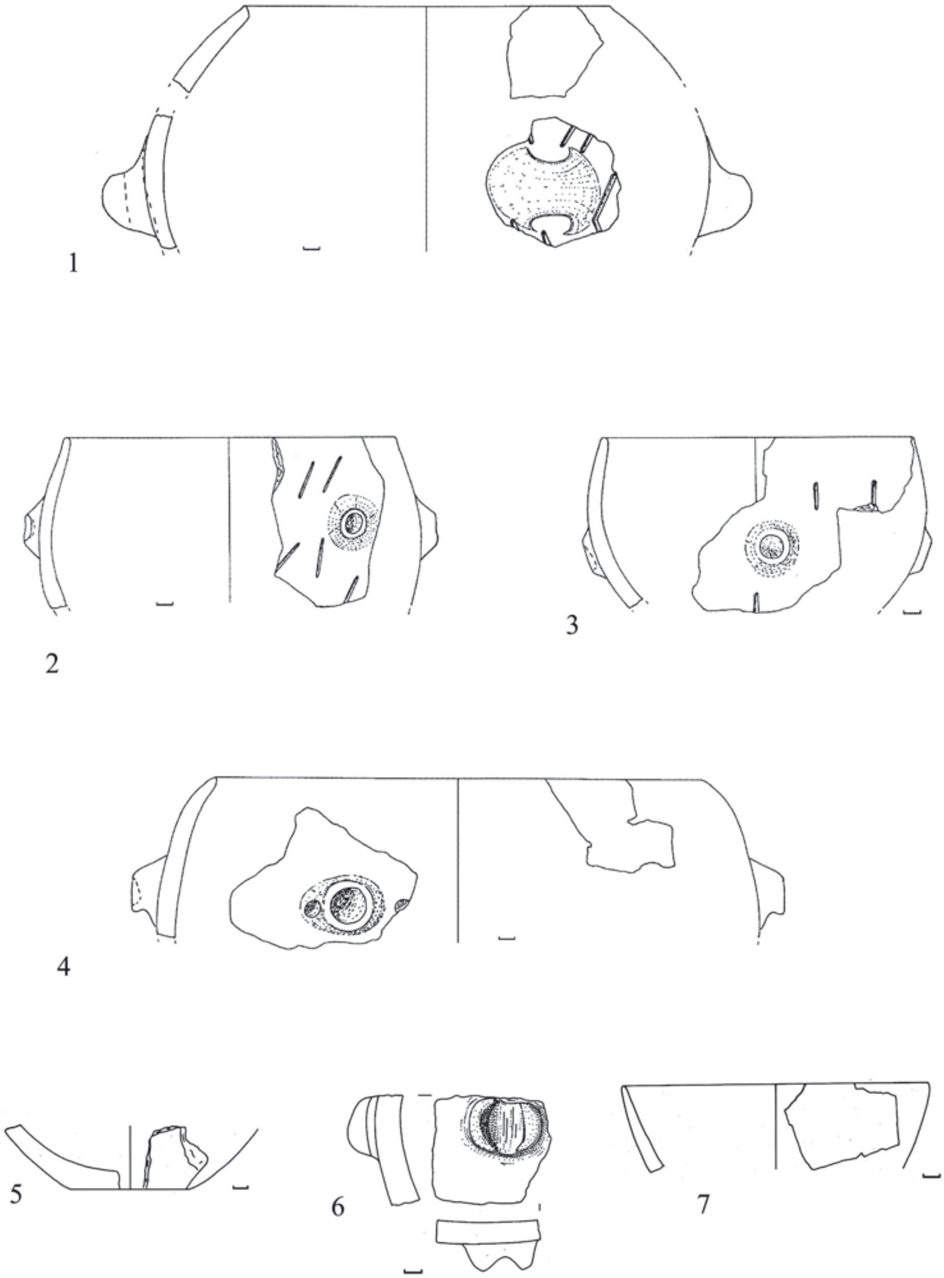

Fig. 2. Pottery with bark pitch of the Brunn 1 site:
1-3 – Feature 2111; 4 – Feature 2114; 5 – Feature 88; 6 – Feature 123; 7 – Feature 202
(Drawings: Nadezhda Kotova)

The first group includes most of the vessels that exhibit small spots of bark pitch on their surfaces. Analysis of the types of these vessels has shown one big globular vessel (Fig. 2: 1), three closed high bowls (Fig. 2: 2, 3, 4), one open high bowl (Fig. 3: 4), an amphora (Fig. 5: 1), two miniature vessels with handles (Fig. 4), two bases from not big vessels (Fig. 2: 5; 3: 8) and two fragment of walls (Fig. 2: 6; 3: 7). The most interesting set of vessels with bark pitch was in Feature 2111: a big globular vessel and two middle size closed high

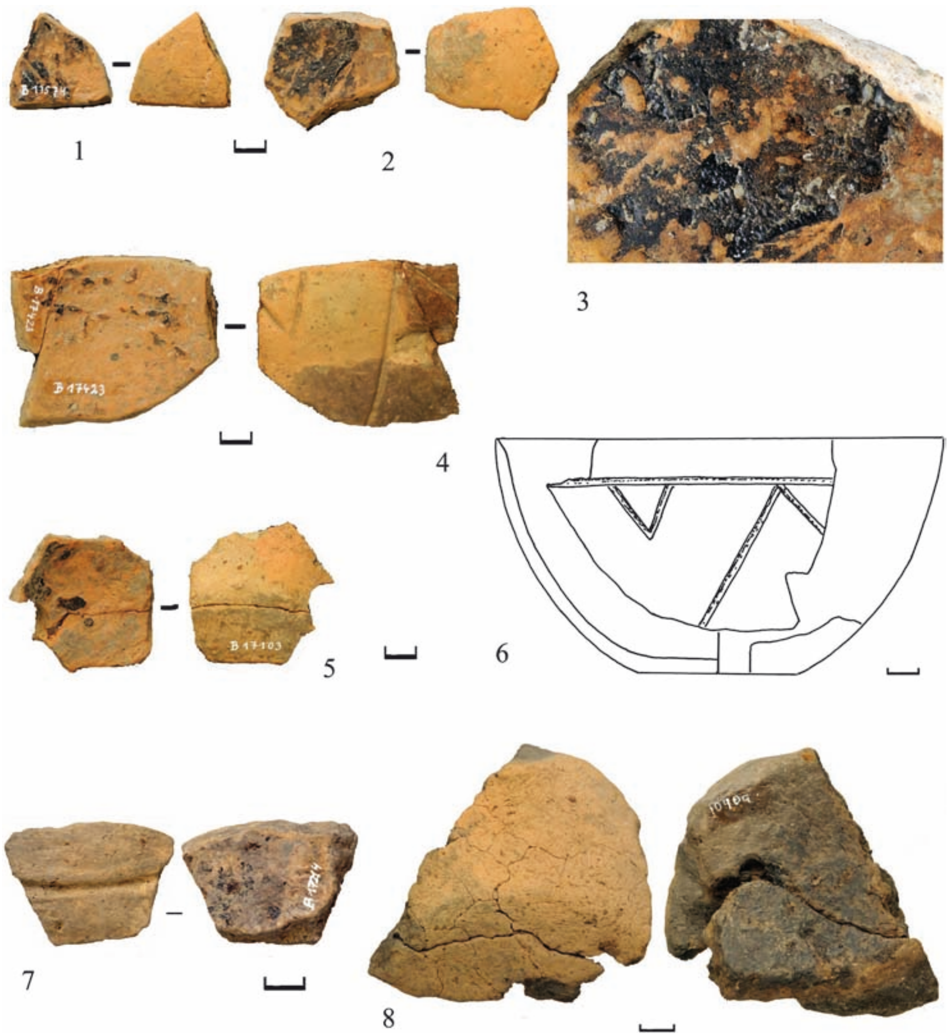

Fig. 3. Pottery with bark pitch: 1-7 – Brunn 1 Feature 2107; 8 – Brunn 2 Feature 101 (Photos: Alice Schumacher; drawings: Nadezhda Kotova)

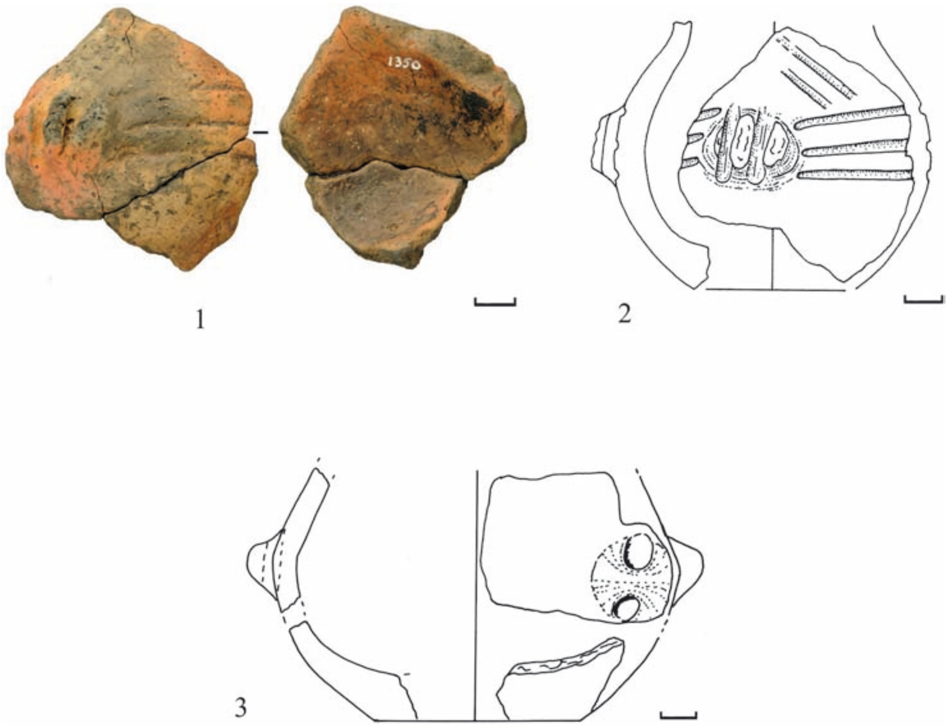

Fig. 4. Pottery with bark pitch: 1, 2 – Brunn 2 site, Feature 144; 3 – Brunn 3, Feature 1717 (Photos: Alice Schumacher; drawings: Nadezhda Kotova)

bowls (Fig. 2: 1-3). Only the amphora and a fragment with knob from a big vessel have black spots on the outer surfaces (Fig. 2: 6; 5: 1). The black spots on the other vessels are located on the inside surface of walls and bases.

Vessels for production and storage of pitch

Two miniature pots with spots of bark pitch inside had exceedingly small handles that could have been used only for hanging (Fig. 4). These miniature vessels could have served for storage.

Big vessels (the globular vessel and high bowls) could have been containers used in the process of production or storage of bark pitch. The three oldest methods of bark production have been reconstructed and two of them needed containers (Kozowyk *et al*. 2017). It is possible that the inhabitants of House 67 at Brunn 1, where three big closed vessels were found (Fig. 2: 1-3), produced and stored bark pitch.

Possible using of pitch together with a bung for closure of an amphora

Two big vessels with bark pitch on the outer surfaces, among which are the amphora (Fig. 5), could have received these spots accidentally. It is an attractive idea that wine or beer was stored in this amphora and its mouth was closed with a bung together with bark pitch. However, we have no information about the use of alcohol at the Brunn sites, only the impression of barley grain on the idol from the Brunn 2 site (Kotova and Stadler 2019, 381) and carbonized wheat grains in a pit at Brunn 6 (Wiesinger 2019). Excepting numerous amphorae, the Brunn collection includes a small vessel of specific shape, similar to a modern wineglass (Fig. 5: 3).

Bark pitch usage as adhesive

The possible use of bark pitch as an adhesive is represented by a small low bowl, which has a spot on the break point (Fig. 2: 7). This localization allows the assumption that this material was used for the repair of this small vessel.

Bark pitch was also used as an adhesive in the construction of a big idol from the Brunn 2 site. This idol may have had a height of about 30 cm (Fig. 6). A vertical hole was situated in the centre of the head and it had traces of bark pitch, which are visible in photographic magnification. It is possible to guess that a small wooden stick connected head and body and that the bark pitch served as a stable fixation.

Usage of bark pitch as a part of decoration

The big idol from the Brunn 2 site has a linear decoration. Some spots of black birch pitch are preserved in a few places in the lines, which are visible in magnified photographs (Fig. 6), and in the eyes. This suggests an idea about the inlaying of the big round eyes with grains or stones. This possibility was assumed for the round eyes of other LBK idols (Gallay and Hansen 2006). S. Hansen assumes that the birch pitch detected in the incised lines on the hips of this idol could have been used to attach an additional material, *e.g.* fabric, leather or straw or served as a colour contrast, including the possibility that the statuette from Brunn am Gebirge was wholly or partly covered with birch pitch (Hansen 2019). We think that bark pitch in the lines of decoration could have also been used for the fixation of grains or to create a contrast of black colour for the linear decoration.

Beech bark pitch was preserved also in the lines of decoration on a high bowl from the Brunn 3 site (Fig. 5: 2). We assume that this bowl was inlaid with grains that were put in the line on a black matrix layer of beech bark pitch. The background to this hypothesis is the shape of two lines, which consist of ovals, similar in size to that of grains.

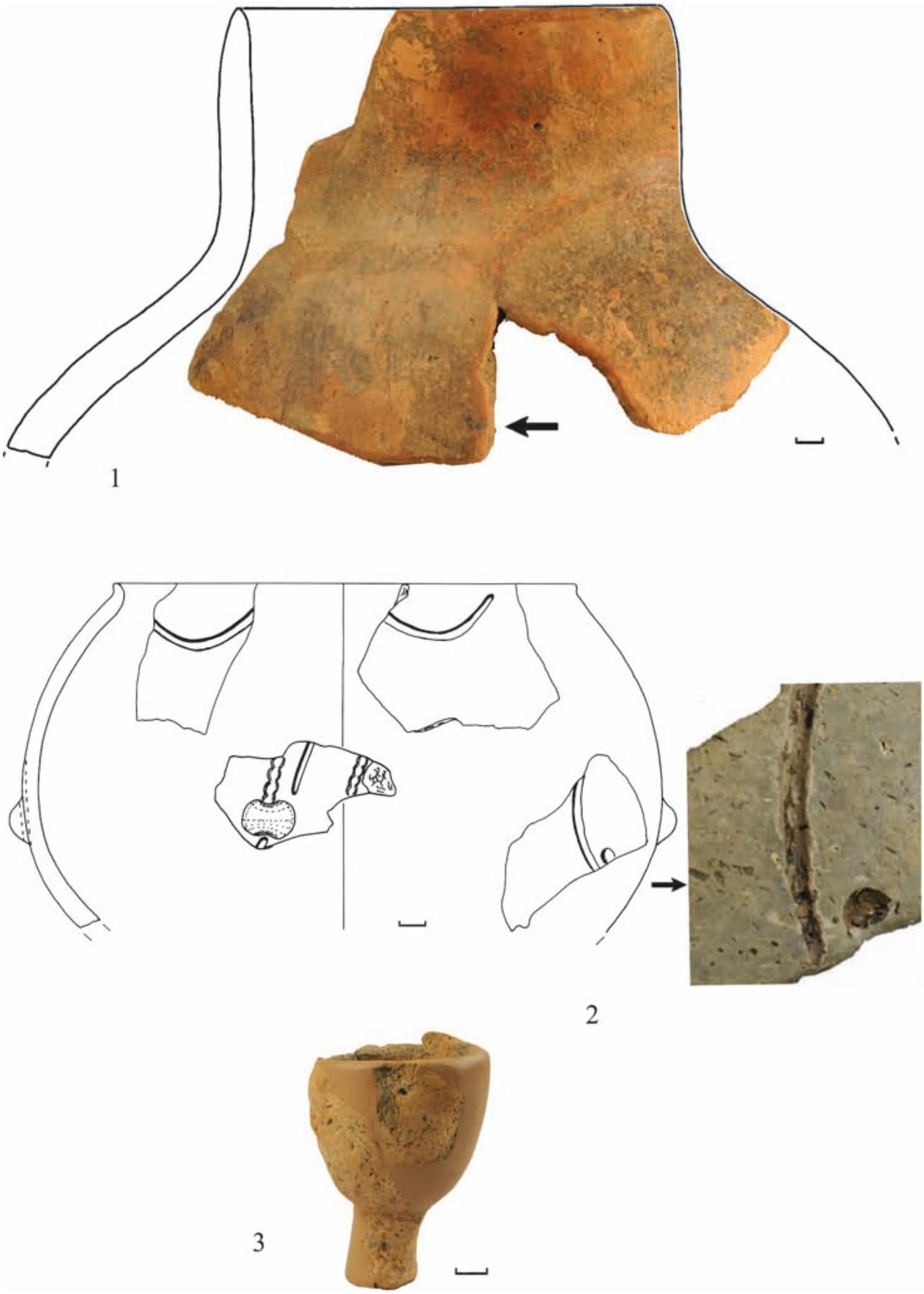

Fig. 5. Pottery with bark pitch: 1 – Brunn 1 Feature 1222; 2, 3 – Brunn 3, Feature 1773
(Photos: Alice Schumacher; drawings: Nadezhda Kotova)

Fig. 6. Idol with bark pitch from Feature 167 of the Brunn 2 site
(Photos: Alice Schumacher)

The use of bark pitch in the study of the Central European Early Neolithic

Radiocarbon dating of bark pitch is an extremely important variant of using of this material in the study of Linear Pottery culture. The method of radiocarbon dating by AMS now is the most popular among archaeologists for the definition of the age of ancient objects; experts from different laboratories are constantly improving it and receiving better and better results. However, now we have the same problems as fifty year ago, which cannot be decided with the improvement of new AMS apparatus and new methods of carbon cleaning. These objective problems are connected with the old-wood effect, which appear in the dating charcoal or some wood products from archaeological objects, or with the reservoir effect with human bones, the bones of some animals and even of charred residue adhering to pottery, in which sea or river food products were cooked. Hope is often placed in the use of material such as seeds as a reliable sample for radiocarbon dating, but this is only justifiable if they were found in a pot or in a fireplace or in a storage building (as we have found it at Brunn), when we can be sure that they belonged to the main phase of settlement. However, sometimes they are found in a pit without pottery, which could be older or younger than the main site, on which these pits are located.

Some years ago, the method of direct dating of carbon from organic additions in ceramics looked like a way that could be improved in the nearest future. Numerous dates were received, especially for the Russian Neolithic. The results were collected in some articles in *Documenta Praehistorica* 44, 2017, for example, Lychagina and Vybornov 2017. However, all these dates from different laboratories can be considered as reliable only in the few cases when they are similar to dates for botanical and collagen dates and can be used only together with other dates, if no contradictions arise in the results. For example, numerous and various samples for radiocarbon dating from the Brunn sites (charcoal, animal and human bones, seeds, organic additions in ceramic clay, and bark pitch) allow us to eliminate a series of dates for pottery that are younger by 1000 years or older by 700 years. This fact minimizes the usefulness of making of dates from carbon contained in the pottery fabric at the current level of cleaning carbon from ceramics and separation of organic remains from plants that were added to clay, and the organic remains (carbonised residues of vegetation of land and water origin) from the silt from which the main part of the Eastern European Neolithic pottery was made (Vasileva 2006).

Now a new method of dating of lipids from pottery is beginning to be used and it looks to really be one of the most reliable (Casanova *et al.* 2020). However, this method is not applicable to mass dating because of the specific process of lipid separation.

All these facts make the dating of bark pitch from prehistoric sites very important. For a long time it has been in use for definition of age of the Neolithic and Eneolithic sites in Fennoscandia, where about 60-70 prehistoric sites were known by the end of the 20th millennium (Pesonen 1999). Numerous dates in different laboratories were made for samples of bark pitch in this region and related areas of Russia (Tarasov *et al.* 2017).

Table 1. Radiocarbon dates of the Brunn sites

Phase	Site	Object	House	Inventory number	Material	Number of sample	Index	BP	Sigma	CalBC1	CalBC2	Pretreatment protocol	To prep (mg)	After prep (mg)	Carbon (mg)	%C
1	Brunn 2	167	16	1295_1	Birch pitch	Brunn_123	Poz-66176	6680	40	5640	5555	ZR	16.1	3.8	3.14	82.6
1	Brunn 2	101	9	1040a_2	Birch pitch	Brunn_140	Poz-91063	6470	50	5480	5370	ZR	17.3	3.3	0.32	9.7
1	Brunn 2	88	7	166	Birch pitch	Brunn_122	Poz-79948	6430	40	5470	5370	TOC	2.7	1.2	0.42	35
1	Brunn 2	88	7	171a_3	Birch pitch	Brunn_131	Poz-66175	6410	50	5470	5340	ZR	14.4	2.9	2.02	69.7
1	Brunn 2	144	10	1350_2	Birch pitch	Brunn_135	Poz-79951	6400	40	5470	5320	TOC	3.3	0.8	0.27	33.8
1	Brunn 2	101	9	1040a_2	Birch pitch	Brunn_132	Poz-79949	6380	40	5470	5310	TOC	7.6	5.3	0.8	15.1
1	Brunn 2	144	10	1350_2	Birch pitch	Brunn_134	Poz-79950	6360	50	5470	5300	TOC	3.5	1.6	0.31	19.4
1	Brunn 2	123	15-16	1098i_1	Birch pitch	Brunn_133	Poz-79931	6280	90	5370	5070	TOC	3.1	0.8	0.13	16.3
2	Brunn 3	1773	38	16040_11	Birch pitch	Brunn_141	Poz-91064	6520	40	5530	5460	ZR	4.7	2	1.44	72
2	Brunn 3	1773	38	16040_11	Birch pitch	Brunn_137	Poz-79952	6300	40	5315	5220	TOC	3.1	1.1	0.57	51.8
2	Brunn 3	1717	34	15901_3	Beech pitch	Brunn_136	Poz-79932	6210	70	5300	5050	TOC	1.5	0.6	0.07	11.7
3	Brunn 1	2107	68	17214	Birch pitch	Brunn_128	Poz-79944	6300	40	5315	5220	ZR	8.4	3.9	3.15	80.8
3	Brunn 1	2107	68	17423_2	Birch pitch	Brunn_130	Poz-79946	6255	35	5300	5215	TOC	4	1.7	1.24	72.9
3	Brunn 1	2107	68	17423_2	Birch pitch	Brunn_129	Poz-79945	6180	40	5210	5060	TOC	5.3	2.4	1.85	77.1

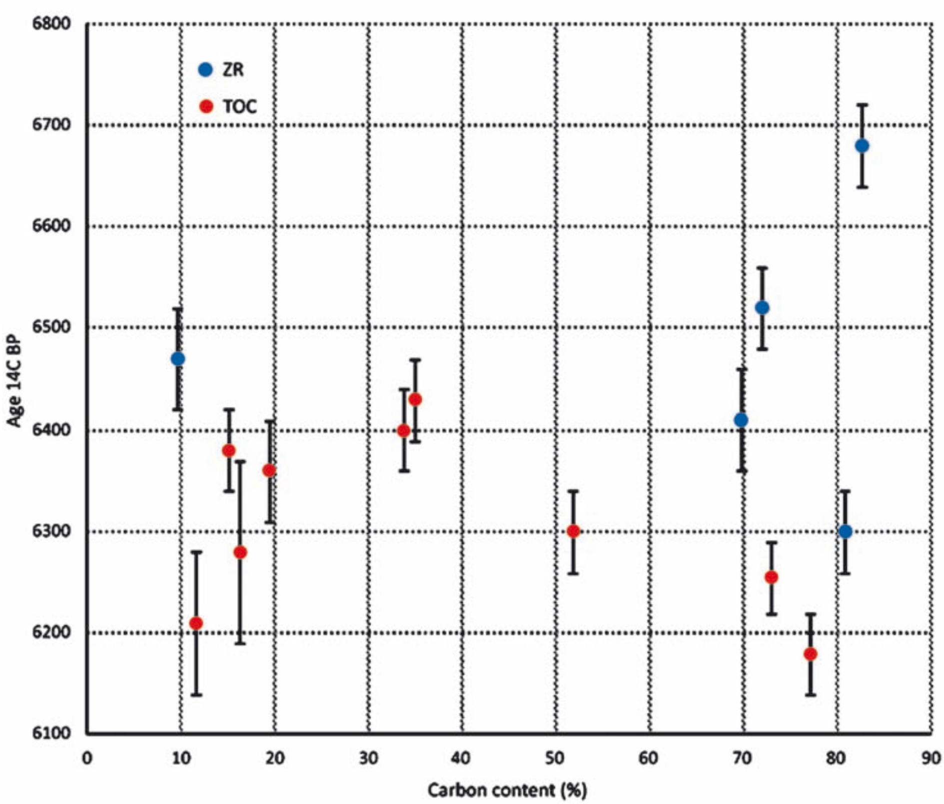

Fig. 7. ^{14}C ages vs percentage of carbon of the bark pitch samples analyzed in the present work. Two methods of sample pretreatment (ZR, TOC – see the text) have been distinguished

We have dated 14 of the samples with bark pitch in the Poznan Radiocarbon Laboratory (Goslar *et al.* 2004). The other four fragments with this material do not contain enough material for dating. The details of laboratory processing and the dating results are presented in Table 1. Samples of bigger mass, or those appearing to be rich in carbon, were chemically treated with the ZR protocol (after Brock *et al.* 2010) removing carbonates with 1M HCl and humic acids with 0.1 M NaOH. Smaller samples, and samples looking to be poor in carbon, were treated only with HCl, just to avoid complete loss of carbon. In Table 1, this gentler treatment was coded as TOC (= total organic carbon). Generally the small masses of samples (between 1.5 and 17.3 milligram, see Table 1) generally precluded taking of aliquots for preliminary analysis of carbon content in the raw material, so chemical treatment (either ZR or TOC) was performed on the whole samples available, and carbon content could be determined only after combustion of the material that passed the chemical treatment. So, the preliminary assessment of carbon content (determining the decision whether to apply the “strong” (ZR) or the gentle (TOC) treatment) could be checked only after the chemical treatment was completed.

As shown in Table 1 and Fig. 7, carbon percentages in the analyzed samples covered a very wide range (between 9.7% and 82.6%) suggesting that most of these samples were not pure pitch but were rather mixtures of pitch and the ceramic matrix. One could then suppose that old carbon bound to minerals constituting the ceramic matrix, could have affected the dating results. If this were the case, the ^{14}C ages should reveal a negative correlation with the carbon content, a relationship that obviously did not occur (Fig. 7). So, we can claim that the carbon from ceramic matrix, did not affect the dating results in an appreciable way.

On the other hand, ^{14}C ages measured on samples treated with the TOC protocol, on average are 100-150 years younger than the ages of samples that passed the full treatment (ZR). The age difference (of 220±60 ^{14}C years) is directly revealed by the two dating results (Poz-91064 and Poz-79952) obtained on samples coming from the same vessel (Inventory number 16040_11), but chemically processed in the two different ways. We thus claim that ^{14}C ages measured on samples treated in the gentler way (TOC) were affected by humic acids, which may be mobile in sediments and might have brought with it carbon descending from later soil horizons. In this respect, ^{14}C ages of samples treated with the ZR protocol may be regarded as the representative ones, whereas those obtained from the TOC fractions should be treated as minimum ages, most probably 100-150 years younger than the actual ages of the analyzed vessels. It is worth pointing out that the range of the “ZR” ages suggests that the vessels were produced over a rather long period (*c.* 300 years or more), an indication that seems to be confirmed by the *c.* 250 year span of ^{14}C ages measured on the TOC fractions of the pitch.

CONCLUSION

The material from the Brunn sites discussed here demonstrate that the Linear Pottery people in 5670-5000 BC produced birch and beech bark pitches. They used pottery (big globular vessels and closed high bowls) as containers during the production and for storage of this substance. Two miniature vessels with handle for hanging had contained small portions of birch and beech bark pitches, which could have been used in medicine or as chewing gum. Both possibilities may be assumed for the prehistory (Jensen *et al.* 2019). We also see evidence of the use of bark pitch as an adhesive for the repair of pottery and in the construction of big idols. An interesting manner of use is the an application of this material in the decoration of ceramics, where we can guess it played a basic role for inlaying items with grains or stones and creation of a contrasting black colour in linear ornamentation. We do not have any material for reconstruction of the use of bark pitch for waterproofing close-shaped vessels as in the Neolithic sites of Northern Greece, which were synchronous with the Brunn sites (Mitkidou *et al.* 2008).

Numerous radiocarbon dates for the Brunn sites (Stadler 2019) have shown that bark pitch now is the most reliable material for age determination of Neolithic objects. The significance of this material increases in the study of the micro chronology of the Neolithic and Eneolithic cultures, which existed not more than 600 years, but archaeologists separate two and more periods of their development (as in the Linear Pottery culture). Especially in situations when houses of some periods are located near each other and nobody can be sure about the associations of bones or seeds with any of them.

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Dmytro Kiosak[1], Mariia Lobanova[2]

ON THE CHRONOLOGY OF THE SABATYNIVKA GROUP OF THE CUCUTENI-TRYPILLIA CULTURAL COMPLEX (CENTRAL UKRAINE)

ABSTRACT

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The paper discusses the dating of the Sabatynivka group of the Cucuteni-Trypillia culture. The authors have compared the sets of radiocarbon dates obtained for the sites of this group, analyzed the relative chronology, and checked the relationship of the dates for the Sabatynivka group with the dating of the contemporaneous cultural aspects. This approach has helped to establish the synchronism of the Sabatynivka group with the Skelia phase of the Seredny Stog culture, Gumelniţa A2 and Cucuteni A3. The sites of the group existed during 44th to 42nd centuries BC.

Key words: Cucuteni-Trypillia, Radiocarbon dating, relative chronology, typological analysis, Skelia ware
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INTRODUCTION

In the last decade, new research has been shedding more light on the prehistory of Central Ukraine. The international projects aimed at the excavations and surveys of Trypillian mega-sites have produced considerable information about this region (Videiko *et al.* 2015; Müller *et al.* 2018; Chapman *et al.* 2019; Hofmann *et al.* 2019; Gaydarska *et al.* 2020). On the other hand, the phenomenon of Trypillian mega-sites will remain isolated without a detailed study of the previous stages of the development of the Trypillian culture. In this paper we discuss a group of sites of Trypillia culture of stage B1 (prior to the B1-B2 phase when mega-sites had appeared; Kotova and Videiko 2004). These sites form a densely settled microregion in the middle stretches of the Southern Buh river. Some sites are well-known (Sabatynivka I, Berezivska HES), others have been discovered recently (Burdo 2015). The Trypillia B1 sites of the Sabatynivka microregion share some joint characteristics that make them different from other contemporaneous sites elsewhere in the Cucuteni-Trypillia cultural complex. An important point is that the Sabatynivka microregion is the easternmost enclave of the distribution of painted ware of the B1 phase. This work aims at establishing the chronology for the Sabatynivka group applying both ^{14}C dates (Kiosak *et al.* 2021; Lobanova *et al.* 2021) and typological analogies for the ceramic collections.

SITES AND METHODS

There are eight sites that are currently attributed to the Sabatynivka group. Some sites have been extensively excavated (Sabatynivka I, Berezivska HES), some were test-trenched (Kamyane-Zavallia I, Shamrai, Topoli, Kozachyi Yar I), others are known only from surveys (Kozachyi Yar II, Dovhyi Yar). The site of Kozachyi Yar II is completely destroyed by activities of a granite quarry and the archaeological remains are gathered in the re-deposited position (Peresunchak 2012). In 2013 and 2018-2019, a team from the University of Regensburg made a geomagnetic survey of the Kamyane-Zavallia I and Kozachyi Yar I sites (Saile *et al.* 2016b). Detailed research was carried out on five sites described in the following.

1. The Sabatynivka I site (48° 9’19”N; 30°11’11”E) is located on a high promontory at the confluence point of rivers Southern Buh and Synytsia. It was found by S.I. Chub in 1929 and excavated by P. V. Kharlampovych in 1932, by O. V. Lagodovska in 1938 and A. V. Dobrovolsky in 1938-39, 1947-1948 (Dobrovolskyi 1952). The general excavated area is over 360 sq. m. The site bore remains of two cultural layers, at least. The lower layer included Trypillian materials, while the upper one is dated to the Late Bronze Age. The ceramic collection of the Trypillian layer contained over 3000 potsherds. It was published by T. S. Passek and A. V. Dobrovolsky (Passek 1949; Dobrovolsky 1952). Later on, E. K. Chernysh, I. V. Palaguta, N. B. Burdo treated the complex as a reference collection for the Sabatynivka group (Chernish 1982; Palaguta 2007; Burdo 2015).

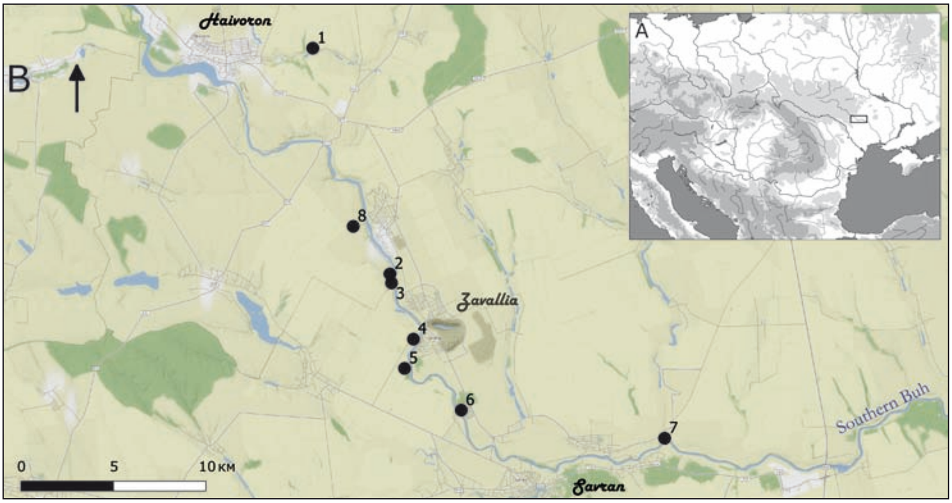

Fig. 1. Map. A: the Sabatynivka microregion on the map of Central Europe; B: the Sabatynivka group sites: 1 – Topoli, 2 – Kozachyi Yar 1, 3 – Kozachyi Yar 2, 4 – Kamyane-Zavallia I, 5 – Shamrai, 6 – Berezivska HES, 7 – Sabatynivka I, 8 – Dovhyi Yar. Topo – Stamen terrain USA/OSM

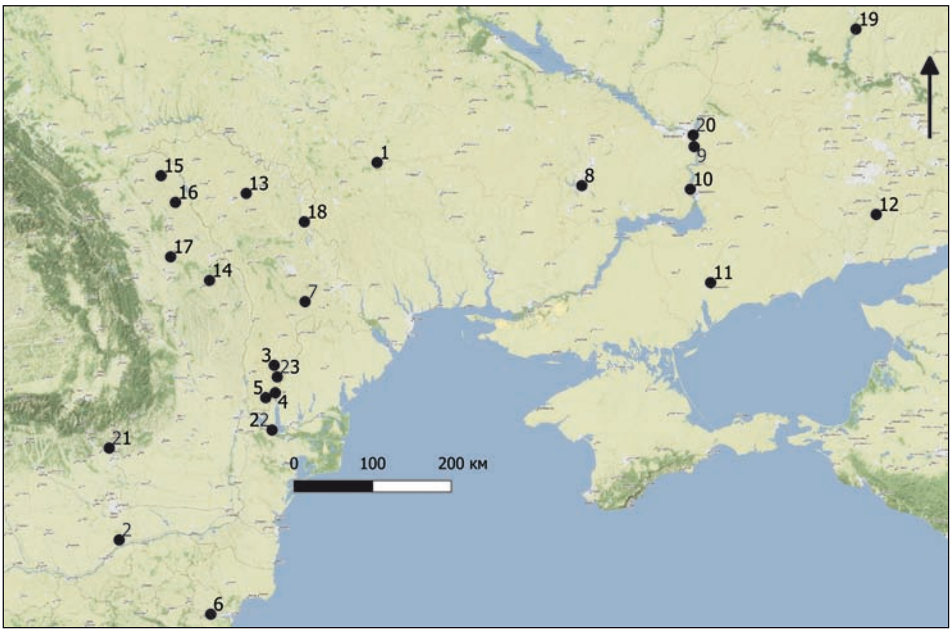

Fig. 2. Relations of the Sabatynivka group. 1 – the Sabatynivka group; 2 – Pietrele, 3 – Cealîc, 4 – Bolgrad, 5 – Vulcăneşti II, 6 Reka Devnia, 7 – Cainari, 8 – Kryvyi Rih, 9 – Strilcha Skelia, 10 – Seredny Stog, 11 – Semenivka, 12 – Rozdolne, 13 – Putineşti III, 14 – Scânteia, 15 – Drăguşeni-Ostrov, 16 – Truşeşti, 17 – Hăbăşeşti, 18 – Jura, 19 – Olexandria, 20 – Ihren VIII, 21 – Mălăieştii de Jos, 22 – Novoselske I, 23 – Taraclia I. Topo – Stamen terrain USA/OSM

2. The Berezivska HES site (48°10'7"N; 30° 2'16"E) is on the left (northern) bank of Southern Buh river, just in 11 km to west from the Sabatynivka I site. It was investigated by V. M. Danilenko in 1958-1959, V. P. Tsybeskov in the 1960s and by O. V. Tsvek in 1989-1999 (Tsvek 1999; Tsvek 2004). The site is the largest so far known settlement of the Sabatynivka group with a total area of 10 ha. V. P. Tsybeskov excavated seven dwellings. The researchers noted a prolonged period of site duration with several consecutive stratigraphic units. The ceramic assemblage includes painted potsherds in various styles of Cucuteni A (Dumitrescu 1963a; 1963b; Palaguta 2007, 47). The site yielded a huge collection of pottery, figurines, stone and flint implements. Unfortunately, this complex remains largely unpublished. Here, we use the small collection kept in the Zavallia secondary school and the collection from V. P. Tsybeskov's work from Odessa Archaeological Museum.

3. Kamyane-Zavallia 1 (48°12'12"N; 30° 0'12"E) is situated on a flat promontory of the first terrace of right bank of the Southern Buh river. It was discovered by V. N. Stanko in 1974 (Stanko and Smolianinova 1974). In 2013, geomagnetic prospection covered the site's area (approximately 1,5 ha). The site consists of a large and undifferentiated "living zone" surrounded by two ditches (Dębiec *et al.* 2014; Saile *et al.* 2016a; Saile *et al.* 2016b). The site yielded ceramic groups with incised and stamped decorations as well as small potsherds with painted decoration indicative of the Trypillia B1 (Cucuteni A3) stage. The lithic inventory is dominated by small flat bifacial projectile points also characteristic for the developed Trypillia (Kiosak 2019). The figurines are covered with incised ornamentation (later type 2 of Zbenovich 1996). Two animal bones coming from filling of the inner ditch were selected for radiocarbon analysis (Kiosak *et al.* 2021).

4. The site of Shamrai (48°11'19"N 29°59'50"E) was discovered by O.S. Peresunchak (Peresunchak 2012). It is situated on a forested hill overlooking the high southern shore of the Southern Buh river. Here the slope is cut by a road bringing to light numerous bones, river shells and potsherds, probably remains of a destroyed pit (Kiosak 2016). An animal bone from remains of the pit was sampled (Kiosak *et al.* 2021).

5. The site of Topoli (48°20'35"N; 29°55'36"E) was also found by O.S. Peresunchak (Peresunchak 2015). It stands on the northern bank of a small stream flowing into the Southern Buh river. It yielded a notable surface collection of potsherds, throwing additional light on the results obtained from other sites from better defined contexts.

We applied the following methods to the selected sites. Small test trenches were opened in the sites of Sabatynivka I, Kamyane-Zavallia I, Shamrai. They were excavated with a refined stratigraphic control in order to secure the association of material remains and samples (animal bones) selected for ^{14}C dating (Kiosak *et al.* 2021). The new ceramic collections were studied by the traditional typological approach in order to define intercultural items that could shed a new light on the relative chronological position of the sites. In this work, we avoid discussing whether the intercultural items are imports or imitations. It is important that they were able to occur roughly simultaneously in various geographic points.

A detailed re-examination of a similar design for older collections is underway for the sites of Sabatynivka I and Berezivs'ka HES (Lobanova *et al.* 2021). Animal bone samples were selected to re-date the site of Berezivs'ka HES too (Kiosak *et al.* 2021). The calibration and comparison of radiocarbon dates has been carried out with the OxCal software (Ramsey and Lee 2013). The comparative analysis of results between radiocarbon dating program and typological approach will validate and refine the supposed chronological position of the Sabatynivka cultural group.

RESULTS

Absolute chronology

The Neolithic and Eneolithic chronology of Ukraine has some important incongruences. The dates from Berlin, Kiel, Heidelberg, Leningrad, Oxford and some other laboratories cluster together with some dates of the Kyiv laboratory (mostly received prior to 1998 or after 2008), while several series of Kyiv dates, which were obtained in 1998-2008, are earlier by some 400 radiocarbon years (Telegin 1986; Telegin 1987; Rassamakin 2012; Gaskevych 2013; Gaskevych 2014).

A similar observation is true for the Sabatynivka group. The sites that were excavated in the 20th century (Sabatynivka I and Berezivska HES) obtained Kyiv dates (Burdo 2003) spanning between 4800-4401calBC (2σ). There were no non-Kyiv dates for the sites of the Sabatynivka group till now. However, the timespan cited above was significantly older than other dates which were made on the samples coming from the sites of analogous chronological position (Cucuteni A) from Romania and Moldova. Recently, the period Trypillia B1 was often dated to 4600-4050 BC (Mischka *et al.* 2016[2019]; Chapman *et al.* 2019) or 4600-4200 BC (Müller and Rassmann 2016).

Five dates from the LARA laboratory in Bern were obtained from animal bones from sites of Berezivs'ka HES, Kamyane-Zavallia I and Shamrai (Kiosak *et al.* 2021). They differ significantly (4341-4056 calBC; 2σ) from the dates that come from the Kyiv laboratory. Four dates can be combined (4332-4256 calBC, 2σ) and a single date (BE-7652, 5346±21 BP) is slightly younger. The dates could be contemporaneous in the narrow time slot of 4328-4241 calBC (2σ).

The new dates contradict the Kyiv conventional dates and are in reasonable correspondence with the radiocarbon chronology of the Romanian sites of Cucuteni A (László 1997; Mantu 1998; Mantu 2000; Lazarovici 2010). Thus, a publication of these dates (Kiosak *et al.* 2021) creates a situation when the chronology of the Sabatynivka group needs to be revisited by means of typological analysis supported by comparison of radiocarbon dates.

Relative chronology

The ceramic assemblage of sites of Sabatynivka type consists of several groups: 1) fluted thin-walled pottery with stamped lines, 2) a group with incised curvilinear decoration, 3) potsherds with shell temper and comb and pit ornaments, and 4) thin-walled, perfectly fired painted fragments of elegant small cups, 5) non-decorated fine ware, 6) coarse ware decorated by barbotine, appliques, impressed pits and wide flutes. The latter two groups are never numerous.

The first and the second groups form the major part of the assemblages (68.8% in the collection of Sabatynivka I). They exhibit a notable variability and they constitute the cultural specificity of the Sabatynivka group. Some styles of decoration are limited to the sites of this microregion. Curvilinear fluted compositions surrounded by rows of stamp imprints are particularly characteristic in this aspect, because they are extremely rare in the sites of other territorial variants of Trypillia B1 period. The third and fourth group usually are not numerous (1-5% of the collection, except Shamrai where the third group constitutes 22% of items). They find direct parallels and, sometimes, analogies (Palaguta 2007; Burdo 2015) in materials of Cucuteni A sites (fourth group) and in the settlements of the steppe mobile herders (third group). Some other, less obvious, "imports" probably link the Sabatynivka group with the Lower Danube sites of the Gumelniţa culture (Burdo 2015).

The fourth group of the Sabatynivka ceramic complex (painted pottery) is made of very pure clay without any temper visible to the naked eye. It has very fine fabric and it was extremely evenly fired, resulting in a constant (light red or intense yellow) colour of outer and inner surfaces and in section. These sherds are found constantly in Sabatynivka group collections but in small numbers, sometimes just some items. They constitute 4.3% in Sabatynivka I, 1% in Topoli, and 4% in Shamrai.

Most potsherds are difficult to attribute to a certain group. Some others are decorated by curvilinear motives in black, red and white colours (Fig. 3: 4-8). White paint forms wide meandering stripes surrounded by thin black lines. I. Palaguta found parallels for these potsherds in Romanian sites of Cucuteni A, namely in Hăbăşeşti, Truşeşti, Bădragii Vechi and Darabani (Palaguta 2007, 47). He also noted the presence of the another decorative style in the upper layers of Berezivska HES – "multi-coil helixes". This resembles material from the settlement of Jura (Sorochin 2002). As far as it is known to the authors, there are no bichromic ("red on white") sherds in the Sabatynivka I site collection, contrary to previously reported information (Popova 2003, 56). Thus, the supposed early chronological position of Sabatynivka I is dubious, quite in line with the reported results of the radiocarbon dating on the other sites of the Sabatynivka group (Kiosak *et al.* 2021).

Recent finds include the upper part of a vessel from the Shamrai site (Fig. 3: 9). On the outer part it is decorated by a triangle going down from the very rim painted by black paint. From the inside it has a pattern of interchanging thin red lines, sometimes in stripes surrounded by black contour. The white paint is missing but it cannot be excluded that it

Fig. 3. Comparative table of Cucuteni A and Sabatynivka group pottery
(1.1, 1.2, 9.1 by Palaguta 2016, 2.1 by Yakovyshyna and Kutseniak 2016, 3 by Tsybeskov 1965, 3,1, 7.1, 7.2 by Sorochin 2002, 4.1, 5.1, 6.1, 8.1, 9.2 by Petrescu-Dîmboviţa *et al.* 1999)

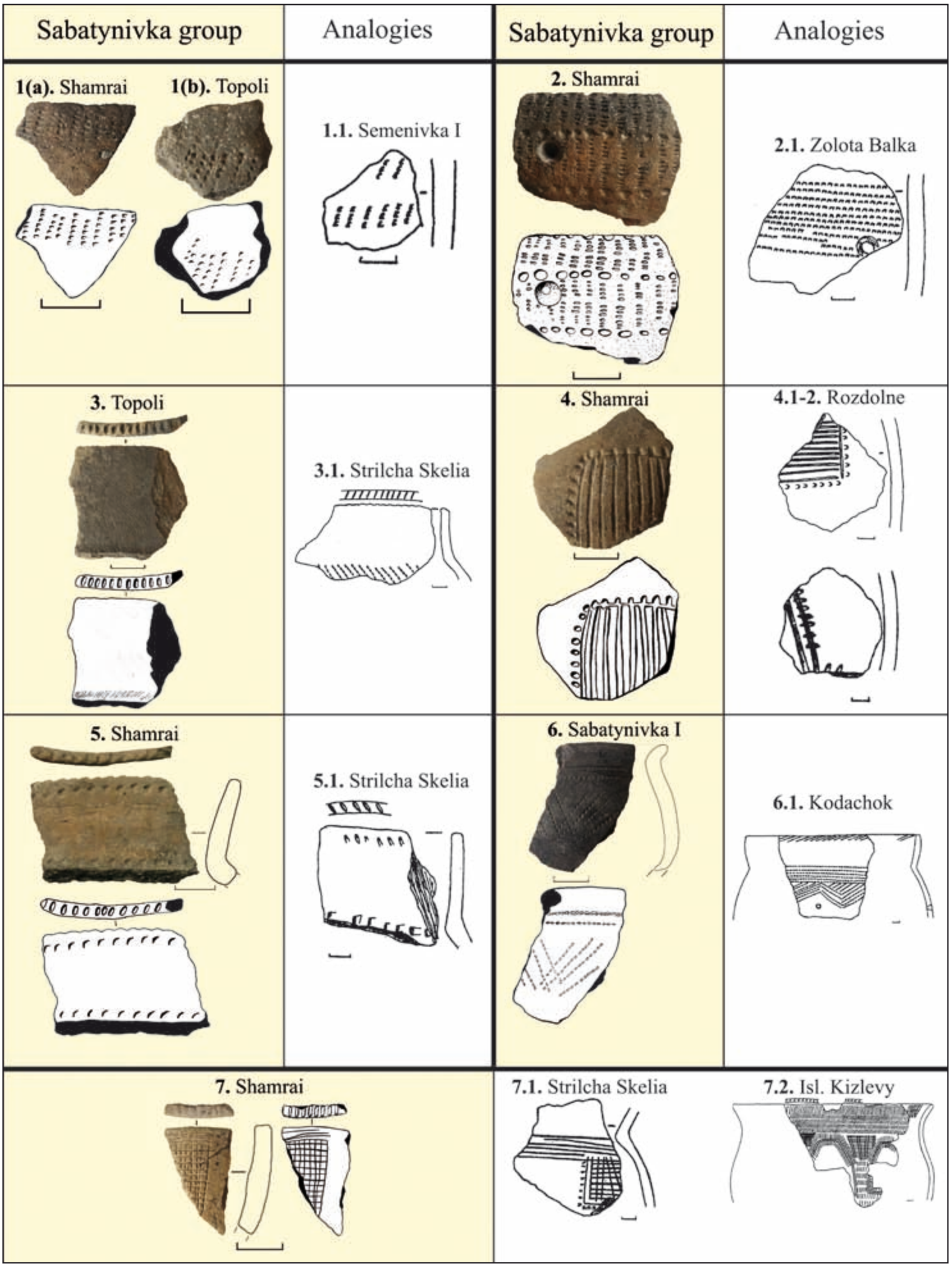

Fig. 4. Comparative table of Seredny Stog and Sabatynivka group pottery (analogies column by Kotova 2006)

was lost due to post-depositional processes. A similar composition is known on beakers with high neck, well-visible shoulder and equal diameters of rim and bottom (Petrescu-Dîmboviţa *et al.* 1999, 649). There is a potsherd with a surface fluted by wide flat grooves and black paint covering the space in-between in the collection of the Kamyane-Zavallia I site. This combination of flutes and black paint could be a late phenomenon (Popova 2003, 70).

Thus, the painted ware from the sites of the Sabatynivka group indicates their contemporaneity with Cucuteni A3 stage.

The third group of Sabatynivka ceramics is similar to the pottery of the mobile herders of the Pontic steppes that are included in the Skelia culture by Yu. Rassamakin (Rassamakin 2004) and represents the second stage of the Seredny Stog culture according to N. Kotova (Kotova 2008).

Most potsherds of the third group have a temper of crushed shells in their fabric. Some fragments have no such admixture, despite being ornamented in "Steppe" decorative style. The sherds have a layered structure in section. Their outer surfaces are well-smoothed, even and have red, reddish, reddish-grey, yellow-grey colour. The inner surfaces are less carefully finished; sometimes they bear traces of smoothing by a combed tool. This type of clay paste and surface finishing are uncommon in Trypillian contexts (Bem 2007, 58). The pottery of the first and the second groups contain fine mineral temper, barely visibly to the naked eye. The third group differs also from the shell-tempered pottery that is well-known from later contexts of Cucuteni-Trypillia cultural complex (Cucuteni C; Schmidt 1932). The surfaces of Cucuteni C ceramic are usually rough and not finely smoothed in contrast to the even surfaces of the third group of the Sabatynivka cultural complex.

There are rim fragments of pots of characteristic shape. The rims are straight or slightly projecting outwards. The necks are short and straight. They rise from rounded shoulders, with an abrupt transition between the shoulder and the neck. The rims are usually divided by evenly spaced cuts. This decoration can give them a "wavy" appearance. There is some decoration by combed stamp under the rim and below a transition to shoulders in most cases. This type of a vessel is typical for the ceramics of the Seredny Stog culture (Kotova 2008). In the latter case, they have rounded or pointed bases. No such bases were recovered from the five analysed sites of the Sabatynivka group. However, the upper parts and their decorations are almost identical. There are many fragments of this type in the collections of the Strilcha Skelia (third and fourth cultural layers), Semenivka I (IIIrd layer), Rozdolne (middle layer) and Seredny Stog II sites (Rassamakin 2004; Kotova 2008).

A fragment of a rounded shoulder is decorated with single imprints combined in a stripe with comb imprints (Fig. 4, 2). A hole was drilled in the fragment, probably in an attempted repair. It represents a pot of the shape described above, or very similar to the latter. There is an exact analogy in the site of Zolota Balka (Kotova 2006, fig. 26: 3). Numerous fragments of the walls of pots are decorated by vertical imprints of a combed tool organized in horizontal rows. They most probably come from vessels of the same type. Similar ornamentation is typical for the Seredny Stog culture and is known from many settlements (Kotova 2006, 94, 109).

Some compositions consist of incised lines that are organized in a “hash-tag” pattern or filling a rhomboid surrounded by dots (Fig. 4: 4, 7). Similar decorations are known from the sites of Strilcha Skelia (third layer), Rozdolne (middle layer), Kyzlevy (Kotova 2006, fig. 17: 8; 26: 7; 32: 2; 33: 5).

A fragment of the upper part of a pot from Sabatynivka I site is decorated by stamped impressions (Fig. 4: 6). There are two horizontal stamped lines under the rim and diagonal intersecting stamped lines on the neck. It has no crushed shells in the ceramic fabric. The decoration resembles a vessel found in the site of Kodachok (third, or Stog phase of Seredny Stog culture; Kotova 2008, fig. 27: 1).

Summing up, the third group of the Sabatynivka ceramic complex finds closest analogies in the settlements of the second phase of the Seredny Stog culture or the Skelia cul-

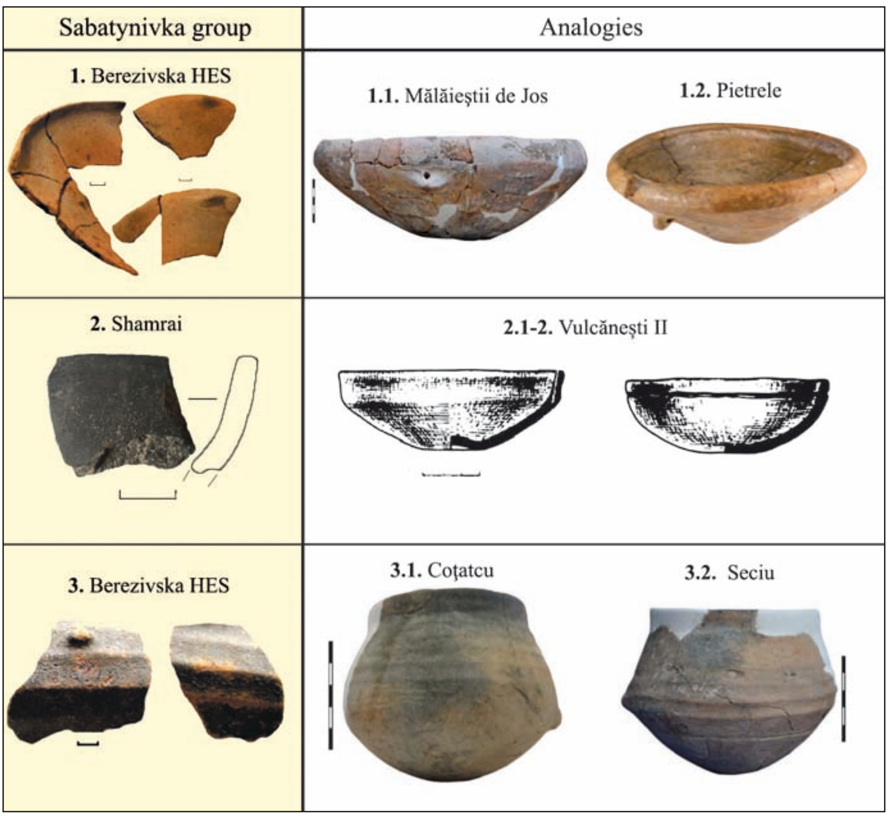

Fig. 5. Comparative table of Gumelniţa (Bolgrad-Aldeni) and Sabatynivka group pottery (1, 3 by Burdo 2015, 1.1 by Hansen *et al.* 2011, 1.2, 3.1-2, 4.1 by Frînculeasa 2016, 2.1-2 by Beilekchi 1978, 4 by Kozubovskyi 1933)

ture. Some elements are traceable to the third phase of the Seredny Stog culture or Stog culture. However, they are few and can be found also in the collections of the previous stage. Thus, *en masse*, the shell-tempered pottery of the Sabatynivka group was related to the ceramic complex of the mobile Steppe herders of the second-third stages of the Seredny Stog culture.

Another line of inquiry is represented by rare "imports" from the Gumelniţa cultural area. There is an almost complete bowl found at the Berezivska HES settlement (Burdo 2015; Fig. 5: 1). It has a grey burnished outer surface and a characteristic conical profile, resembling to a great extent bowls known on the sites of Bolgrad (Bolhrad) – Aldeni aspect and on the sites of Gumelniţa itself. A fragment of grey burnished bowl was collected from the Shamrai site (Fig. 5: 2). It has a profile corresponding to the shapes of bowls from the sites of Bolgrad and Vulcăneşti II (Lower Danube region). Widely spaced nervures form the fluted surface of a yellow well-smoothed upper part of a thick-walled vessel (Berezivska HES – Fig. 5: 3). A similar decoration is well-known from the sites of Gumelniţa as well as in Stoicani-Aldeni sites (Subbotin 1983; Hansen *et al.* 2006; 2009; 2012).

DISCUSSION

The radiocarbon dating has yielded contradictory results for the Sabatynivka group. The Kyiv dates place its existence in the timespan 4800-4400 BC, while the new AMS dates indicate it lasted from 4350 till 4250/4150 BC (Burdo 2015; Kiosak *et al.* 2021). Typological analysis of the ceramic complex has revealed links with surrounding cultures that could help to clarify the issue of chronology of the Sabatynivka group.

The chronology of Cucuteni A phase is far from being clear. The series of dates are overlapping and somewhat contradictory (Fig. 6). The "Kyiv" dating of Sabatynivka group is not relevant in the context of the absolute chronology of Romanian sites of Cucuteni A. It is obviously too early. They are contemporaneous with the available dates for the Precucuteni sites of Romanian Moldova (Rassamakin 2012). Meanwhile, the "AMS" ranges for the sites of the Sabatynivka group finds certain correspondence in the dataset for western part of the Cucuteni-Trypillia cultural complex (Mantu 1998; Lazarovici 2010). Namely, they are slightly later than Polyvaniv Yar III-1 (Trypillia B1), earlier dates for Scânteia (Cucuteni A3) and two earlier dates for the site of Putineşti III and could be synchronous with the site of Drăguşeni-Ostrov, other four dates for Scânteia, as well as sites of Leca Ungureni (A3), Preuteşti-Haltă (A3), Hăbăşeşti (A3), Cuconeştii Vechi (A3). The single date for the Dumeşti site (A3) is a little later than the AMS dates for the Sabatynivka group (Fig. 6). The data from the Sabatynivka group points to their probable co-existence in the 44^{th} to 42^{nd} centuries BC.

Shell-tempered pottery of the Sabatynivka sites is a direct analogy to the ceramic of the second stages of the Seredny Stog culture (the so called Skelia pottery). This cultural aspect

Fig. 6. Comparison of selected ^{14}C dates for Cucuteni A and Sabatynivka group.
P3 – Putineşti III, DO – Drăguşeni-Ostrov, PH – Preuteşti-Haltă, CV – Cuconeştii Vechi, LU – Leca-Ungureni, H – Hăbăşeşti, D – Dumeşti, PY – Polyvaniv Yar, Sab-Kyiv: sum of radiocarbon dates obtained for the Sabatynivka group in Kyiv laboratory; Sab-AMS: sum of radiocarbon dates obtained for the Sabatynivka group by AMS dating; SI – Sabatynivka I, BH – Berezivska HES, KZI – Kamyane-Zavallia I, Sh – Shamrai

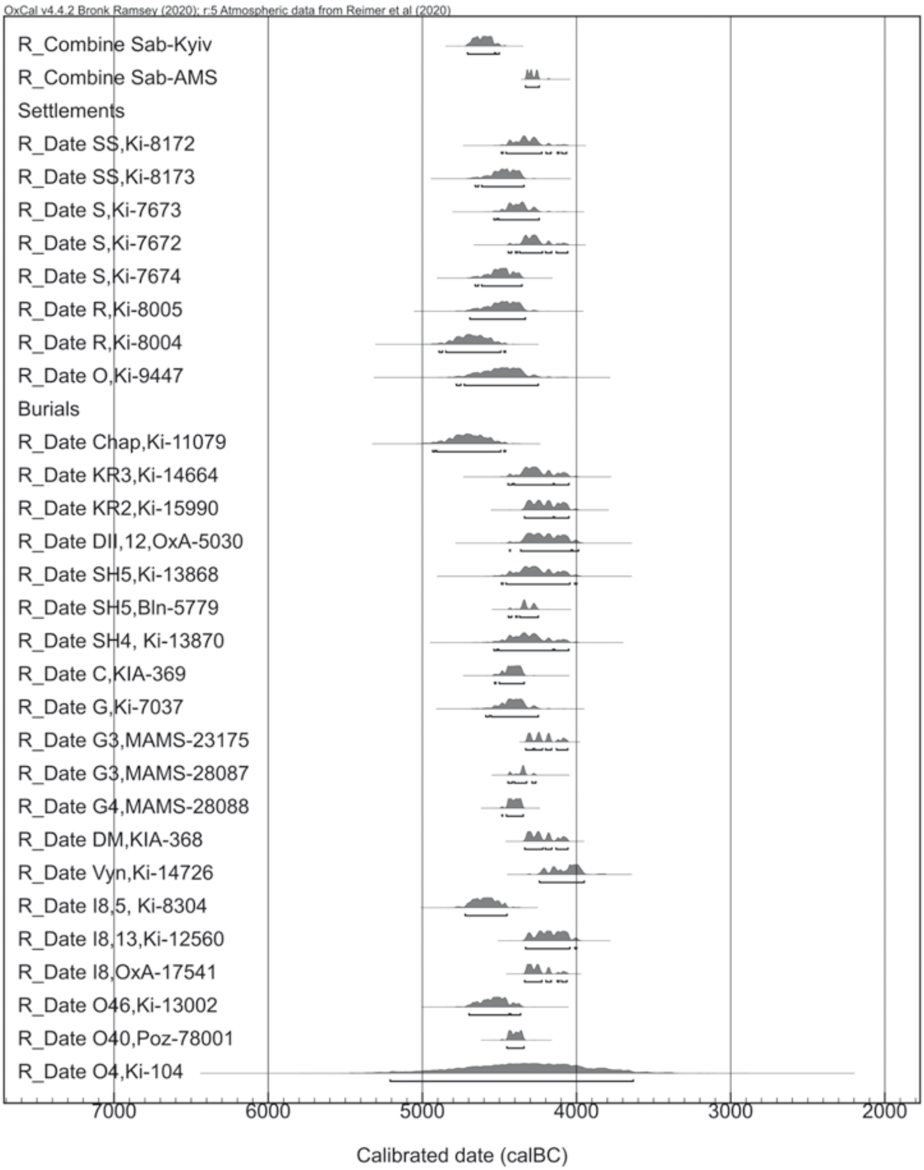

Fig. 7. Comparison of selected ^{14}C dates for Seredny Stog (Skelia and Stog phase) and Sabatynivka group. SS III I. – Strilcha Skelia, date Ki 8173 refers to layer III, date Ki-8172 refers to the fourth layer, S – Semenovka, layer III, R – Rozdolne, middle layer, O – Olexandria, Chap – Chapli, KR3 – Kryvyi Rih, b.3, KR2 – Kryvyi Rih, b.2, DII, 12 – Dereivka II, b. 12, SH5 – Shakhtar 29/5, SH4 – Shakhtar 29/4, C – Căinari, G – Giurgiulești, burials 3 and 4, DM – Decea Mureşului, b. 12, Vyn – Vynohradne 3/15, I8 – Ihren VIII, burials 5, 13 and 5a, O46 – Olexandrivsk, b. 46, O40 – Olexandria, burial 40, O4 – Olexandria, burial 4. Sab-Kyiv: combination of radiocarbon dates obtained for the Sabatynivka group in the Kyiv laboratory; Sab-AMS: combination of radiocarbon dates obtained for the Sabatynivka group by AMS dating

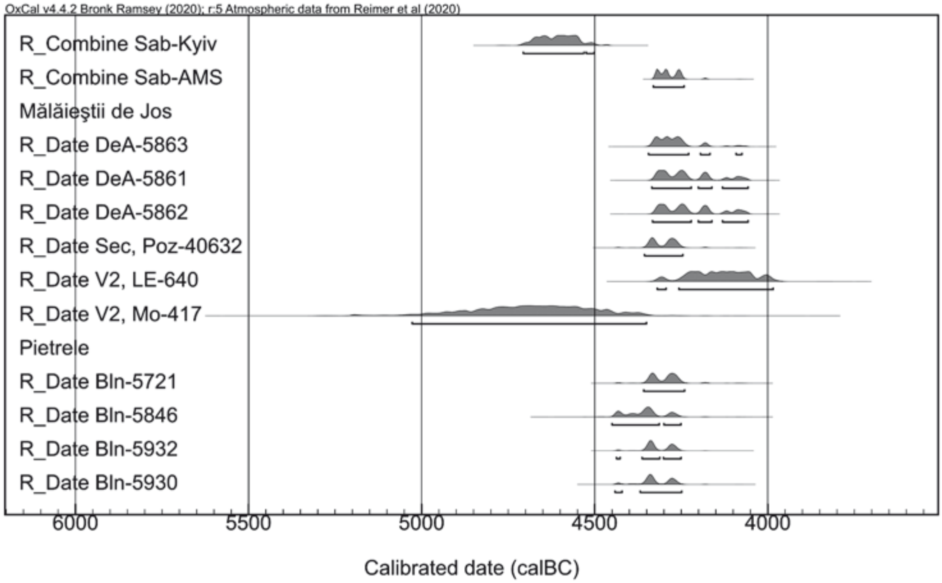

Fig. 8. Comparison of selected ^{14}C dates for Gumelniţa (Bolgrad-Aldeni) and Sabatynivka group. Sec – Seciu, V2 – Vulcăneşti II; Sab-Kyiv: combination of radiocarbon dates obtained for the Sabatynivka group in the Kyiv laboratory; Sab-AMS: combination of radiocarbon dates obtained for the Sabatynivka group by AMS dating

has similar incongruences in chronology like the Sabatynivka group itself (Fig. 7). Skelia settlements are known from Dnieper Rapids region and Northern Azov Sea region. They were dated in the Kyiv laboratory to the timespan 4842-4242 calBC (2σ) (Kotova 2008). The dates for the IVth layer of the Strilcha Skelia site, which belongs to another later phase (Stog; Kotova 2008), provides a *terminus ante quem* – 4488-4065 calBC (2σ). This dating corresponds with the chronological framework suggested for the Sabatynivka group by Kyiv dates.

However, it contradicts the series of dates obtained in other laboratories on burials of the Skelia phase, which are generally later. The burials are situated far away from settlements, in the areas inhabited mostly by bearers of other cultural aspects. The synchronism of settlements and burials was suggested by Yu. Rassamakin and developed by N. Kotova (Rassamakin 2004; Kotova 2008). The burials are mostly dated to 4488-4050 calBC (2σ). The only obvious outsider is Burial 46 from the Olexadrivsk necropolis (4698-4364 calBC – 2σ). An indicative case is the famous Giurgiuleşti cemetery. The first date for it encompassed 4588-4248 calBC (2σ). However, a more recent series of dates has helped to narrow the range for the burial field down to 4484-4264 calBC (2σ) (Govedarica and Manzura 2016). A similar "drift" has happened to the Olexandria cemetery and is expected for the site of Chapli (Rassamakin 2017). The date for Vynohradne burial, which belongs to another later cultural tradition (Rassamakin 2009), provides a *terminus ante quem* (4241-3950 calBC – 2σ). Thus, while the dating of Skelia settlements requires re-analysis, the phenomenon of Skelia burials lasted also in 44th to 42nd centuries BC. The latter range is roughly corresponding to the "AMS" dating of Sabatynivka group.

The shell-tempered pottery was found at the sites of Bereşti (Cucuteni A3), Izvoare and Fedeleşeni in Romania (Bem 2007, 58) as well as at the sites of Druţa I, Duruitoarea Nouă, Nezvisko, Jura, Polyvaniv Yar III-1 (Moldova and Ukraine; Palaguta 1998; Popova 2003). The chronology of Cucuteni stage A3 was discussed above. The Romanian researchers call these finds a "Cucuteni C" type of pottery, linking it with a characteristic ceramic of the later phases of Cucuteni A-B and B (Bem 2007, 58). However, from the point of view of the classification of Seredny Stog pottery, the "typical" shell-tempered ceramic differs from the potsherds found on the sites of Trypillia B1 (Tsvek and Rassamakin 2001-2002; Reingruber and Rassamakin 2016), including the sites of the Sabatynivka group. The latter resembles mostly Skelia pottery with some components of the next stage of Seredny Stog culture development, namely the Stog phase.

It is interesting that roughly the same can be said about the shell-tempered pottery found in Gumelniţa culture contexts. It finds close analogies in the complexes of Skelia phase (or separate culture) and is securely dated in the contexts of Pietrele settlement to the time slot of 4450/4350-4270/4260 BC, with a particular emphasis on the second half of the 44th century (Reingruber and Rassamakin 2016, 285, 286). A vessel of another type (with a pointed bottom and stamp decoration) comes from a context dated to the time after 4300 BC (Reingruber and Rassamakin 2016, 287). Thus, the dates of Skelia pottery in the Danube valley and on the Southern Buh river are roughly synchronous.

Gumelniţa was recently dated to 4600-4250 BC (Hansen *et al.* 2012; Reingruber 2012; Reingruber and Rassamakin 2016). There is a hypothesis of its prolonged existence based on the dates from the sites of the Lower Danube basin (Manolakakis 2017). The earlier stages of Gumelniţa bear evidence of interaction with the people of the Precucuteni Culure (Trypillia A), which existed prior to development of Cucuteni A – Trypillia B1 (Sorochin 2001). Thus, the earliest dates for Gumelniţa A1 (4600-4450 BC; Reingruber and Rassamakin 2016) should be excluded from our consideration. The Trypillia B1 wares were found in the contexts of later phases of Gumelniţa – stages A2-B1 (Frînculeasa 2016; Reingruber and Rassamakin 2016). A profound Trypillian impact is recorded on the sites of a particular variant of the Gumelniţa cultural block, namely the sites of the so-called Bolgrad-Aldeni or Stoicani-Aldeni aspect (Sorochin 2001). It was suggested that the latter represents a local variant of the Gumelniţa A1 phase. However, there were some imports of Trypillia B1 wares in the Bolgrad-Aldeni sites of Taraclia I and Novoselske I (Subbotin 2013, 113). The recent radiocarbon dates from north Muntenia indicate that the later phases of Stoicani-Aldeni cultural aspect could have co-existed with the phase of Gumelniţa A2 and with Cucuteni A3 (Frînculeasa 2016). Some of the dates that were obtained from Bolgrad-Aldeni sites are in good correspondence with "AMS" chronology of the Sabatynivka

I group, thus reinforcing the possibility of their coexistence that comes from the typological analysis of “imports”. Thus, the dates for the Gumelniţa culture and Bolgrad-Aldeni aspect are likely to contradict the “Kyiv” chronology of the Sabatynivka group, while they are in good correspondence with the “AMS” set of dates.

We should take into account the dating of the Early Trypillia sites situated in the same microregion with the Sabatynivka group. There are nine known sites (Peresunchak 2012). Some are situated just in 5-10 km from the sites of Berezivs’ka HES and Sabatynivka I. Two sites were dated by AMS approach: Mohylna III and Mohylna V (Kiosak *et al.* 2021). The dates encompass 4677-4466 calBC (2σ). So far no numerous early Trypillian components have ever been noted in the collections of the Sabatynivka group sites (Burdo 2015). So, we suppose that the dating of the Mohylna sites represents a *terminus post quem* for the Trypillia B1 sites of the region. This excludes effectively the first half of the fifth millennium from the timespan of their existence. Painted pottery bearers had likely penetrated the region after 4500 calBC and, in fact, there is a certain gap between available the AMS dates for the Early Trypillian sites and the Sabatynivka group settlements.

The new chronology places the Sabatynivka group into another environmental context. The Kyiv dates suggested its development during the Holocene climatic optimum. Meanwhile, new dating demonstrates that the sites of the Sabatynivka group existed till the very beginning of the climatic phase hl_{b1-6} by M. F. Veklych (1987). Based on the pollen cores and soil sequences from Central Ukraine, N. Herasimenko describes this period as the time of a notable aridization in the steppe, the reduction of deciduous woods, and the disappearance of hornbeam (Herasimenko 2004, 23). It is a phase of a slow trend towards even more arid climate and grassland expansion in the IV millenium BC (Herasimenko 2004, 23, 24).

It is interesting that dense settlement of the Sabatynivka microregion started with the Linear Pottery culture (four sites; Kiosak 2017; Kiosak and Salavert 2018), continued via Trypillia A (nine sites; Peresunchak and Burdo 2015; Peresunchak 2018), till the Trypillia B1 period (eight sites;Burdo 2015). However, there is a sharp decrease in the sites of the later phases of Trypillia. Trypillia B1-2 was attested by a small collection of potsherds at the multi-layered site of Melnychna Krucha (Kiosak and Salavert 2018; Salavert *et al.* 2021). The B2 phase is known at the site of Hetmanivka, some 15 km to south of the Sabatynivka I site (Kiosak *et al.* 2014) and the Late Trypillia sites are absent in the microregion. Maybe the climatic instability of the late fifth millennium BC is to be blamed for this shift of the occupation intensity?

CONCLUSIONS

Thus, combining various lines of enquiry, we can conclude that the Sabatynivka group existed in the 44th to the 42nd centuries BC. The sites of the Sabatynivka group have produced evidence for intercultural contacts in many directions. It seems that the Sabatynivka group was partially synchronous with the Skelia phase of the Seredny Stog culture, Cucuteni A3 and Gumelniţa A2-B1. These lively connections made the Southern Buh valley an intersection point for different influences and cultural and social impulses, an ideal environment for social innovations.

The sites of the Sabatynivka group can be helpful in the synchronization of the Steppe cultural groups that occupied the Dnieper Rapids region and eastwards, with the archaeological record of the region between the Carpathians and the Dniester and Danube rivers. In particular, the combination of Skelia ceramic ware and the Cucuteni A painted pottery in the pit at the site of Shamrai could be a reference point to link and date these two phenomena.

The Skelia ware was the first "steppe-influenced" pottery to enter the Cucuteni-Trypillia archaeological record (Tsvek and Rassamakin 2001-2002; Reingruber and Rassamakin 2016). By 4350-4250 BC, it co-existed with some elements of the Stog ware. The potsherds with "steppe influence" from the Sabatynivka group differ from the well-known ware of Cucuteni C type, which is usually found in the settlements of Trypillia B1-B2 and later periods. The latter resembles ceramics of the Stog phase of the Seredny Stog culture, but mostly – vessels of the Dereivka culture of the middle Aeneolithic (Kotova 2013). The "steppe" component of the Sabatynivka I ceramic assemblage parallels the earlier Skelia ware. Thus, we can assume that the different stages of the Trypillia phenomenon were marked by contacts with various steppe groups. The establishment of these "partnerships" is a separate task, which cannot be solved from *ad hoc* ideas about cultural development, but requires empirical evidence in the archaeological record for every event of interaction.

So, the sites of the Sabatynivka group were settled during a chronological stage recorded in many regions (Manzura 2000; Govedarica 2004; Kotova and Videiko 2004; Rassamakin 2004; Videiko 2004; Manzura 2005; Reingruber 2012; Subbotin 2013; Govedarica and Manzura 2016; Reingruber and Rassamakin 2016) and which is characterized by the co-existence of the Skelia phase of the Seredny Stog culture, burials of Novodanylivka type, Cucuteni A3 (Trypillia B1) and Gumelniţa A2. It seems that the end of this chronological stage was also the end of the Sabatynivka group. This event of broad historical significance most likely occurred around 4250/4150 BC, at least in the Southern Buh valley. The event corresponds with the beginning of a pronounced aridisation of the steppe (Herasimenko 2004). Thus, we can suppose that environmental pressure was partially responsible for the demise of the Sabatynivka group.

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UTILITY STRUCTURES OF THE TRIPOLYE CULTURE

ABSTRACT

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Over a hundred years of exploration of Tripolye Culture sites have resulted in the excavation of hundreds of buildings. This paper discusses the identification of the Tripolian utility structures, their construction details, interior features, and function. The differences between utility structures and houses are also addressed. The results of the presented analysis make possible the distinguishing of three variations of utility structures. Each of these is exemplified by the cases from sites of different chronology.

Keywords: Tripolye, building, utility structure, house, building, interior
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INTRODUCTION

Over a hundred years of exploration of Tripolye Culture sites have resulted in the excavation of hundreds of buildings. Most frequently those were interpreted as the remains of houses. However, the question of the existence of utility structures in Tripolye Culture settlements has also been raised. Different characteristics enabling the identification of such buildings have been suggested, but the issues of their function and reasons for construc-

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Fig. 1. Location of sites analyzed in this study:
1 – Kamenets-Podolskiy, 2 – Bernashevka, 3 – Ozhevo-Ostrov, 4 – Voloshkovo 6 (Gorby), 5 – Belikovtsy, 6 – Klischev, 7 – Talianki, 8 – Veselyi Kut

tion remain open. This paper discusses the identification of utility structures, their construction details, interior features, and function. The article also addresses the differences between utility structures and houses.

In the following, it should be noted that in studies of the Tripolye Culture, house remains are labelled "ploschadki", while what is interpreted as the collapsed fired clay floor of an upper storey of buildings is called a "platform" (*e.g.* Kruts 2003).

Let us briefly analyse the interpretations of buildings as utility structures. Vladimir Kruts (1989) considered the buildings without interior details as such structures. This conclusion was based on the excavations of the Tomashovskaya group settlements, where the buildings without interior features are quite rare. However, more recent studies have shown that such constructions are in fact found at the Tripolye sites more frequently. It is not excluded that the "lack" of interior features was in fact caused by the high degree of collapse of a building. Another reason may be the low temperatures reached during the burning of buildings that preserved the excavated remains. Interior details did not become heated enough to be preserved as fired clay. Later on V. Kruts abandoned his assumption because assemblages of finds of different categories in buildings without interior features correspond to the assemblages coming from houses. Other researchers continued the identification of utility structures based on the size of buildings (*e.g.* Shumova and Ryzhov 2005). In this respect, it has to be admitted that a number of houses also have a small size.

Utility structures: Characteristics and variability

Let us now consider the characteristics of the excavated utility structures enabling their identification. These are the size of a building, its interior details and assemblage of finds. Figure 1 represents the location of sites with utility structures analysed in this study.

CRITERIA FOR IDENTIFICATION

The correlation between the building size, elements of interior and assemblages of finds referred to different categories has made possible the distinguishing of a type of utility structures in Tomashovskaya group settlements (Chernovol 2012). Analysis of all excavated houses of this group from seven sites has shown that a number of buildings of this type can be identified.

In the case of the excavations at Talianki (see Kruts 1990), only a single building from belongs to this type (Chernovol 2012; Kruts 1990). The analysed building had a size of 4 × 4.5 m; interior elements were not found on the upper storey, while the lower storey included a trough of a size of 2 × 2 m. Six grinding stones were located around it. This building was located near House 19 of a size of 4 × 11.2 m. The utility structure did not obtain a field number during excavation and was interpreted as a part of House 19.

The remains of buildings similar to the Talianki case are also known at other Tripolye sites. These are the building in Veselyi Kut settlement dated to phase Tripolye BI-II (Tsvek 1984) and two buildings in Klischev dated to the same period (Zaets and Ryzhov 1992). These constructions had nearly equal size. Ploschadka 18 in Veselyi Kut located near House 18 had a size of 14 × 5.5 m. One building in Klischev was located near House 10, which had a size of 14.9 × 7 m. One more building from this site did not receive a field number during excavation. Its size was 3.5 × 2.5 m. The utility structure was located near the House 11 of a size of 12 × 5 m (Fig. 2).

Each utility structure was aligned parallel to the long wall of a house at a distance of 1-1.5 m from it. Installations were recorded on the ground floor of these structures. The building from Veselyi Kut additionally included six grinding stones. According to the author of the excavations (Zaets and Ryzhov 1992, 32, 33). Construction 9 from Klischev had a single storey, while the daub indicates the remains of walls and ceiling. A cluster of animal bones, 26 miniature vessels (pots, bowls and leads) and eight stone tools were found inside the utility structure. We should admit that the finds do not necessarily represent the function in this case, and may relate to the ritual of house abandonment (Kruts 2003). According to the typology of Tripolye buildings suggested by Passek (1940), buildings of this kind correspond to small houses.

The analysis of buildings belonging to the Tomashovskaya and other groups indicates that houses for living necessarily include an entrance and living room, while the living

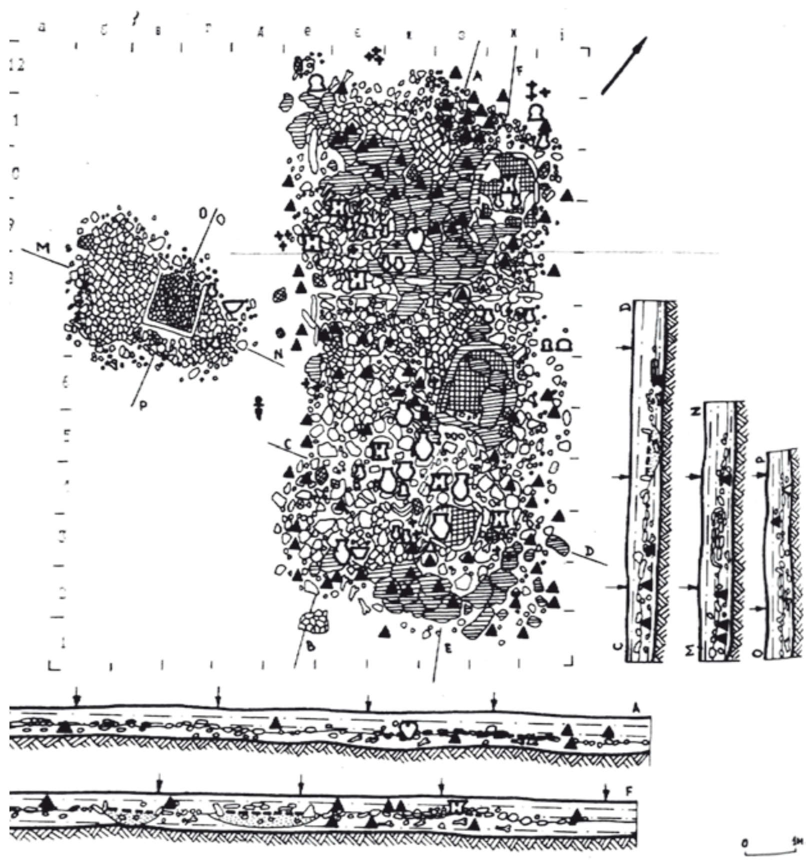


Fig. 2. Klischev. Ploschadka 11 and utility structure near it (after Zaets and Ryzhov 1992)

room should include objects used in daily life, such as an oven. Besides this, the minimal area of a room required for the placement of its inhabitants was estimated at 6 m^2 (Diachenko and Chernovol 2009). Let us consider this value. The minimal length of the Tomashovskaya group house reaches 7 m. However, a number of buildings included altars, which required an additional 2 m in the length of the building. Buildings belonging to the other local cultural units do not necessarily have an altar, so their minimal length reaches 5 m. Therefore, buildings, the length of which does not exceed 5 m, cannot be considered as houses due to their small area. If the factor of preservation does not impact the size of the ploschadka, such buildings are considered as utility structures.

The function of a building may be also approached through the analysis of the interior details. Buildings referred to the Tomashovskaya group include troughs with a grinding stone attached to them and interpreted as working places associated with food preparation (for instance, the remains of seeds were found during the flotation of soil from the pit placed next to the trough on the lower storey of Ploschadka 6 in Ozhevo-Ostrov (Pashkevich and Chernovol 2015). This feature was placed in a living room, to the right from the entrance. The size of the trough is equal to or greater than 0.5 × 0.5 m, so that only a single grinding stone may be attached to it. Troughs in utility structures are significantly larger, and they may be associated with a number of grinding stones around such an interior element. This makes possible the assumption that such buildings represent the communal processing of food. Since such activities could be linked to rituals, ceremonies *etc.*, the analysed buildings might have incorporated utility and cult functions.

It should be noted that the so-called “grinding stones” or querns could have been used in activities of other kinds instead of for food preparation. According to the studies of Galina Poplowko, stones resembling grinding stones in shape were used in the production of ceramics. Dry clay further added to ceramic clay, was processed on such stones (Poplowko 2017). Hence, we cannot exclude the possibility that a number of utility structures were associated with ceramic production. Furthermore, grinding stones could also have been used secondarily as building material when they were too heavily abraded.

WORKSHOPS

Other economic activities reflected by small buildings were also noted. For example, a complex probably associated with the processing of leather was investigated at the settlement of Ozhevo-Ostrov. A kiln used for the firing of limestone was placed in the centre of this complex. Narrow ditches linked this kiln to some pits that were located on the lower storey of the houses placed nearby. The width of the ditches reached 0.4 m, while their depth reached 0.3 m. Clay was attached to the walls and bottoms of these ditches. Later on this clay was fired, probably, as a result of burning the wood inside them in order to obtain ash. The mix composed of calx and ash was moved to the pits and then they were filled with water. The mix was used for keeping the leather in it for easier removing of pelage (Fig. 3).

Fragments of ‘platforms’ (see above) identified above such kilns may be interpreted as roofs over kilns. The remains of this type of construction were found between Ploschadka 1 and 2. The fragments of ‘platforms’ there are represented by the large blocks of burnt daub that had imprints of boards. Unfortunately, the poor preservation of the structure does not make possible the estimation of its size.

It should be noted that the function of small buildings sometimes remains unclear. For instance, a building of a size of 2.6 × 4.6 m was investigated in Belikovtsy dated to Tripolye phase BI-II (Gusev 1995, 64). A room sunken into the ground to the depth of 0.8 m was found below a ploschadka (Fig. 4). The installation discovered at the bottom of this room was interpreted as an oven by S. Gusev. The size of this building corresponds to the dimensions of the utility structures described above. However, this assumption is not supported by any other arguments yet.

Fig. 3. Ozhevo-Ostrov. Kiln and system of ditches between Houses 1 and 2. Illustrated by D. Chernovol

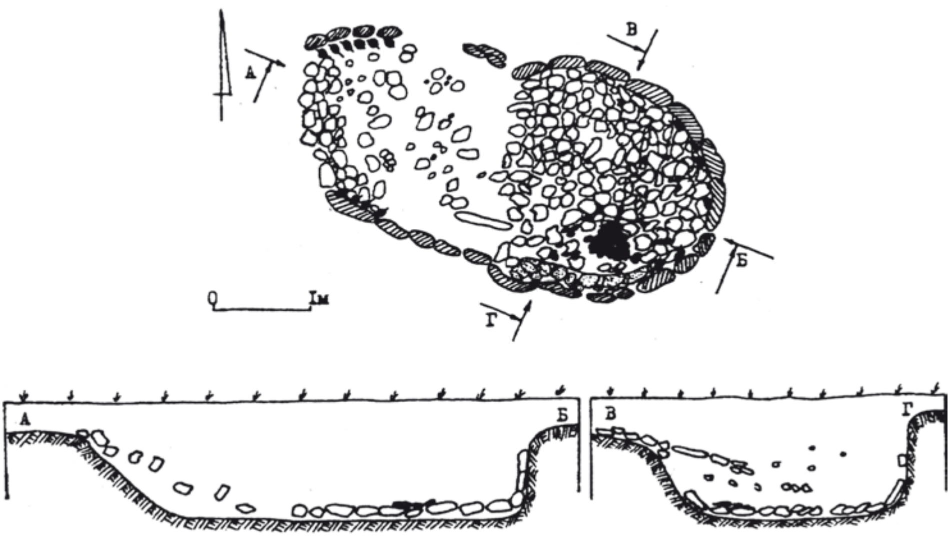


Fig. 4. Belikovtsy. The plan of ploshchadka (after Gusev 1995). Illustrated by D. Chernovol

Summarizing, we may distinguish a variation of ploschadki, the length of which does not exceed 5 m. Such buildings most likely were not used for living but may be associated with different economic activities which required a construction similar to a house.

STORAGE FACILITIES

The other variant of utility structures is represented by storage facilities. These buildings may be exemplified by Ploschadka 8 at the settlement of Bernashevka II dated to phase Tripolye CI. This building had a rectangular shape of a size of 5.5 × 7.5 m (Figs 5a

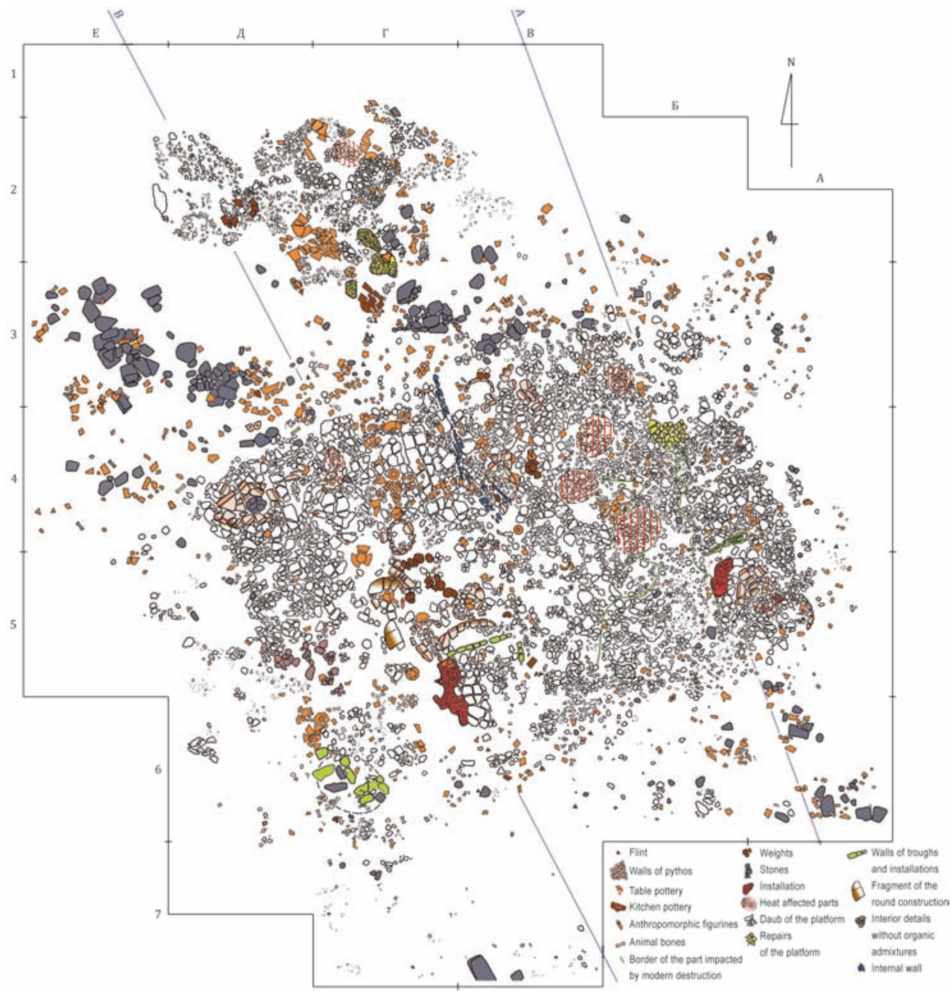


Fig. 5a. Bernashevka II. Ploshchadka 8, upper storey. Illustrated by D. Chernovol

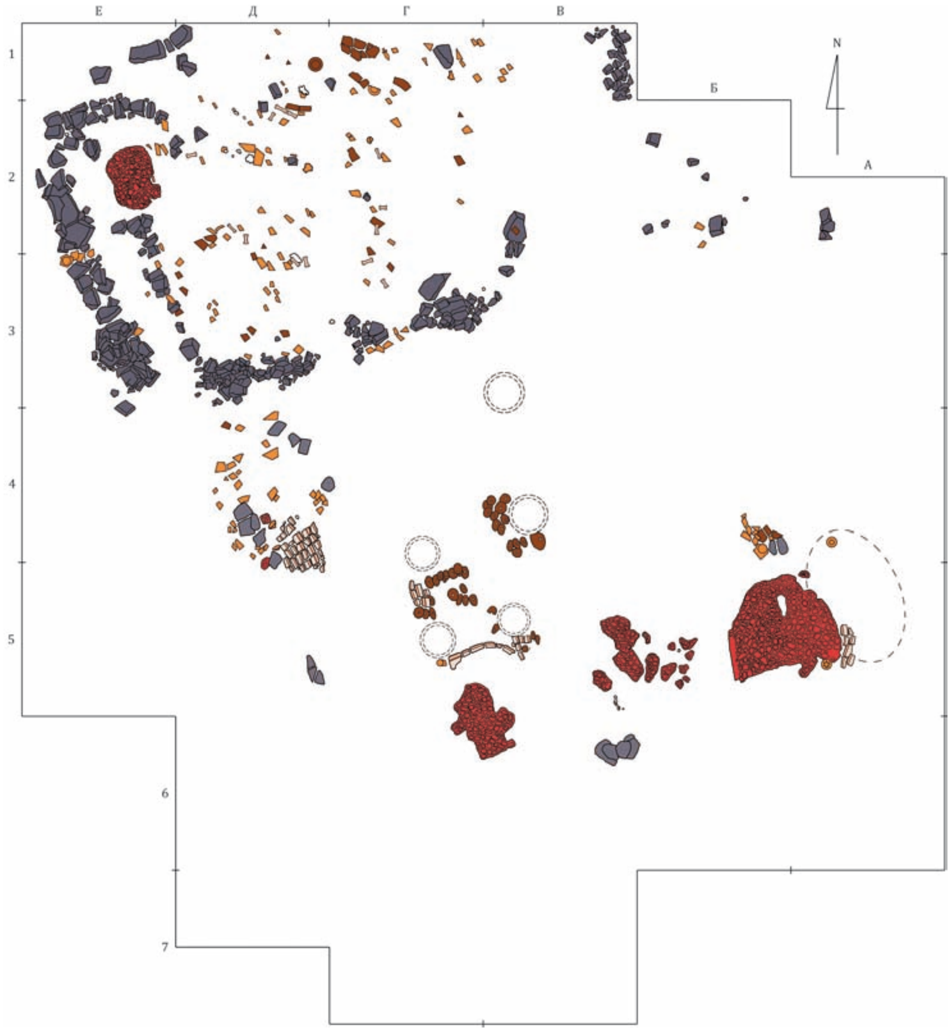


Fig. 5b. Bernashevka II. Ploshchadka 8, lower storey. Illustrated by D. Chernovol

and 5b; Chernovol 2013). This building had two storeys. The upper storey was subdivided into two rooms of nearly equal size, 3.5 × 5.5 m. The entrance did not include any interior details. However, fragments of a trough and a grinding stone were found in the left corner of another room. Besides the trough, fragments of a round interior structure of diameter of *c.* 0.5 m morphologically resembling an altar was found in the centre of this room. Unlike other altars, this feature was made of clay with organic admixtures, which raises doubts considering its ritual character. Numerous vessels were placed to the right from the entrance, mainly along the internal wall, where ovens are usually located in houses.

Interior structures, *i.e.* three installations preserved fragmentarily, on the lower storey of this building were mainly located along the left long wall. One installation had walls. The one near the wall opposite the entrance was linked to a pit, partly located inside the building and partly outside it. This raises questions about the construction of the wall and its existence at all. A helmet-shaped lid covering some ochre and fragments of a container vessel were found in this pit (Fig. 6).

Numerous fragments of table pottery were found below the collapsed fragments of the 'platform' in the central part of the building. These sherds represent bowls, helmet-shaped lids and pear-shaped vessels. A cluster of loom weights was also found in this part of the building, probably indicating the location of a loom.

In general, fragments of seven container vessels were found in the lower storey of this building. Fragments of their walls were mainly found together with fragments of burnt daub, but the bases were located *in situ* on the ground floor. This was the first find of container vessels at the settlements of the Petrenskaya group. Previously, such vessels were associated only with Tomashovskaya group houses (*e.g.* Kruts 2003). Unlike the Tomashovskaya group, container vessels of a pear shape, these finds had a mortar shape.

The location and density of the interior structures in this building and the high number of container vessels inside it allow the interpretation of this building as a storage facility. It is not excluded that, besides storing food, this building was used for other activities associated with the grinding stone, loom and installations.

Fig. 6. Bernashevka II. Ploshchadka 8, container vessel. Photo by D. Chernovol

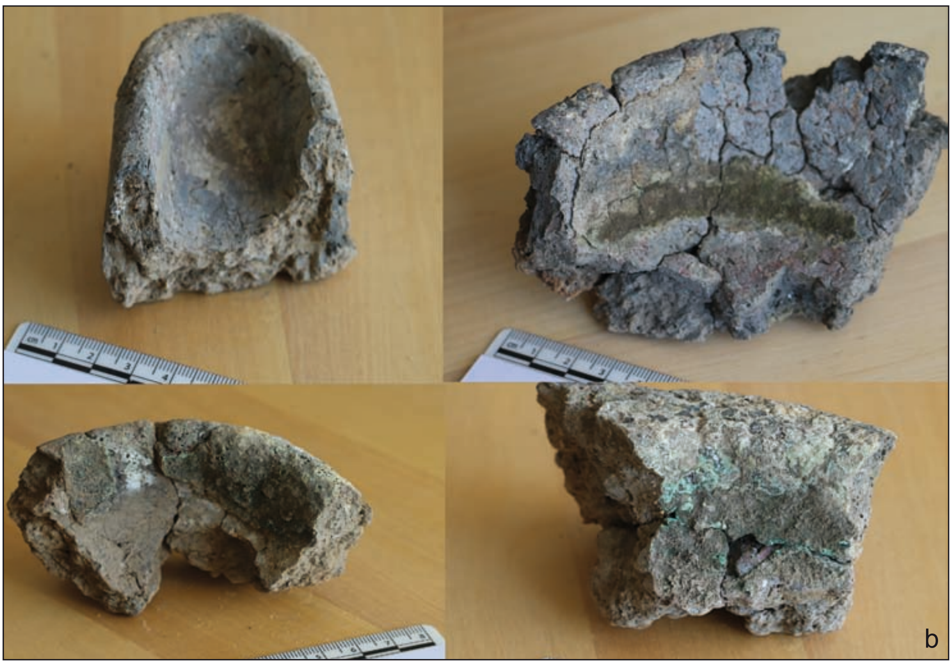
SINGLE STOREY CONSTRUCTIONS

The third variety of buildings is represented by single storey constructions, remains of which are represented by fragments of burnt daub formerly covering the walls. This variation is represented by the buildings in Kamenets-Podolskiy, Voloshkovo 6 and Dobrovody.

According to the finds, the utility structure in Kamenets-Podolskiy was associated with copper processing (Figs 7 and 8; Czernowol 2017). Daub fragments had only imprints of the thin sticks to which it was applied indicating their relation to the walls. Daub fragments were located in a line that was 2 m width. Therefore, we are dealing with the single storey building with a ground floor. This utility structure was only partly investigated, because of its location in the modern city of Kamenets-Podolskiy. The remains of this building are partly covered by the periphery of a house block. Therefore, it is not possible to reconstruct the size of this utility structure. However, the excavated part allows us to characterise the function of this building. This ploschadka belongs to the Petrenskaya group dated to the Tripolye CI phase. Considering other excavation-sites in this part of a city, the workshop was probably located in the internal part of the settlement structure.

Fig. 7. Kamenets-Podolskiy. The wall of the workshop. Photo by D. Chernovol

a



b

Fig. 8. Kamenets-Podolskiy. Profile of the pit in the workshop (a) and the fragments of smelting bowls (b)
Photo by D. Chernovol

Fig. 9. Voloshkovo 6 (Gorby). Ploshchadka 2. Photo by D. Chernovol

Fig. 10. Voloshkovo 6 (Gorby). Ploshchadka 2, the beam in installation 3. Photo by D. Chernovol

A pit of a size of 2.1 × 2.9 m and with a depth of 1.2 m was investigated below the remains of the wall (Fig. 8). Its filling included numerous remains related to copper casting. More specifically, 40 fragments of crucibles, including 18 fragments of rims with copper on them were found (Fig. 8). Such fragments were also found on the ground floor of the building. One fragment of a casting mould was also found below the remains of the wall (Fig. 7).The crucibles were made of clay with organic admixture. They were partly turned to a ceramic slag because of the affect of heating. Most probably, this pit belonged to the structure of a workshop. It had a flat bottom and a step on the wall (maybe a place where the craftsman was sitting). A shallow depression of a depth of 0.1 m was found near the opposite wall. The walls were quite steep. It should be noted that Tripolye Culture pits are mainly lens-shaped in section. They were initially used for the extraction of clay and then turned into garbage pits. The pit in the workshop also was turned to a garbage pit, but the change in its function corresponds to the time after destruction of the walls.

In this case, the unique character of the building is associated with the construction techniques. Single storey buildings are rather exceptional for Tripolye CI, being typical for the Tripolye CII/2 phase. The lack of a second storey was probably caused by the high temperatures generated on the first storey. The interpretation of the function of this utility structure is made possible by the character of the finds.

Similar buildings were excavated at the settlement of Voloshkovo 6 (Gorby) referred to the Brynzeni group of the transitional period from phases Tripolye CI to Tripolye CII. These buildings were located at a distance of 10 m from each other outside the settlement. Ploschadka 2 of a size of 9.5 × 6 m was aligned along a north-south axis, while Ploschadka 3 of a size of 4 × 5 was aligned along an east-west axis (Figs 9-12). Information on Ploschadka 2 is limited, due to its later destruction by Bronze Age pits.

Along the long walls of Ploschadka 2, large fragments of burnt daub with imprints of wattles of a diameter of 5 cm were found. The thickness of these fragments reached 10-15 cm. All the daub fragments are associated with walls. The back wall was highly affected by heat reaching a temperature of 1,000°C (the latter is reflected by the vitrified daub). Probably this utility structure was subdivided into two rooms, *i.e.* an entrance room and the working space. This assumption is supported by the fragments of daub located in a line that is perpendicular to the long walls of the building. Besides this, the installation located nearby on the long axis of the building may indicate the entrance to the working space. If this assumption is true, then the size of the entrance room was 4 × 6 m, and the size of the working room was 5.5 × 6 m. Generally, such an organization of space is known for the lower storey of the buildings of type B (see below; Chernovol 2012; 2013). Interior details in such buildings were located closer to the back wall.

Five clay installations were discovered on the ground floor. Two of them were located along the left long wall, one near the back wall, one to the right of the entrance, and the other one in the centre of the structure. Four of these installations were preserved in fragments, while installation 3 near the back wall had interesting construction details. It had

Fig. 11. Voloshkovo 6 (Gorby). Ploshchadka 3. Photo by D. Chernovol

Fig. 12. Voloshkovo 6 (Gorby). Ploshchadka 3, movable table. Photo by D. Chernovol

a rectangular shape of a size of 2 × 2 m. The installation was elevated above the ground floor by 7 cm. It was made of two layers, *c.* 3.5-4 cm thick. The upper layer was smoothed, preserving the imprints of the lower layer on its bottom side. The lower layer having a surface of a black colour was not fired well. The heating was directed from the top downwards. A round trough-shaped depression of a diameter of 0.7 m was made in its eastern part. The height of its walls reach 10 cm and their thickness reach 4 cm (Fig. 10). A 0.3 cm thick layer of burnt mollusc shells was found in this trough. By burning the shells of the mollusc *Unio*, one may obtain the components of paint or a component used in processing of leather. Broken kitchen pots were found near each installation. Some pots had crater shapes, some had spherical shapes. Probably, these pots were used as containers during production of white paint.

Ploschadka 3 was better preserved. Its walls had collapsed inside the building and visually resembled a ‘platform’ (Fig. 11). However, the clay elements of the building, due to the imprints of wood, are associated with walls. This questions the construction techniques of small-sized utility structures.

Usually researchers did not provide the readers with morphological description of the constructions of the analysed buildings, noting only the remains of ‘platforms’ (*i.e.* collapsed upper floors). In one case (Ploschadka 9 in Klischev) remains of walls were noted, but were not accompanied by detailed descriptions (Zaets and Ryzhov 1992, 32, 33). Our analysis suggests that the small-sized utility structures were single storey buildings. In cases of the inward collapse of the walls, the latter could be misunderstood as being ‘platforms’. The detailed description of the walls of Tripolye houses was made possible by the excavations of House 4 in Dobrovody, where the preservation of construction details was excellent (Kruts *et al.* 2005). Later on, this allowed the identification of walls at other Tripolye settlements.

A number of installations with grinding stones were found on the ground floor of the Ploschadka 3. A movable rectangular table of a size of 0.7 × 1 m and 0.05 m height was found in the centre of this building (Fig. 12). It is notable that this table had a shape similar to a trough, because its central part had fallen down, while walls below it used as a support remind us of the walls of a trough. One of the long walls of this table had a 0.2 m length depression. The strength of this feature was increased by embedding wooden sticks in the construction. The function of the table is unclear. It rather reminds us of a ritual feature. A mix of calcite was found nearby, indicating the function of the utility structure. Therefore, similar to Ploschadka 2, Ploschadka 3 is associated with activities related to calcite processing.

A similar building was excavated at the Tomashovskaya group settlement of Dobrovody in 2016 and also interpreted as a utility structure (Korvin-Piotrovskiy *et al.* 2016). However, its size is different, while the interpretation of function requires further consideration.

Besides the analysed utility structures associated with buildings preserved as ploschadki, one should not exclude buildings that did not have walls covered by clay. Such features may be indicated by some installations located outside ploschadki. The use of installations are outside buildings is known for the overall duration of the culture. Most frequently they are located near houses. Installations were made of clay without the organic admixtures typical for the bases of ovens in houses. These installations were composed of several layers of clay indicating the periodical repair and, therefore, a relatively long period of functioning. They were affected by heating from the top downwards. Generally, installations are similar to open fireplaces. However, this does not directly suggest an identical function.

An installation including a 0.2 m deep round depression of a diameter of 0.3 m covered with clay was found at the Early Tripolye settlement of Bernashevka (Chernovol 2016). Most probably, this depression was used for placing a pot there (Fig. 13). Numerous kitchen pottery sherds were found near this installation. This may indirectly indicate its use for cooking, maybe in summer time. A cluster of fire-affected stones was found between this feature and the nearest house. It is not excluded that these stones were heated on the installation and then used for heating water or for cooking. Five flat stones of a size of 0.2 × 0.3 m were located near the installation at a distance of 3 m from each other forming a "rectangular" perimeter to this feature. The stones could have supported pillars holding up a roof. It should be noted that the "rectangle" was aligned parallel to the ploschadka. The roof might have been used during the rains. If this is the correct interpretation, this feature represents one more variation of the utility structures.

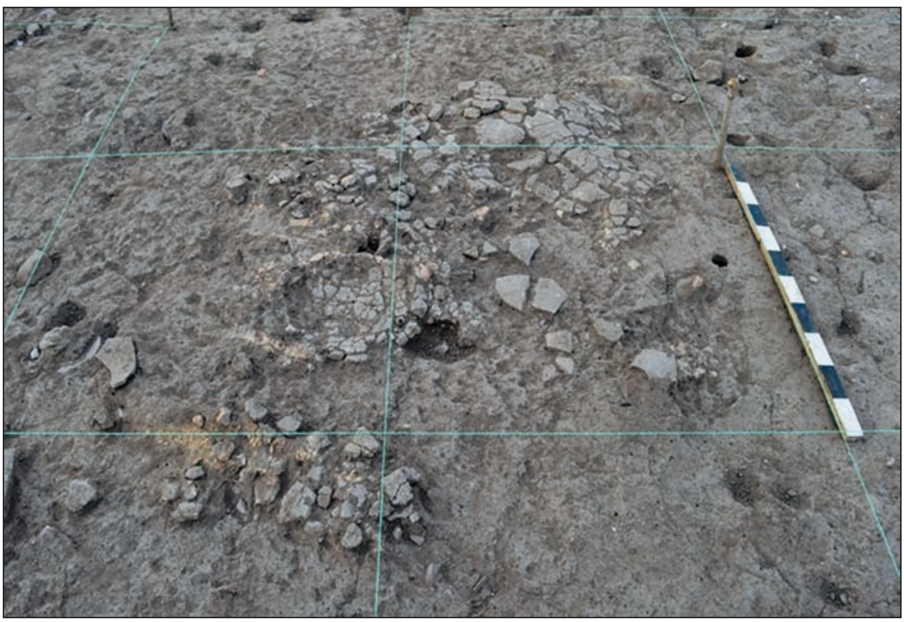


Fig. 13. Bernashevka I. Installation outside dwellings. Photo by D. Chernovol

A number of pits investigated at Tripolye Culture settlements might have been covered with a roof. This assumption is based on the following excavation results. A flint processing workshop with specially prepared working areas was explored at the settlement of Pekari II dated to Tripolye CI (Ovchinnikov and Pichkur 2003). Permanent exploitation of such features might have required a roof. A similar workshop linked to the production of axes was also explored at the settlement of Lomachintsy (Balakin 1995). Despite there being no direct evidence confirming such roofs, the proposed assumption may be supported by noting the numerous cases of flint workshops located in the lower storey of houses. In the analysed case, such activities might have been relocated to specially prepared workshops.

CONCLUSION AND DISCUSSION

The number of utility structures known for Tripolye settlements at present is quite low. If the area of a Tripolye house is subdivided into spaces associated with activities of different kinds, then the average area used for the location of people and sleeping reaches *c.* 14-16% of the total size of a house. This may be illustrated by the sample obtained for the megasite of Talianki (Chernovol 2012). Other parts of a building were used in different daily activities. Buildings with altars also include a ritual area near the altar, which comprises some 1% of the total area of a house. Food processing was probably associated with working areas. Therefore, we can assume that the function of utility structures is related to activities of other kind.

The results of the analysis presented here make possible the distinguishing of at least three variations of utility structures. These are as follows:

Variation 1 includes buildings of a small size, 4 × 4 m on average, which does not make living in them possible. The activities in them were probably associated with communal work, maybe of a ritual character, and also the production of components used in ceramic production and leather processing. Such utility structures may be located near the houses, but sometimes they are spatially distinct in the settlement structure.

Variation 2 is represented by storage structures of a size corresponding to dimensions of houses. Interior details in storage buildings are arranged in a way that does not make living in them possible. Also such buildings lack ovens. Numerous containers and table vessels were placed on both storeys.

Variation 3 includes single storey workshops associated with copper working and other activities, such as calcite processing.

It should be noted that the analysis of the Tomashovskaya group houses allowed the drawing of conclusions on the location of different interior details, i.e. installations, troughs, ovens, benches, across almost the overall house space. The lower storey and the entrance room of the upper storey were used for different economic activities. Up to six working places were associated with houses of this local group. In structures with utility additions to houses, the area used for sleeping reached only 5% of the total area of the structure (*e.g.* Kruts *et al.* 2008). Most of the Tomashovskaya group houses relate to variation A structures (buildings without interior details on the lower storey). Buildings belonging to the variation B (those that include interior elements on the lower storey) dominate in other local cultural units. The increase in a size of a house generally means the increase of the number of working places. This pattern questions the necessity for utility structures, especially considering the fact that we know of bone and flint processing, and even leather processing (Ozhevo-Ostrov) inside the houses.

Most probably, the utility structures were built for different reasons. First of all, some activities needed to be moved away from living spaces. For example, installations outside the houses used as fireplaces in summer time meant that the house's oven was not used for heating and thus the process did not cause an increase in temperature inside a house. It is interesting that the so-called "summer kitchens" still exist in Ukrainian villages and were used for this reason. Of course, copper casting needed to be moved away from the place where people lived.

Social and sacred reasons for the construction of specific utility structures also should not be excluded. These factors might have led to the construction of small buildings with elevations and troughs. If such buildings were used for communal cooking, then this activity could have had a ritual character. If such buildings were associated with the processing of components used as admixtures to ceramic clay, then different potters might have commonly used those buildings. Storage facilities may have been associated with population groups that were units of the structure of the settlement's population. Since the storage facilities are represented by a single case, of course, this assumption needs further confirmation.

On another hand, the small number of utility structures might be the result of their differential preservation. Ploschadki were formed as a result of the ritual burning of houses. So, it is not excluded that it was mainly houses that were burnt, while the utility structures might have remained unburnt and therefore not so easy to detect in excavations and the preservation of described buildings described here was partly caused by occasional fires.

The analysed cases also allow the drawing of several conclusions considering the location of the utility structures at the settlements of the Tripolye Culture. In the Petrenskaya group settlement of Kamenets-Podolskiy, such a feature was located in the internal part of the settlement, while in the Brinzeni group site of Volshkove 6 (Gorby) the utility buildings were located outside of the area where houses were located. The location of a copper casting workshop in the centre of the settlement might have been caused by the value of the tools produced there. Calcite processing was probably associated with communal activities and moved away from the living space of the settlement. Leather processing in Ozhevo-Ostrov required an access to water, which dictated the choice of location of this complex in the settlement structure. Other features analysed in this paper were linked to houses and used for the daily needs of their inhabitants.

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SETTLEMENTS AND ECONOMY OF THE FUNNEL BEAKER CULTURE COMMUNITIES. ARCHAEOLOGICAL AND PALYNOLOGICAL EVIDENCE FROM THE ANNUALLY LAMINATED LAKE BOTTOM SEDIMENTS (GOSTYNIN LAKE DISTRICT, CENTRAL POLAND)

ABSTRACT

Pelisiak A. and Rybicka M. 2021. Settlements and economy of the Funnel Beaker Culture communities. Archaeological and palynological evidence from the annually laminated lake bottom sediments (Gostynin Lake District, central Poland). *Sprawozdania Archeologiczne* 73/2, 67-92.

Palynological information preserved in pollen diagrams is of key importance for investigating prehistoric human activity. According to M. Ralska-Jasiewiczowa (2012, 9), the results of the multidisciplinary research of annually laminated lake sediments carried out in Lake Gościąż and its surroundings in the Gostynin Lake District are of particular importance for assessing anthropopressure in the past. In light of the results of human-environment analyses, the environmental disturbances recorded in laminated bottom sediments from Lake Gościąż can be described as reflecting pollen being to some extent "a report from afar". In the analysed case, the pollen fallout may have originated from longer distances, and the recorded transformations of plant assemblages, both with respect to phase 5 and phase 6 from Gościąż, can be attributed to humans inhabiting up to 10 km from Lake Gościąż. On the other hand, the observations made in the palynological sites of Białe, Lucieńskie, and Gąsak are well-correlated with the archaeological evidence of human activity.

Keywords: pollen diagrams, Funnel Beaker Culture, economy, annually laminated sediments
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INTRODUCTION

The basis and starting point of idea of this paper is threefold: (1) human impact recorded in the annually laminated bottom sediments of Lake Gościąż (Ralska-Jasiewiczowa, van Geel 1992; 1998a; 1998b; Pelisiak and Rybicka 1998; Ralska-Jasiewiczowa *et al.* 1998; Ralska-Jasiewiczowa 2012); (2) results of palynological research on the bottom sediments of lakes Lucińskie and Białe, and the Gąsak peat bog and the human impact recorded there (Rybicka and Wacnik 2012; Wacnik and Rybicka 2012); (3) archaeological investigations, including excavations of several sites, carried out by the authors of this paper around the lakes Gościąż, Białe, Lucieńskie and the Gąsak peat bog (Pelisiak and Rybicka 1998; Pelisiak *et al.* 1994; 2006; Rybicka 2004; 2005; 2011; 2012). All these lakes and the area of archaeological research are located in the Gostynin Lake District in Central Poland. The goal of our considerations is to compare palynological and archaeological evidence of human activity. We focused on the period between 3900 and 3300 cal BC and on the settlement system, economy and impact on the landscape of the Funnel Beaker Culture (FBC) communities on the area in question.

POLLEN DIAGRAMS – CREDIBILITY OF PALYNOLOGICAL DATA

Palynological information preserved in pollen diagrams is of key importance for investigating prehistoric human activity (*e.g.* Kruk 1980; 1994; Pelisiak and Rybicka 1998; Pelisiak *et al.* 1994; 2006; Ralska-Jasiewiczowa and van Geel 1992; 1998a; 1998b; Makohonienko 2004). While generally accepted in studies on the activity of prehistoric peoples, this statement must each time be followed by numerous caveats stemming from the nature of the palynological sources themselves, the nature of the sediment from which the analysed samples were collected, the lay of the land, the prevailing wind direction, *etc.* (Makohonienko 2004, 235). The first analytical review of pollen diagrams from the territory of Poland from the perspective of their suitability for investigating the interactions between humans and the natural environment, the anthropogenic changes in the environment, and the mechanisms (land-use patterns) behind these processes was presented by Janusz Kruk (Kruk 1980, 145-173). Since pollen diagrams can be expected to contain unambiguous palynological indicators of human settlement and to record events caused by humans but also indicators reflecting a variety of natural processes, Kruk distinguished several groups of indicators of Neolithic settlement, beginning from those most ambiguous (Kruk 1980, 149).

Analyses of palynological sources for traces of human settlement should always take into account the geographic characteristics of the region and therefore all factors potentially disturbing the picture of the plant cover as emerging from the frequencies of pollens of particular species in subsequent horizons of palynological diagrams. This is particularly important with respect to areas with varied topography. The plant species structure reflected in the quantities of pollens belonging to various taxa in sediment levels corresponding to horizons of the pollen diagram is affected by both the characteristics of pollen grains of particular species (different susceptibility to wind transportation depending on size, weight, and shape) and a range of external factors. Another important factor is the difference in the amount of pollen generated by particular species, which may lead to overrepresentation of some taxa and underrepresentation of others. In the context of research on Neolithic settlement in mountainous areas (here: the Central Uplands of Germany), these factors were analysed by Paweł Valde-Nowak, who used observations made by other researchers as well (Valde-Nowak 1995). In fact, Valde-Nowak's observations remain valid for all landscapes, and call for a critical approach to palynological data and, by implication, to caution in formulating conclusions concerning human activity based on this category of evidence (*cf*. Makohonienko 2004, 236). The measurements of contemporary pollen fallout above the upper forest limit, carried out in the Alps by Maren Jochimsen, have produced interesting, and surprising, results (Jochimsen 1986; Valde-Nowak 1995, 62). Measurements taken in the same place in different years produced completely different results in terms of proportions of AP and NAP. A separate issue was the recorded inversion of the pollen picture in relation to the actual vegetation – AP values exceeding 82% were recorded in areas devoid of forest, while forested areas produced NAP values exceeding 73% (Jochimsen 1986, 219, table 3). These data, cited by Valde-Nowak (Valde-Nowak 1995, 62), demonstrate how topography, wind direction, forest cover, and weather can disturb the picture of plant cover reconstructed on the basis of pollen frequencies of various plant species.

Particular horizons of pollen diagrams provide us with a cumulated record of flora from the area immediately adjoining the place where the palynological samples were collected and, to a varying extent, with information concerning plants growing at some distance, sometimes quite a significant one, from the investigated palynological site. The crucial factor determining pollen transport is wind, with a lesser role played by water, birds, and insects. The forest cover, and the resulting zonal nature of pollen transportation within the forest and above it, is also important (Tauber 1965). The role of forest as a factor indirectly connected with pollen transportation, and therefore indirectly affecting the proportions of pollens of particular taxa in particular horizons of a diagram, is quite obvious. The findings of Henrik Tauber cited above can have a wide application in this respect.

Taking into account the various factors affecting the distribution of pollen, Herbert Straka distinguished five zones from which pollen grains recorded in settlements originate (Straka 1975, 74, 75; Valde-Nowak 1995, 62). The first zone encompasses the area of the peat bog or lake from which the sample was collected, and its shores. This area is marked by a pattern of local deposition of pollen. The second zone is the area within 500 m from the peat bog or lake, the next one extends to 10 km, another one from 10 to 100 km, and the last zone is over 100 km. As emphasised by Straka, the vast majority of pollen originates from an area within a 10 km radius, while the percentage of pollen grains transported over longer distances (long-distance transportation) is usually insignificant. However, their quantities may increase in areas devoid of forest or those where the forest cover is sparse (Valde-Nowak 1995, 62).

Pollen dispersion depends considerably on the horizontal movements of air masses (Tauber 1965; Straka 1975, 166; Valde-Nowak 1995, 63). Wind direction and strength are linked with topography, and the transportation of pollen is affected by plant cover as well. Both these factors are crucial in the dispersal of pollen grains, and as a result they affect the frequencies of particular taxa in pollen spectra. Three basic horizontal zones of pollen transportation can be distinguished for forested areas. The lowermost zone is the area among the trees. The air moves the slowest there (0.5-1.5 m/s), and the trees create a natural barrier hampering pollen dispersal. As a result, pollen spectra from woodlands contain primarily the material from the peat bog/lake and its immediate vicinity. In the second zone (immediately above the treetops), the speed of air movement is 2-6 m/s. Pollen grains can be transported over longer distances, which means that the pollen represents local vegetation. The third zone encompasses higher strata of the atmosphere, where winds can blow with a speed exceeding 4 m/s. This is a natural route for pollen to disperse over significant distances. This zone links with the regional component in pollen diagrams (Valde-Nowak 1995, 63). A separate issue is the impact of the size of the peat bog or body of water from where the samples were collected on the proportions of pollen originating from immediate, local, and regional fallout. Experimental research has revealed interesting regularities in this respect. Simply put, the respective proportions of taxa belonging to immediate, local, and regional components in small peat bogs (100-200 m in diameter) are 80%, 10%, and 10% of pollen grains, while in large peat bogs these proportions are 10%, 70%, and 20%, respectively (Valde-Nowak 1995, 63, 64). These observations are of particular importance for the lakes of the Gostynin Lake District (Fig. 1; Ralska-Jasiewiczowa *et al.* 1998; Pelisiak *et al.* 2006; Rybicka and Wacnik 2012). Using the above size categories, most of these lakes represent large water bodies (exceeding 200 m in diameter). Therefore, the structure of the pollen spectra from the Gostynin Lake District reflects above all the local pollen component, and to a much lesser extent the immediate and regional components (Pelisiak *et al.* 2006). This conclusion has significant research implications: it means that the picture recorded in the pollen diagrams should primarily be analysed in the context of and referring to the human activity in an area within a radius of 10 km from the palynological sites. In light of the above, in order to verify the credibility of information from pollen diagrams collected from the laminated sediments of Lake Gościąż, similar analyses were carried out in the surroundings of Lakes Białe and Lucieńskie and the Gąsak peat bog, situated around 10 km south of the benchmark palynological site mentioned above (Pelisiak *et al.* 2006; Rybicka and Wacnik 2012).

The discussion on the interpretation of palynological diagrams can be additionally revived by information published by Mirosław Makohonienko (2004, 236) concerning two important issues: the extent to which the size of the area under cultivation is reflected in palynological diagrams and how large an area needs to be deforested for a significant decline in AP to be recorded. As demonstrated by experiments, in some cases in boreal forests even cultivated fields as large as 2500 ha may find no reflection in a pollen fallout recorded merely 250 m away, and deforestations of a range of 4100-2500 ha may not translate into a decline in AP in a diagram from a lake surrounded by forest (Makohonienko 2004, 236). As emphasised by Makohonienko (2004, 236), this is precisely why we can notice only a "weak reflection of Neolithic deforestations in pollen diagrams, with the cleared areas used as cultivated fields surrounded with forests…".

An additional factor of great importance for assessing the credibility of reconstructing human-environment relations is the state of research on settlement in the areas surrounding palynological sites.

PALYNOLOGICAL EVIDENCE OF HUMAN ACTIVITY FROM THE GOSTYNIN LAKE DISTRICT

Lake Gościąż

According to M. Ralska-Jasiewiczowa (2012, 9), the results of the multidisciplinary research of annually laminated lake sediments carried out in Lake Gościąż and its surroundings in the Gostynin Lake District (Fig. 1-2) are of particular importance for assessing anthropopressure. A monograph published in 1998 set the palynological data against the archaeological evidence uncovered during surface surveys and excavations carried out within a radius of 5 km from the lake, and against data – at that time relatively sparse – originating from more distant parts of the region (Pelisiak and Rybicka 1998). The problems with unambiguous identification of human communities responsible for the more or less evident (and very well-dated) disturbances in the natural environment discernible in the diagram from Gościąż were interpreted at that time as reflecting either the poor development of the ancient settlement network in the immediate surroundings of the lake, or its insufficient investigation (Pelisiak and Rybicka 1998). The latter argument was raised in particular with respect to the Neolithic and the Bronze Age, periods manifested in the pollen record by intensive environmental transformations, which contrasted with the archaeological data from the lake's surroundings (up to 5 km), suggesting a low intensity of occupation (Pelisiak and Rybicka 1998; Pelisiak *et al.* 2006). This gave rise to the question of whether the indicators of human activity clearly discernible in the diagram reflect a human presence in more distant areas, up to 10 km or more, or the pollen represents the third or fourth fallout zone in Straka's classification (Straka 1975, 74-75; Valde-Nowak 1995, 62).

When considering the evidence from the bottom deposits relating, to the effects on the landscape of the FBC communities on the area in question, phase 5 and 6 of human impact

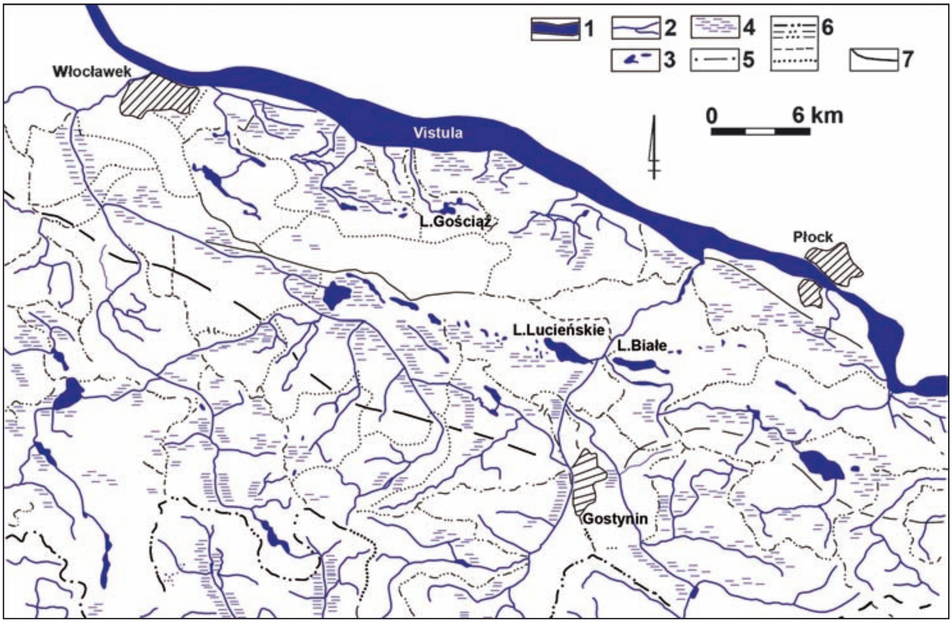


Fig. 1. Hydrology of the Gostynin Lake District (after Pelisiak *et al.* 2006):
1 – Vistula; 2 – streams; 3 – lakes; 4 – bogs; 5 – Vistula-Odra watershed; 6 – watersheds of lower orders; 7 – scarp of morainic plateau'

on vegetation are of particular importance (Ralska-Jasiewiczowa, van Geel 1998; Pelisiak *et al.* 2006).

Phase 5. What deserves particular attention are changes in plant cover dated around 3900-3600 BC, which represent phase 5 of anthropogenic disturbances distinguished in the Gościąż diagram (Fig. 2; Pelisiak *et al.* 2006, 209). According to M. Ralska-Jasiewiczowa (1998a), its beginning correlates with a decline in elm (*Ulmus*), as is also the case in the diagram from Nasiłów in Kuyavia (Makohonienko 2008, 364-365). The proportion of birch (*Betula*) declines in the Gościąż diagram, while the percentages of *Corylus* and *Populus* (*tremula* type) increase, and the increase in oak (*Quercus*) is less evident. The proportion of spruce (*Picea*) drops, and juniper (*Juniperus*) appears. Permanent fluctuations can be observed in *Quercus* and *Corylus*. The proportions of NAP (*Gramineae*, *Artemisia*) and ruderal plants (*Urticadioica*, *Plantago major*, *Chenopodiaceae*) show a rise. In addition, pollens of *Frangula alnus*, *Humulus lupulus*, *Solanum dulcamara*, and *Thalictrum* were recorded, which suggests openings in alder forests. At the same time, changes in deciduous forests are reflected in the Gościąż diagram by *Melampyrum* and *Pteridium aquilinum*, and *Calluna vulgaris* and *Juniperus* appear in dry places. Species like *Plantago media* and Anthericum appear in forest openings. Single grains of wheat pollen were also identified, providing direct evidence of the presence of Neolithic communities. These

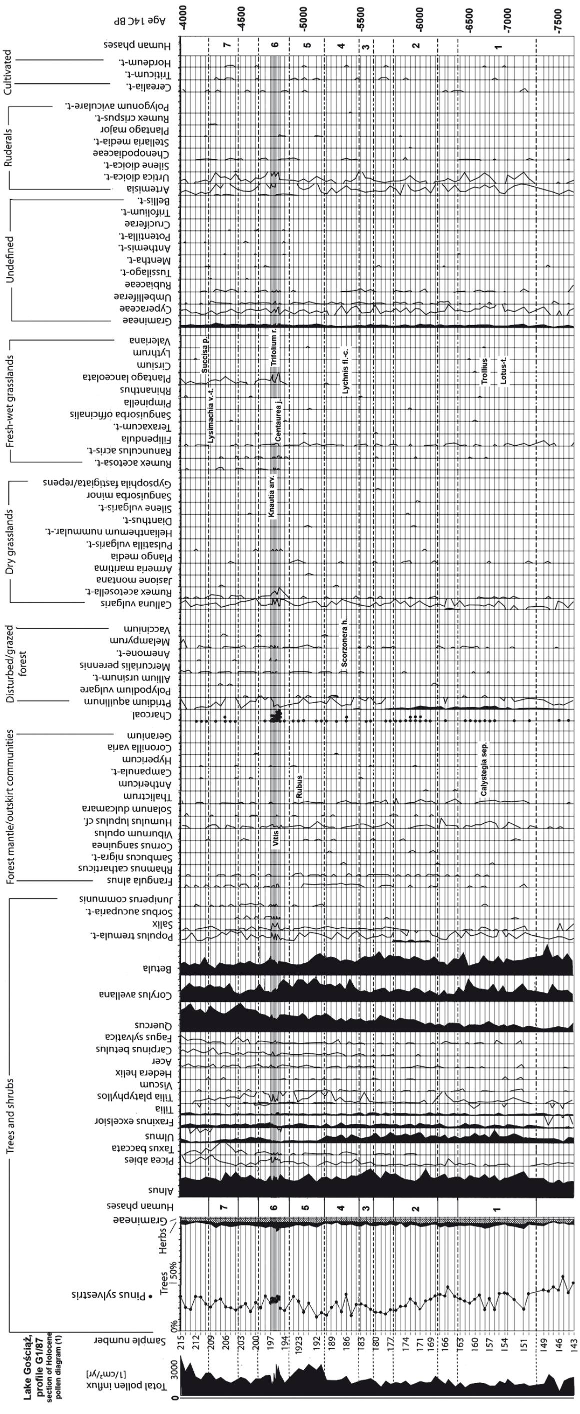


Fig. 2. Lake Gościąż. Kujawsko-Pomorskie voivodship. Pollen diagram referring to the period 7500-4000 BC (after Ralska-Jasiewiczowa and van Geel 1998 a)

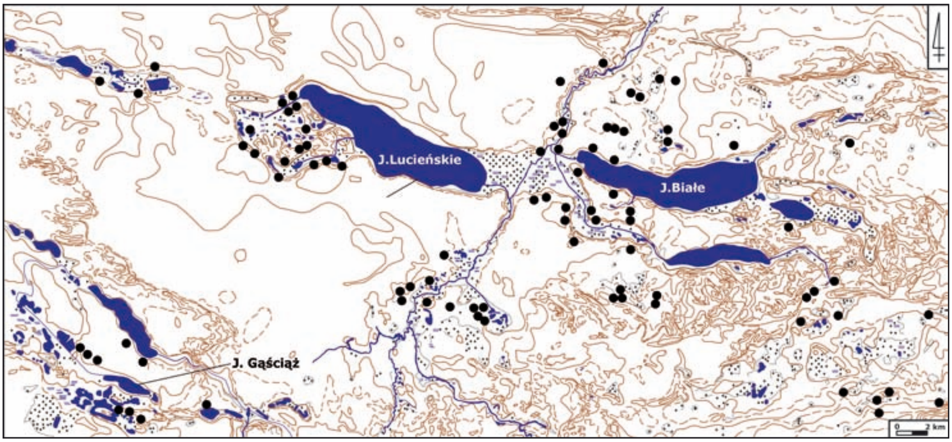
changes were interpreted, first of all as evidence of forest grazing and collecting forest fodder for animals (Ralska-Jasiewiczowa, van Geel 1998a, 272; Pelisiak *et al*. 2006, 22).

Phase 6. The activity of Neolithic farming populations is even more evident in the Gościąż diagram during phase 6 of anthropogenic disturbances dated to 3600-3200/3100 BC (Fig. 2; Pelisiak *et al*. 2006, 109-110). Its beginning is marked by increased frequency of ruderal plants: *Plantago major*, *Artemisia*, and *Chenopodiaceae*. The curves of hazel (*Corylus*), oak (*Quercus*), elm (*Ulmus*), and ash (*Fraxinus*) initially decline to later increase, and the same can be said about the pollens of pine (*Pinus*), birch (*Betula*), aspen (*Populus tremula*), willow (*Salix*), and rowan (*Sorbus aucuparia*). Sorrel (*Rumex acetosa*), brown knapweed (*Centaurea jacea*), white clover (*Trifolium repens*), and many others grew in open meadows. There was a marked presence (1.5%) of ribwort plantain (*Plantago lanceolata*). Deforestations of dry habitats is evidenced, among others, by sorrel (*Rumex acetosella*). The sediment corresponding to that phase also contained large amounts of charcoal dust, possibly indicative of intensive, intentional burning of forests (Pelisiak *et al*. 2006, 22, 109). The proportion of the pollen of elm (*Ulmus*) declines. Phase 6 closes with a depression of ruderal plants and *Plantago lanceolata*.

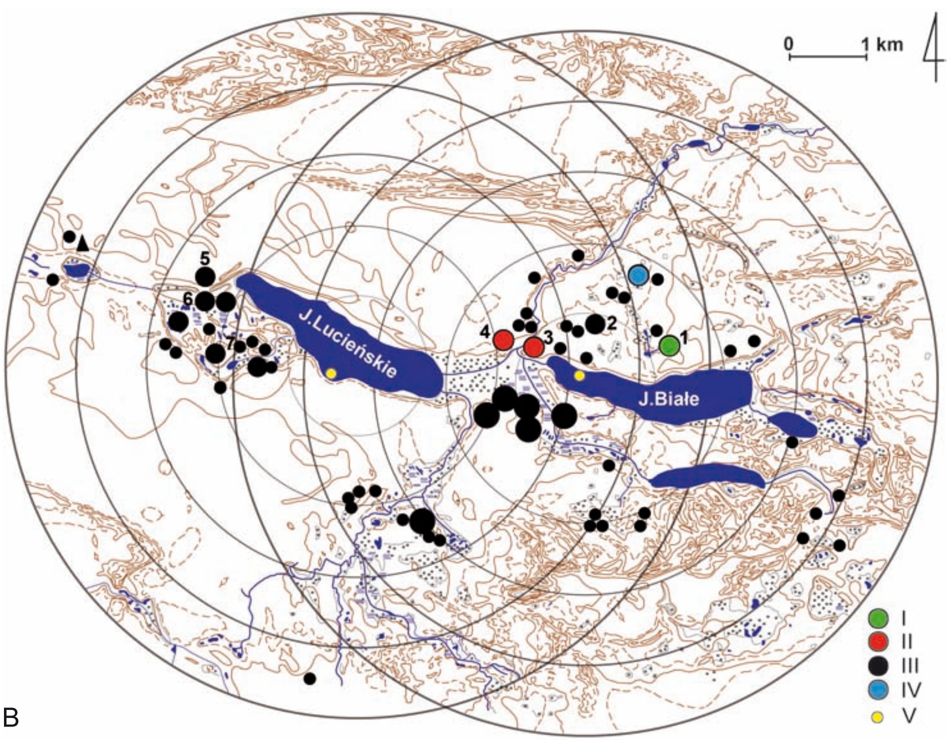
It should be also noted that M. Ralska-Jasiewiczowa and B. van Geel (1998a) identified three cycles of human activity within phase 6. In their opinion, the first one involved the appearance of human groups and settling of the area, evidenced by the spread of *Artemisia*, *Chenopodiaceae*, and *Plantago major*. The second cycle involved increased deforestation and creation of pastures, evidenced by a high proportion of NAP, a decline in deciduous trees, and a rise in pioneer tree species and pollens of nettle and plants typical of open areas. The last cycle was marked by decreased intensity of animal grazing and the return of vegetation to abandoned areas, as shown by the increase in pollens of *Artemisia*, *Pteridium aquilinum*, *Taxus*, *Juniperus*, *Corylus*, and trees (*Fraxinus*, *Ulmus*, *Quercus*).

Lakes Białe and Lucieńskie, and the Gąsak peat bog

To verify these findings, a research project entitled "The impact of Prehistoric and Medieval Societies on the Natural environment of the Gostynin Lake District, Central Poland" was carried out in successive years by M. Rybicka and A. Wacnik (Rybicka and Wacnik 2012). The research included collecting sample cores from laminated lake sediments in places varying in terms of the intensity of prehistoric occupation in their surroundings. Diagrams obtained for Lakes Białe and Luteńskie and the Gąsak peat bog (Wacnik and Rybicka 2012), sites situated approximately 10 km south of Lake Gościąż, were analysed. The intensity of Neolithic settlement around these three palynological sites was different from that around Lake Gościąż (Fig. 3: A, B; Rybicka 2012). It should be also noticed that unfortunately, the changes of the environment recorded in the pollen diagrams of Białe and Lucieńskie lakes and the Gąsak peat bog do not have as precise a chronology as those from the bottom sediment of Lake Gościąż (Wacnik and Rybicka 2012).



A



B

Fig. 3. Location of the FBC sites. A – in the vicinity of lakes: Gąsak, Białe and Lucieńskie. B – in the vicinity of lakes Białe, Lucieńskie. I – "Wiórek" settlement sites; II – Late Wiórek settlement sites; III – Funnel Beaker settlement points of undetermined chronology; IV – "Luboń" settlement sites; V – palynological sites; 1 – Białe, Site 14, Gostynin district; 2 – Klusek Biały, Site 28, Gostynin district; 3 – Klusek Blały, Site 7, Gostynin district; 4 – Lucień, Site 12, Gostynin district; 5 – Budy Lucieńskie, Site 1, Gostynin district; 6 – Budy Lucieńskie, Site 9, Gostynin district.

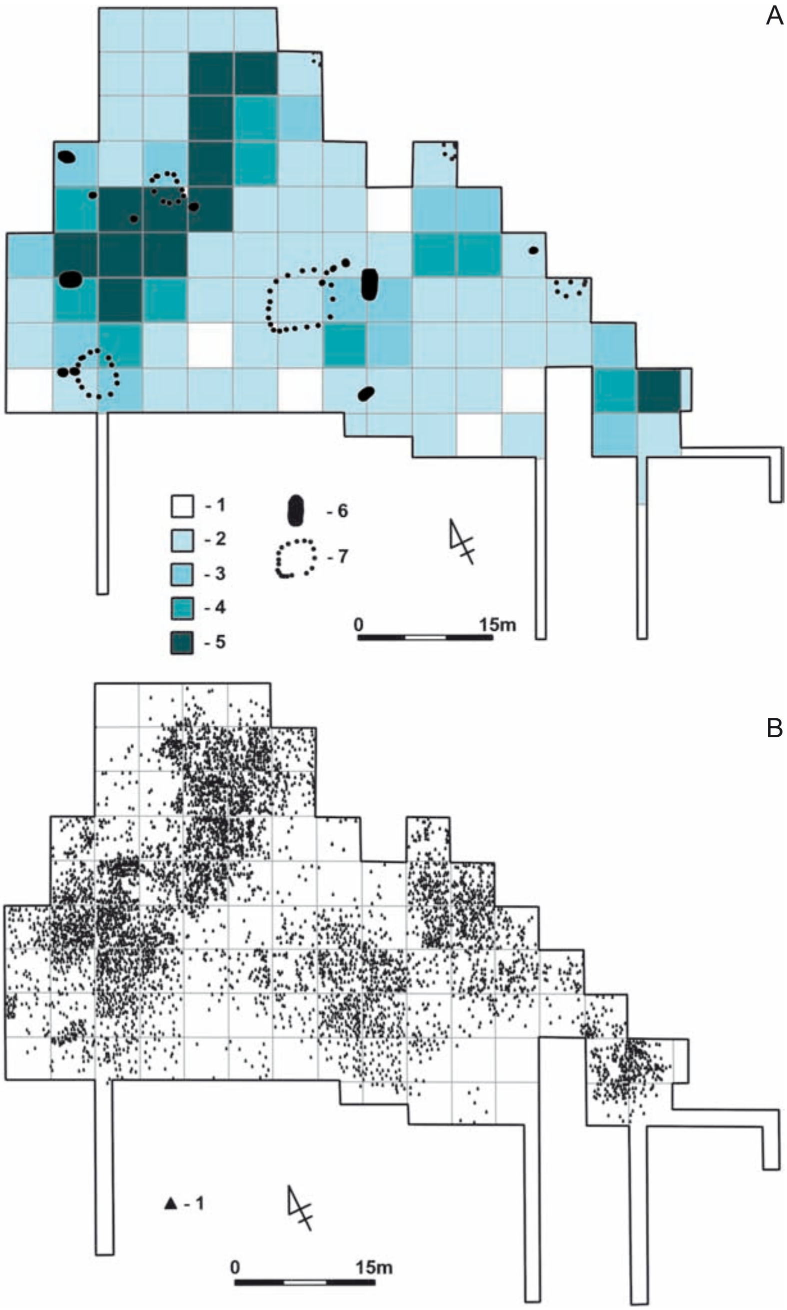


Fig. 4. Annopol, Gostynin District, Site 1. A – Frequencies of FBC pottery in the layers of the excavation unit. 1 – absence of pottery; 2 – 0,1-0,5 kg; 3 – 0,51-1,00 kg; 4 – 1,01-2,00 kg; 5 – 2,01-3,00 kg; 6 – more than 3 kg; 7 – concentration of daub; B – Scatter pattern of the FBC pottery

Summing up the results of the palynological analyses, it was concluded that distinct anthropogenic intervention in the woodland environment took place *c.* 3800-3700 BC around both Lake Białe and Lake Gąsak, detectable in a distinct reduction of *Ulmus*, a less significant reduction of *Fraxinus* and *Betula* (Wacnik and Rybicka 2012), and, around Lake Białe, of linden and pine as well. Changes observed in these diagrams correlate with phase 5 of the anthropogenic disturbances in the Gościąż diagram. Around 3810-3640 BC, a rise in concentrations of large charcoal fragments is observed. This is earlier than the dating of phase 6 of anthropogenic disturbances in Gościąż, marked by distinct traces of forest burning. The phenomenon recorded in the diagram from Lake Białe corresponds with phase 5 of anthropogenic disturbances in Gościąż, dated to around 3960-3600 BC (Pelisiak *et al.* 2006, 109). According to the authors of the analysis of environmental transformations in the vicinity of Lakes Białe and Lucieńskie and Gąsak peat bog, the decrease in the proportion of trees in plant assemblages around Lake Białe led to the increased frequency of light-loving shrubs (*Corylus*, *Juniperus*, and *Populus*). The appearance of a park structure was also recorded in that period in forest communities around Lake Gąsak (Wacnik and Rybicka 2012, 178), where *Sambucus nigra* shrubs started to grow, possibly accompanying human settlements. Around 3510 BC, declines in curves of *Fraxinus* and *Quercus*, and later *Ulmus* as well, were recorded in the diagram from Lake Lucieńskie, as well as an increase in the proportions of *Corylus*, *Betula*, and *Alnus*. The growing size of deforested areas resulted in increased proportions of herbaceous plants such as *Rumex acetossella*. *Cerealia* appeared as well. In the discussed period, the high percentage of *Corylus* in the diagram from Lake Białe possibly suggests the emergence of deforested areas nearby, with vegetation of the meadow type. An increase in *Alnus* and *Acer* was not particularly discernible in that diagram, possibly because herbaceous plants intensively grazed by animals did not produce much pollen (Wacnik and Rybicka 2012, 172). Around 3460-3140 BC, the percentage of herbaceous plants (like *Artemisia*, *Chenopodiaceae*, *Plantago lanceolata*, and *Rumex acetosella*) distinctly rises in the Lake Białe diagram, and *Centaurea jacea*, *Aster*, *Plantago media*, and *Rumex acetosa* appeared. However, no cultivated plants were recorded. *Plantago lanceolata*, associated with poorly grazed meadows (Makohonienko *et al.* 1998; Makohonienko 2004), appeared around the Gąsak peat bog about 3470 BC, and in the diagram from Lake Lucieńskie circa 3110 BC (Wacnik and Rybicka 2012, 178, 182). In the diagram from Lake Białe, fire indicators started to disappear around 3460-3330 BC, and a brief regeneration of forests with elm, oak, and linden took place *c.* 3240 BC, accompanied by increased proportions of pollens of *Poaceae* and *Artemisia* and a slight increase in *Rumex acetosa* and *Centaurea jacea*. This speaks for open areas with meadow-like vegetation, where animals could be grazed. Concentrations of charcoal increased again around 3240-3010 BC, possibly indicating continuation of local forest burning for the needs of intra-forest economy. Later, the percentage of herbaceous plants increases again.

A comparison of the evidence of human activity recorded in pollen diagrams from Gościąż and Białe lakes and the Gąsak peat bog led to the conclusion that similar tendencies of environmental changes occurred there: fluctuations of *Ulmus* values, evidence of forest clearings including presence of charcoal in the sediments, occurrence of formations of opened land, frequencies of ruderal taxa, and not considerable presence of *Cerealia* except phase 5 from Lake Gościąż and the period about 3500 BC in the diagram from Lake Lucieńskie.

FUNNEL BEAKER CULTURE IN THE GOSTYNIN LAKE DISTRICT. ARCHAEOLOGICAL EVIDENCE

In the fourth millennium BC, the Gostynin Lake District started to be settled by communities representing the FBC, marking the beginning of Neolithization of the region (previously first clearances had been locally opened in compact forest cover by Mesolithic groups: Pelisiak *et al*. 1994; 2006). This area did not offer sufficient environmental condition for early Neolithic people, and the presence of LBK settlements has not been recorded in the Lake District itself (Rybicka 2004; Pelisiak *et al.* 2006). LBK groups occupied Kuyavian areas with heavy, fertile soils, suitable for their mode of agriculture (Czerniak 1994), which were absent in the Gostynin Lake District.

FBC communities inhabited the entire area of the Gostynin Lake District, although the settlement network cannot be described as compact or well-developed (Rybicka 2004). In general, the chronological framework of FBC settlement in the Gostynin Lake District can be currently set as spanning from around 3800/3700 to 3200/3100 BC. A total of 240 settlement points (settlements and campsites) of this culture have been identified in the eastern part of the region. However, monumental tombs of the type known from Kuyavia have not been found there (Rybicka 2004; 2006).

The short-term FBC settlements in the Gostynin Lake District occupied an area of 0.5 ha each and were inhabited by groups of several dozen people. The settlements were often relocated, with good examples known from the vicinity of lakes Białe and Lucieńskie. Apart from settlements chronologically corresponding to phase 5 of the anthropogenic disturbances identified in Gościąż, settlement clusters in this area also included settlements correlating with phase 6, situated at a distance of a few kilometres from each other (*e.g*. Klusek Biały Site 7, Klusek Biały Site 28, and Białe Site 14). In the best-investigated parts of the Gostynin Lake District, settlements of similar chronology were established at least 4-5 km from each other (Rybicka 2004), and their inhabitants exploited an area within a radius of 4 km from the dwellings (Pelisiak *et al*. 2006, 34-44). However, the immediate vicinities of settlements seem to have played the major role in the economy (Rybicka 2004; Pelisiak *et al*. 2006, 44), as was demonstrated, for example, by research on LBK in Kuyavia (Nalepka 1999; Grygiel 2004), which confirmed hypotheses previously expressed in the literature (Kobyliński 1986; Kruk *et al*. 1996).

Period 3900-3600 BC

In the Gostynin Lake District, no remains linkable with the AB phase of the Sarnowo type have been identified (Rybicka 2004; 2012; Pelisiak *et al.* 2006). The chronology of that phase currently remains debatable (*e.g.* Nowak 2009; Rybicka 2011), and its beginnings can be placed in the early centuries of the 4th millennium BC (Papiernik and Brzejszczak 2018), which would correspond with phase 5 of the anthropogenic disturbances distinguished in Gościąż (Pelisiak *et al.* 2006). FBC settlements from the Gostynin Lake District included small, short-term settlements (up to 0.5 ha in size) linked with the younger stages of the Sarnowo phase/early Wiórek phase, such as Helenów Site 1 and Klusek Biały Site 28 (Rybicka 2004; 2005), or with the early stage of the Wiórek phase (*e.g.* Grzybów Site 23 and Witoldów Site 1; Rybicka 2004). They were found in different parts of the discussed region, including 10 km south of Lake Gościąż, near the palynological site of Białe and Lucieńskie at a distance of 1-3 km from them. It should be also emphasized that repeated surface surveys carried out in the forested surroundings up to 5 km around the Lake Gościąż have not revealed FBC sited dated to the period 3900-3600 BC.

FBC communities of that period established their settlements in environments resembling primeval forest, as evidenced by disturbances recorded in the diagram from Lake Białe around 3800-3600 BC, with an increase in the fraction of large charcoal fragments indicative of the burning out of forests. These changes may have been caused by the activity of inhabitants of the settlement at Klusek Biały Site 28, which was occupied in this period (Rybicka 2005). As for Lake Gosciąż, phase 5 is characterised there by the presence of wheat pollen and by evidence for forest clearances, although no human groups potentially responsible have been identified. Settlements of that date (Klusek Biały Site 28) situated in a cluster 10 km south of Gościąż produced no direct evidence of agriculture, such as plant macro-remains or osteological remains (Rybicka 2005), and they only yielded tools (sickles) made of imported chocolate flint (Dobrzyński 2014). No house remains have been found either (Rybicka 2005).

Period 3600-3300 BC

Of particular interest are FBC remains representing the period between 3600 and 3300 BC (Rybicka 2004), which means corresponding with phase 6 of the anthropogenic disturbances identified in the laminated sediments of Lake Gościąż (Pelisiak *et al.* 2006). No permanent FBC settlements from that period have been found close to Gościąż, but they were identified 10 km further south-east, around Lake Białe and the Gąsak peat bog (Fig. 3A; 3B; Rybicka 2012). These settlements form chronologically and functionally diversified clusters there, which are comprised of settlements from the early Wiórek phase (*e.g.* Klusek Biały Site 28) and the classic phase; examples of the latter are Białe Site 14, Klusek Biały Site 7, and Lucień Site 12 (Rybicka 2004; 2012). One can observe settlement

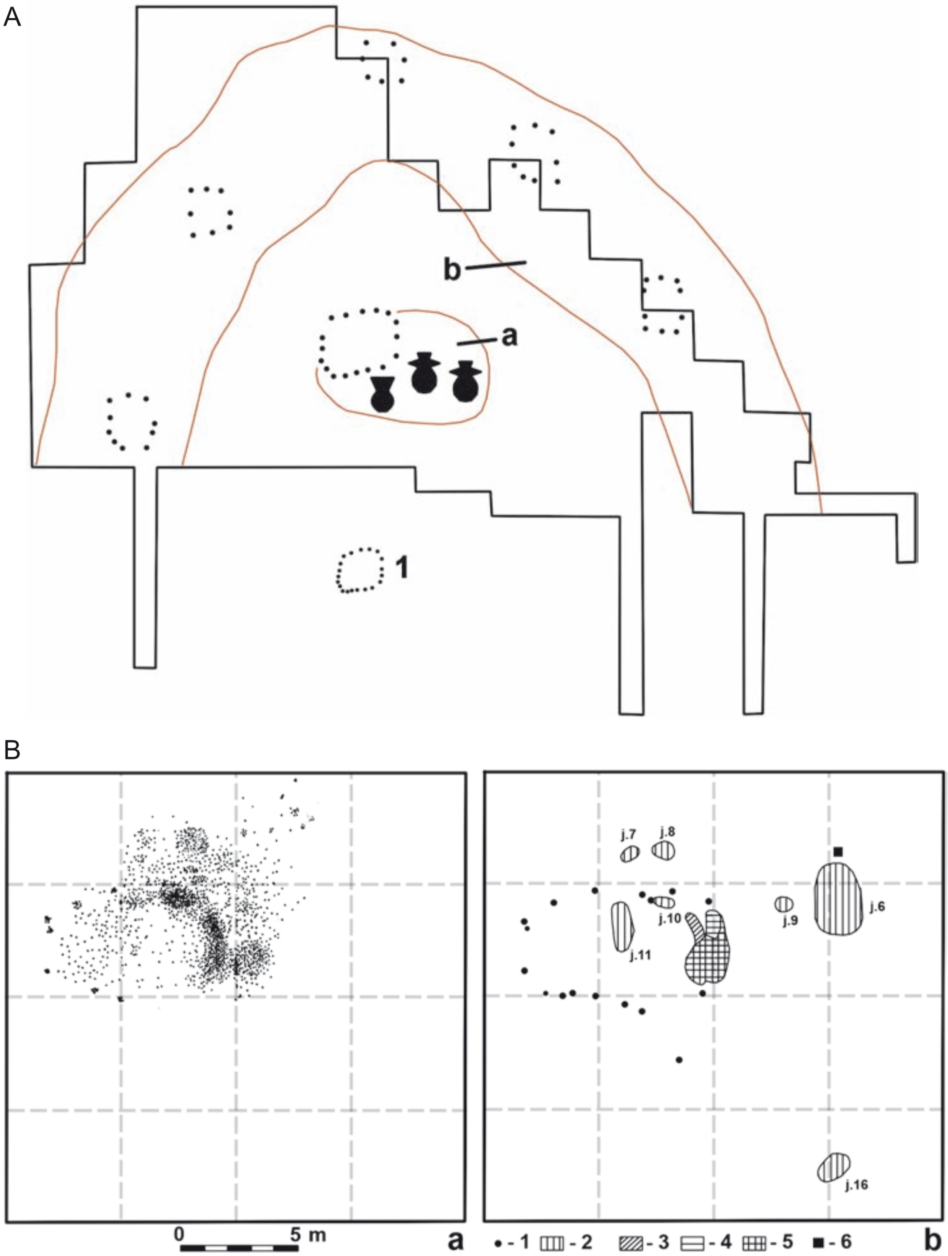


Fig. 5. Annopol, Gostynin District, Site 1. A – scheme of the settlement organization: a-utility-ritual area; b – utility area; 1 – houses (after Rybicka 2004). B – house no. 3 (after Papiernik and Rybicka 2002): a – distribution of daub within a concentration denoted as house no. 3: layer III (level 40-50 cm); b – distribution of settlement pits in the vicinity of house no. 3; 1 – post holes; 2 – pits; 3 – layer of daub; 4 – layer of clay; 5 – layer of clay with admixture of an undetermined substance of light grey colour; 6 – quernstone

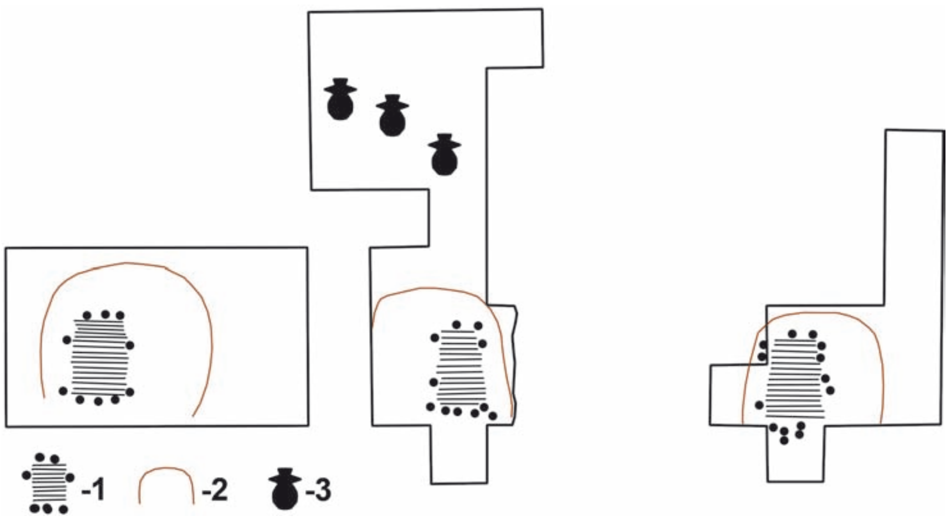


Fig. 6. Białka, Site 2, Gostynin district. Scheme of the settlement organization.
1 – houses; 2 – household area; 3 – ritual area

shifts within a small area (Klusek Biały Site 28 and then Białe Site 14, Klusek Biały Site 28, and Lucień Site 12). This may have translated into disturbances of plant cover becoming established in that area, evidenced in pollen diagrams by indicators characteristic of forest openings. Also, as was signalized above, *Cerealia* pollen grain are present in pollen diagram from Lucieńskie Lake; this group of plant remains is however, absent in FBC sites located around this lake (Rybicka 2004; 2012).

Remains of FBC datable to 3600-3300 BC were also recorded in more distant areas of the Gostynin Lake District. Examples include the relatively short-lived settlements in Annopol Site 1 (Fig. 4-5), Stefanów Site 3, and Białka Site 2 (Fig. 6), situated from 10 to 30 km from the above-mentioned palynological sites. These settlements differ in terms of their spatial arrangement (Fig. 4, 5; Papiernik and Rybicka 2002; Rybicka 2004), and they were inhabited by groups of several dozen people. Occupying an area of 0.5 ha, the settlement at Annopol Site 1, the best-excavated FBC Site in the Gostynin Lake District (and possibly representative for the region), yielded six dwellings manifesting themselves by concentrations of daub (Fig. 5: A, B; Papiernik and Rybicka 2002). They were arranged in an oval, with the largest dwelling in the centre (Fig. 5: A). The features arranged around the central area were also dwellings, and their surroundings were used for various economic activities (Rybicka 2004, 195-197). All the houses were surrounded by yards of differing sizes. The central house probably served some other social role as well, and the area around it possibly had some ritual meaning, as suggested by the prevalence of collared flasks among the pottery discovered there. In Białka Site 2 (Fig. 6), features manifesting themselves as daub concentrations were arranged in a row, while the centre of the site was a ritual area, where no other pottery than collared flasks was found (Rybicka 2004). In general, these settlements were built according to a plan.

ARCHAEOLOGICAL AND ARCHAEOBOTANICAL DIRECT AND INDIRECT EVIDENCE OF PLANT CULTIVATION FROM FBC SITES IN THE GOSTYNIN LAKE DISTRICT

The location of FBC settlements on acid soils has affected the state of preservation of organic remains, with the discovered osteological remains being few and fragmented. Remains belonging to sheep/goat, pig, hare, deer, and birds were identified in the assemblage from Annopol Site 1, and a similar set of species was identified at Białka Site 2 (Rybicka 2004, 233). Cattle remains have not been found. The presence of hare – an animal typical of open habitats (Makarowicz 1998, 236) – is indicative of the presence of deforested areas around the settlements in question. No macroscopic plant remains have been recorded except those preserved in pieces of daub. The analyses of small samples from Białka Site 2 and Annopol Site 1, carried out by A. Bieniek, revealed two glume bases of hulled wheat (*Triticum* sp.), two impressions of einkorn (*Triticum monococcum*) wheat spikelets, and one impression of glume bases of einkorn wheat in Białka. The sample from Annopol contained two spikelet impressions of *Triticum monococcum* and one of einkorn wheat (Rybicka 2004, 231). These are direct indicators of cereal cultivation. Among indirect evidence, one can mention numerous quern stones (Fig. 7; five from Annopol Site 1, one from Huta Nowa Site 1, and six from Grzybów Site 43), sickles (Papiernik and Rybicka 2002; Dobrzyński 2014), and axes (Rybicka 2004, 228-232). In the Annopol settlement, 2 or 3 macrolithic artefacts made of Volhynian flint, 1 or 2 axes of Świeciechów and banded flint, and 1 to 3 tools of chocolate flint were found close to each house, demonstrating that all the inhabitants had access to imported raw materials from which the tools necessary in the agricultural works were made (Papiernik and Rybicka 2002). Finished lithic artefacts made from types of stone originating from south-eastern deposits were also used by people from other settlements, both from the area of Lakes Białe, Lucieńskie, and Gąsak (Białe Site 14, Huta Nowa Site 1; Rybicka 2004, 211; Dobrzyński 2014) and those situated more than10 km from Lake Gościąż (Białka Site 2, Stefanow Site 3; Rybicka 2004).

In summary, agricultural activity of FBC communities from the Gostynin Lake District in the period of 3600-3200 BC is known primarily from indirect evidence originating from archaeological excavations (sickles, quern stones), while direct evidence (wheat macro-remains, bones of domesticated animals; Fig. 8) is less abundant. Nevertheless, the indirect evidence provided by archaeological research, in the form of quern stones, sickles made of imported raw materials, and scarce cereal macro-remains

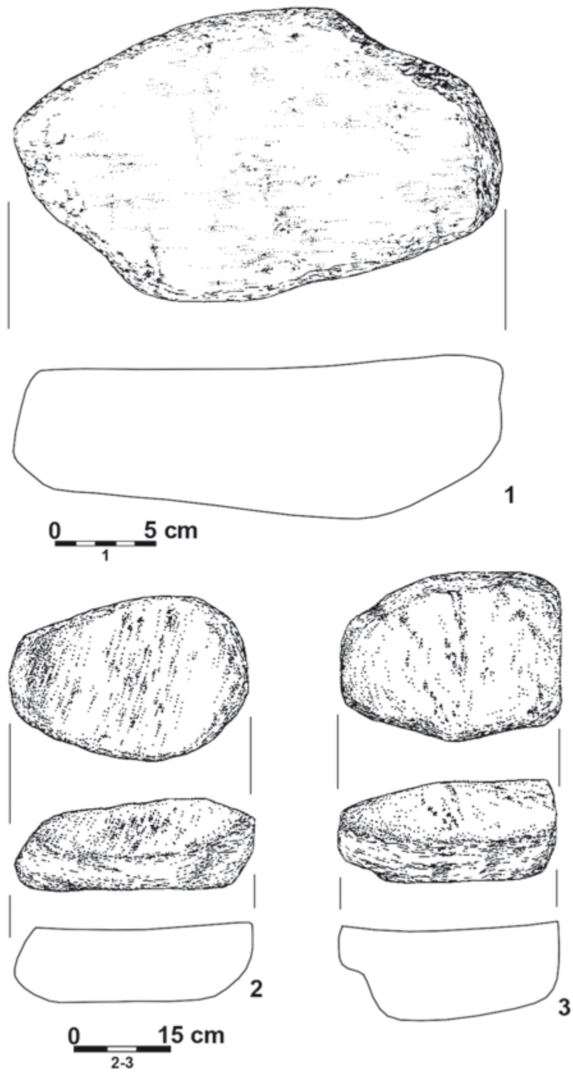


Fig. 7. Quernstones.
1 – Huta Nowa, Gostynin District, Site 1; 2, 3 – Annopol, Gostynin district, Site 1

from, Annopol Site 1 and Białka, Site 2 and other sites (Rybicka 2004), does not provide sufficient grounds for assessing the role of cereal cultivation in agriculture either. All they do is confirm the cereals were cultivated and confirm the results of the palynological analyses.

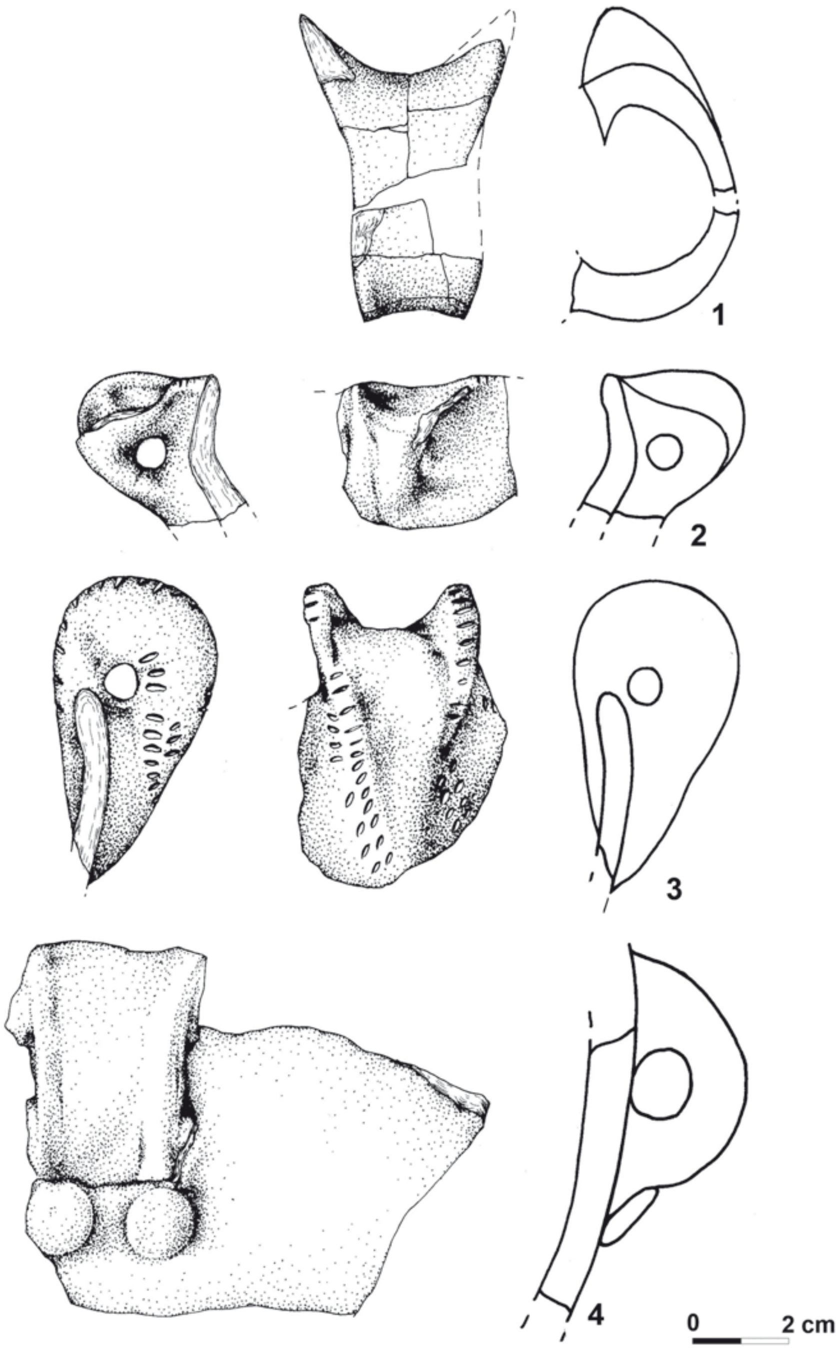


Fig. 8. Stefanów, Site 3, Gostynin District. Selection of pottery of the FBC

FINAL REMARKS. THE ECONOMY OF THE FBC COMMUNITIES IN THE GOSTYNIN LAKE DISTRICT IN THE CONTEXT OF THE KUYAVIAN CLUSTER OF FBC

As discussed above, palynological data from pollen diagrams are considered to be of key importance for studying prehistoric human activity (*e.g.* Kruk 1980; 1994; Pelisiak and Rybicka 1998; Pelisiak *et al.* 1994; 2006; Ralska-Jasiewiczowa, van Geel 1992; 1998a; 1998b; Makohonienko 2004). Such a conclusion, however, needs to be followed by a few reservations. Taking into account a number of factors influencing the pollen fallout, the explanation of changes in plant assemblages observed in palynological diagrams requires reliably placing these changes on the timescale and understanding the human presence in the area.

The presented diagrams from the Gostynin Lake District reveal distinct indicators of human activity, in the form of clear traces of fire, high percentages of pasture (*e.g.*, *Plantago lanceolata*) and ruderal plants, with an incidental presence of cereals (Ralska-Jasiewiczowa and van Geel 1998a; Pelisiak and Rybicka 1998; Pelisiak *et al.* 2006; Wacnik and Rybicka 2012). These are indirect indicators of agricultural activity, chronologically corresponding to the Funnel Beaker culture. However, they do not provide sufficient grounds for determining the character of the economic model. The insignificant presence of cereals in the diagrams (Pelisiak *et al.* 2006; Wacnik and Rybicka 2012) does not allow for the role of cereal cultivation in the FBC economy to be assessed. Distinct changes corresponding to phase 6 of the anthropogenic disturbances recorded in Gościąż (Pelisiak *et al.* 2006) can be linked with the classic stage of FBC development, in the Gostynin Lake District dated to around 3600-3200 BC (Rybicka 2004). Remains of permanent FBC settlement of such a date have not been recorded around Lake Gościąż itself. This discrepancy may stem from poor understanding of the settlement in the region, with the current picture not reflecting its actual importance for FBC communities in that period, or, more likely, the pollen preserved in the laminae representing this phase originated from more distant areas, 10 km from Lake Gościąż (*e.g.*, around Lake Białe) and even further, where settlement of that date is confirmed.

A fact documented beyond any doubt in the diagrams from Lakes Gościąż, Białe, and Lucieńskie is the practice of slash-and-burn agriculture, considerable changing the primary plants landscape. On the other hand, the short lifespans of the relatively small settlements inhabited by small groups of FBC people, and therefore their frequent relocations, would not have resulted in permanent deforestations in most parts of the Gostynin Lake District.

Interestingly, the intensification of agricultural activity of the FBC communities in the Gostynin Lake District from about 3600 BC correlates with the importation of Świeciechów flint, and Volhynian flint in particular (Papiernik and Rybicka 2002; Rybicka 2004; Diachenko and Rybicka 2018; 2019), which at that time is also present in Kuyavian settlements dated to around 3600-3300 BC, like Nowy Młyn Site 6 and Wilkostowo Site 23/24, (Domańska 2013; Rzepecki 2014; Grygiel 2016; Papiernik 2016; Diachenko and Rybicka 2019). Aleksander Kośko (1981, 139) believed that sickles from imported materials (especially those made of Volhynian flint) played an important role in harvesting cereals. Such tools have been found in large numbers in the Gostynin Lake District in the settlements of Annopol Site 1 and Białe Site 14 (Papiernik and Rybicka 2002; Dobrzyński 2014), as well as in the Kuyavian settlements of Nowy Młyn Site 6 and Wilkostowo Site 23/24 (Domańska 2013; Papiernik 2016).

Analysing daub from several sites in Kuyavia representing the so-called Mątwy group horizon of FBC (Tarkowo Sites 23 A and 23B, Inowrocław-Mątwy Site 1), M. Klichowska identified barley as the predominant element in the crop structure (Kośko 1981, 137, 138). This allowed A. Kośko (1981, 138; *cf.* remarks in Mueller-Bieniek 2016, 762) to put forward a hypothesis positing the predominance of barley in the lowland FBC, as a crop more suitable for cultivation in medium-quality soils. In his opinion (Kośko 1981, 139), the cereal deposits from Radziejów Kujawski Site 1, Opatowice Site 12, and Zarębów Site 1 (Klichowska 1970; 1979; Rybicka 1995), suggesting *Triticum* as the main cereal cultivated in their environs cannot be treated as representative as they originate from cultural features. However, the analyses of impressions preserved in daub and pottery from Kuyavian settlements dated to 3600-3300 BC (*e.g.*, Osłonki Site 2: Mueller-Bieniek 2016, 763; Wilkostowo Site 23-24: Abramów 2014; 706) indicate that it was actually wheat (*Triticum monoccocum*, *Triticum dicoccum*) that was the predominant crop cultivated by FBC groups of that period, while barley occurred only incidentally (Abramów 2014, 506). This is corroborated by the analysed daub samples, albeit not particularly large, from FBC settlements in the Gostynin Lake District, where, as in Kuyavia, wheat has been identified but barley has not (Rybicka 2004).

The changes in the frequency of *Plantago lanceolata* in the diagrams from the Gostynin Lake District cannot be given unambiguous interpretation in terms of the importance of animal husbandry (*cf.* Pelisiak *et al.* 2006; Wacnik and Rybicka 2012). Janusz Kruk (2004, 25) posed a very important question of whether there are "...environmental reasons for the appearance of deforested spaces (...) outside the climatically-determined steppe zone?". He also noted that "...the appearance of open landscapes might indirectly attest to keeping large herds of livestock..." (Kruk 2004, 25). In the classic palynological studies, the grazing of animals (not necessarily implying a pastoral economy) is reflected precisely by the increase in *Plantago lanceolata* (Kruk 2004, 26). There is no equivocal osteological evidence of cattle herding in the Gostynin Lake District. The bone remains discovered there were few and highly fragmented, and in Annopol Site 1 and Białka Site 2 they belonged to sheep/goat, hare, deer, and birds (Rybicka 2004, 233). The importance of sheep in the economy of the Funnel Beaker communities of the Gostynin Lake District is indirectly suggested by vessels with handles in the form of a ram's head (Rybicka 2004), numerous in the south-eastern group of FBC (Rybicka *et al.* 2014). In contrast, cattle prevailed in the economy of the Kuyavian groups of this culture in the Wiórek phase, *e.g.* in Inowrocław-

Mątwy Site 5, Inowrocław Site 55, and Dąbrowa Biskupia Site 21, with a lesser role of sheep/goat, and an insignificant role of pig (Kośko 1981, 139). A similar structure was recorded in Nowy Młyn Site 6 and Osłonki Site 2 (Makowiecki and Makowiecka 2016, 790, 795) dated to around 3600-3300 BC. Aleksander Kośko (1981, 140) suggested in this context that areas devoid of forest may have favoured some forms of mobile pastoralism, involving sheep. A different picture was recorded in the settlement of Wilkostowo Site 23/24, where cattle prevailed, with a significant percentage of pig and a smaller percentage of sheep/goat (Waszczuk 2014, 432). According to D. Makowiecki and M. Makowiecka (2016, 825, 826), cattle played the predominant role in the economy of FBC communities in Kuyavia, followed by sheep/goat. Pastoral husbandry of these animals was possible thanks to the presence of open grasslands (Makowiecki and Makowiecka 2016, 829, 833). In light of the osteological data, the deforestations and increases in wild herbaceous plants (including *Plantago lanceolata*) recorded in the diagrams from the Gostynin Lake District only allow animal grazing to be suggested, possibly including cattle and sheep (*cf.* Pelisiak *et al.* 2006; Wacnik and Rybicka 2012).

According to Kruk and Milisauskas (1999, 115), FBC communities in the lowlands adapted their economic model "…to conditions different than in loess areas, and transformed it into an agricultural model with great potential for development…". The slash-and-burn technique was crucial in agriculture, and the importance of axes and macrolithic blades used as sickles increased in the FBC (Kruk and Milisauskas 1999, 147). In addition, they noted that for cereal farming FBC communities could use "numerous small openings spread through woodlands, cultivated with the extensive use of fire. The source data clearly indicate that FBC communities used this method" …" (Kruk and Milisauskas 1999, 147). The analysis of both palynological diagrams and archaeological data from the Gostynin Lake District from a period spanning from around 3800 to 3200/3100 BC fit into these findings particularly well (Rybicka 2004; Pelisiak *et al.* 2006; Wacnik and Rybicka 2012). This was a period when the pattern of FBC settlement in the south-eastern group of this culture was marked by so-called mid-sized settlements, when the settlement network became more stable and the role of slash-and-burn agriculture was more established. The central-place stadium, whose beginnings have been dated to around 3640 BC (Kruk and Milisauskas 1999, 120), corresponds to phase 6 of the anthropological disturbances in Gościąż. The results of the palynological and archaeological analyses from the Gostynin Lake District fit well into the model of FBC settlement and economy presented by Kruk and Milisauskas (1999). Slash-and-burn agriculture, whose beginnings correspond to the stadium of mid-sized settlements, has been confirmed in the Gostynin Lake District. The settlements in that region were small and were frequently relocated (the case of Klusek Biały Site 7 and Białe Site 14), which translated into dynamic changes in charcoal frequency in pollen diagrams (Pelisiak *et al.* 2006; Wacnik and Rybicka 2012). At the same time, the import of Volhynian flint in Kuyavia and the Gostynin Lake District falls in a period corresponding with the central-site stadium in the loess areas of southern Poland. That period was marked by intensive contact with Trypillia groups, including direct contact at the peripheries of the latter, evidenced by imports of Trypillia pottery and artefacts of Volhynian flint (Kośko 1981; Rybicka 2008; 2017).

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DWELLINGS AND THEIR NEAREST SURROUNDINGS IN THE 4TH MILLENNIUM BC IN THE EASTERN CARPATHIAN AREA: A CASE STUDY FROM THE GORDINEŞTI II-*STÎNCA GOALĂ* SETTLEMENT

ABSTRACT

Sîrbu Gh. and Król D. 2021. Dwellings and their nearest surroundings in the 4th millennium BC in the Eastern Carpathian area: a case study from the Gordineşti II-*Stînca Goală* settlement. *Sprawozdania Archeologiczne* 73/2, 93-108.

Investigation into the construction of dwellings, their spatial arrangements, and the nearest surroundings is highly relevant in studying the functioning of an archaeological phenomenon. During the recent years of excavation undertaken at the Gordineşti II-*Stînca Goală* site, we have revealed the remains of at least two dwellings and their economic surroundings that on the whole may be referred to as household clusters. In this paper, we would like to focus on one of them (House no. 1). Our main goal is to present not only the key attributes of the dwelling but also the results of the spatial analysis of features and artefacts found inside and outside of it. Based on those data, we can suggest that this dwelling consisted of two functionally varied rooms. This inference seems to be also relevant in the broader sense; it can expand the general knowledge related to issues relating to the household clusters usage in the Eastern Carpathian area at the end of the 4th millennium BC.

Keywords: Late Eneolithic, Gordineşti, Moldova, settlements, dwellings, household cluster
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INTRODUCTION

Investigation into the construction of dwellings, their spatial arrangements, and the nearest surroundings is highly relevant in studying the functioning of an archaeological phenomenon. During the excavation campaigns undertaken at the Gordineşti II-*Stînca goală* site in 2016-2019, we revealed and thoroughly documented the relics of at least two dwellings and their directly adjacent economic zones. These dwellings, together with their surroundings, may even be considered as basic units of production referred to as household clusters (*e.g*. Grygiel 1986; *cf*. Flannery 1976; Kent 1984; Jongsma and Greenfield 2003).

Analysis of these units seemed to be crucial from the perspective of the general significance of the Gordineşti II-*Stînca goală* settlement for the perception of the historical and cultural circumstances in the Eastern Carpathian area at the end of the 4th millennium BC. An assessment of the issue related to the specific types of dwellings for this period and, last but not least, their internal organization within the settlements showed that we are dealing with a more complicated puzzle. Thus, in this paper, we would like to focus more closely on one of these dwellings (House no. 1) excavated in 2016-2018. Our goal is to present the key attributes of the dwelling and some results of the spatio-functional analysis of the features and artefacts found in the context of the whole household cluster.

SITE LOCATION AND HISTORY OF RESEARCH

The settlement that we present in this study is located in the Prut-Dniester interfluve in Northern Moldova on the south-eastern edge of the Gordineşti village, Edineţ District (48°08'24.25" N; 27°09'34.58" E). It is situated on an elongated and flattened limestone promontory (*c*. 500 m long and *c*. 100-120 m width) surrounded by the deeply eroded canyon of the Racovăţ River, the left tributary of the Prut River (Fig. 1). The remains of the settlements occupy its western part, which is heavily damaged by modern deep ploughing that preceded tree planting. Based on the spatial distribution of artefacts on the promontory surface and the results of a magnetometer survey (Przybyła *et al*. 2017, 49-58; Sîrbu *et al*. 2018, 28-30), we are able to determine the size of the settled area, which is *c*. 5 ha. This living space was enclosed on the east with an artificial defence system in the form of a wall and a ditch (Sîrbu *et al*. 2018, 31-33; Sîrbu *et al*. 2019a).

The site was discovered and first excavated in 1971 by V. Dergacev. During that field campaign, which was focused on verification of the cultural layers, two trenches covering an area of 147 sq.m. were dug. Admittedly, no household clusters were identified during this investigation, but it is worth emphasizing that rich assemblages of material such as pottery and many other artefacts made of clay, flint, stone, bone and horn were discovered (Dergachev 1973, 90-100). A few years later, in 1977, the site was also visited by V. Markevici and V. Bikbaev in order to verify and confirm the previous discoveries.

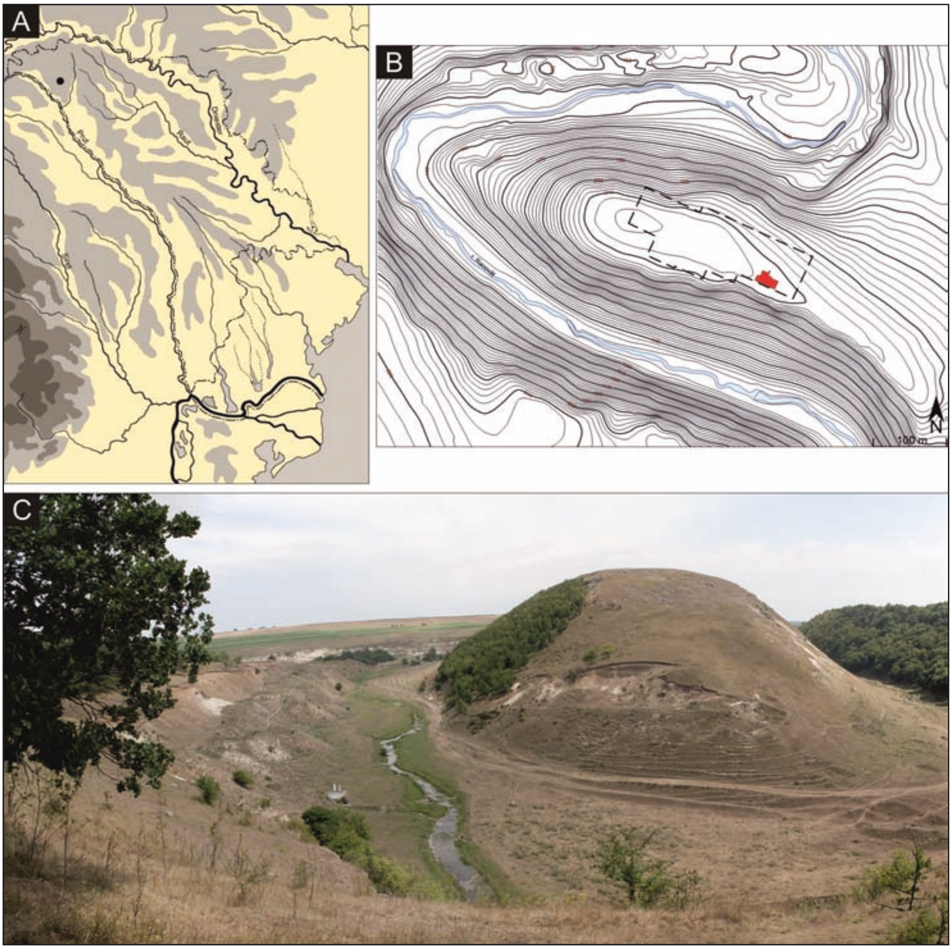

Fig. 1. A – Gordinești II-Stînca goală site on the map of the Republic of Moldova; B – Trenches III-IV and Caseta A on the topographic plan of the site; C – photo with promontory view from the north-west

Since 2016, invasive field work has been conducted at the site. In the first season we focused on the excavation of the Trench conditionally called no. III (in continuation of the other two investigated in 1971 by V. Dergacev), which covered the south-western corner of Trench II (1971). It is oriented along the NE-SW axis and delimited by a 1 m wide baulk. Trench III was divided into five sectors (A, B, C, D, E) and has an area of about 90 sq.m. (Sîrbu *et al.* 2017a; Sîrbu *et al.* 2017b, 25-27; Sîrbu *et al.* 2019, 103-126). The main goal of the following campaign in 2017 was in turn to decipher the real range of the dwelling remains that had been partially recognized in the previous season. Therefore, in the south-eastern corner of Trench III, Trench IV was set-out, it was delimited by a control baulk

0.5 m wide, divided into two Sectors (A and B), with an area of about 40 sq.m. (Sîrbu *et al.* 2019). In 2018, we continued the research on Trench IV that was extended by a part called '*Caseta A*' with a size of 18 sq.m. (see Fig. 2, 2018). This work was aimed at completing the data obtained during the 2017 season by unveiling a cluster of burnt daub registered in the north cross-section of Trench IV (Sîrbu *et al.* 2019).

RESULTS OF THE EXCAVATION CAMPAIGNS

During our first excavation campaign (2016), after removing the humus soil with a thickness of about 25-30 cm, a layer composed of dark brown soil mixed with plenty of gravel appeared. Archaeological material was discovered across practically the entire surface of the trench. A compact concentration of burnt daub (with dimensions 2.2 × 1.7 m) was revealed near the south-western corner (Fig. 2; 3: A). It was interpreted then as a prospective surface of the remains of a dwelling. Going further, fragments of burnt daub with wood imprints were found scattered throughout the southern perimeter of Trench III. Apart

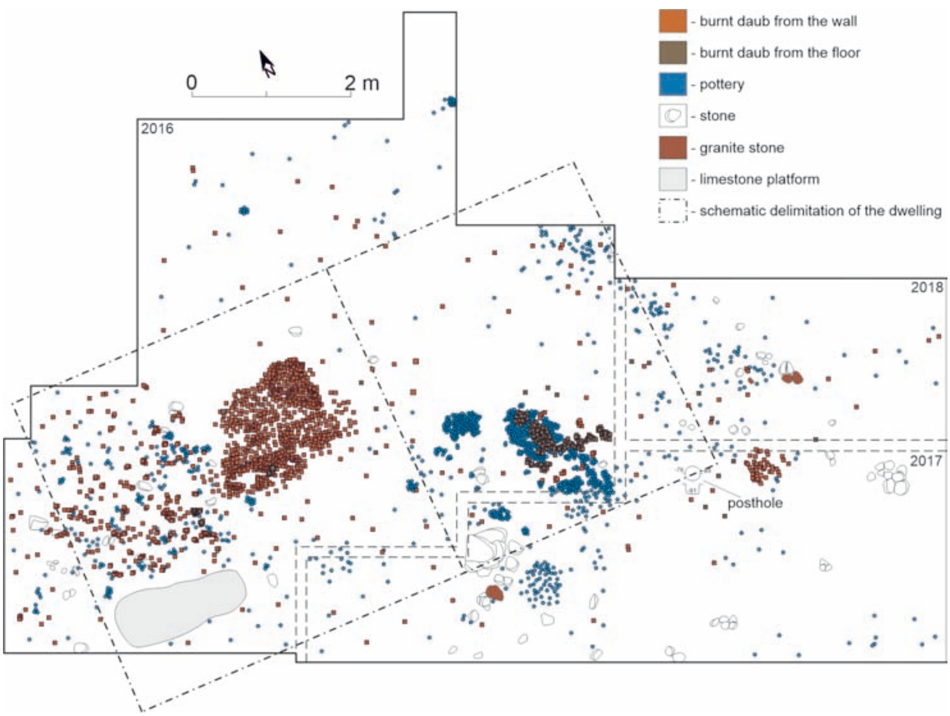

Fig. 2. Gordinești II-Stînca goală site. Plan with materials discovered *in situ*

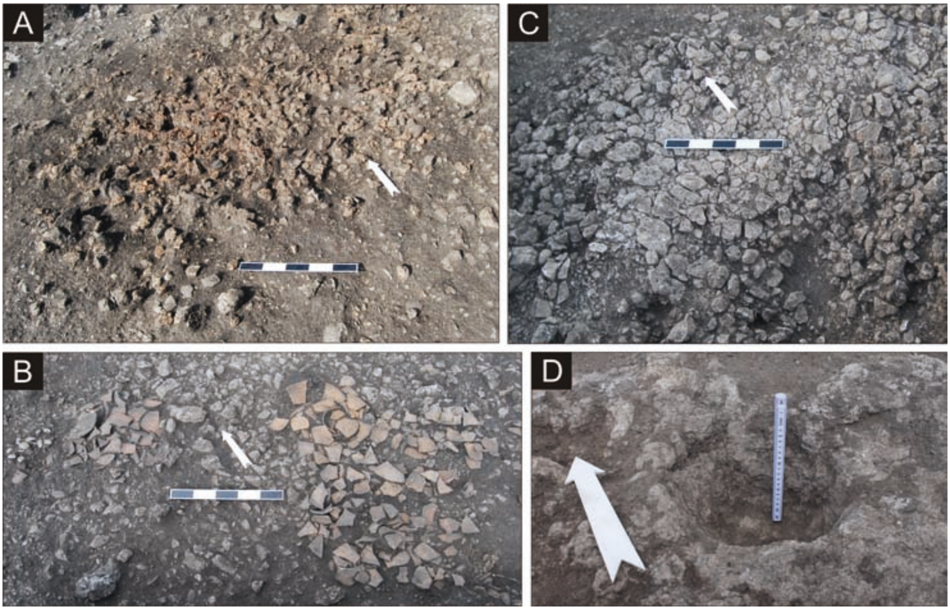

Fig. 3. Gordinești II-*Stînca goală* site. A – concentration of burnt daub; B – concentration of pottery sherds; C – limestone platform; D – posthole

from the compact burnt daub remains with an admixture of organic temper, fragments that contained sand were also found *in situ*. Finding these fragments practically in the same perimeter where the fragments of walls were discovered allowed their identification as remains from the floor.

Another kind of *in situ* concentration of material, comprising hundreds of sherds from several broken vessels was discovered near the south-eastern corner (Fig. 2; 3: B). Interestingly, multiple carbonised grains were also found in this place, they were, however, located directly beneath the mentioned pottery.

Furthermore, a quite puzzling structure was unveiled in the south-eastern side of the presumed dwelling (Fig. 2; 3: C). It was a limestone platform with a smooth surface (see Sîrbu *et al*. 2017b, Fig. 1: E). The anthropogenic origin of this feature seems to be very likely as it was visibly different from the adjacent natural limestone background.

After completing excavations from 2016, it was still not possible to establish precisely the dwelling's boundaries. The soil, which was mixed with a large amount of gravel, plus the erosion processes prevented its better delimitation.

In 2017, as in the previous campaign, after removing the humus with a thickness of about 20-35 cm, we came upon brown soil mixed with gravel. This layer was black, loose and mixed with pebbles as well as small and medium-sized pieces of clay found in some parts of the trench. During the field work, the presence of a dense concentration of pottery and flint artefacts was revealed *in situ*. Additionally, one compact accumulation of burnt daub with dimension of 55-75 cm was unveiled in the northern part of the Trench IV. The breaks of the individual pieces were brownish-yellow, and they were tempered with chaff. Some of them were 19 × 9 × 6.5 or 11 × 7 × 3.5 cm in size. If we consider the fact that there are imprints of branches (about 2-2.5 cm in diameter) in the burnt daub, then these fragments can be identified as a part of a wall (see Fig. 2, 2017).

At a distance of about 1 m west of the above-mentioned accumulation of burnt daub and approx. 45 cm below the ground surface, one posthole in the shape of a circle was revealed (Fig. 2; 3: D). It had a diameter of 50 cm and was dug directly into the limestone bedrock up to a depth of 30 cm. This feature is particularly interesting in the context of the characteristic cluster of stones registered in the south-western part of the Trench IV. Their location in relation to various components of the dwellings seems to suggest that they could have reinforced a wall.

During the third field campaign in 2018, we observed the same stratigraphic pattern as before. It was clearly visible that below the humus soil, there was a layer of granulated chernozem with a dry texture mixed with a small number of fragments of burnt clay, stones, and other artefacts. An agglomeration of pottery was found right in the centre of the 'Caseta A'. Moreover, it is worth mentioning that some massive pieces of granite stone, 28 × 18 cm (see Fig. 2, 2018) and numerous amorphous pieces that had separated from them as a result of thermal processes were also present. Interestingly, we can see traces of processing and polishing on some sides of this granite stone. In fact, *in situ* archaeological materials were discovered over the entire eastern surface of 'Caseta A'. This may be a possible continuation of the dwelling surface that was identified in the previous campaigns.

THE SURFACE OF THE DWELLING AND ITS NEAREST SURROUNDINGS. A RECONSTRUCTION ATTEMPT

The detailed analysis of the data obtained during three field campaigns may allow us to formulate some suggestions regarding the construction of House no. 1 (or more appropriately, household cluster no. 1) and its internal and external arrangement. In this study the information on the spatial distribution of *in situ* artefacts such as burnt clay, ceramics and flint artefacts is crucial. Based on this type of spatial data and computer reconstruction, we can carefully assume that the excavated dwelling was rectangular in shape and consisted of two functionally varied rooms. Its main long axis was oriented southwest-northeast.

As the spatial analysis indicates, most of the burnt daub fragments with distinct wood imprints were preserved inside the first of these rooms with dimensions of about 5.60 × 5.80 m. Based on the imprints oriented parallel to the lateral walls of the room (see Fig. 4), we presume that the concentration of the burnt daub, discovered *in situ*, is related to the wall that was inserted to separate the two rooms. Additionally, numerous remains of wild

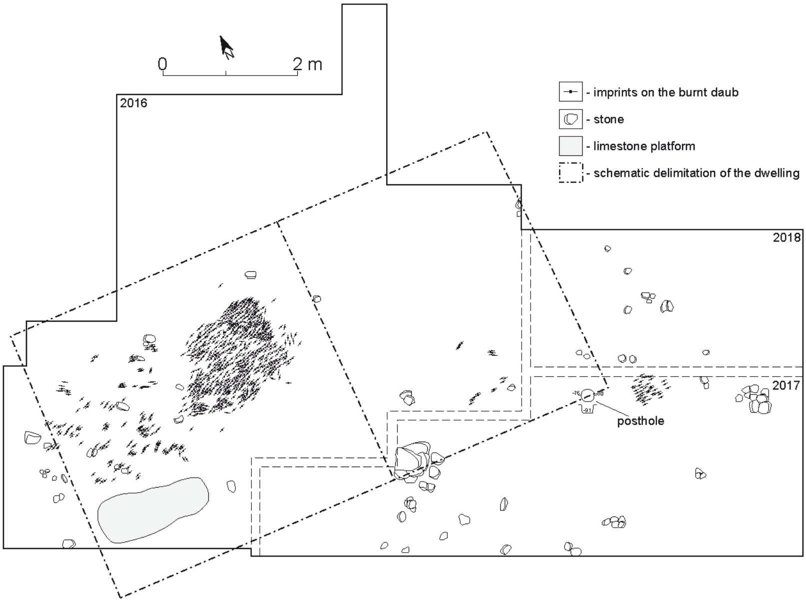

Fig. 4. Gordinești II-Stînca goală site.
Orientation of the imprints on the burnt daub fragments of the wall

and domestic fauna were also found in this part (see Fig. 5) (Croitor and Sîrbu 2017, 215-219). Thus, according to the obtained data we can assume that this space was intended for living.

We might suppose that the second of these rooms was used in a quite different way. This part of the dwelling, which was 5.60 × 4.60 m, should be interpreted rather as household space, where most of the everyday activities were done. The function of this room may be confirmed by the discovered postholes and distinctive agglomeration of stones (see Fig. 2; 3: C, D; excavations in 2017). The perimeter of this room was determined using the spatial distribution of the *in situ* accumulation of pottery as well as numerous objects related to the loom (circular and conical loom weights, spindles). It is worth stressing that most of the flint artefacts (including axes and chisels) were discovered in the context of this space.

In addition to determining the general range of the dwelling surface, which was possible especially thanks to the use of graphic reconstruction, we also focused on the issues concerning shaping its economic surroundings. Therefore, we recorded the exact locations of all the flint chips in order to obtain information on the activities related to the processing of flint. Based on the observed spatial patterns, it is clearly visible that this flint waste was distributed in the perimeter of the second room and outside of it (see Fig. 5).

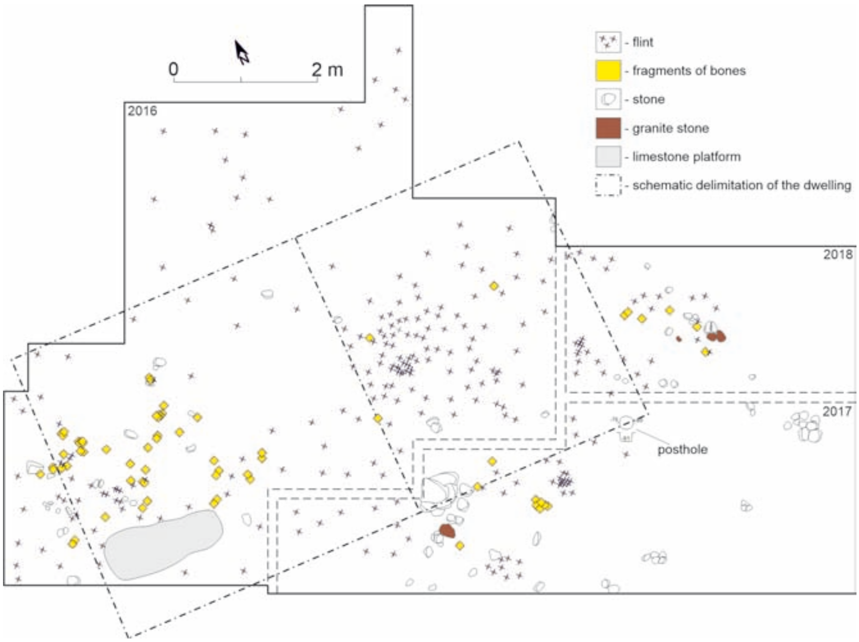

Fig. 5. Gordinești II-Stînca goală site. Concentration of flint artefacts and bone fragments

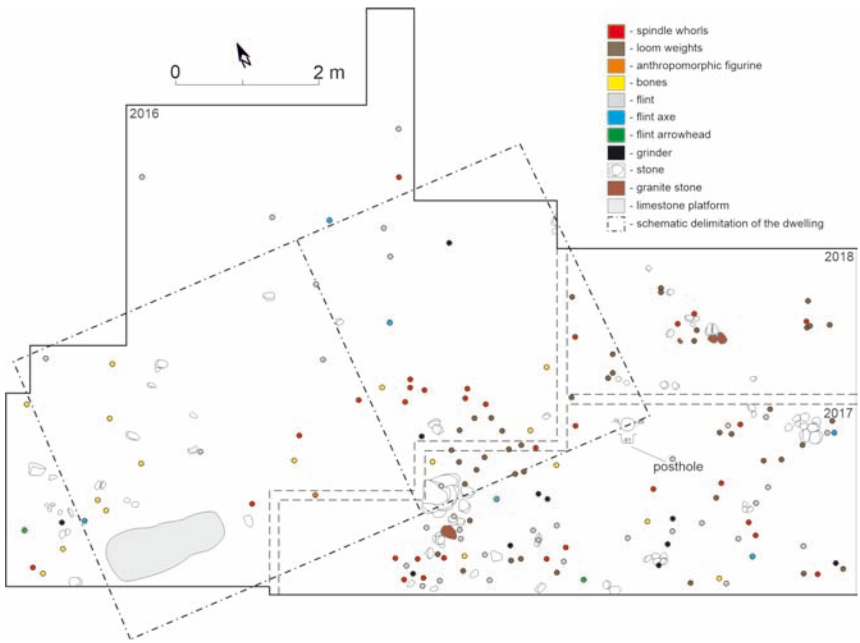

Fig. 6. Gordinești II-Stînca goală site. Distribution of the inventoried pieces

Analyzing the distribution of the whole assemblage of excavated material, we can see that most of the finds were concentrated in the context of the perimeter of the second room (see Fig. 6). This is another valuable argument that may support the correctness of seeing the dwelling as having been divided into two functionally diverse rooms. Moreover, it seems that we should also highlight the presence of an economic zone next to the dwelling, more precisely near the second room. As we mentioned in the introduction, such dwellings together with their economic surroundings may be considered as basic units of production and referred to as household cluster (*e.g.* Grygiel 1986; *cf.* Flannery 1976; Kent 1984; Jongsma and Greenfield 2003). We can assume that the inhabitants of the excavated dwelling could have actively used the space outside its boundaries, most probably the zone adjacent to its southern and eastern walls.

However, precise determination of its specificity is difficult due to some circumstances, for instance the high degree of erosion of the settlement's surface. Therefore, it is currently impossible to assess the exact range of the household cluster unit, however based on the geophysical data (Przybyła *et al.* 2017) and some preliminary tests done in the other part of the settlement, we can safely presume that this kind of economic unit was not so extensive.

RADIOCARBON DATING

An essential part of our investigation was also to determine the absolute chronology of House no. 1 and its nearest surroundings. Radiocarbon dates were obtained for carbonised grains (three samples) and animal bones (three samples) discovered within the reconstructed household space (Table 1). The first of these samples (*Triticum sp.*) was collected near the south-eastern corner of the Trench III directly beneath the concentration of hun-

Table 1. Gordineşti II-Stînca goală site. List of radiocarbon dating. Calibration based on tools of OxCal v.4.4. (Bronk Ramsey 2017) with calibration curve: IntCal20 (Reimer *et al.* 2020).

No.	Site	Lab code	Species	BP	68.2% (1 σ)	95.4% (2 σ)	References
1	Gordineşti II-*Stînca goală*	Poz-83658	*Triticum* sp.	4480±35	3331-3097	3346-3028	Rybicka *et al.* 2020; Sîrbu *et al.* 2020
2	Gordineşti II-*Stînca goală*	Poz-83659	*Triticum* sp.	4480±35	3331-3097	3346-3028	Rybicka *et al.* 2020; Sîrbu *et al.* 2020
3	Gordineşti II-*Stînca goală*	Poz-83660	*Triticum* sp.	4475±35	3331-3094	3344-3026	Rybicka *et al.* 2020; Sîrbu *et al.* 2020
4	Gordineşti II-*Stînca goală*	Poz-83728	*Bos Taurus*	4430±35	3313-2936	3330-2922	Rybicka *et al.* 2020; Sîrbu *et al.* 2020
5	Gordineşti II-*Stînca goală*	PLD-36215	*Capra hircus*	4425±25	3262-2939	3320-2925	Sîrbu *et al.* 2020
6	Gordineşti II-*Stînca goală*	PLD-36214	*Cervus elaphus*	4315±20	2922-2897	3010-2888	Sîrbu *et al.* 2020

dreds of pottery sherds. They produced two identical dates of 3311-3097 BC and one 3331-3094 BC (68.2%) (Table 1). The subsequent absolute dates, however, were obtained for animal bones (*Bos Taurus, Capra hircus* and *Cervus elaphus*) identified in the context of western part of dwelling. Their calibrated values are: 3313-2936 BC, 3262-2939 BC, and 2922-2897 BC respectively (68.2%) (Table 1). These six dates suggest that the House no. 1 and its nearest economic zone could have existed in the period of *c.* 3300-2900 BC (68.2%). However, we should point out that the end of this time range is actually the result of one outlier data (PLD-36214: 4315±20 BP) obtained for an animal bone of *Cervus elaphus* (Table 1). Its real value should be verified in the following studies on the absolute chronology of the entire settlement of Gordineşti II-*Stînca goală* (*cf.* Sîrbu *et al.* 2020, 130).

SOME CONSIDERATION REGARDING THE TYPE/TYPES OF DWELLINGS OF THE HORODIŞTEA-GORDINEŞTI CULTURAL GROUP

In most cases, full understanding of the forms and/or functions of prehistoric buildings is rather difficult due to their fragmentary state of preservation. Considering the settlement patterns of the Cucuteni-Tripolye culture, we can undoubtedly observe the fact that the technique of building the dwellings developed during the evolution of this culture. These changes seem to be related to functional issues. In this such a concept, it can be accepted that the formal syntagma follows function (Trebsche 2009, 507).

In one of his works, P. Trebsche presents and evaluates five methods that allow interpretations of the characteristics of prehistoric dwellings: a) *Ad hoc* interpretations, these are mostly made implicitly and should be replaced by systematic approaches; b) equalization of building types with functions, this method has limits because functional equivalents have to be considered; c) conclusions by analogy, they depend mostly on the choice of objects for comparison; d) circumstantial evidence, time-consuming and expensive techniques of excavation and sampling as well as careful studies of taphonomy are necessary; e) contextual analyses may easily result in circular arguments (Trebsche 2009, 507). We can use them in our considerations regarding House no. 1 in the Gordineşti II-*Stînca goală* settlement. The analysis based on these five methods can provide a much clearer and more informative picture that is, at least, close to prehistoric reality and given our contemporary interpretation.

The typical dwellings of the Cucuteni-Tripolye culture are represented by rectangular structures of varying sizes. Among the relatively well-preserved relics of these dwellings there are primarily remains of burnt daub *ploschadka* (house remains), and therefore such elements are usually the starting point for determining their basic parameters (Kruts 2003, 74).

It is obvious that any attempts to reconstruct dwellings are based on analyses and interpretations of burnt daub remains. Thus, depending on their state of preservation, they can provide information about the shape and size of the dwelling, the nature of its floor and walls, and the construction materials used. On the other hand, they leave room for speculation when it comes to the spatial arrangements of dwellings as well as their resistance structure (László 2007, 103).

We must point out that while there is enough specialized literature devoted to the issues concerning the architecture of dwellings in the Cucuteni-Tripolye culture, knowledge is still quite limited and insufficient in the case of the Horodiştea-Gordineşti cultural group. This is primarily due to the lack of comprehensive large-scale research that would create a general picture of the distribution of dwellings within the settlements. It should be noted that dwellings were discovered only in 15 out of 232 currently mapped settlements: Horodiştea-Dealul Mălăişte – 4 (Dumitrescu 1934, 112-120; Dumitrescu 1945, 127-163; Dinu 1977); Erbiceni-Dealul Sărăturilor – 15 (Dinu 1977; Dumitroaia 2000, Fig. 2) and Dealul Mănăstirea – 1 (Dinu 1977); Cîrniceni-Pe Coastă – 12 (Alaiba and Grădinaru 1995, 64-80; Dumitroaia 2000, Fig. 3); Trinca-Izvorul lui Luca – 3 (Leviţki 1997; Leviţki 1997a, 213-274); Feteşti II – 1 (Larina 1986; Larina and Sîrbu 2014, 189-199); Hancăuţi I-La Frasin – 2 (Bikbaev 1987); Tsviklovtsi-Greada – 3 (Movsha 1970a, 129, ris. 1; Chernysh 1982, 227); Mali Dorohostai I – 3 (Konoplia 1990, 205-213); Listvin-Gostrii gorb – 10 (Peleshchishin 1997, 56-90); Holyshev-Zamchisko – 7 (Peleshchishin 1973, 321; 1974, 326, 327); Vinniki-Zhupan – 1 (Diachenko *et al.* 2019, 27); Pechora – 1 (Chernysh 1959, ris. 17); Sandraki-Pagurok – 1 (Lagodovskaia 1953, 77; Lagodovska 1956, 118-129). It should be, however, mentioned that the data on the dwellings in Cîrniceni-Pe Coastă are confusing and incomplete. Out of the 12 dwellings, the data refers to, only four have characteristics similar to surface constructions (Alaiba and Grădinaru 1995, 64-80; Dumitroaia 2000, Fig. 3).

According to specialists, the small number of known dwellings is directly related to the low degree of verification of the excavations carried out (Dumitroaia 2000, 54). Based on the available data, it is possible to highlight two types of dwellings for the Horodiştea-Gordineşti: surface dwellings and dwellings with deep base (Dergachev 1980, 52, 120; Chernysh 1982, 227; Movsha 1985, 239). Some sources, however, also provide information about three types: surface dwellings with burnt daub *ploschadka*, semi-dugout and dugout dwellings (Dergačev 1991, 18-26; Dergachev and Manzura 1991, 13).

Considering the state of preservation, House no. 1 at the settlement of Gordineşti II-*Stînca goală* seems to correspond to the surface dwellings of the burnt daub *ploschadka* type, which is known in Russian literature as a reduced *ploschadka* (*редуцированная площадка*) (Dergačev 1991, 21; Dergachev 1980, 52, 120; Dergachev and Manzura 1991, 13) and in Romanian (see Dumitroaia 2000, 54; Lazarovici and Lazarovici 2007, 313, Alaiba 2007) as the dwelling in cucutenian tradition (locuiţe de tradiţie cucuteniană).

We cannot say that both syntagms are suitable not only for delimiting the dwelling(s) that we recognized in Gordineşti II-*Stînca goală*, but also for dwellings in other settlements. We should take into account a number of aspects related to the correct documentation of *in situ* artefacts, topographic specificity, soil character, and last but not least, the climatic factors. Reconstruction of the form of House no. 1, its internal arrangement and surroundings helps to understand how the architecture of buildings was transformed by adapting to the specific context of time.

In general, the large settlements declined during the preceding period, *i.e.* Tripolye CI and they were not in use in phase Tripolye CII/2. The process of degradation of the so-called *ploschadka* could have been one of the elements of the broader transformations that take place at the end of the 4th millennium BC in the Eastern Carpathian area (*e.g.* Dergachev 1980; Zinkovskiy 2013, 96).

Another opinion regarding the disappearance of the *ploschadka* is also related to climatic change that began, according to some specialists, during the Cucuteni A-B phase, and the weaker dwellings from the Cucuteni B phase might have resulted from the beginning of exhaustion of agricultural land, which forced those communities to change their location more often (Florescu 1966, 23, 24; Marinescu 1969, 7, 8). The observation could also be supported by a less consistent cultural layer in the Cucuteni B phase settlements and by a large number of single-level sites. Huts and dwellings with a circular plan seem to be only sporadic occurrences and cannot be considered typical for the Cucutenian communities from the Eastern Carpathian forest-steppe (Monah and Cucoş 1985, 45).

SUMMARY AND CONCLUSIONS

Summarising the data presented above, we can underline once again that House no. 1 discovered and examined in 2016-2018 represents the category of cultural phenomenon specific to the end of the 4th millennium BC. The results of the detailed spatial analysis of this unit, both its interior and exterior, allow us to observe some interesting facts. For instance, the continuation of some older traditions of Cucuteni-Tripolye architecture and spatial organization can be noticed, while on the other hand, there is clear evidence of major changes in the organisation of settlement patterns in the Prut-Dniester interfluve. The transformations inside the settlement structures were probably the results of broader and more complicated factors, both internal and external. It is possible to relate this to the increasing mobility of Late Eneolithic communities at the end of the 4th Millennium BC in South-Eastern Europe.

Although the results described here represent the initial stage of our research, they may significantly impact expanding the general knowledge of the Late Eneolithic settlements strategies not only in the Prut-Dniester interfluves, but also in the entire region of the Eastern Carpathian area. This also can be confirmed by the yet unpublished results of the latest research (2019) in the context of household cluster no. 2 in the western part of the Gordineşti II-*Stînca goală* site.

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FIELD SURVEY AND MATERIALS

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PRELIMINARY CHARACTERIZATION OF THE PREHISTORIC MINE OF CHOCOLATE FLINT IN PORĘBA DZIERŻNA, SITE 24 (WOLBROM COMMUNE, LESSER POLAND VOIVODESHIP)

ABSTRACT

Sudoł-Procyk M., Krajcarz M. T., Malak M. and Werra D. H. 2021. Preliminary characterization of the prehistoric mine of chocolate flint in Poręba Dzierżna, site 24 (Wolbrom commune, Lesser Poland Voivodeship). *Sprawozdania Archeologiczne* 73/2, 109-135.

Researches on prehistoric flint mines are currently widely developing, as they allow a deep insight into the past economy, early industry, and the network of trading routes and inter-regional contacts. In the territory of Poland and in general, Central Europe, one of the most important flint raw materials was an Upper Jurassic chert, so-called chocolate flint. In this paper are presented preliminary results of the research of chocolate flint mine in Poręba Dzierżna, site 24 (Kraków-Częstochowa Upland, southern Poland). The outcrop, and anthropogenic relief indicating the activity of prehistoric miners, were discovered in 2013. Recently excavations undertaken on the site recorded the remains of mining shafts, spoil heaps, and rich traces of workshops. The deposits of chocolate flint were previously known only in the Holy Cross Mountains, 130 km to the NE. The research undertaken has therefore a significant impact on the existing interpretations related to the extraction, use, and distribution of chocolate flint by prehistoric communities in Central Europe.

Keywords: geoarchaeology, Stone Age, raw material, Poland, Kraków-Częstochowa Upland, prehistoric communities
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1. INTRODUCTION

Several prehistoric flint mines are known so far from the hilly region of Kraków-Częstochowa Upland (Dagnan-Ginter 1974; Ginter 1974; Kozłowski *et al.* 1976; Lech 1981; Ginter 1983, 24-28; Kopacz and Pelisiak 1986; Bańdo *et al.* 1992; Sobczyk 1993; Pelisiak 2006; Kopacz 2017). The object of exploitation was there a particular type of chert raw material – so-called Polish Jura flint or Kraków flint (Polish: *krzemień jurajski* or *krzemień podkrakowski* according to Ginter and Kozłowski 1969, 18). These mines are concentrated in the southern part of the Upland, near the Ojców National Park, *e.g.* at Sąspów and Bębło, in Kraków district (*e.g.* Lech 1981, 22ff; 2011), although some of them are situated in the central part of the Upland. Most of these mines have been interpreted to represent Neolithic Danubian communities (Linear Pottery Culture, Pleszów group of the Lengyel-Polgár Cultural Complex, and Malice Culture). Some much later mines, related to the manufacturing of gunflints during the 19th century, are also known, for example in Zelków and in Mników (*e.g.* Ginter and Kowalski 1964; Werra *et al.* 2019).

The region of Kraków-Częstochowa Upland has been for a long time considered as a source of the Polish Jura flint (or the Kraków flint) only. In recent years, research on silicite raw materials in this region has been very popular (*e.g.* Krajcarz *et al.* 2012; Kochman *et al.* 2020; Matyszkiewicz and Kochman 2020). As a result of this research, two other silicite raw material types was discovered, *i.e.*, the *Kraków-Częstochowa striped flint* and especially the *Kraków-Częstochowa chocolate flint* (Krajcarz *et al.* 2012, 418; Krajcarz *et al.* 2014). The discovery of previously unknown raw materials in this region, with a very good knapping quality, has provided new perspectives in terms of prehistoric flint procuring and mining in the area (Sudoł-Procyk *et al.* 2018a, 93). Detailed geological mapping and archaeological survey within the outcrops of the Kraków-Częstochowa chocolate flint in Udorka Valley resulted in further discovery of a characteristic relief, resembling prehistoric flint mines. The area has been appointed an archaeological site and registered at the Lesser Poland Voivodship Heritage Office in Kraków as Poręba Dzierżna, site 24 (Wolbrom community, Olkusz district) (Fig. 1: A, B).

The site is located in the south-western part of the Ryczów Upland, which is one of the central microregions of the Kraków-Częstochowa Upland (N 50 °26'16.78", E 19°45'37.24", at an altitude of about 355 to 372 m above the sea level). It is separated from the surrounding villages and farmlands by forested hills. The site is located on the eastern bank of so-called Udorka Valley – a valley of a small temporary stream Udorka, a tributary of Pilica.

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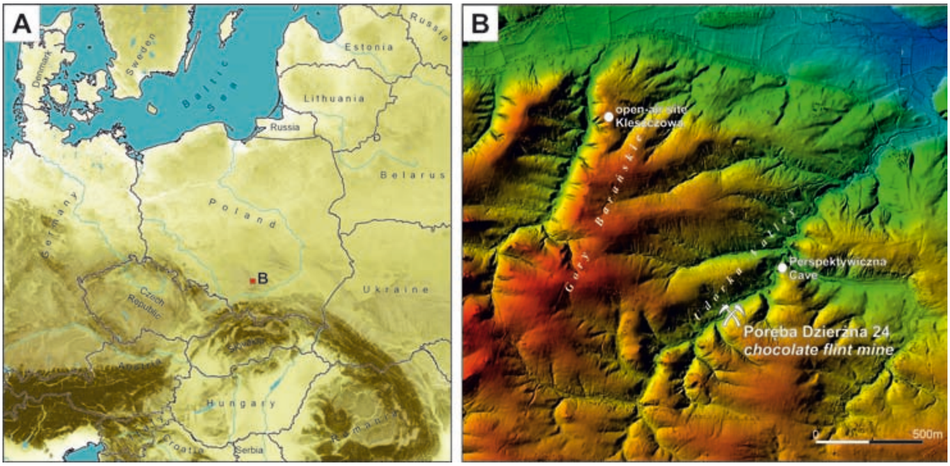

Fig. 1. Location of site 24 in Poręba Dzierżna. A – location of the Udorka Valley region on the map of Poland (drawn by M. Skrzatek, with authors' changes), B – location of the sites described in the text (drawn by M. Jakubczak and M. Szubski, with authors' changes)

In the vicinity of the site, another similar but much smaller cluster of pit-like landforms has been identified during a detailed analysis of the numerical terrain model and field surveys (Sudoł-Procyk *et al.* 2018a, 93). Similar relief was also observed in the area of striped flint deposits, located about 3 km to the west (Sudoł-Procyk and Krajcarz 2021). Future research should provide additional data about these sites.

2. HISTORY OF RESEARCH

Research on the occurrence of flint outcrops in the central part of the Kraków-Częstochowa Upland was started in 2007 by a research team composed of: Maciej T. Krajcarz, Magdalena Krajcarz, Magdalena Sudoł and Krzysztof Cyrek. During the next years, the field survey was supported by Jadwiga Wodarz, Lucjan Wodarz, Teresa Madeyska, Tadeusz Wiśniewski, and BSc and MSc students of archaeology from the Nicolaus Copernicus University in Toruń (Poland) and University of Warsaw (Poland). Initially, this work was aimed at identifying potential deposits of raw materials used for making tools found in the Biśnik Cave (Sudoł *et al.* 2016, 63). In the following years, the research area was extended to the entire Ryczów Upland. This task was executed by the detail field geological mapping of the area, with special respect given to the Jurassic silicites.

Much of the Udorka Valley is today heavily forested and cut with deep ravines, which makes it very difficult to conduct surface prospecting. Therefore, tracking the chocolate flint outcrops took several seasons, and it was only in 2013 when we succeeded to locate the deposits of this raw material (Sudoł-Procyk *et al.* 2018a, 91). During field surveys in this region, some fragments of chocolate flint were found in the currently dry stream bed. The so-called 'chert from Udórz' (Krajcarz *et al.* 2012, 415) is the dominant type of the silicite material here, and chocolate flint is an accessory material. Surfaces of flint pieces found in the stream bed bear signs of transport by water (reddish patina, smoothing, and chipping). Later, the occurrence of this raw material was also recognized in the vicinity of the valley, near the villages of Kąpiele Wielkie and Miechówka. The nodules of chocolate flint are distinguished by their regular, tabular form, and smooth homogenous silicite material without intraclasts, usually brownish in colour (Sudoł-Procyk *et al.* 2018a, 91).

Further survey in the outcrop area led to the discovery of numerous pits, certainly of anthropogenic origin and clearly resembling a prehistoric flint mine relief. Detailed archaeological survey within the field of pits revealed the remains of lithic workshops related to the initial processing of the chocolate flint raw material (Sudoł-Procyk *et al.* 2018a, 91; Krajcarz and Sudoł-Procyk 2019a, 14). The discovery of the traces of mining exploitation and the evidence of systematic processing in the adjacent flint workshops allows to classify this complex as a significant source of raw material used in the past (see Lech 1981, 7).

Further surveys and trial excavations conducted in 2018 and 2019 confirmed that the pits were indeed connected with prehistoric mining (Sudoł *et al.* 2018b; Krajcarz and Sudoł-Procyk 2019b). In 2020, an interdisciplinary research team (M. Sudoł-Procyk, D. H. Werra, M. Malak, M. T. Krajcarz) began comprehensive excavation research as a part of a five-year project funded by the Polish National Science Centre.

3. GEOLOGY AND GEOMORPHOLOGY OF THE SITE

The Udorka Valley is assymetric, with a slightly inclined left (western) slope and a steep right (eastern) slope, which is additionally undercut by the stream erosion, resulting in a 4 m up to 6 m high escarpment or cliff (Fig. 1: B). The stream is currently weak and appears only temporary, after the early spring meltout of snow and after the strongest summer thunderstorms. The stream bed is quite narrow, being only as wide as around 50-60 m near the site (Fig. 2: B). The bed comprises of at least two alluvial terraces and a narrow floodplain. Terraces are built mostly of silts, and the alluvia of floodplain and current channel are composed of limestone and chert gravel, and silts.

The mining field is situated around 4 m up to 25 m above the stream bed, right above the erosional escarpment of the Udorka stream, on a lower part of an eastern denuded slope (Fig. 2). This slope is built of well-bedded Upper Jurassic (Upper Oxfordian-Kimmeridgian) limestones with chert, covered with regolith consisting of reddish loam with weathered limestone and chert blocks, and covered with loess-like sediments. On the slope, limestones occur at least 1 m below the modern terrain surface. Only a few outcrops of these limestones are currently available and they all have extremely limited spatial

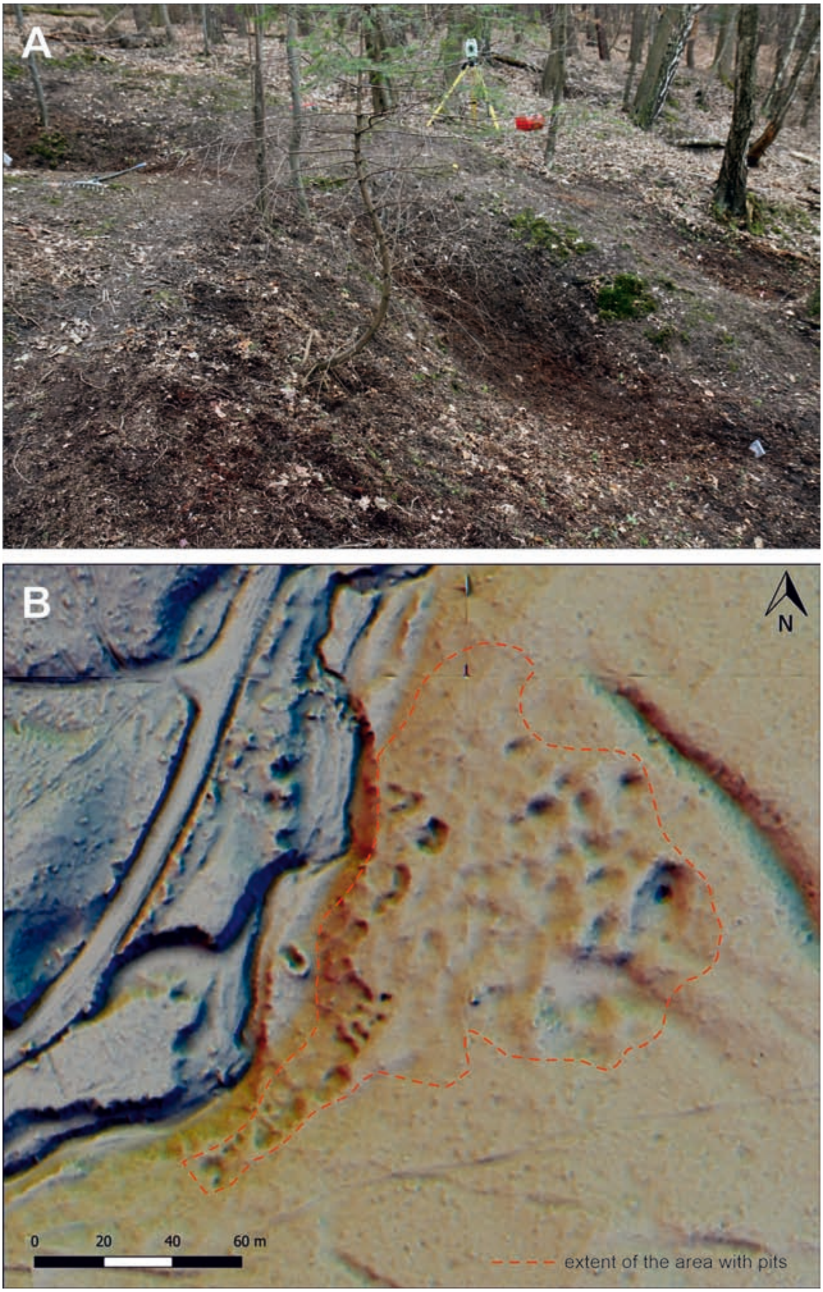

Fig. 2. Anthropogenic transformations of the terrain at the site.
A – the area of the site before excavation (photo M. Sudoł-Procyk), B – digital terrain model of the site (after Sudoł-Procyk *et al.* 2018a, with authors' changes)

range. They are uncovered at several points at the Udorka's erosional escarpment, where they form cliffs up to 2 metres high, and are also visible locally at the bottom of the stream bed. The Jurassic rocks form an anticline in the area of the site, whose crest is crossing the site, probably along WNW-ESE direction. The chocolate flint-bearing bedded limestones occur within the crest. On the limbs of this anticline, the flint-bearing limestones are covered by younger massive and talus limestones without chert.

The sources of Kraków-Częstochowa chocolate flint at the site and in its vicinities include: the limestone bedrock, the regolith, the valley's alluvia, and the colluvial fills of some gullies cutting the slope. This local variety of chocolate flint is similar to some varieties of the classic chocolate flint known from the north-eastern margin of Holy Cross Mountains (Polish: Góry Świętokrzyskie; Krukowski 1923; Schild 1976) and has the same stratigraphic position. The monoclinal structure of the Kraków-Częstochowa Upland suggests that one should expect the occurrence of chocolate flint-bearing facies along the entire eastern edge of the Upland. However, the Udorka Valley is the only spot where their occurrence has been demonstrated so far (Krajcarz *et al.* 2012, 420).

The macroscopic characteristics of the Kraków-Częstochowa chocolate flint have been presented by Krajcarz *et al.* (2012, 418) and Sudoł-Procyk *et al.* (2018a, 93). Nodules are flat with parallel upper and lower surfaces. The thickness of these nodules is 2-10 cm and their diameter ranges from several to several dozens centimetres. The cortex is thin (about 0.5-5 mm, average 1-2 mm), white, smooth but with numerous fossils and grains on the surface, clearly separated from an outside rock. Below the cortex, a several-millimetres thick white dull non-transparent zone occurs, distinctly separated from the inner silica substance. The silica mass is dark, from dark brown to yellowish brown, greyish brown, and milky white. It is fine-crystalline, dull, slightly transparent, with a fatty or pearly lustre. In some specimens, horizontal bands of coarse-crystalline silica occur inside the mass. The weathered cortex is orange. The weathered silica mass is dull, nontransparent, grey to yellowish grey or bluish grey, in some specimens striped. The knapping properties are very good. When knapped, this silicite gives a subconchoidal fracture (Krajcarz *et al.* 2012, 418).

4. THE MINING FIELD: TOPOGRAPHY AND ARCHAEOLOGY OF THE SURFACE RELIEF

The mining field is easily identifiable by its characteristic anthropogenic relief: numerous quite regular oval pits, usually surrounded by low banks of earth containing limestone blocks and sparse products of flint knapping (Fig. 2: A). Morphology and spatial relationships between these structures were analysed by airborne laser scanning (LiDAR-ALS) (Fig. 2: B; Sudoł-Procyk *et al.* 2018a, 93). Based on this, we distinguish four zones of slightly different topography (called Zones 1, 2, 3, and 4 in the further text) within the mining field (Fig. 3).

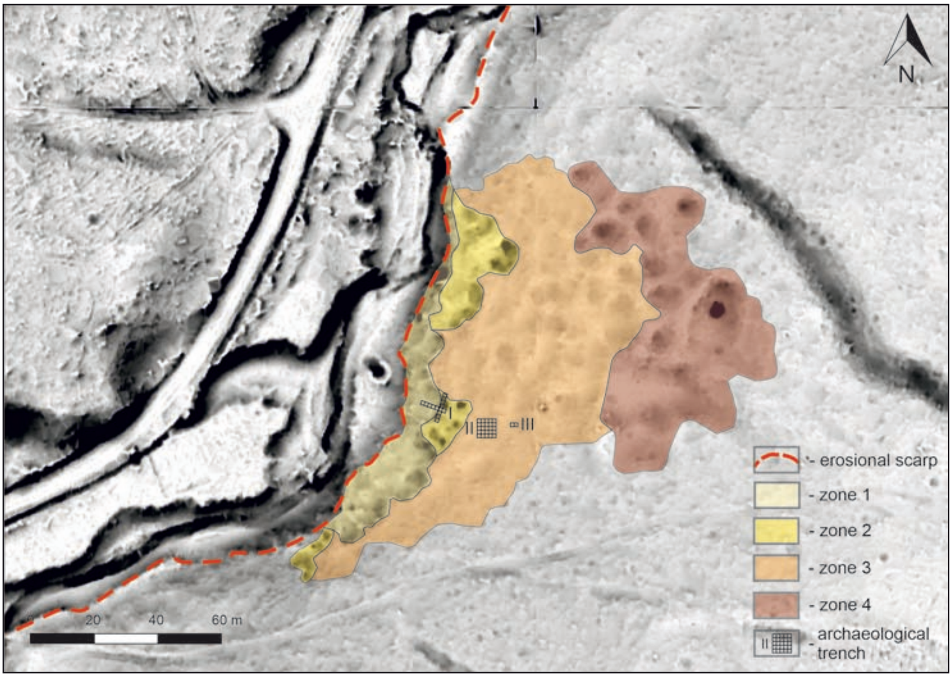

Fig. 3. Range of the site with various zones of relief and location of archaeological trenches (drawn by M. Sudoł-Procyk)

The most elevated part of the site is a vast area of relatively large pits of various depths and shapes (Zone 4 – Fig. 3). It extends for a distance of over 100 m from the valley bottom. The pits in this zone are deep and are surrounded by large and distinct spoil heaps. The largest of the pits measures 13 m by 25 m across. This is also one of the highest elevated pits. Features located lower on the slope (*i.e.*, in Zone 3 – Fig. 3) often have a diameter of only a few metres. The surface area in Zone 3 is flatter. The surface relief is so blurred that it is impossible to clearly define the number of features. Despite this, around almost every one of the identified pits the faintly marked relics of heaps can be observed. To the south of them, there is a sizeable zone of niches dug into the top part of the erosional scarp of the Udorka stream, extending over a distance of almost 100 m (Zone 1 – Fig. 3). Between Zone 1 and Zone 3, in some localized places on the slope, there are quite deep pits, but not exceeding 3 meters in diameter (Zone 2 – Fig. 3). In contrast, in Zone 1 there are many slight pits with a diameter of up to several metres that have the form of niches open towards the stream. This suggests that they were created by repeated exploitation activities. These niches are surrounded by small spoil heaps, usually with a few flint products. The heaps are typically located at the north, east and south sides of each niche, *i.e.*, are situated higher on the slope than a niche itself. The lack of distinct spoil heaps from the edge situated toward the stream may suggest that most of the waste material in this part was thrown down the escarpment into the stream, and was periodically washed away by the stream. At the lowest section of the slope, at the very edge of the stream bed, there are two large erosional niches undercutting the slope and possibly cutting off a part of Zone 1 (Fig. 2: B, Fig. 3; Sudoł-Procyk *et al.* 2018a, 94).

Detailed archaeological survey was conducted over the whole area of the chocolate flint outcrop, where the anthropogenic relief with the pits described above was identified. Only a relatively sparse amount of archaeological material came from the surface, found primarily in the depressions and niches located in the immediate vicinity of the valley edge. It was not easy to detect the archaeological material because it is covered by thick forest litter. Among the surface finds, however, natural blocks, test-flaked pieces, incipient cores, and semi-products were successfully documented. The flint is quite heavily patinated, which means that it has remained on the surface for a long time. The material exposed on the surface is associated with the knapping of the raw material with a hard hammerstone. The flint finds were accompanied by a few limestone flakes. Some of them are heavily weathered, which proves that at least some knapping activity was focused on the raw material dug from the topsoil or regolith, and not from the underlying limestone (Sudoł-Procyk *et al.* 2018a, 94).

5. STRATIGRAPHY

The excavations have so far covered two parts of the site. The first includes the steep lower section of the slope – in the Zones 1 and 2, the second is located on the more elevated and flatter section of the slope – in the Zone 3 (Fig. 3).

In the first case, in order to obtain the most accurate information about the structure of the pits, two trenches, 1 m wide, were laid out along and across the slope and intersecting at right angles (Trench No. I; Fig. 3). The excavations revealed a complex of archaeological features: step-like cuts in the regolith, a shaft dug in the limestone, and heaps of limestone blocks and limestone dust. The stratigraphy allows reconstructing the prehistoric activity as carried out by exploring the sediments of the regolith (layer 2; Fig. 4: A), usually to a depth of about 1 m. In the zone located lowest on the slope, the exploration was carried out much deeper, until reaching the flint beds within the limestone bedrock, *i.e.* to a depth of about 2 m (Fig. 4: A). The stratigraphy at this point turned out to be extremely interesting, the sediments on the slope were the remains of mining heaps and loess sediments, in which flint finds have been documented. The shaft was cutting all these deposits, and was filled with another series of colluvial sediments (layers 2a, 11a and 12a; Fig. 4: A).

Analysis of the cross-sections (Fig. 4: A) indicates that the stratigraphy of sediments and the presence of anthropogenic structures clearly differ the backfill of the pits from the

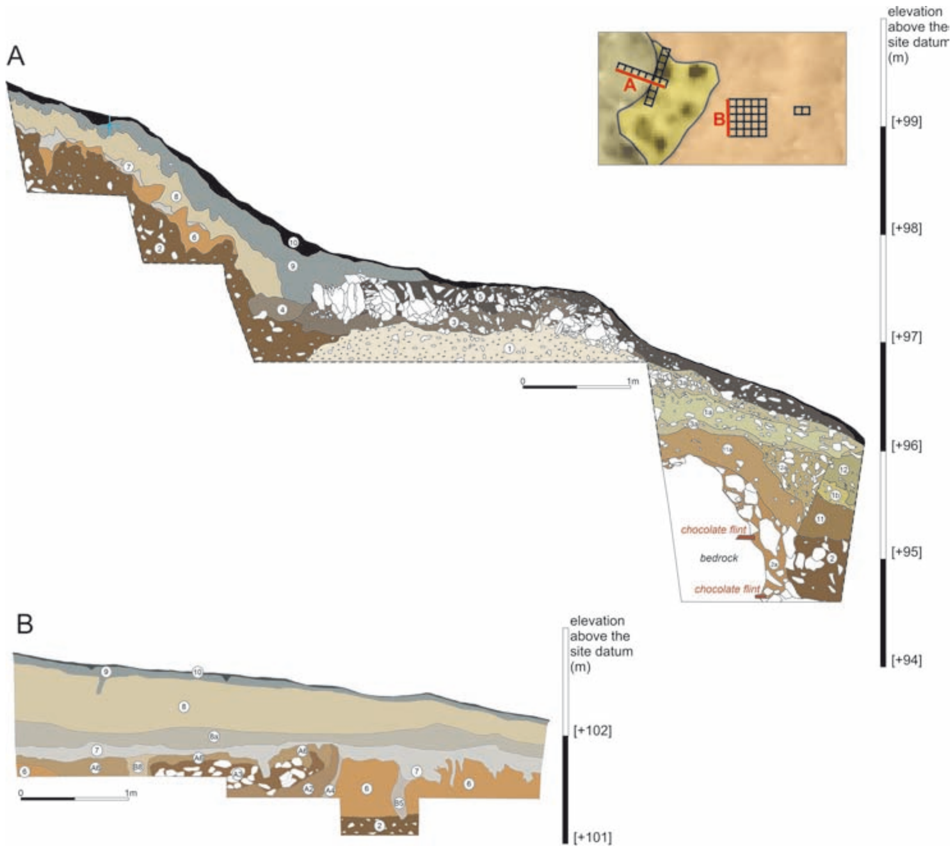

Fig. 4. Cross-section S (along the slope) in Trench No. I (A) and cross-section W in Trench No. II (B); the location of cross-sections is marked with a red line (drawn by M. Sudoł-Procyk).
Description of layers: 1 – light gray loam with large amount of weathered fine limestone debris; 1a, 1b – light gray loam with large amount of weathered fine limestone debris (re-deposited material of layer 1?); 2 – orange clay loam with a natural weathered flint concretions (a regolith); 2a – orange clay (re-deposited material of layer 2, possibly mixed with material of layer 11a); 3 – dark grayish brown loess with fine limestone debris; 4 – gray loess; 5 – black humiferous sediment with large amount of limestone stabs and limestone debris; 6 – orange loess (Bt horizon of a paleosol with single flint artifacts); 7 – whitish loess (Et horizon of a paleosol); 8 – yellowish loess (BC horizon of a modern luvisol – a layer with flint artifacts); 8a – yellowish loess similar to layer 8, darker; 9 – black humiferous silt (AE horizon of a modern luvisol, possibly partially re-deposited by colluvial processes); 10 – contemporary litter (O horizon of a modern luvisol); 11 – orange-brown silt with fine limestone debris – a layer with flint artifacts; 11a – orange-brown silt with fine and coarse limestone debris (re-deposited material of layer 11, a backfill of the pit) – single flint products; 12 – gray-brown silty sand with large amount of limestone debris; 12a – gray-brown silty sand strongly with numerous intercalations of light gray silt (similar to layer 1) with large amount of limestone debris, possibly composed of mixed material of layers 12, 3a and 1a (re-deposed layer 12?, a backfill of the pit); A2, A3, A4, A6 – a backfill of a large archaeological feature, possibly of anthropogenic and/or colluvial origin (A2 – orange clayey silt with large amount of lithics, A3 – brown loam with limestone clasts, with sparse lithics, A4 – gray silt, A6 – orange clayey silt with large amount of lithics); B5, B8 – probably backfills of small archaeological features (whitish silt, horizontally laminated, with lithics and charcoals)

Fig. 5. Archaeological feature in Trench No. II. A – flint products in situ, B – large feature, C – small features (post-holes?) (photo by T. Wiśniewski)

area outside of the pits. It seems that after their exploitation was finished, the pits were filled with pieces of limestone probably coming from nearby niches. A few flint products were registered in the fillings of these features.

The layout of sediments registered in the same cross-section in the higher parts of the slope is different (Fig. 4: A). Here, the loess-like stratum occurs (layer 8), composed of the material redeposited from the areas of the slope above. Large amount of flint finds was documented within this stratum. The cross-section taken across the slope showed the activity of erosive processes and the presence of erosional structures (rills or paleochannels) filled with colluvial loess containing flint finds that had originally been deposited on the higher parts of the slope. Several small pseudomorphs after frost wedges occur in the loess. Some flint artefacts were found within the fills of these structures. Because the frost wedges are typical periglacial structures connected to the cold climate of Pleistocene stadials, this allows to date at least a part of the flint assemblage to the Pleistocene.

Trench No. II located in the Zone 3 (Fig. 3) also showed the presence of redeposited loess sediments with a large amount of flint finds. Underneath there are preserved the remains of a semi-circular feature, with a diameter estimated to around 3 m (Fig. 4: B). The feature was filled with silty-clay stratified sediments. So far, almost 7,000 flint finds have been registered within. These are the remains of the pre-treatment of the raw material (Fig. 5: A). The feature cuts through the layers of barren loess and further the regolith. The bottom of this structure has not been reached yet, so currently we can only hypothesize that this feature is a remain of a shaft and goes deeper down through the rock to reach the flint layers. Several smaller features have been found around this large feature (Fig. 5: B). These are circular or oval pits of around 20 up to 30 cm diameter, up to 60 cm deep, backfilled with laminated silty sediment with abundant charcoal fragments. The shape and location of these features suggest that they could be post-holes (Fig. 5: C), maybe remains of a structure that served as a roof over the large feature. However, we cannot exclude at the current state of recognition that these small structures have a natural origin. From these structures, numerous charcoal samples were collected for anthracological identification and radiocarbon dating (currently still being analysed). Excavations in this area will be continued in the following seasons.

6. MINING STRATEGY

Due to the current preliminary stage of research on site 24 at Poręba Dzierżna, little can be said about the methods of work of the prehistoric miners. Observing the various relief forms visible in the terrain and based on the first results of fieldworks, we can assume that different methods of exploitation were applied depending on the distance from the valley bottom and the steepness of the slope, and most probably, also the depth of the flint stratum.

Extensive niches located in the lowest part of the site, formed in the immediate vicinity of the stream's erosional scarp, probably as a result of repeated use of small pits open towards the riverbed (Zone 1 – Fig. 3). Flint layers may have been exploited by horizontal workings or shallow open-cast mines. A similar situation was observed for example at the Neolithic mines at Rijckholt-St. Geertruid (Nederlands) and the Defensola mine (Gargano,

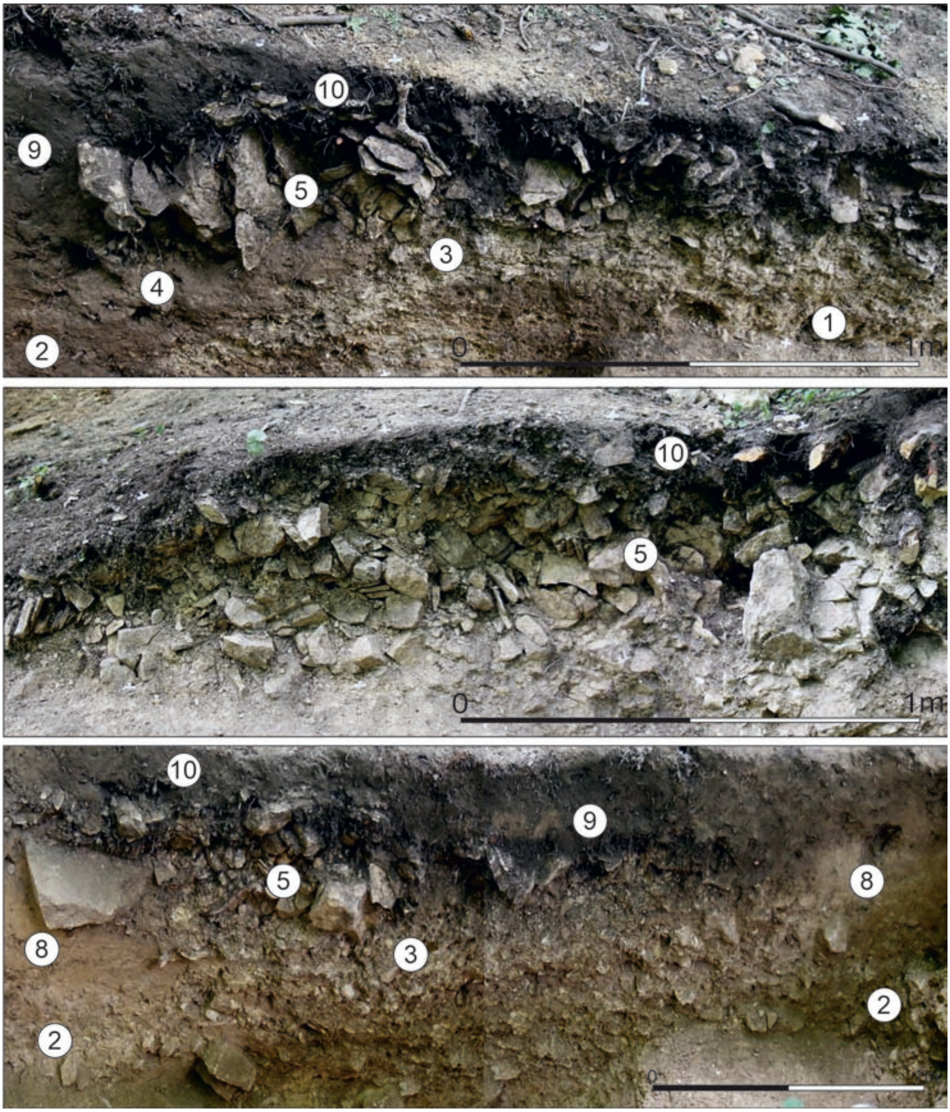

Fig. 6. Backfills of the pits (photo by M. Sudoł-Procyk); for the description of layers see Fig. 4

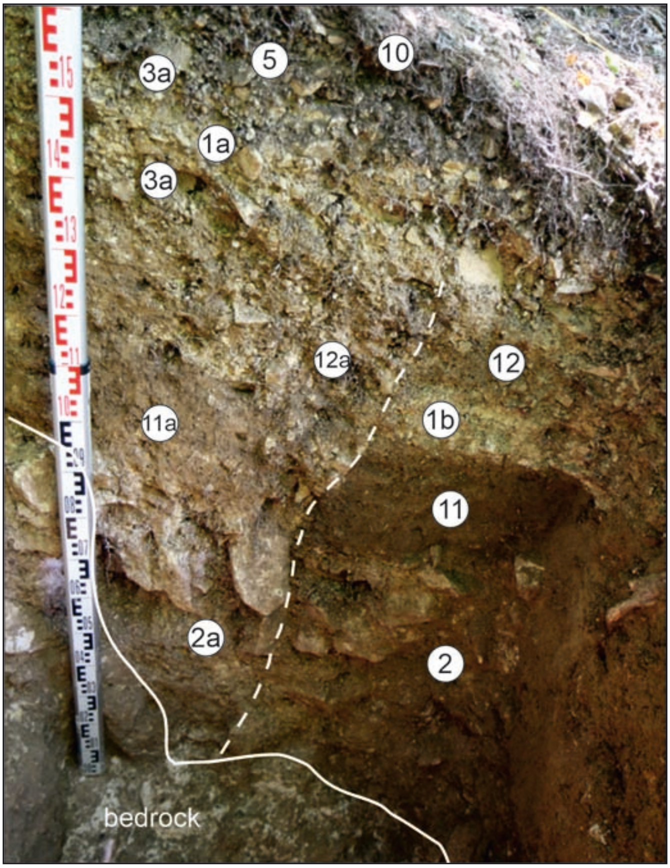

Fig. 7. The edge of a feature (a shaft?) (photo by M. Sudoł-Procyk); for the description of layers see Fig. 4

Italy; Felder *et al.* 1998, 73; Tarantini *et al.* 2016, 252, 253). This is the simplest method of raw material exploitation, apart from the simple collection of the raw material from the surface, which in the case of outcrops located on a slope should ever be expected.

In a more elevated part of the slope (Zone 2 – Fig. 3), remains of pits have been found in the Trench No. I located in the lower part of the slope. Their fillings are heterogeneous: the floor is filled with fine rock rubble with a silty sediment washed in from above, while in the upper part there are large slabby limestone blocks, with empty voids still preserved between them (Fig. 6), giving the impression of being arranged in a tile-like manner (also vertically). The limestone blocks had probably come from adjacent niches. Flint finds were only rarely found in the fillings of these features.

In the Trench No. I, it was possible to document the edge of a feature (a shaft?), the depth of which reaches 150 cm (Fig. 4: A, Fig. 7). This feature cuts through redeposited colluvial

Fig. 8. Two beds of chocolate flint visible in situ in the limestone bedrock (photo by M. Sudoł-Procyk)

sediments that are the remains of mining heaps, loess containing flint finds, and regolith with small fragments of tabular flint nodules and fragments of rock, and finally it cuts the limestone bedrock and reaches two flint layers. The exposed limestone wall is not weathered; its fresh condition and lack of a regolith, usually covering the limestones in the region, suggests that it had been exploited by prehistoric miners. Due to the small area of the archaeological excavation, little can be said about the methods and tools used in the exploitation of the raw material. Certainly, some efforts were made to keep the wall vertical, possibly in order to obtain as much raw material as possible, but maybe also due to technical purposes. No traces of tools were found on the rock walls in this place. However, observing the shape of the rock blocks that are part of the filling of the adjacent pits, we can assume with high probability that the rock was removed in the form of horizontal plate-like fragments. This exploitation continued until the desired flint deposit was achieved.

The bottom part of the excavation corresponds with two levels of the chocolate flint found *in situ* within the limestone. They are separated by about 0.5 m limestone stratum (Fig. 4: A, Fig. 8). The first (upper) level consists of small, irregular, bulky concretions, the size of which, as a rule, does not exceed 10 cm. The second (lower) level, on the other hand, is composed of large regular tabular nodules of more than 60 cm in length and 10 cm in thickness. We suspect that the lower flint level (at least in this area of the site) was the desired target of exploitation, because the shaft bottom is situated just below it. In the backfill of this feature, several triangular flint forms were found, with flake scars formed under the influence of pressure and crushing, suggesting their functional nature. They were most likely used as wedges.

Trench No. II dug in the higher parts of the slope, where the terrain slightly flattens out (Zone 3 – Fig. 3), revealed the presence of numerous cultural features under the redeposited loess colluvium. Currently, the excavations are being carried out within one of them. So far, only the uppermost parts of the fill of this feature have been explored, therefore it is not possible to clearly define its character. However, already at this stage of the research, the structures observed within it indicate that we are probably dealing with the remains of a shaft with a diameter of about 3 m.

A large amount of charcoal (under analysis) and burnt flint objects were documented in all features. Perhaps some of them may be associated with traces of the re-use of the top parts of the remains of shafts (which could have been used as a natural shelters) as the locations of the workshops (Bąbel 2014, 77).

7. CHRONOLOGY OF THE SITE

Stratigraphic premises, absolute dating (^{14}C and OSL), and techno-typological features of the flint material indicate the presence of human activity at the end of the Pleistocene and the beginning of the Holocene.

The dates obtained so far (Table 1) relate to several groups of deposits: the natural loess deposits that were dug through during prehistoric mining, the colluvial material covering the archaeological features, and the infill of an archaeological feature that was probably related to the workshop activity. The dates for the loess (GdTL-3540 and GdTL-3541, around 18-10 ky BP) indicate that mining activity happened after around 10 ky BP. The dates for the infill of the feature (Poz-124476 and GdTL-3538, around 10-9 ky BP) are probably close to the chronology of one of the activity phases at the site. The dates for the covering colluvium (GdTL-3537 and GdTL-3539, around 6-3 ky BP) suggest that the mining activity had ceased some time before around 6 ky BP.

Table 1. List of radiocarbon and OSL dates

Lab No.	Dating technique	Date	Layer	Context
GdTL-3539	OSL	3.13 ± 0.21 ky BP	8	Colluvial sediments covering the archaeological features
GdTL-3537	OSL	5.99 ± 0.36 ky BP	8	Colluvial sediments covering the archaeological features
GdTL-3538	OSL	9.07 ± 0.48 ky BP	A3/A4	Wall of the archaeological feature
Poz-124476	radiocarbon	9150 ±50 BP (uncalibrated)	A4	Wall of the archaeological feature
GdTL-3540	OSL	10.38 ± 0.62 ky BP	7	Loess cut by the archaeological feature
GdTL-3541	OSL	18.7 ± 0.11 ky BP	6	Loess cut by the archaeological feature

8. FLINT WORKING

The largest number of flint finds came from excavations located on the higher parts of the slope. The most representative structure of the flint items is provided by the assemblage from Trench No. II (Fig. 9), where 6,932 finds have been documented in an area of 21 m^2 (the depth of the Trench No. II ranged from 50 to 140 cm from the ground surface). It should be noted that about a quarter of them came from the upper group of redeposited sediments, the layer 8 (see Fig. 4: B), and the remaining ones were documented in the topmost layers of the feature. Considering that further exploration of this feature will take place in further seasons of the project, it may be expected that this number will surely increase.

The most numerous category comprises industrial waste: fragments of flakes showing even a very small amount of working (48.7%). It is a very diverse collection, containing large specimens, several centimetres and several dozen centimetres across, heavily patinated and covered with cortex, and small items, mostly unpatinated, with traces of fire.

The second largest group of artefacts consists of flakes and their fragments (Fig. 10) – these comprise 36.5% of the finds. Most (69%) are covered with cortex to a greater or lesser extent. There are 7% of fully cortical flakes, while 31% are devoid of natural surfaces. The butts of the flakes are generally large, mostly cortical or utilizing a convenient natural nodule surface. There are also visible bulbs of percussion, indicating the use of a hard hammerstone. Initial observations indicate that the prevailing form comprises irregular, massive flakes from the initial phases of the core shaping, sometimes bearing traces of part of the pre-core preparation, or part of the precore and striking platform (*i.e.* technical flakes). Smaller, more regular flakes from more advanced later stages of treatment are also encountered. A significant category of the finds (8%) is comprised of chips.

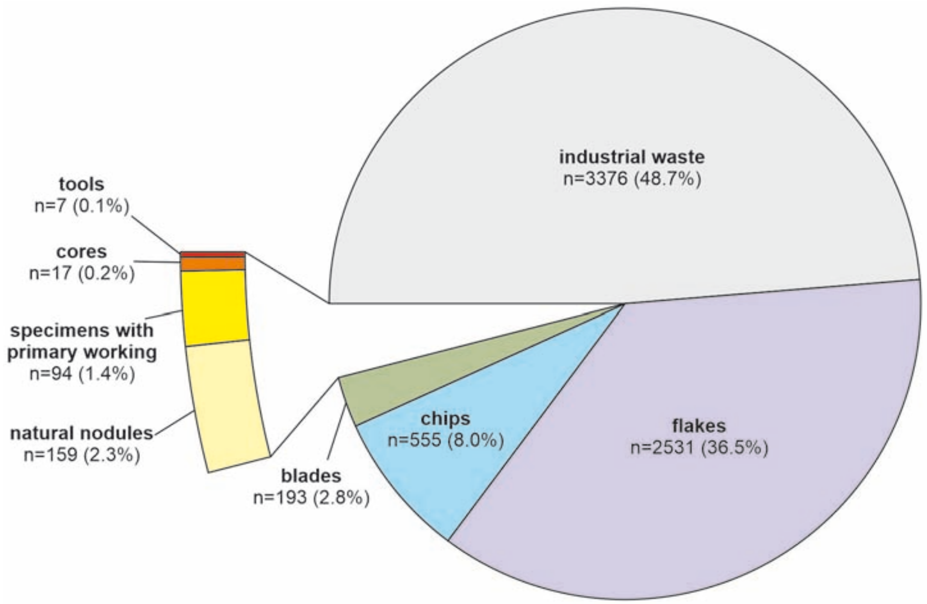

Fig. 9. Quantitative structure of flint products in Trench No. II

Natural nodule fragments (2.3%) and specimens with traces of initial working (1.4%) are present in a smaller percentage (Fig. 11). The former are mostly strongly patinated, cortical, sometimes with burn marks. Nodules with single detached flakes show similar features.

A small category are cores (Fig. 12), which consists of 17 specimens and their fragments. All of them can be included in the category of incipient cores. Three fragments derive from the distal parts of cores, and include part of the flaking surface and striking platform that are natural or prepared by a single flake.

Blades and bladelets, as well as their fragments (Fig. 13) constitute 2.8% of all the finds. There are large, regular, trapezoidal specimens, without cortex, sometimes burned. Also present are small, sometimes cortical, less regular bladelets, often triangular in cross-section. Several technical blades were also distinguished.

The least numerous group consists of tools (Fig. 14) and they comprise: an end-scraper made of a fragment of a nodule (Fig. 14: 1), a truncated blade with the truncation on the apex (Fig. 14: 2) and a burin made on a spall. Two flakes with retouched edges complete the assemblage. It is worth mentioning that also found in the trench were two flint hammerstones (Fig. 14: 3) that had been adapted from previously used cores.

Looking at the state of preservation of the finds, it is noticeable that more than half of them (57%) are covered with patina, usually to a moderate and strong degree, and more

Fig. 10. Selection of flint products: 1-6 – flakes (photo by T. Wiśniewski)

than a quarter of them (28.2%) show traces of contact with fire. As far as the degree of burning is concerned, virtually all its stages were observed: from very strong (cracked, grey or white surface; Fig. 13: 8, 10, 11), through overheating, changing the surface colour to reddish-brown, to very weak, without a clearly visible transformation of the flint structure (Fig. 10: 3; 14: 2).

The analysis of flint products is only at a preliminary stage. The percentages of the individual technological groups undoubtedly prove the existence of a mining workshop (see

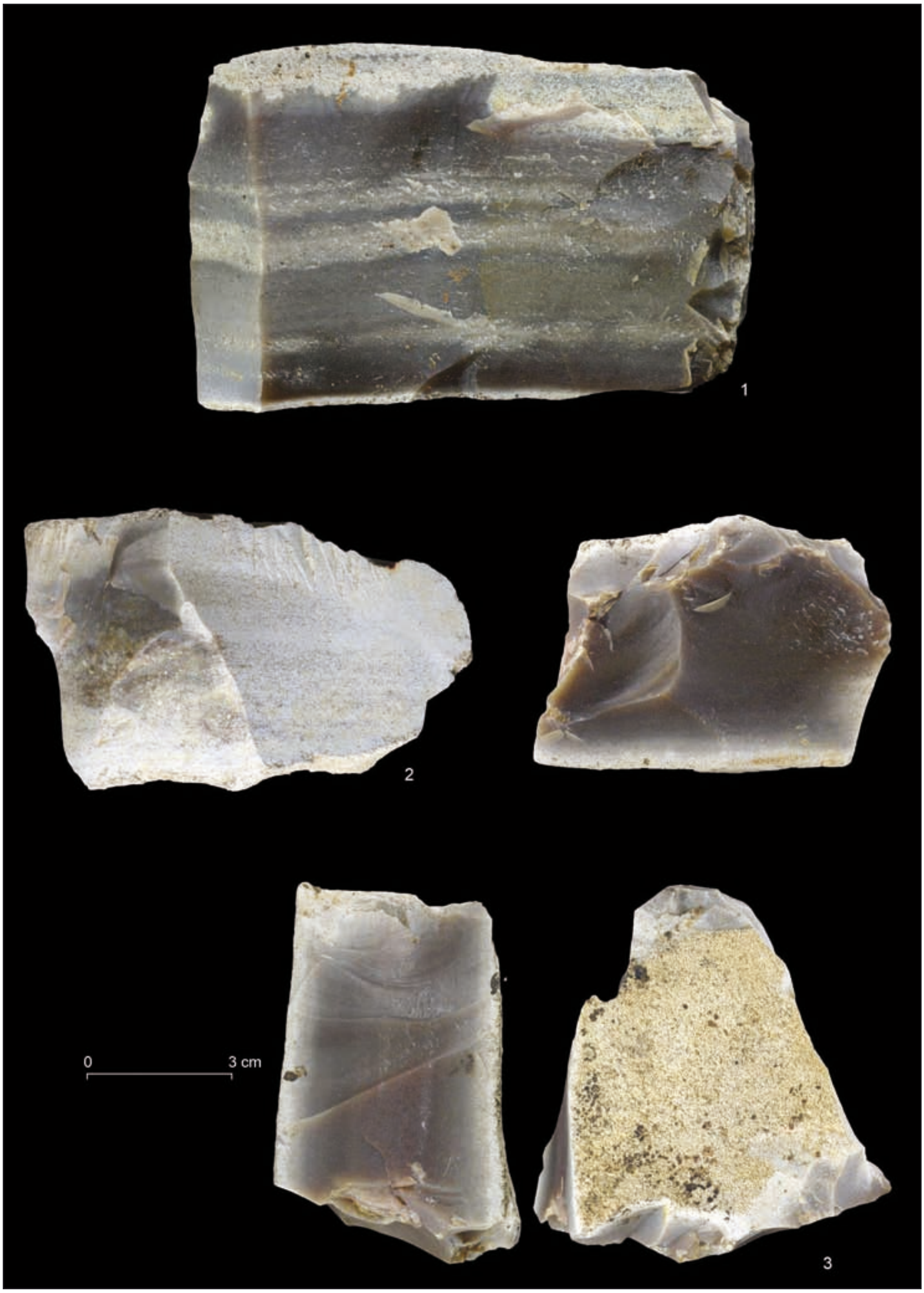

Fig. 11. Selection of flint products: 1-3 – natural nodule fragments with traces of initial working (photo by T. Wiśniewski)

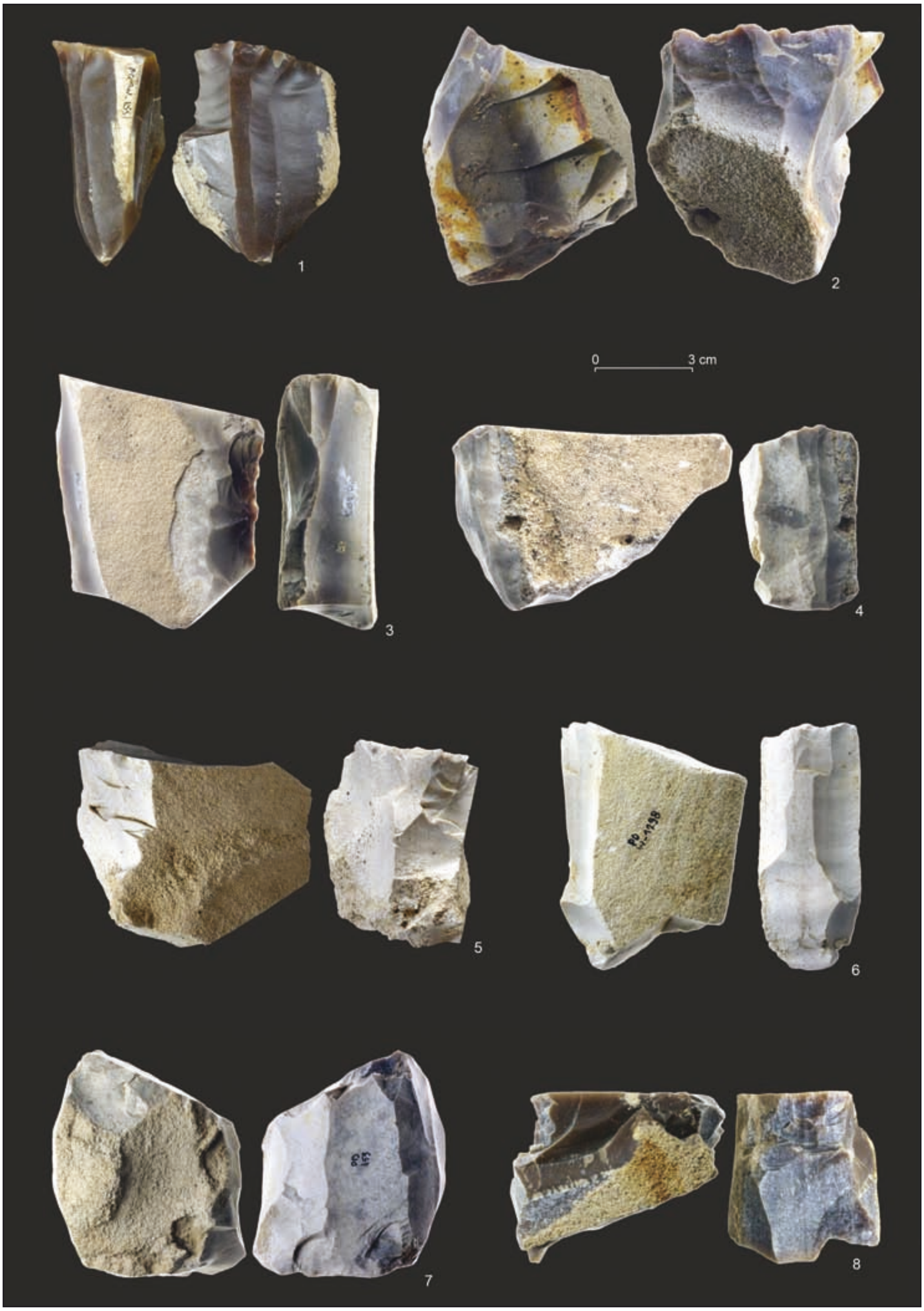

Fig. 12. Selection of flint products: 1-8 – cores (photo by T. Wiśniewski)

Fig. 13. Selection of flint products: 1-11 – blades (photo by T. Wiśniewski)

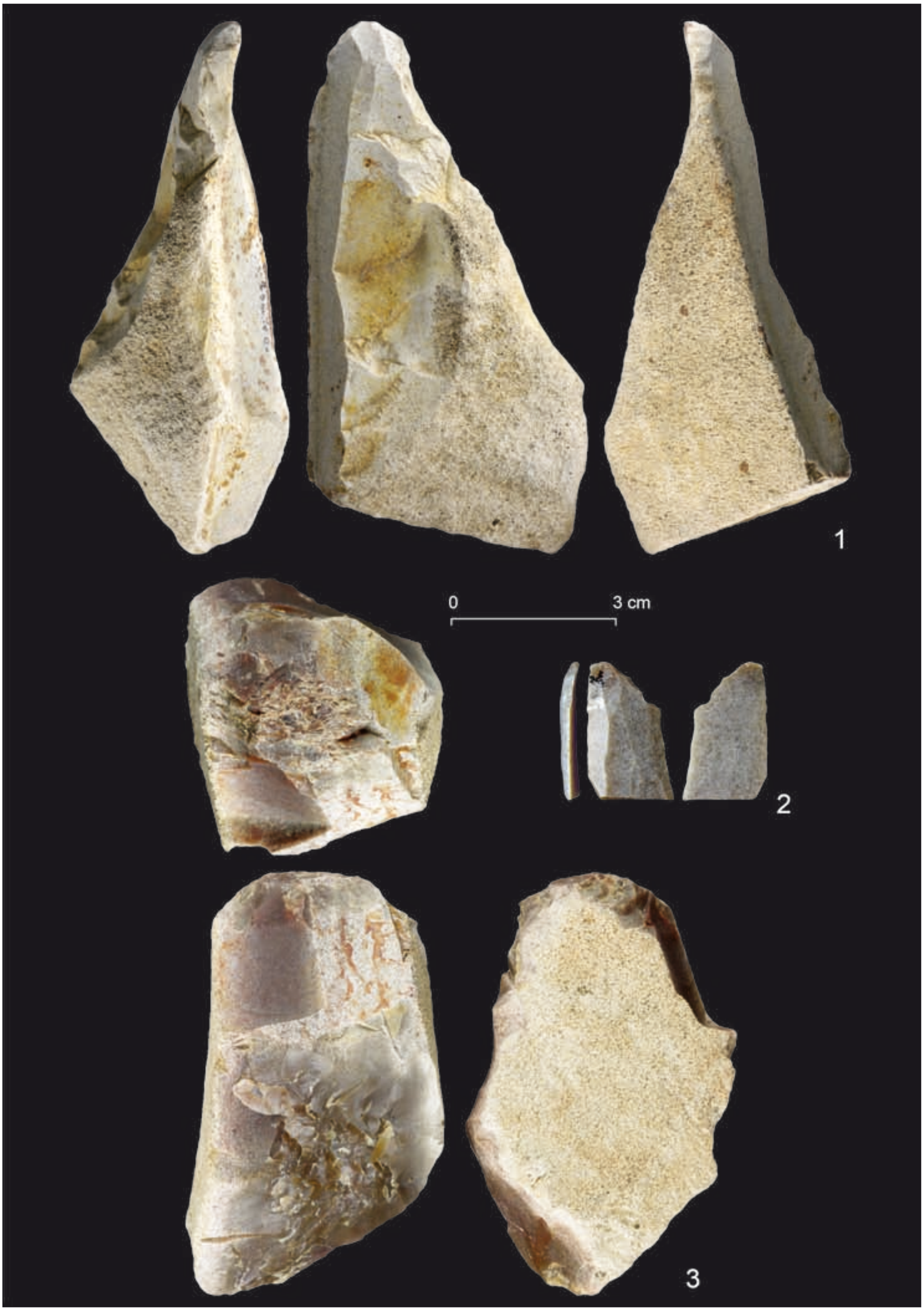

Fig. 14. Selection of flint products: 1-3 – tools (photo by T. Wiśniewski)

e.g. Dzieduszycka-Machnikowa and Lech 1976, 39; Schild *et al.* 1985, 54ff; Lech 2012, 93; Lech and Werra 2019, 94, 95). The results of the stratigraphic analysis and absolute dating indicate that we are dealing with more than one chronological episode of use of the site. More precise conclusions will be possible only after carrying out detailed planigraphic analyses of material from different cultural layers.

9. DISTRIBUTION OF FLINT PRODUCTS AND RAW MATERIAL FROM THE MINE: THE IMPORTANCE OF THE RAW MATERIAL

Chocolate flint stands out among the varieties of siliceous raw materials from Poland, both in terms of technical and visual values. Its very good quality was known and appreciated by prehistoric communities since the Middle Palaeolithic (see Ginter 1974, 9, 10, 63ff). Products made of this raw material are known from almost all regions of Poland, as well as neighbouring countries (Sudoł-Procyk 2021).

When the only known outcrops of the chocolate flint were on the north-eastern margin of the Holy Cross Mountains, earlier interpretations had assumed that all the chocolate flint that was present in the inventories of prehistoric sites from the Kraków-Częstochowa Upland was brought to the area from there. The discovery of a new chocolate flint outcrop and the site of its exploitation by mining sheds interesting light on the issues of the origin and use of this raw material by prehistoric communities, mainly those living in the immediate areas.

Traces of the use of chocolate flint coming most probably from the mines at Poręba Dzierżna site 24 are known currently from sites located up to 3 km away. The most numerous inventories, largely utilising chocolate flint, were documented in the Perspektywiczna Cave (approx. 300 m from the outcrop) and in the open-air site in Kleszczowa (about 3 km from the outcrop; Fig. 1: B; Sudoł-Procyk 2020, 294). The character of these Late Palaeolithic and Mesolithic workshop inventories confirms the knappers had a good knowledge of the raw material and its exploitation. The location of workshops in open-air and cave sites in the vicinity of the outcrops is an important evidence for the exploitation of local deposits of chocolate flint and the methods of its use.

As a result of the discovery of the chocolate flint outcrop in the Udorka Valley and the Poręba Dzierżna 24 site mine, it is necessary to determine the scale of use of this raw material by prehistoric communities. An important issue is the question of what role this newly-discovered mine played in terms of the exploration and distribution of chocolate flint in general. This is particularly important in order to understand the presence of chocolate flint in prehistoric Polish and foreign inventories. The existence of a second source raises the question of whether the raw material on any given site came from the Holy Cross Mountains or Kraków-Częstochowa Upland regions may put the issue of distribution of this raw material in a completely new light (Sudoł-Procyk and Krajcarz 2021). Until methods are developed to distinguish chocolate flint from these two regions, it will be difficult to indicate what the real distribution range of this raw material. Further research should provide answers to these questions.

10. CONCLUSIONS

Chocolate flint was one of the most important raw materials used by prehistoric communities from the Paleolithic through to the Late Bronze Age times in Central Europe. It has been identified at archaeological sites in Poland (almost all over the country), Belarus, Latvia, Lithuania, Ukraine, Czechia, Slovakia, Hungary, and Austria. Its prehistoric procurement was well recognized in archaeology for the Holy Cross Mountains region, but we prove that it was also known and exploited by prehistoric societies in another region, namely central part of the Kraków-Częstochowa Upland.

The newly-discovered chocolate flint deposit, which was exploited by mining and connected with further processing of the raw material at the spot, is the first site of this type in the Kraków-Częstochowa Upland. The flint mine in Poręba Dzierżna changes our knowledge of the prehistoric network of chocolate flint procurement and distribution at the end of the Pleistocene and at the beginning of the Holocene.

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THE TRZCINIEC CULTURAL CIRCLE BARROW FROM NIECIECZ WŁOŚCIAŃSKA IN THE SOUTHERN PODLASIE

ABSTRACT

Romaniszyn J., Makarowicz P., Górski J., Affelski J. and Smoliński A. 2021. The Trzciniec Cultural Circle barrow from Niecciecz Włościańska in the Southern Podlasie. *Sprawozdania Archeologiczne* 73/2, 137-166.

The societies of the Trzciniec Cultural Circle (TCC) were characterized by a complex and unique funeral rite. Despite its multidimensionality, it is possible to identify a number of patterns repeated in the ritual activity of these populations. This especially concerns barrow cemeteries erected during the classical phase of TCC development. To date, these types of structures are known from the southern (upland) provinces of this cultural formation. However, the barrow from Niecciecz Włościańska in Southern Podlasie that is comprehensively described here is the first richly equipped monument discovered in the northeastern (lowland) province of the TCC. The aim of this article is the complex characterization of the barrow and the interpretation of remains associated with the funeral rite. The authors apply standard archaeological methods supported by typochronological and radiocarbon analyzes to establish the chronology of this feature. The presented data is essential and crucial for understanding the northerneastern area of the TCC, which remains insufficiently recognized to date.

Keywords: funeral rite, Trzciniec Cultural Circle, barrow, under-barrow structures
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1. INTRODUCTION

In conjunction with the construction of the 'Niewiadoma' retention reservoir on the Cetynia River, excavations near the village of Nieciecz Włościańska were conducted in 2012. As a result of this fieldwork, archaeological complex with total area 7.27 ha was explored, which included sites numbered 11, 12, 13, 14, 39 and 40. The work was led by Krzysztof Karasiewicz, Antoni Smoliński and Małgorzata Kiełbasińska (Przedsiębiorstwo Handlowo-Usługowe 'Anwit'), and the results are summarized in an unpublished report (Kiełbasińska *et al.* 2012).

The sites are located in the western part of the Siedlce Upland, which is a part of Southern Podlasie, a region characterized by a moraine landscape (Różycki 1969; Kondracki 2001, 341, Solon *et al.* 2018). The fieldwork area was situated around 2 km north of Nieciecz Włościańska (Sabnie county, Mazowieckie voivodeship). The site is located on a fattened hill, which is an extension of the longitudinal part of the slope of the Cetynia River valley (Fig. 1). This region gently rises to the south and it is actually a deforested wasteland. The area of the sites was covered by brown leached and acid soils, as well podzolic and luvisol soils (msip.wrotamazowsza.pl).

The titled barrow was discovered in the range of Nieciecz Włościańska, site 11, located in the southeastern part of the excavation area (Fig. 2). The archaeologists documented 56 features classified as having a 'Trzciniec culture' origin. Three had a funerary character (features nos 30, 109 and 144). Particularly interesting was feature 30 – the remains of a barrow. The aim of this article is the archaeometric characterization, as well as the cultural and chronological identification of the barrow, and the interpretation of the remains of the funeral rite documented below this almost completely levelled mound.

The characterization and interpretation of this feature is especially important because Trzciniec Cultural Circle (TCC) funeral structures remain poorly recognized (Makarowicz 2010a) in the northeast Vistula Basin (the so-called 'podlasko-mazowiecka group' by Gardawski 1959). It is worth emphasizing that, excluding Koryciny (Pawlata 2010), the barrow from the Nieciecz Włościańska represents the most northeastern extent of the TCC.

During the excavation of Nieciecz Włościańska, site 11, 122 features were documented, among which 59 were associated with the TCC. There were 47 pits, nine hearths, two flat cremated graves and the barrow. In the TCC features, 150 pottery fragments, 17 flint items, three animal bones, and one stone polisher were discovered.

It must be emphasized that TCC features were also excavated in neighboring sites (no. 12, 13 and 39). They occurred individually or in small groupings. However, the biggest

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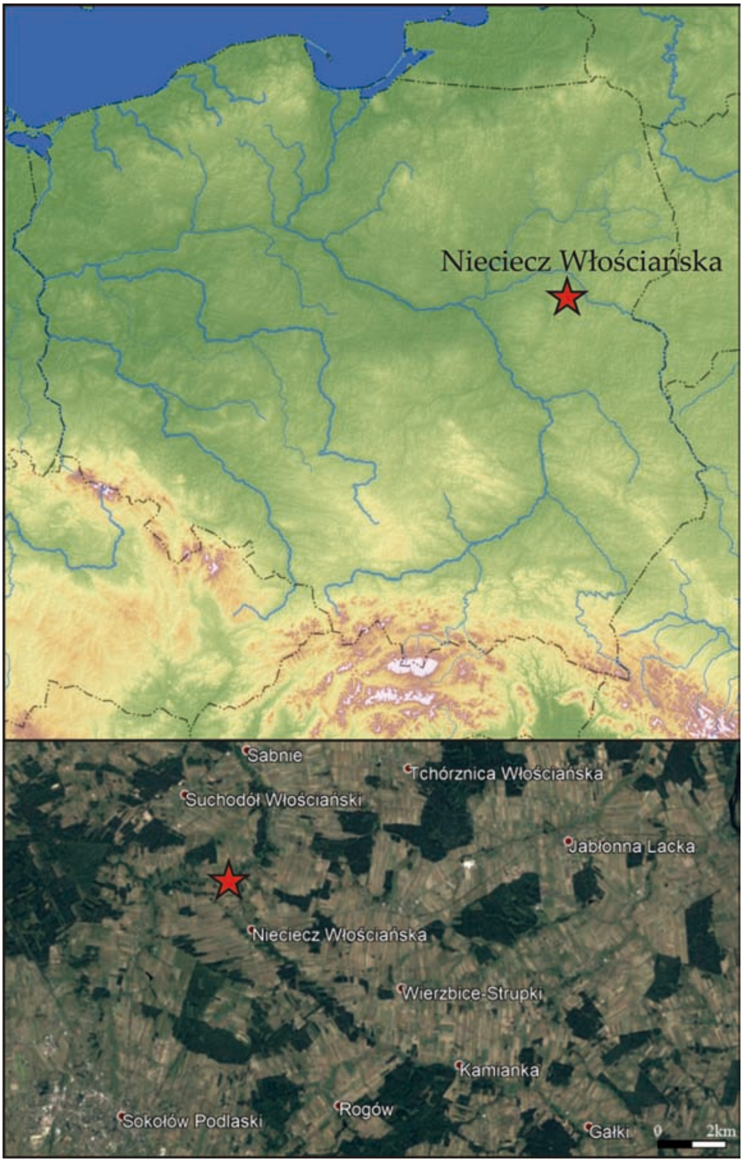

Fig. 1. Location of the Nieciecz Włościańska sites (Esri®; GoogleMaps®)

concentration of ‘Trzciniec’ features is visible in Nieciecz Włościańska, site 11, within the vicinity of the described barrow. The observed arrangement of these features suggests their occurrence continues in a southern, southeastern, southwestern, and eastern direction beyond the excavated area.

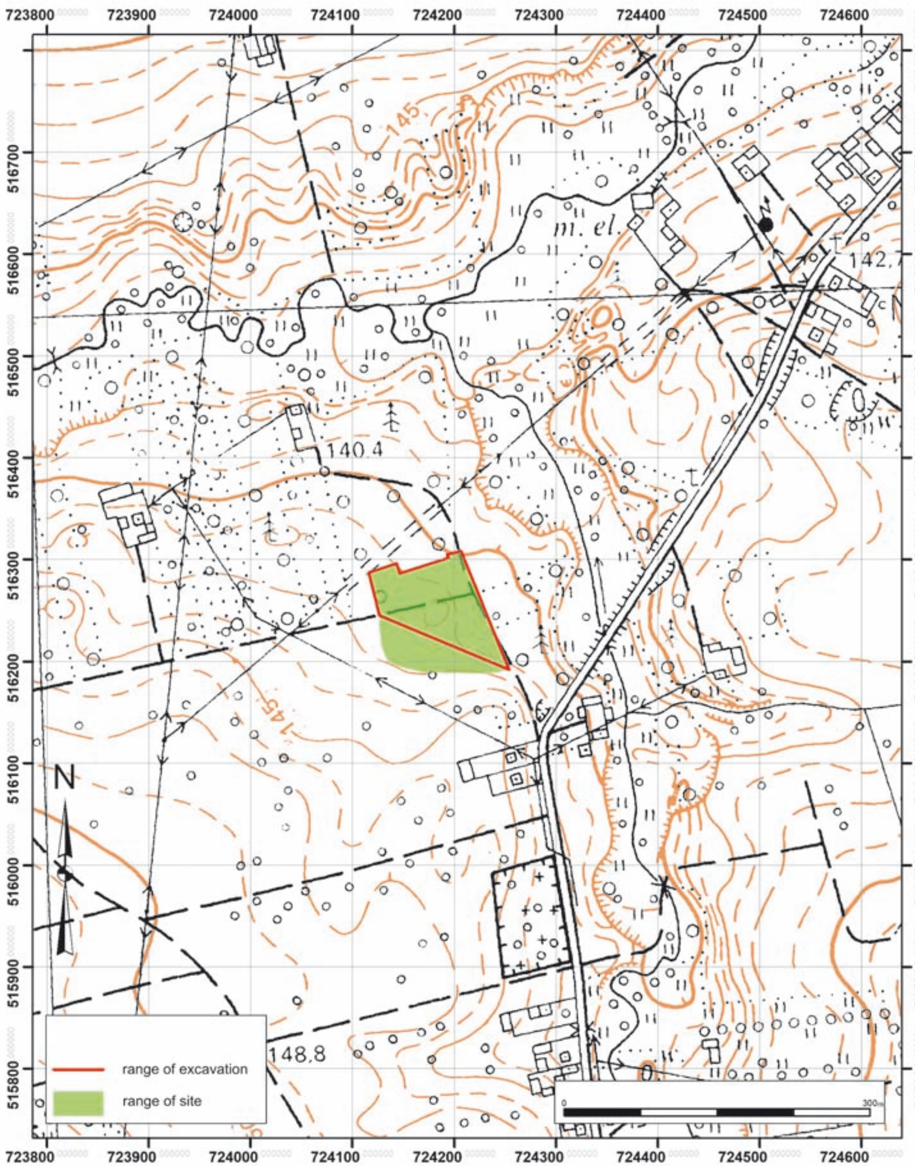

Fig. 2. Location of the Nieciecz Włościańska site 11 (PZGiK®)

2. THE BARROW (FEATURE NO. 30) AND UNDER-BARROW STRUCTURES

The remains of the barrow were situated in the southeastern part of the site (Fig. 3). It was totally levelled and was nearly oval in shape, with dimensions of 16.8 × 15.4 m. The barrow was explored in 20 cm mechanical layers within four sectors (quarters) leaving bulk between them in the form of a cross-arrangement. Each subsequent layer was docu-

Fig. 3. Plan of Nieciecz Włościańska, site 11

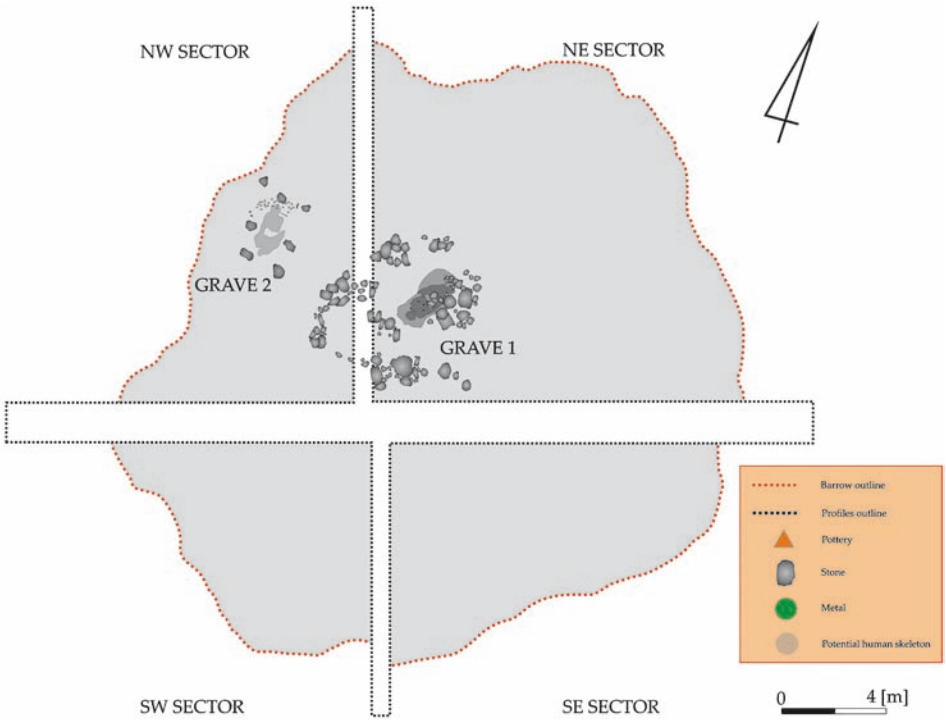

Fig. 4. Nieciecz Włościańska, site 11. Plan of feature 30

mented by drawings and photos. Observation of the profiles confirmed the mound was levelled in recent times. On the surface the excavators noticed two under-barrow features (potential burials) in areas characterized by darker colored soils. They were designated Grave 1 and Grave 2 (Fig. 4). As a result of the barrow exploration, 407 'Trzciniec' potsherds and seven pottery fragments dating to the transition from the Neolithic to the Early Bronze age were found. Moreover, excavations recovered 58 flint and two stone artifacts, 21 bronze items, and four cremated and crushed bone fragments that were too poorly preserved for analysis.

2.1. Grave 1

Grave 1 was located in the central part of the barrow, mostly in the northeast sector. It was a stone construction with an irregular (close to oval) shape consisting of around one hundred erratic stones (Fig. 5). This structure's dimensions were 4.8 × 4.2 m and it was longer along the north-south axis. The feature consisted of a southwest and northeast 'chamber', both built from stones arranged in a discontinuous manner. The southwest

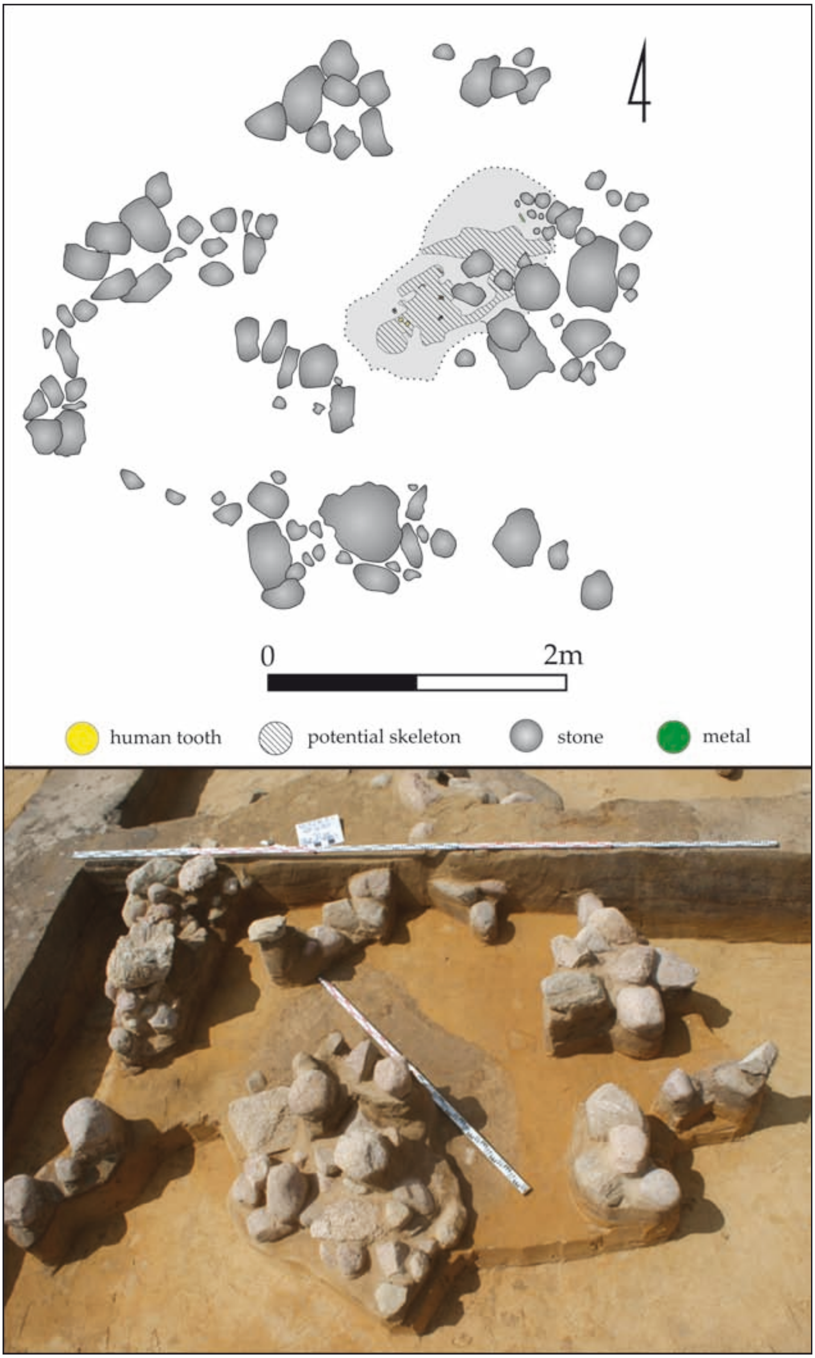

Fig. 5. Nieciecz Włościańska, site 11. The plan of Grave 1 (photo by M. Kiełbasińska, K. Karasiewicz)

chamber with dimensions of 1.4 × 0.95 m was oriented on a northwest-southeast axis. In the southern part of the northeast chamber, with a shape close to oval and a diameter of 1.85 × 1.1 m, in which the remains of a deceased in the form of two crushed teeth were recovered. Moreover, the excavators observed the outline of human remains had not preserved in the heavily washed soil. Based on this observation, it can be stated that the deceased was buried in a crouched position on the left side with the hands next to the face. The burial was oriented on a southwest-northeast axis with the head to the southwest.

In Grave 1, 17 pottery fragments, 17 bronze artifacts, and four flint items were found (Fig. 6). Among the bronze objects, two small spiral shields, seven spiral tubular elements,

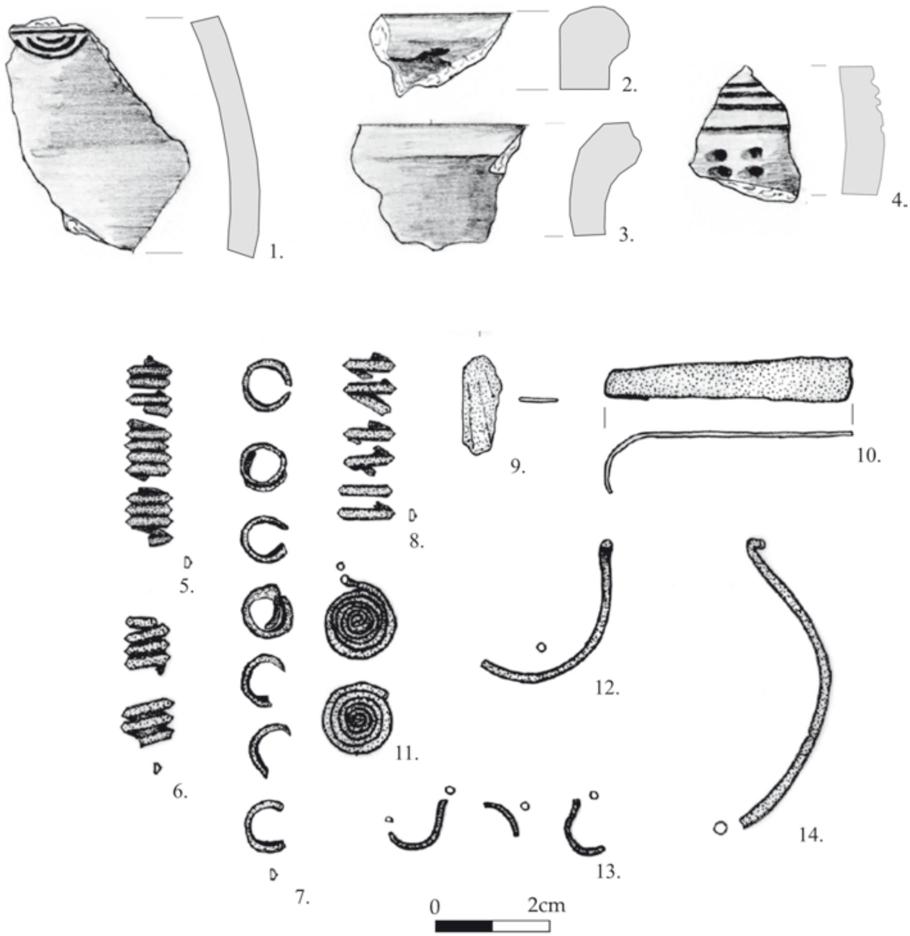

Fig. 6. Nieciecz Włościańska, site 11. Pottery fragments and bronze artifacts from Grave 1 (drawing by K. Machnio)

Fig. 7. Nieciecz Włościańska, site 11. Bronze artifacts from Grave 1 (photo by P. Kobek)

five wires (possibly fragments of a bracelet), two small laminas, and one large lamina were distinguished (Fig. 7). All these items had small dimensions (around 2 cm in length or diameter). Based on the position of the outline of the human remains, it can be assumed that, excluding one large plane lamina found in vicinity of the feet, the remaining bronze items were noticed near the deceased's chest or hands. Moreover, several flint flakes produced using the splintering technique, including a tranchet, were found in this grave but their association to the TCC is unclear.

2.2. Grave 2

Grave 2 was situated in the northwest sector of the barrow. It was a nearly rectangular construction oriented on a north-south axis with dimensions of 3.05 × 1.95 m. This feature was built of six stones situated in the corners and along the middle of the long sides of the rectangle (Fig. 8). No bones were found within this construction; however, as with Grave 1, traces of the contours of a skeleton were observed on the washed soil surface. Based on

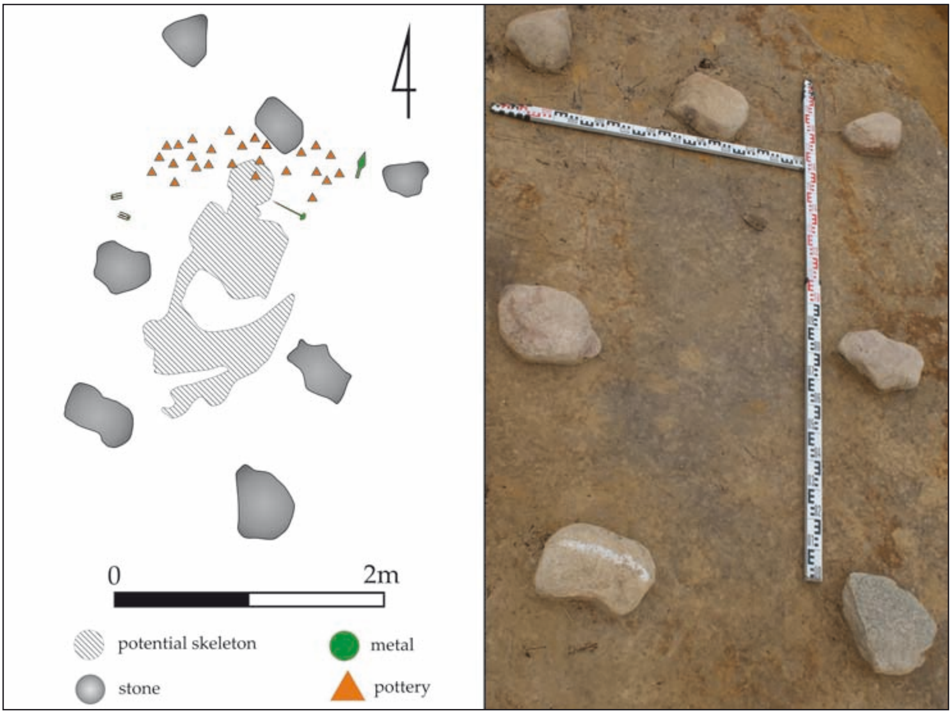

Fig. 8. Nieciecz Włościańska, site 11. Plan of Grave 2 (photo by M. Kiełbasińska, K. Karasiewicz)

this, it can be assumed that the deceased was buried in a crouched position on the left side with the hands in the vicinity of the face. The burial was oriented on a northeast-southwest axis with the head to the northeast.

In the described feature, four bronze artifacts, including a spearhead, nail-head pin, and two spiral bracelets (Figs 9 and 10), and many fragments of vessels (pots) were documented. The spearhead measures 12.9 cm in length and 3.5 cm in width and was recovered to the northeast of the potential location of the head of the deceased in proximity to potsherds. Fragments of wood preserved inside its sleeve were sampled for radiocarbon analysis (section 3.2). The pin, which was 13.55 cm in length with a head measuring 1.55 cm in diameter, laid directly in the vicinity of the potential head of the deceased. Two bracelets 5.1 cm in diameter were recovered around 1 m to the northwest of the potential deceased.

In Grave 2, 66 pottery fragments were recovered. Many of them belonged to one vessel and were discovered in the vicinity of the potential head of the deceased. It is a gently profiled G112 type pot (Górski 2007, fig. 10) with a diameter around 10 cm and was ornamented with five horizontal lines and two wavy lines on the upper part of the shoulder. Additionally, fragments of pottery characteristic of the Neolithic in this area were found in

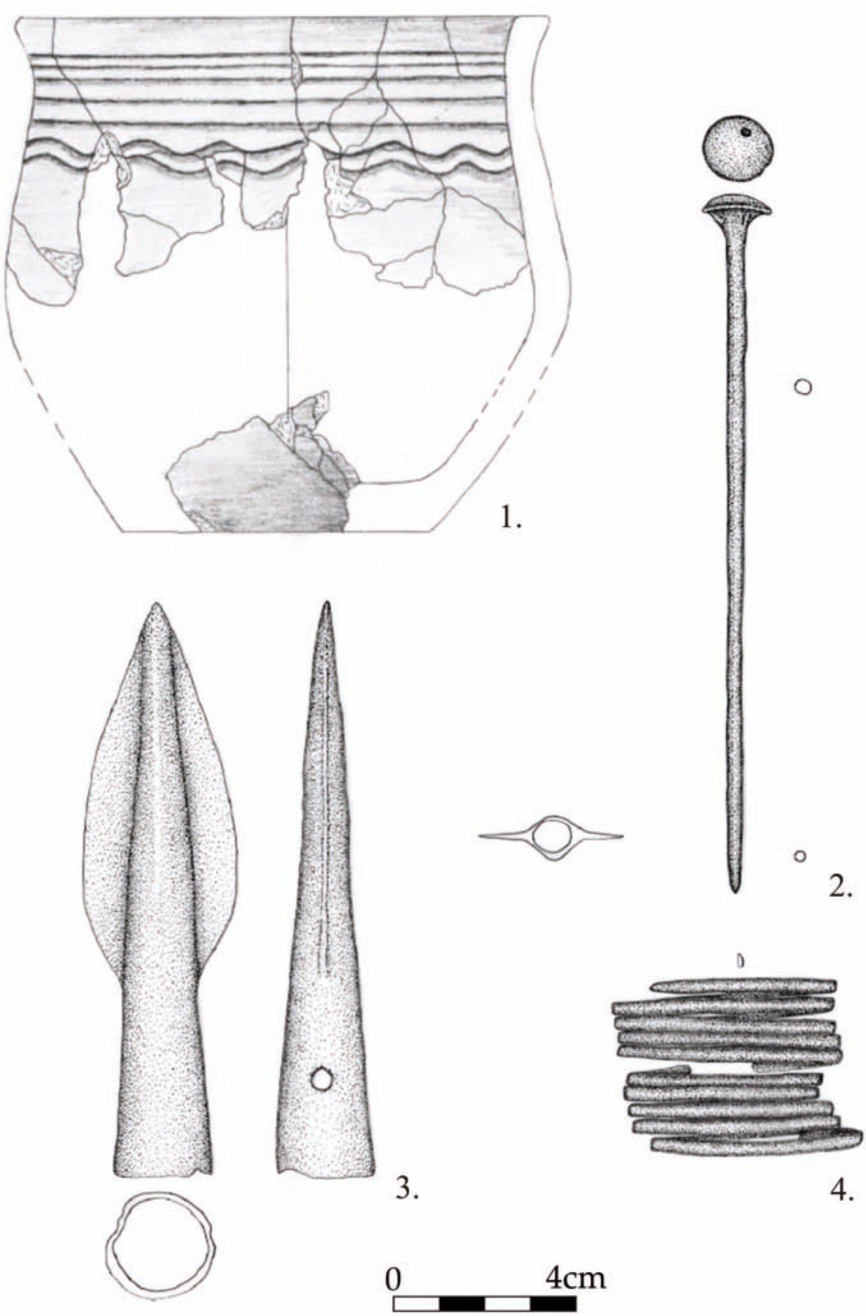

Fig. 9. Nieciecz Włościańska, site 11. The pottery and bronze artifacts from Grave 2 (drawing by K. Machnio)

Fig. 10. Nieciecz Włościańska, site 11. Bronze artifacts from Grave 2 (photo by P. Kobek)

the lower mechanical layers. Furthermore, four flint items, including a burnt flake, were found in this grave.

2.3. Other archaeological materials from the barrow mound

In addition to the finds from Graves 1 and 2, pottery fragments were excavated from different mechanical layers within the barrow outline (Fig. 11). In total, 324 fragments of TCC pottery and seven sherds from the transition from the Neolithic to Bronze Ages were registered inside the mound. These include potsherds with decoration including multiple incised horizontal, vertical, and wavy lines, horizontal grooves, and horizontal bars (decorative groups: I, III, XIV, XV, XVII, XXI based on Górski 2007).

Furthermore, three stone artifacts were documented in the upper layers of the barrow. A polishing stone made from quartzite was found in the northwest quarter. Another specimen produced from quartzite sandstone was excavated in the southeast sector. Additionally, a grinder made from granite was found in the upper layers of the barrow. Moreover, over 50 flint artifacts were registered within the range of the barrow. These were mostly specimens made using the splintering technique and can be associated with Bronze Age flint production technology. One diagnostic tool, a blade, was distinguished in this collec-

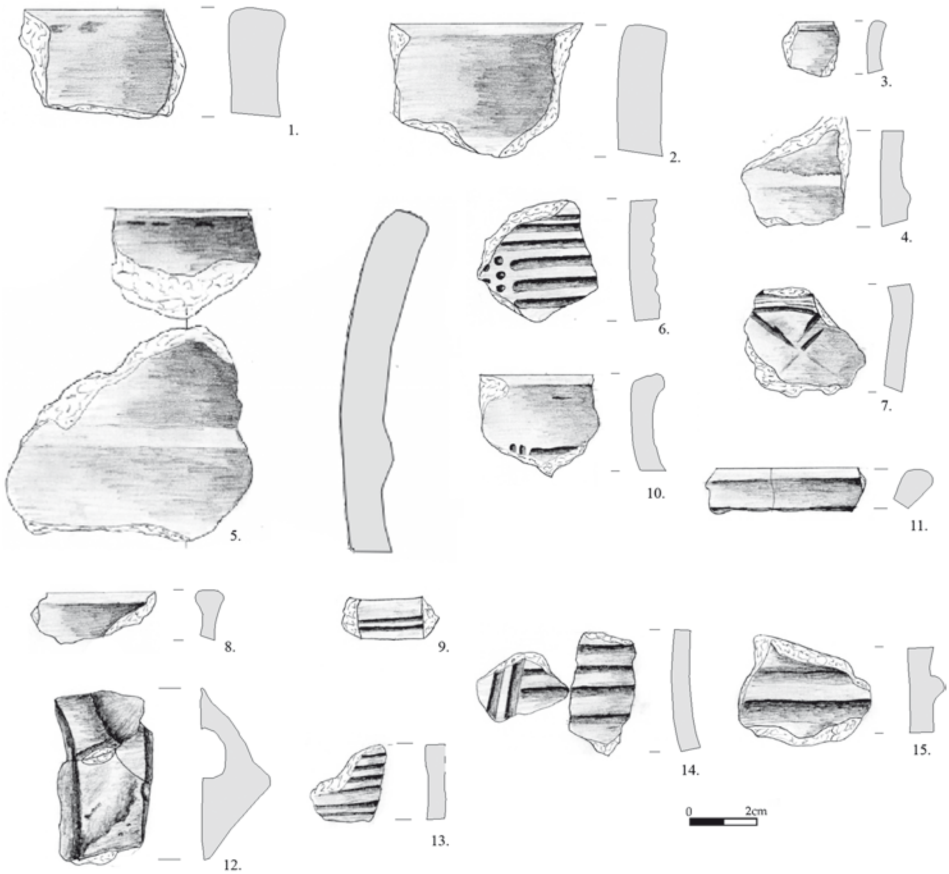

Fig. 11. Nieciecz Włościańska, site 11. Examples of pottery from the barrow (drawings by K. Machnio)

tion. It must also be mentioned that a number of the flint artifacts were heavily burnt. Finally, two small pieces of burnt bone were found in the upper layers of the mound. Unfortunately, because of poor preservation, they could not be anthropologically identified.

3. CULTURAL AND CHRONOLOGICAL ANALYSIS

The chronology of the Nieciecz Włościańska barrow was established using both relative (3.1) and absolute (3.2) methods. Specifically, the typochronological analysis of the diagnostic traits of the pottery (3.1.1) and bronze artifacts (3.1.2) as well as radiocarbon analysis of wooden fragment from inside the spearhead sleeve were conducted to estimate the most reliable timeframe in which the barrow from Nieciecz Włościańska was erected.

3.1. Relative chronological analyses

The relative chronology was primarily established based on the analysis of the traits of the ornamentation and, to a lesser extent, on macro- and micromorphology of the pottery. The technological features did not play a larger role in this case. The characteristics of the bronze artifacts from the under-barrow constructions in Nieciecz Włościańska are also important for establishing the relative chronology of the mound. It should be noted that, contrary to the western province of the TCC, the described area was distinguished by a limited occurrence of bronze items (Dąbrowski 2004, Karte 2). Nevertheless, both Graves 1 and 2 were richly equipped with metal artifacts.

3.1.1. Typochronological analysis of the pottery

The type of pottery fragments excavated from Nieciecz Włościańska with horizontal and wavy lines (Figs 6: 4; 9: 1 and 11: 6, 9, 13, 14) is widespread throughout the 'lowland' version of the TCC. These patterns are often also accompanied by horizontal bars. Multiple wavy lines, typically three or four, are present on the body of vessels. In the Vistula Basin, they are most abundant in the territories of the Mazovian Lowland and Podlasie (Gardawski 1959, tabl. XLIV: 5, 6, 12; XLIVII: 29; XLVIII: 23-25; XLIX: 9; Taras 1995, tabl. IV: 1, 4; V: 7, 9; VII: 3; IX: 2; l. X: 1; XI: 1; XII: 1; XIII: 2; XXXIV: 10; Domaradzka and Józwiak 2011, ryc. 9: 6; Skorupska 2013, tab. 5: 5; Wawrusiewicz and Bienia 2014, ryc. 7: 4). A significant number of vessels ornamented with wavy lines and connections with other patterns come from the Polesie site in the southern part of Mazovian Lowland (Górski *et al.* 2011, ryc. 2.38). Single specimens are known from the Lublin Upland (Gardawski 1959, tabl. XLI: 22; Taras 1995, tabl. XLVII: 5), the San Basin (Adamik-Proksa 2019, tabl. CXIV: 4), as well as the western and northwestern borderlands of the TCC (Gardawski 1959, tabl. XIII: 17, 25; Makarowicz 1998, tabl. 71: 2). The same ornamentation occasionally occurs east of the Bug River (Makarowicz *et al.* 2016, fig. IV.298). The vessel with this pattern from Nieciecz Włościańska is not characteristic and quite unusual. The pot is short, and its proportions are closer to those of vases. A few similar specimens ornamented with wavy lines are known from the Mazovian Lowland (Gardawski 1959, tabl. XLVII: 24, 29; XLIX: 9).

The other diagnostic potsherds from Nieciecz Włościańska represent features typical of classical TCC materials. The characteristic attributes of this formation include horizontal lines, horizontal notches, and stamp ornamentation (Figs 6: 4 and 11: 15). Likewise, 'hanging' arches ornamentation (Fig. 6: 1) is known in the Mazovian and Podlasie areas (Grabarek 2012, ryc. 7: 2; Skorupska 2013, tabl. 2: 1; 5:2, 5).

Specific micromorphological elements are thickened and obliquely cut rims (Fig. 6: 2, 3; 11: 2, 8, 10, 11). These represent a sort of 'hallmark' of the classical stage of the TCC (Gardawski 1959; Taras 1995; Kłosińska 1997; Górski 2007, 2017; Makarowicz 2010a; Górski *et al.* 2011; Muzolf 2012).

To date, a periodization system has not been established for the described territory. Because of this, the relative chronology of this material is unknown. Certainly, it can be associated with the classic stage of the TCC, which existed through the late Early Bronze Age (period A2 according to P. Reinecke). The only specimen of a pot with wavy lines from Kuyavia, irrespective of taxonomical assignment – HT1 (Czebreszuk 1996, 159, 160) or HT1/3 (Makarowicz 1998, 103, 106, 107) – is associated with the early stage, which in this region dates to between the 19th and 17th centuries BC (Makarowicz 1998, fig. 13). Another fragment of a vessel with multiplied lines from San Basin (Skołoszów – Adamik-Proksa 2019, tabl. CXIV: 4) dates to the first part of the classical stage (assemblages of type A1) and dates to 1700-1600 BC (Adamik-Proksa 2019, 142-144). However, both periodization systems were developed in territories located quite far from the Niecziecz Włościańska site, not only geographically, but also culturally in terms of the different rhythms of the development of local TCC groups in these areas. Therefore, the most important observations considered here are from the site 1 in Polesie in the basin of Bzura River. In this light, the described ornamentation can be associated with the second pattern group (GS 2), which dates between the 17th and 15th centuries BC (Górski *et al.* 2011, 113, Fig. 3.2, 4.30).

In conclusion, it can be assumed that presented diagnostic pottery traits situate the analysed material from Niecziecz Włościańska in the early stage of the classical phase of the TCC development (Early-Classic horizon).

3.1.2. Typochronological analyses of the metal artifacts

Graves 1 and 2 are among the most richly furnished TCC graves in terms of metal artifacts. The unadorned pin from Grave 2 has a poorly modeled and perforated nail-head. Because of these traits, this specimen is hard to unequivocally classify. Poorly modeled finials of bronze pins are characteristic of the Balczewo type, among which unadorned specimens occur (*e.g.* from Chachalnia near Krotoszyn). They are primarily known from Kuyavia and the northeastern part of Silesia. As with other pins of this type, they are associated with the early stage of the Tumulus culture (Vorlauzitzer kultur) (Gedl 1983, 42, 44, 45, Taf. 5: 115, 119, 44B).

The described specimen is also related to pins with punctured heads because of its perforation. However, the majority of this type of artifact has more distinctly conical or spherical heads. Regardless, these items also date to the early stage of the pre-Lusatian cultural development (Gedl 1983, Taf. 3-4). A single example of the same type of poorly modeled pin but with a decorated head comes from Skowarcz in Pomerania (Gedl 1983, Taf. 4: 100). The flat-convex head form of the pin from Niecziecz Włościańska is similar to those of specimens from Legnica and Wrocław-Osobowice in Lower Silesia, which similarly date to the early stage of the Tumulus culture (Gedl 1983, 66, Taf. 19: 244, 245). Based on this data, there is no doubt that the characterized pin dates to the BB_1 phase of the Bronze Age.

Interestingly, pins with the same head shape are known from under-barrow graves in different areas of the TCC. A 'post-Únětice' pin with a spherical and perforated head was found in Okalew, site 3, barrow 10, grave 2, at the confluence of the Warta and Prosna Rivers (Abramek 1971, tabl. 4: f; Kłosińska 1997, 9). A pin with a similarly perforated head to the Niecierz Włościańska specimen came from grave 1a of the barrow cemetery in Dacharzów site 1, on the Sandomierz Upland (Florek and Taras 2003, ryc. 6: d). It has a decorated and twisted shaft. Analogues of this pin can be found among the Dunaújváros type, which is related to the Dolný Peter and Koszider horizons (Bóna 1975; 1992; Florek and Taras 2003, 42; Vicze 2011; Vicze *et al.* 2013), while its ornamentation relates more to items from the early and classical stage of the Tumulus culture (Florek and Taras 2003, 43). 'Southern' analogues include a specimen from Dacharzów dating to the BA_2/BB_1-BB_2 phases of the Bronze Age. A similar pin with a twisted shaft, although with decoration, is known from the grave under barrow 8 in Komarów in the Upper Dniester Area (Sulimirski 1968, fig. 26: 1; Romaniszyn and Makarowicz 2020). This specimen was found with other bronze artifacts typical of the Koszider horizon (Dąbrowski 1972, 34, 115; Bóna 1975; 1992; Vicze 2011; Vicze *et al.* 2013). An analogical pin with smaller dimensions but from a similar context (*i.e.*, with a bracelet and spiral ornaments) was found in Bukówna barrow III, in the Upper Dniester Area (Swiesznikow 1967, Tabl. VIII; Dąbrowski 1972, tabl. XIV: 8-11; Makarowicz *et al.* 2016). Pins are also known from Putiatyńce and Beremiany in this region (Lysenko and Lysenko 2009, Fig. 5, Fig. 6, Fig. 7; Makarowicz 2009, Fig. 17). Similar specimens are also known from under-barrow graves in Netishyn and Ustenskoye on the Volhynian Upland (Berezanska and Samolyuk 2004; Lysenko and Lysenko 2009, Fig. 7: 2). All of these sites are exclusively barrow cemeteries located in different parts of the TCC range: from the Greater Poland Lowland in the west to the Dnieper Upland in the east. The presence of this type of pin in the TCC inventory was likely influenced by the Otomani/Füzesabony and Vatya cultures from the Carpathian Basin (Makarowicz 2010a, 341).

Spearheads are not sensitive chronological markers, and it is difficult to temporally classify this type of artifact. The specimen from Niecierz Włościańska resembles both older examples (*e.g.* Babin in Western Pomerania – Blajer 1990, Tabl. II: 4, 5, 7, 8), as well as younger ones (*e.g.* Chycina in Greater Poland – Blajer 1999, Tabl. 18: 1, 2, 5). Morphologically, the spearhead from Niecierz Włościańska is similar to a recently published specimen from Pomorowo in the Warmia Region, which is related to the Bagtep type and dates to BB_1 (Blajer *et al.* 2019, 70, 71).

Spearheads are typically found in the eastern provinces of the TCC, mostly in the Middle Dnieper area (Klochko 1994, 119, 124; 1998, 217, 236; 2006; Makarowicz 2009, Fig. 13; 2010a, ryc. 6.10), which is connected to a local metallurgical center (Klochko 1998). In the western enclaves of the TCC, only single examples of spearheads are known from, for example, Żyrardów, Kraski, and Tyszowce site 25A. The most similar analogue to the Niecierz Włościańska specimen is known from Obuchiv in the eastern province of the TCC. However, contrary to the described artifact, the Obuchiv specimen has a small, perforated handle (Makarowicz 2010a, ryc. 3.19.). In total, around 30 spearhead specimens have been documented from TCC contexts to date (Makarowicz 2009, Fig. 13).

The two bracelets from Grave 2 occur commonly in the TCC in both the Upland and Lowland provinces. This type of artifact is documented both in hoards (mostly in the western part of the TCC – Blajer 2001, Mapa 72), as well as in funerary contexts throughout the TCC territory (Lysenko and Lysenko 2009, 350, 351; Makarowicz 2010a, Fig. 6.3). However, it is worth mentioning that this type of artifact has not yet been registered northeast of the Vistula River (Makarowicz 2010a, 341). The specimens from Nieciecz Włościańska are the first examples of spiral bracelets to be identified in this region.

Other bronze objects – perhaps elements of a necklace – are nondiagnostic in a chronological aspect. Based on the preserved fragments, the Nieciecz Włościańska specimens are considered similar in form to an artifact from barrow 8 in Komarów (Sulimirski 1968, 108; Fig 26). Inspiration for the pattern of spiral ornaments with small shields in TCC assemblages likely originated in both the Tumulus culture circle (Blajer 1999) from beyond the Carpathian Arc, as well as in the environment of Carpathian Basin cultures (Makarowicz 2010a, 341, 342).

The chemical and metallurgical analysis of the bronze artifacts will be the subject of a separate article; therefore in this text we will only mention that such objects recorded in the Nieciecz Włościańska barrow were made of high tin bronze.

3.2. Absolute chronology

To establish absolute chronology, two samples of wood (parts of a javelin) that were poorly preserved inside the sleeve of the spearhead from Grave 2 were selected for radiocarbon analysis (Poz-57704, 3430±40 BP and Poz-57705, 3340±35 BP). The analysis was conducted using the AMS method in the Poznań Radiocarbon Laboratory and the obtained ^{14}C dates were calibrated using the OxCal program v. 4.4.2. (Bronk Ramsey and Lee 2013) against the calibration curve IntCal 20 (Reimer *et al.* 2020).

The obtained results oscillate around the second half of 18th century and first half of 17th BC (Table 1 and Fig. 12). The sample Nieciecz_ob_30_gr2_A provided wide time ranges after calibration: 1879-1622 BC (95.4% confidence level) and 1869-1641 BC (68.3% confidence level), with the period 1772-1676 BC as the most likely age (53.6% confidence interval). The result of the second sample (Nieciecz_ob_30_gr2_B) indicates a slightly younger chronology from between 1746 and 1518 BC (95.4% confidence level), more precisely from 1669-1540 BC (68.3% confidence interval), and the most likely age oscillates between 1635-1540 BC (61.5%). To establish the most reliable date range for both wood samples from the sleeve of the spearhead and, indirectly Grave 2 and the barrow, the *Combine* function was applied (Fig. 13.) in the OxCal program (Bronk Ramsey and Lee 2013). Based on this analysis, Grave 2 and the excavated barrow in general, most likely date to

Table 1. Radiocarbon dates from the barrow in Nieciecz Włościańska (Oxcal v.4.4.2, Bronk Ramsey and Lee 2013)

No.	Laboratory signature	Feature	Material	BP	BC (68.3%)	BC (95.4%)
1.	Poz-57704 Nieciecz_ob_30_gr2_A	Grave 2	wood	3430±40	1869-1849 (9.2%) 1772-1676 (53.6%) 1654-1641 (5.4%)	1879-1839 (13.7%) 1826-1622 (81.8%)
2.	Poz-57705 Nieciecz_ob_30_gr2_B	Grave 2	wood	3340±35	1669-1656 (6.7%) 1635-1540 (61.5%)	1736-1716 (4.9%) 1692-1518 (90.5%)

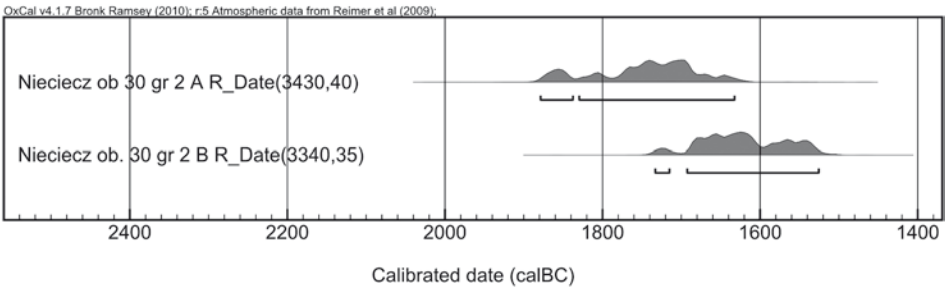

Fig. 12. Radiocarbon dates from the barrow in Nieciecz Włościańska

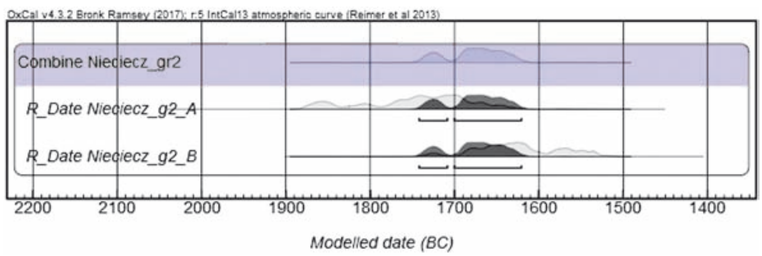

Fig. 13. Chronology of the barrow from Nieciecz Włościańska after application of the *Combine* function in the OxCal v4.4.2 program (Bronk Ramsey 2009)

between 1745 and 1566 BC (2σ confidence level), probably within the period from 1745-1612 (94.6%), which can be narrowed down to between 1731 and 1626 BC (1 σ), and again to between 1688 to 1626 BC (59.8%). It seems that the construction of the under-barrow structures (assuming they are contemporary) and the erection of the barrow above date to the end of first half and first quarter of the second half of the 17th century BC.

In light of the absolute and relative chronologies, the most likely time range of the 'episode' of barrow erection, including the grave interment and mound construction, should be placed between 1700 and 1600 BC, and more precisely during the first quarter of the second half of 17th century BC. Similarly rich 'Trzciniec' burials that also date to early periods of the TCC development include sites in Netishyn on Volhynia (barrow VIII – two graves; Berezanskaya *et al.* 2004; Makarowicz 2010a, 312, 313), Iwanowice Włościańskie, Góra Klin site grave 11 (Gajewski 1969), Komarów barrows 6 and 8 (Sulimirski 1964; Fig. 2; 1968, 107-108, Fig. 26: 7-9; Swiesznikow 1967, 85, tabl. I: 1-4, 7-10; Romaniszyn and Makarowicz 2020), and Ivanye barrow II, graves 1 and 2 (Sveshnikov 1968; Makarowicz 2008). A significant observation is that the barrow from Nieciecz Włościańska can be chronologically situated with those mentioned above, falling in the range of the early stage of the TCC, which relates to the first part of the classical phase. It is unusual that the inventory of the bronze artifacts from Nieciecz Włościańska and Netishyn are very similar. Although these sites are located over 400 km apart, in both cases, a spearhead, undecorated pin with a poorly vaulted and perforated head, and spiral bracelets were found. Despite its great distance from settlement clusters in the southern part of the TCC where the majority of barrow cemeteries are registered (Makarowicz 2010a, Fig. 4.1), the mound from Nieciecz Włościańska located in the northeastern province corresponds perfectly and confirms the renaissance of the 'kurganization' process directly connected with TCC societies during the first half of the 2nd millennium BC (Górski *et al.* 2003; Makarowicz 2010a).

4. THE BARROW FROM NIECIECZ WŁOŚCIAŃSKA IN THE CONTEXT OF OTHER TCC FUNERAL STRUCTURES

Numerous bronze ornaments (jewelry) excavated from Grave 1 suggest that this burial probably was that of a woman. The placement of spiral and tubular bronze elements in the vicinity of the deceased's chest evidenced these were probably fragments of a larger necklace. In the case of metal items from Grave 2, it can be assumed that they belonged to a male individual (a warrior?). This is primarily confirmed by the presence of the spearhead, an element associated with a military function which has been documented in other male burials in TCC contexts. This spearhead as well as a pin were placed next to the potential head of the deceased in Grave 2.

The presence of vessels confirms the deceased in both graves were supplied with ritual foods and beverages, a universal and common aspect of the funerary practices of the 'Trzciniec' society (Makarowicz 2010a, 272-276). Fragments of vessels and flint excavated below the mound and near the burial contexts provide evidence of complex ritual behaviors. These practices related to the funeral ceremony, which likely included ritual or commemorative feasts, destroying vessels, as well as consuming animal meat (Taras 1995, Florek and Taras 2003, 71, 72; Górski 2007; 2010; 2017; Makarowicz 2010a, 279, 280; Makarowicz *et al.* 2013; Romaniszyn 2015; 2018).

The symbolism and origin of the barrow funeral rites of the TCC societies have been frequently published in the archaeological literature (*e.g*. Górski 1996; 2010; Florek and Taras 2003, 70-72; Górski and Jarosz 2007; Makarowicz 2010a; 2010b; 2011). The much older chronology of the barrow described here allows us to consider the early mechanisms of the 'kurganization' process in the northern part of the TCC. It was a dynamic phenomenon that in very short time spread to different enclaves of this cultural formation, which is confirmed by radiocarbon dates (Górski *et al*. 2003; 2011; Makarowicz *et al*. 2021).

The analysis of the distribution of 'Trzciniec' sites indicates that barrow cemeteries and single mounds mainly occurred in the compact highland belts in the southern provinces of the described cultural formation (Makarowicz 2010a, 204). It seems, therefore, that the Nieciecz Włościańska mound is an excellent and unique polygon for studying the funeral rites of Middle Bronze societies in the northeastern part of the TCC. Additionally, this barrow was discovered within the borders of a settlement and another funerary feature was found in its vicinity (Features 109 and 144 – a flat graves), which further highlights the multidimensionality of the funerary rite system characteristic of the 'Trzciniec' society. This arrangement is similar to the situation from a large funerary and settlement complex in Polesie, site 1, in the Mazovian Lowland (Górski *et al*. 2011).

Despite the variability and complexity of the 'Trzciniec' funerary rite, a series of identifiers can be recognized that fit within a general sepulchral canon. In Southern Podlasie, and more broadly in the northeastern province of the TCC, few funeral features of this cultural formation have been recognized (Makarowicz 2010a, Fig. 4.3; Piotrowska 2012, Fig. 1). For this reason, it is difficult to define which funeral pattern was dominant in this area. The only necropolises that have been systematically excavated in this region are a cremation cemetery in Laski Stare on the edge of the Mazovian Lowland (Kempisty 1968), a complex of cemeteries and settlements in Polesie (Górski *et al*. 2011; 2012), and a barrow cemetery in Koryciny (Pawlata 2010).

With regard to the pattern of TCC funeral sites across the landscape, the described barrow represents the general tendency. Funerary structures were erected without exception on elevated landscape zones which were characteristic in shape and height (Górski 1996; 2017; Makarowicz 2010a, 207-218; 2011; Makarowicz *et al*. 2019). These are exposed places towering over their surroundings. The area of the Siedlce Upland on which Nieciecz Włościańska is located is characterized by a hilly landscape resulting from postglacial processes. The described monument was situated on the higher part of the slope. This location conforms to the general trend of the placement of funerary grave structures by the TCC societies (*e.g*. Makarowicz 2010a, 216, Fig. 4.9; Makarowicz *et al*. 2019).

Generally, TCC cemeteries were founded in the vicinity of settlements and less often within unspecified settlement zones (Makarowicz 2010a, 220; Górski *et al*. 2011; Piotrowska 2012, 101). It is also worth noting that the practice of erecting funerary features within the borders of settlements is primarily observed in the southern area of the TCC (Makarowicz 2010a, 220; Górski and Makarowicz in print). It should be emphasized that most of these features comprise flat, separated funerary structures, such as features 109 and 144 from Nieciecz Włościańska. Barrows indirectly associated with a settlement were discovered in Polesie (Górski *et al.* 2011). These remains included an under-barrow collective grave with sepulchral architecture as well as destroyed flat cremated graves (Górski *et al.* 2011, 27-300). Based on numerous radiocarbon dates, the established chronology confirmed these funeral structures were erected at different times (Górski *et al.* 2011, 133-146). Another example of a barrow within the border of a settlement comes from Adancăta in northeastern Romania (Niculică *et al.* 2013; Niculică 2015, Pl. XXXIX).

Based on existing data, it is not yet possible to define the exact chronological association of the settlement in Nieciecz Włościańska and the timing of the mound erection. In the literature, the habit of locating a funerary feature within the borders of a settlement is derived from the south (Věteřov and Otomani-Füzesabony cultures; Makarowicz 2010a, 220; Górski and Makarowicz in print). This hypothesis is confirmed by the higher frequency of graves within settlements in West Lower Poland. It seems this issue demands more detailed studies in the future.

A characteristic trait of the TCC funerary rite is the occurrence of complex and various sepulchral architecture. Different types of under-barrow features constructed from soil, wood, stone, or clay are documented among the TCC structures (Florek and Taras 2003, 63-69; Makarowicz 2010a, 228-242; Makarowicz *et al.* 2016). The barrow from Nieciecz Włościańska revealed two stone constructions with significant dimensions. It should be assumed that the erection of this grave structure involved and integrated the whole local community (Górski 1996).

Both under-barrow graves were structurally different from each other. Grave 1 was a large, irregular feature close to oval in shape inside of which space was provided to accommodate the burial of the deceased. The analysis of known TCC funeral constructions did not reveal any examples that strictly corresponds to the form of Grave 1. An architecturally similar stone structure was present in Costăna (Barrow-grave T1) in northern Romania (Boghian *et al.* 2012), although this monument is associated with the Babino culture. Moreover, structures of this type built from erratic stones or stone slabs have been discovered in both the northern (Okalew, kurhan 6; Abramek 1971, 71, ryc. 3: e) as well as the southern (Adăncata, T2, Komarów, kurhan 14, Bogucice; Sulimirski 1968, 108; Gardawski 1971, 153; Florek and Taras 2003; Niculică 2015, pl. XLIX) provinces of the TCC.

Although slightly smaller and simpler, the construction of Grave 2 is very interesting (Fig. 14). Almost identical funerary features with rectangular shapes and stones arranged in the corners and along the longer sides were found during recent excavations in Bukivna (Makarowicz *et al.* 2013; Lysenko *et al.* 2015; Makarowicz *et al.* in print), in the upper Dniester area. These included constructions in barrows 1/I/2010 (feature 3) and 7/I/2014 (features 6 and 7; Makarowicz *et al.* 2013; Lysenko *et al.* 2015; Makarowicz *et al.* in print). Contrary to the feature from Nieciecz Włościańska, the Bukivna did not contain bones (inhumated or cremated) and these constructions were interpreted as cenotaphs – sym-

Fig. 14. Nieciecz Włościańska, site 11.
The stone construction of Grave 1 (foreground) and Grave 2 (background)
(photo by M. Kiełbasińska, K. Karasiewicz).

bolic burials (Makarowicz *et al.* in print). However, it cannot be excluded that osteological material did not preserved due to unfavorable soil conditions (Makarowicz *et al.* in print). The re-analysis of the funeral rite from another TCC necropolis in the upper Dniester area at Komarów revealed the occurrence of the same type of funerary construction (Romaniszyn 2018). Examples of such structures were discovered in barrows 34 and 45 from this cemetery (Sulimirski 1968, 111ff.). In the second feature, as at Nieciecz Włościańska, cremated human remains were noticed (Romaniszyn and Makarowicz 2021). The comparison of the sepulchral construction from Nieciecz Włościańska and features from the upper Dniester area suggest that this type of funeral structure, although unique, comprised part of a universal pattern with deeper symbolism. However, the documentation of these features in completely different areas of the TCC opens further discussion about the funeral rites and symbolism of ritual behaviors of TCC societies from the 2nd millennium BC.

Based on fieldwork and the remains of small pieces of human bone, it is difficult to unequivocally state what type of burial (cremated or inhumated) was discovered in the graves beneath the Nieciecz Włościańska barrow. In the opinion of the excavators, all four bones recovered from the barrow showed traces of fire activity (Kiełbasińska *et al.* 2012, 4-6). Furthermore, in the vicinity of the stone constructions, smudges on the subsoil were observed that may have been associated with the burning process. This evidence suggests that fire was during the funeral ceremony prior to the construction of the mound. This sepulchral treatment consisted of burning the (wooden?) funeral construction with the deceased and grave goods inside. In the literature, this habit is call *in situ* cremation and this type of funerary behavior is known from different enclaves of the TCC (Kempisty 1978; Kłosińska 1987, 41; Górski 2007; Makarowicz 2010a, 244, 385).

There were two separate burials inside the Nieciecz Właściańska barrow. Funeral structures containing collective burials are characteristic of the ritual activity of the "Trzciniec" societies (Makarowicz 2010b; Górski 2017). They are registered throughout the TCC territory, from the western to eastern provinces (Makarowicz 2010a, 244-253; 2010b, 379-387). Among the different types of collective burials, 'paired burials' are distinguished, in which two deceased were interred under the same barrow (Makarowicz 2010a, 346). Examples of 'paired burials' are known primarily from the Volhynian Upland and have been documented at Netishyn (barrow VIII), Boratyń Wielki, Szepel, Peresopnica, Siekierzyńce, and Kordyshiv (Romaniszyn and Skrzyniecka 2019, 262). In the case of the example from Nieciecz Właściańska, the radiocarbon analysis did not distinguish whether these features were interred contemporaneously or at different periods. The analysis of the funerary inventory suggests the 'paired burial' included both a male and female individual. Recent studies of TCC funeral rituals indicate this type of burial occurs throughout the entire formation of this culture (Makarowicz 2010a, 381), as well as in local variants (Romaniszyn and Skrzyniecka 2019, 262).

Summarizing the above information, it should be stated that the society that erected the mound in Nieciecz Włościańska duplicated several specific schemes of sepulchral construction characteristic of the TCC. This is evidenced by the location of this barrow in a specific (sacral?) area of the landscape, the erection of a composite sepulchral construction, the funeral behaviors associated with the interment of the deceased, including probable fire activity, and covering the funeral components with a mound. The fragments of crushed vessels from Grave 2 suggest the society provided ritual nourishment for the deceased. The relics of funerary rites discovered in the Nieciecz Włościańska barrow confirm the heterogeneity and complexity of the TCC sepulchral behaviors, that nonetheless follow the general scenario of ritual activity known from these societies documented in the literature (Kośko 1991; Makarowicz 2010a, 276-280).

The rich individual funerary equipment of the deceased from the burial mound in Nieciecza Włościańska also requires comment. It seems that prestigious metal items initially were owned by selected groups or individuals. Following the tendency to equip the deceased during burial, the depersonalization of grave goods over time can be observed (Makarowicz 2003; 2010a). The rich burials from the earlier stage of TCC development do not have counterparts among later burials. Indeed, collective graves are predominant in later burials, making it difficult to attribute grave goods to specific individuals. This is viewed as a recession of individualizing and personalistic tendencies in favor of collective behaviors (Makarowicz 2010a, 331). In this context, it should be noted that in the earlier stage of the TCC development, hoards are represented in greater numbers relative to later periods. These sets have a characteristic 'ornamentation suite' and they can highlight group identity in relation to 'countrymen' and 'strangers' (Blajer 1996, 98, 104). Some have been found within settlements and could have been collectively owned by the village community (Górski 2017, 110, 111). The rich funerary equipment of the deceased from the Nieciecz Włościańska barrow can be interpreted as reflecting the funeral rites observed primarily in the 'upland' area of the TCC, where the tendency of under-barrow graves to 'individualize death' and personalize grave goods, including those that indicate the sex of individuals, is visible. The issue of richly equipped barrows of the TCC societies has been previously discussed in detail (Makarowicz 2010a, 295-322).

It is possible that one of the reasons for community diversification and the development of local elites in relation to the western part of the TCC could have been the takeover by individual or groups of brokers in the amber trade (Górski 2017, 108-110). The discovery of the Nieciecz Włościańska barrow can lead to the conclusion that not all richly furnished burials should be associated, whether directly or indirectly, with amber or bronze distribution. Instead, some may be related to individual achievement of high social positions at a time of major and dynamic change during the stages of formation and territorial expansion of the TCC community (Górski 2017, 110).

5. CONCLUSIONS

The presented barrow is a funeral structure characteristic of the TCC. A picture of complex and specific burial practices is drawn by analyzing the relics of funeral constructions and traces of ritual behavior. The erection of barrows in exposed spaces, the occurrence of complex grave architecture, and archaeological evidence of multi-stage ritual activities that supplied the deceased with spectacular funerary goods were characteristic for this cultural formation.

The barrow from Nieciecz Włościańska is one of the few comprehensively excavated funeral features in the northeastern province of the TCC. Therefore, this monument has significance for characterizing barrow funeral rites as well as establishing the absolute chronology of the Trzciniec circle in this area.

The presented analyses delineated the probable time at which this barrow was erected. The mound was built at the end of first half of the 2nd millennium BC, probably in the first quarter of the 2nd half of the 17th century BC and should therefore be associated with the classical phase of the TCC. This was a period of intensification in the process of building barrows throughout the range of the described cultural formation. The mound from Nieciecz Włościańska located in the lowland area represents a number of traits characteristic for this type monument from other TCC provinces, mostly from the upland area. This barrow testifies the complex and multidimensional ritual life of 'Trzciniec' societies and, along with barrows from Polesie, site 1 and Koryciny sites 5 and 6, confirms the transfer of the idea of erecting barrow cemeteries in a northeastern direction.

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BRONZE BRACELETS DEPOSIT FROM NIEWIERSZYN BY THE PILICA RIVER

ABSTRACT

Janiak R., Januszewicz B., Pisarek B., Sikora J. and Ziętek J. 2021. Bronze Bracelets Deposit from Niewierszyn by the Pilica River. *Sprawozdania Archeologiczne* 73/2, 167-201.

In the autumn of 2017 in Niewierszyn in the Aleksandrów commune, a deposit of two bronze bracelets was discovered. The discovery site was on the edge of the Pilica floodplain terrace.

The bracelets were almost identical in size and ornamentation. Also, the chemical composition of the bronze from which they were made was very similar. It may be hypothesised that the ornaments were made by the same manufacturer, probably at a similar time. Based on the analysis of the form and ornamentation, the bracelets in question can be dated to HA1. This dating corresponds to the settling of the areas in the Pilica river basin by communities associated with the Konstantynów Łódzki group, characterized by features of the early Urnfield culture. Virtual modelling of casting and an experimental cast were used to elucidate the manufacturing technique. Apart from a chronological and cultural analysis, the text attempts to show the hoard against a wider (micro-regional) settlement background, including through potential visibility analysis.

Keywords: Bronze Age, Central Poland, Konstantynów Łódzki group, deposit, bracelets
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DISCOVERY DESCRIPTION

In November 2016, a member of staff in the Museum in Piotrków Trybunalski was contacted by an individual who had come across two bronze bracelets buried underneath a thin layer of earth (Fig. 3). This man, an angler, reported that he discovered the hoard by accident while digging bait for fish. On arrival at the indicated site, the finds were secured. In the process of scrutiny, the bracelets were determined to have been laid in a shallow pit at a depth of 30 cm. The pit filling consisted of light grey topsoil sand. Apart from the bracelets, a few pieces of charcoal were found at the bottom. No other relics could be found. Upon examination, the site of the finds was drawn and photographed for documentation and a report on the archaeological work was produced. The documentation along with excavated findings was passed on to the then Voivodeship Bureau of Monument Conservation in Łódź, Department in Piotrków Trybunalski. The excavation site was located in Niewierszyn, Aleksandrów commune, Piotrków Trybunalski district, on the edge of the floodplain of the right bank of the Pilica River (Fig. 1; 2). The circumstances of the discovery allowed the set of bracelets to be recognised as an intentional deposit which, due to the form of relics and ornamentation, was initially associated with the population of the Konstantynów group.

The place where the deposit was laid was on the edge of the Pilica floodplain terrace, on its right bank (Grzybkowski and Kutek 1966). This level was built of Pleistocene river sands. Below the edge of the terrace lay Holocene floodplain sands.

TYPICAL FEATURES OF THE RELICS

The bracelet denoted “A” (Fig. 4: a, b; 5: a) was made from spirally coiled bronze rod with a characteristic lentoid cross section, which in its central part was 1.35 cm wide and 0.73 cm thick. The ends of the spirals tapered, and they were slightly rounded. The adornment was formed by coiling the rod in such a way that it formed two coils with the ends overlapping by about two centimetres on each side. The diameter of the bracelet was 7.6 cm with a weight of 175 grams.

The object was adorned with a group of perpendicular and diagonal lines going towards the edge (Fig. 5: b). In some parts the diagonal lines were separated with a group motif of very short lines. The layout of short lines was in turn perpendicular to the diagonal

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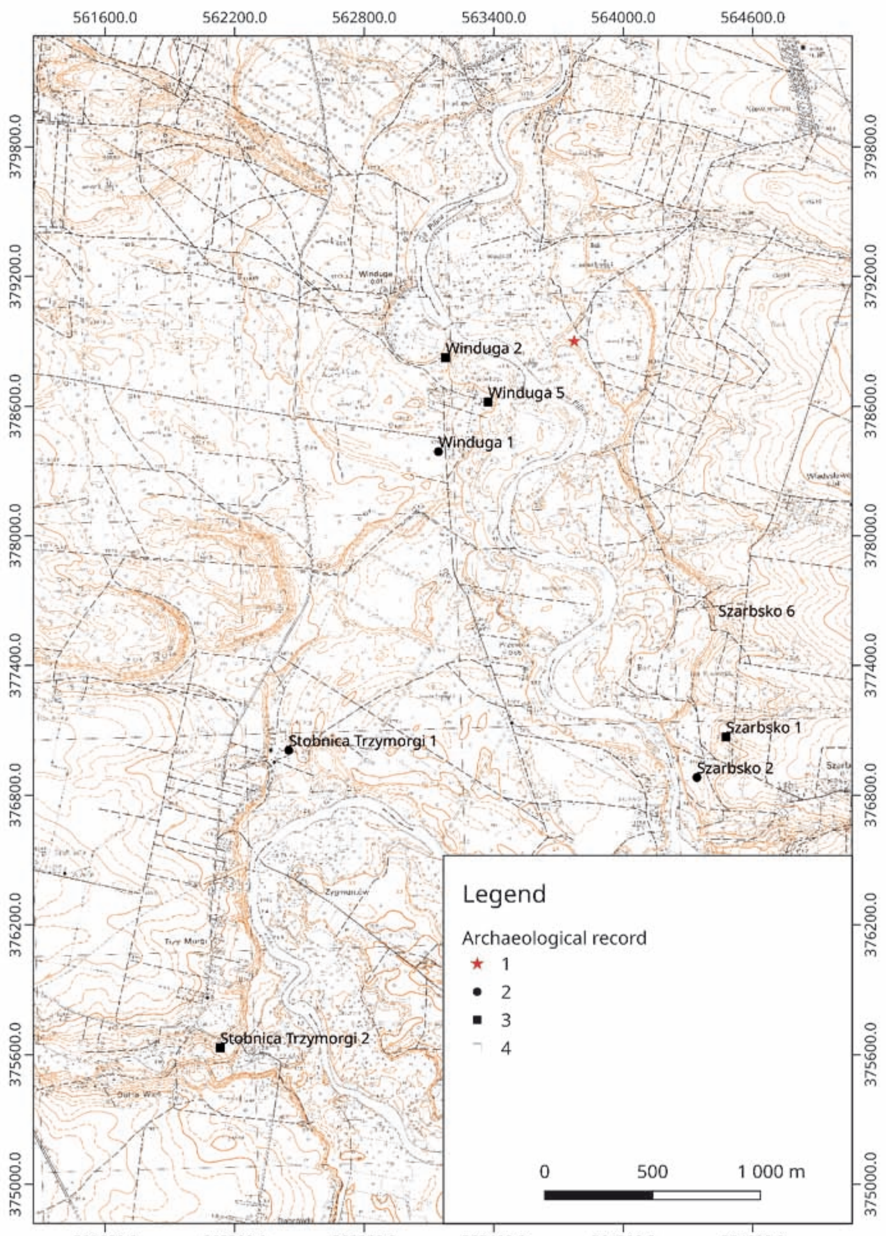

Fig. 1. Location of the deposit of the bronze items against the background of the planigraphy of archaeological sites. Based on the topographic map in the scale 1: 10000 in the 1992 system, from the resources of GUGiK. Symbols (according to the AZP nomenclature):
1 – location of the bronze item deposit; 2 – cemetery; 3 – settlement; 4 – trace of settlement.
Prepared by R. Janiak and J. Sikora

Fig. 2. Niewierszyn, Piotrków Trybunalski district.
The discovery site marked with an arrow, sight from the west. Photo by J. Ziętek

lines. The decoration was carved in such a manner that only neighbouring edges were covered with it. It was particularly noticeable in the way the edges of the spiral were ornamented only in the central part of the coil. The external parts were not decorated with the line motif. In the central part of the perimeter (which is equivalent with the widest section of the rod), it is clearly visible that the ornamentation was placed also on the edge of the bracelet as well as on the faces of the coil.

The second bracelet, denoted here "B" (Fig. 4: c, d; 5: c) is 7.3 cm in diameter. It was designed in the identical manner. The same metal rod type with lentoid cross section with its ends tapering was used. It was also made of two coils. Compared with bracelet "A", the object showed considerable similarity in terms of the ornamental motif and the manner it was arranged (Fig. 5: d). However, certain differences can be noted. The first distinction is that in the central part of the spiral, both rims were decorated with thick lines corresponding with each other. Such a practice gave the bracelet a sort of symmetry. Another difference is the covering of the rims of the central part of the bracelet with a decorative pattern on a much shorter section. In the middle part the spiral was 1.25 cm wide and 0.6 cm thick with the weight of 150 grams. Measurements indicate that the ornament on "B" was smaller and consequently lighter. Thus, the different parameters of the two objects may lead to different conclusions during the reconstruction of the methods and a design style.

Fig. 3. Niewierszyn, Piotrków Trybunalski district. The bronze bracelets included in the deposit. Photo by J. Słomska

Fig. 4. Niewierszyn, Piotrków Trybunalski district, Deposits of the bronze objects: bracelet A (a, b); bracelet B (c, d). Photo by J. Słomska

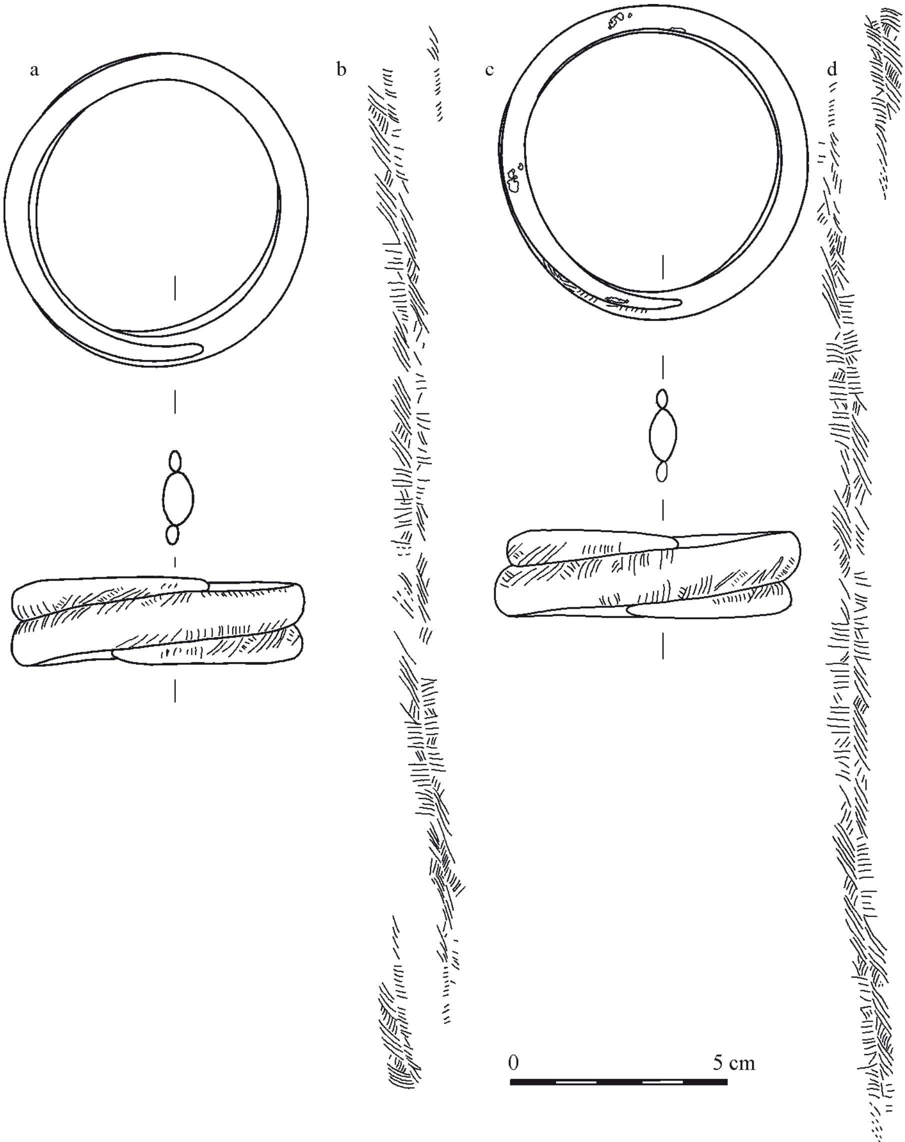

Fig. 5. Niewierszyn, Piotrków Trybunalski district.
Deposits of the bronze objects: bracelet A (a); decoration of bracelet A (b); bracelet B (c); decoration of bracelet B (d). Drawn by R. Janiak

METHODOLOGY OF PHYSICOCHEMICAL EXAMINATIONS OF BRACELETS

The examinations of the chemical composition on the surface of the bracelets were performed by the X-ray microanalysis method EDS – X-ray energy dispersion. A scanning microscope JEOL JSM-6610LV integrated with the MiniCL-GATAN Cathodoluminescence

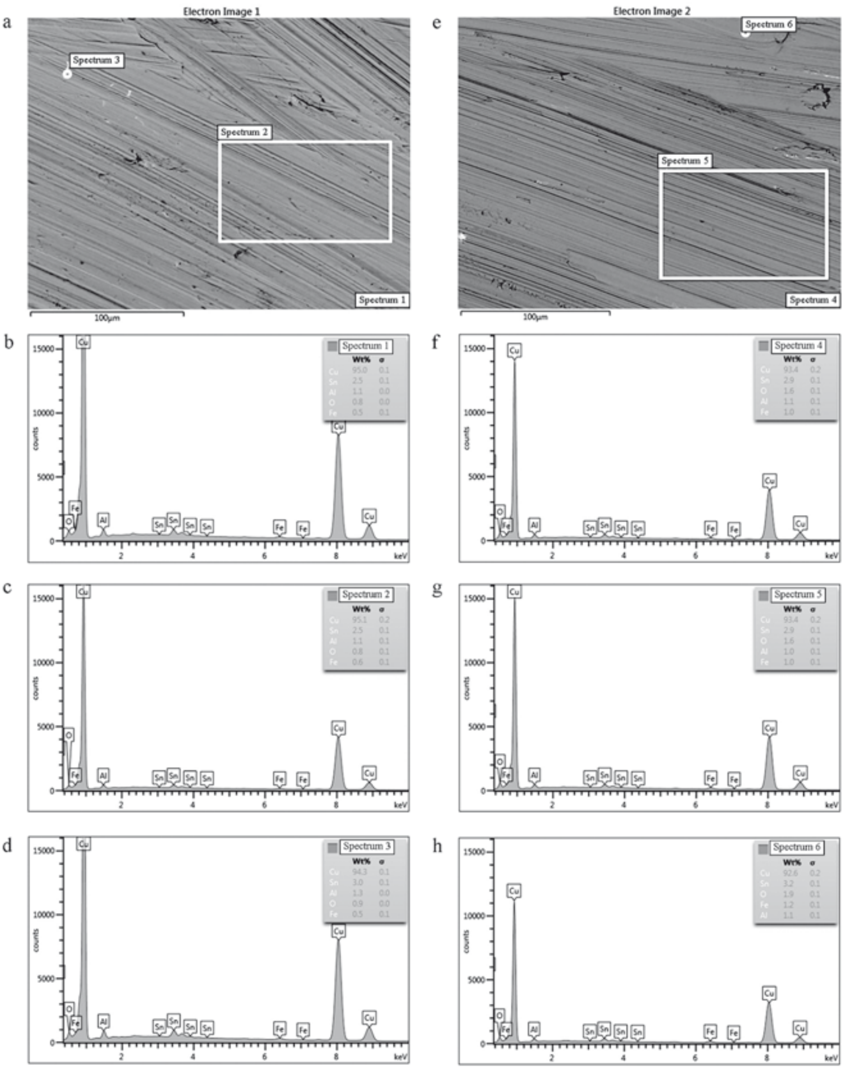

Fig. 6. Photographs and chemical analysis results, bracelet A (a-d) and bracelet B (e-h): a, e – photographs of the analized areas; b, f – from the maximal surface area (Spectrum: 1 and 4); c, g – from a selected area (Spectrum: 2 and 5); d, h – from a point (Spectrum: 3 and 6). Prepared by B. Januszewicz

Table 1. Chemical composition of CuSn3 tin bronze per test casting

Chemical composition, %										
Zn	Pb	**Sn**	P	**Fe**	Ni	Si	Te	As	Sb	Ag
0.136	0.142	**3.23**	0.0088	**0.0428**	0.095	0.003	0.027	0.0131	0.0152	0.0031
Al	S	**Cu**	Other							
1.29	0.0039	**94.9**	0.0901							

Imaging System and Oxford Instruments EDS X-MAX 80 systems as well as a backscattered electron activation system EBSD NordlysMax were used for the investigations. The tests were carried out with the use of the EDS AZtecEnergy software.

The specimens for the analysis were prepared by removing the surface oxide film (from an area as small as possible, to reveal the uncorroded material). The examined bracelets were placed in the chamber of the microscope and the optimal test parameters were established, *i.e.*: working distance 10 mm, accelerating voltage 20 kV, beam current 60, analysis time 120 seconds. The analysis of the chemical composition was performed for the following areas: the total surface area is shown in the photograph, a selected area and a point (Ø1 μm).

A 3D scan of the bracelet A (Fig. 6) was carried out using a 3D ATOS Core scanner with GOM Scan software. Reference marks with a diameter of 1.5 mm were fixed to the bracelet to fold the scans using GOM Scan software. The geometric dimensions of the scanned bracelet were determined using GOM Inspect software for inspection, ensuring complete processing of the mesh, 3D inspections and reporting.

Simulations of the process of pouring, cooling and solidification of tin bronze in a ceramic mould (heated to 150°C) in the investment casting technology were carried out using professional software MAGMA 5.4 from Magmasof®.

The test casting was made of tin bronze CuSn3 with the chemical composition shown in Table 1. This alloy was obtained after diluting the commercial casting alloy CuSn12-C (PN-EN 1982:2017-10 – English version) by the addition of Al– EN AW-1070A (PN-EN 573-3:2019-12 – English version), Fe (ARMCO Pure Iron) and Cu (Copper Cathodes Grade A).

The chemical composition of CuSn3 bronze intended for test casting was tested on a stationary emission spectrometer type SPECTROMAXx.

CHEMICAL COMPOSITION TESTS

Figure 6: a-h shows photographs of the surface of bracelets A and B as well as the results of the chemical composition analysis performed on areas of different sizes: the maximal surface area, a selected area and a selected point. For both bracelets, Figure 7: a-c shows a compilation of the analysis results from the maximal area – from the surface area presented in the photographs (Fig. 7: a), from the selected area (Fig. 7: b) and the selected

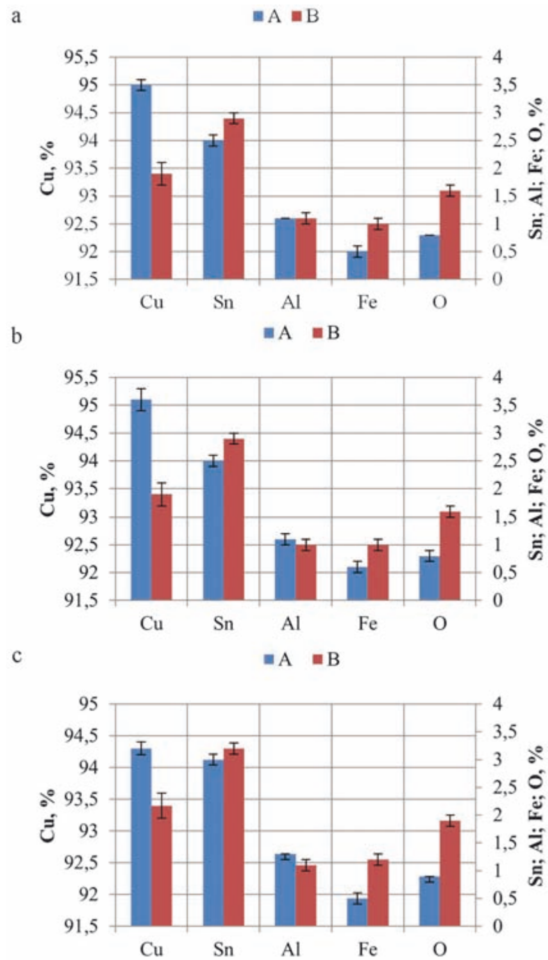

Fig. 7. Compilation of the chemical composition analysis of bracelets A and B: a, e – from the maximal surface area (Spectrum: 1 and 4); b, f – from a selected area (Spectrum: 2 and 5); c, g – from a point (Spectrum: 3 and 6). Prepared by B. Pisarek

point (Fig. 7: c). It can be inferred from the presented analyses that both bracelets were cast from tin bronze (alloy CuSn) with a tin content within the scope of 2.5-3.2%.

Due to the historical value of the bracelets, to identify the alloy's microstructure components, no microsections involving damage to the bracelets' external surface were made. The identification of the microsection components of the examined bronze can be performed theoretically, by way of analyzing the characteristic temperatures of the phase transformations and the scopes of the phase equilibrium concentrations in the Cu-Sn system. Figure 8: a, b shows phase equilibrium diagrams for the Cu-Sn system (up to 40%

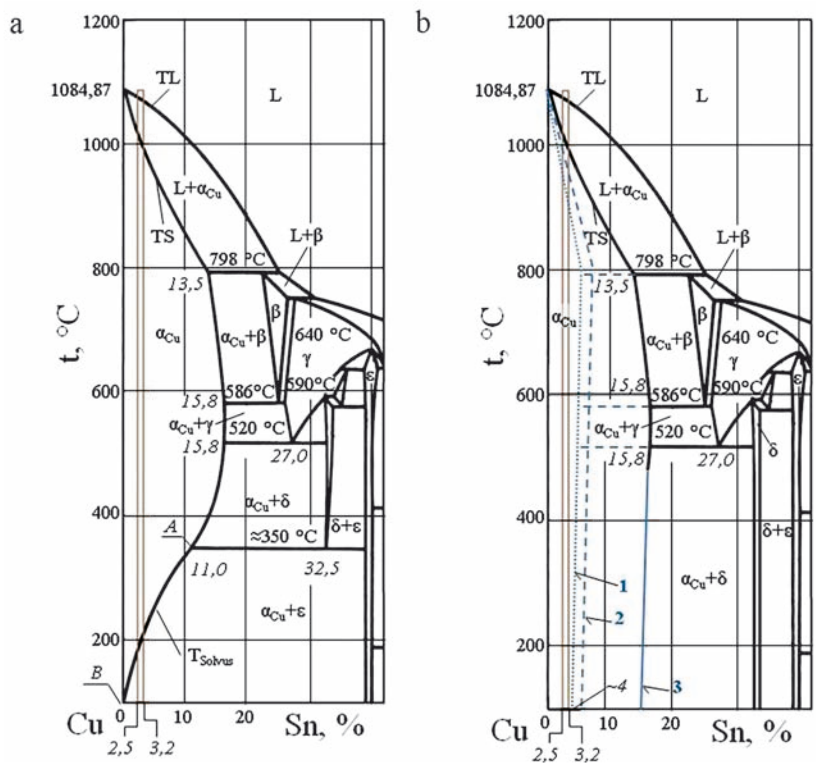

Fig. 8. Phase equilibrium diagram of alloys CuSn (up to 40% Sn): a – stable (based on: Saunders and Miodownik 1990), b – metastable (based on: Schad and Warlimont 1972); 1 – gravity die cast; 2 – sand mould cast; 3 – especially slow cooling. Prepared by B. Pisarek

Sn): stable (Saunders and Miodownik 1990) and metastable (Schad and Warlimont 1972). To melt bronze with this chemical composition, the former needed to be superheated over the liquidus temperature $TL_{(3\%\ Sn)}$≈1080°C by about 100-150°C. According to the phase equilibrium diagram (Fig. 8: a, b), after the alloy has been cast into the mould, its whole volume solidifies in the temperature scope of TL and TS (solidus temperature) as one phase α_{Cu}.

According to the stable phase equilibrium diagram (Fig. 8: a) (Saunders and Miodownik 1990), the bronze cools down in a single phase to T_{solvus} – the temperature of Sn solubility change in phaseα_{Cu}, which decreases with a temperature drop, forming precipitations of phase ε (Cu_3Sn) along the grain boundaries of phase α_{Cu}. Due to the relatively low concentration of the Sn additive in the bronze, the precipitations of phase ε will be small and in relatively low amounts. And so, the microstructure of this bronze will probably consist of two phases: α_{Cu} and ε.

Table 2. Minerals used to obtain Cu (based on *Przeróbka kopalin miedziowych* 2007-2008)

Nuggets	Sulfide ores				Oxide ores
Native copper	Covellite	Chalcocite	Chalcopyrite	Bornite	Cuprite
Cu	CuS	Cu_2S	$CuFeS_2$	Cu_3FeS_2	Cu_2O
99.9 % Cu	66.50% Cu	79.80% Cu	34.57% Cu	63.33% Cu	88.22% Cu

Table 3. Minerals used to obtain Sn (based on *Przeróbka kopalin cynowych* 2007-2008)

Sulfide ores			Oxide ores
Teallite	Stannine	Cylindrite	Cassiterite
$PbSnS_2$	Cu_2FeSnS_4	$6PbS{\cdot}6SnS_2{\cdot}Sb_2S_3$	SnO_2
30.51% Sn	27.61% Sn	26.54% Sn	78.77% Sn

In turn, it can be inferred from the study (Schad and Warlimont 1972) that, in casts solidifying at different cooling rates, depending on the thermal conductivity λ of the mould material (Fig. 8: b) (a cast in a steel gravity die λ=58 W/m·K, a cast in a sand mould λ=0,70 W/m·K, especially slow cooling λ<0,20 W/m·K), the microstructure of the examined bronze can remain as a single phase, consisting of a metastable phase α_{Cu} supersaturated with Sn, or as two phases, with the Sn concentration in the alloy over ~4%, consisting of phases $\alpha_{Cu}+\delta$ (δ is the supercooled eutectoidal phase containing about 35% Sn, crystallizing in the alloy after its supercooling below 520°C).

The characteristic minerals used to obtain copper have been presented in Table 2 (Processing of copper minerals) and those for tin – in Table 3 (Processing of tin minerals).

According to data in the literature (Coghlan 1975; Oudbashi *et al.* 2012), a tin content in bronze at the level below 2-3% can be caused by impurities in the ores which were used to melt the bronze.

It can be inferred from the presented literature analyses as well as from the performed investigations that the examined bronze was melted from a stannine copper-tin ore (Table 3). The ore contains about: 30% Cu and 28% Sn as well as 12% Fe and 30% S. The examined tin bronze contains an elevated concentration of Fe within the scope of 0.5-1.1% Fe, while the Sn content is insignificant. The iron dissolves in the copper to about 4% at., and so, it is localized mainly in the α_{Cu} solution or it forms intermetallic phases. The lack of S concentration in the examined bronze is probably caused by the process of sulphide ore roasting in an oxygen-containing environment's air, as a result of which volatile sulphur dioxide SO_2 is formed. The reduction of sulphide ores at elevated temperatures was invented in ancient times (Gowland 1921) probably by accident. As a result of facing a fireplace with copper ore chunks, at the elevated temperature of the fire, the ore underwent reduction. This did not remain unnoticed by the contemporary man, who, on finding metallic copper grains in the ash, identified the obtained metal as native copper, well-known at those times.

In the pyrometallurgical process, in the Bronze Age, ores, were melted in furnaces made of mud and clay (Shrivastva 1999; Craddock 2000) – clay in the area of Poland contains about 11.5-28.19% Al_2O_3 (Kostecki 1961; Cieśla *et al.* 1983). The melted bronze contains CuO particles, which, as a result of a reaction with Al_2O_3, leads to a synthesis $CuO+Al_2O_3 \rightarrow CuAl_2O_4$ (Hu *et al.* 2016) generating spinels. It should be presumed that the presence of Al and O in the examined bronze is probably caused by the presence of spinels $CuAl_2O_4$.

FORMAL AND STYLISTIC ANALYSIS OF THE BRACELETS

The characteristic features of the shape of the bracelets, important from the point of view of identification of the potential technology of their manufacture, include:

- the spiral arrangement of coils of approximately constant internal diameter,
- no sharp edges or marks of possible mechanical treatment,
- three parts can be identified in the shape of the bracelets:
  – one part covering the central coil of the spiral with an (approximately) constant cross-sectional area along the radius of curvature of the bracelet,
  – two ends of a spiral with a diminishing cross-sectional area along the radius of curvature of the bracelet;
- the characteristic radii of curvature can be distinguished on the cross-sectional area along the radius of curvature of the coils, respectively:
  – in the top part of the cross-sectional area, r_t,
  – in the bottom part of the cross-sectional area, r_b,
  – on the outer surface of the cross-sectional area R_o,
  – on the inner surface of the cross-sectional area R_i;
- the ornamentation is present on the external surface of the bracelets closer to the top and bottom of the coils respectively.

Due to the characteristic shape of the bracelet in its central part (the middle coil) as well as the ends of the spiral (all bracelet sections are rounded), it was assumed that the shape of the bracelet could be obtained by the lost wax casting technology.

Analysing the geometry of the bracelets and their ornamentation, the following hypotheses were adopted about the possibility of making them:

1) a straight bronze bar without an ornament was cast using the lost wax method, the ornament was made with a tool with a blade with a top angle close to 90° with regard to the casting bar, and then bent the rod into a spiral,

2) a spiral was cast by the lost wax method with the ornamentation made on the wax model using a tool with a blade with a top angle close to 90°.

Fig. 9. Bracelet A with adhesive reference marks. Photo by B. Pisarek

A 3D scanning method was used to measure the geometric shape and dimensions of the bracelets. Figure 9 shows the adhesive reference markers with a diameter of 1.5 mm on a selected bracelet, which enabling the computer folding of individual photos taken with the 3D scanner. Due to the fact that the central coil abutted the adjacent coils, it was not possible to scan precisely the surfaces in contact with each other.

Figure 10 a-g shows the analysis of the bracelet dimensions made with the GOM Inspect software. The internal diameter of the bracelet was estimated by means of a cylinder adjusted to its internal surface, a cylinder with a diameter of D=59.63 mm was determined.

The characteristic changes in the radii of curvature of the bracelet cross-section geometry are summarised in Table 4 and Figure 11a, b. The bracelet is characterized by a preserved parabolic tendency of changes mainly R_o, R_i and r_b with relatively high precision, with

Table 4. Diameter and curvature radii in bracelet cross-section geometry

	Placement (Fig. 10)									
	top (P-III)		t_m (P-I)		middle (P-IV)		m_b (P-II)		bottom (P-V)	
	d, mm	r(R), mm	*d*, mm	r(R), mm	*d*, mm	r(R), mm	*d*, mm	r(R), mm	*d*, mm	r(R), mm
r_t	$d_{30}=2.09$	1.05	$d_{22}=3.43$	1.72	$d_{34}=3.36$	1.68	$d_{26}=1.52$	0.76	$d_{38}=1.18$	0.59
r_b	$d_{31}=1.88$	0.94	$d_{23}=2.35$	1.18	$d_{37}=2.98$	1.49	$d_{27}=2.62$	1.31	$d_{39}=1.14$	0.57
R_o	$d_{33}=7.04$	3.70	$d_{24}=12.74$	6.37	$d_{36}=13.76$	6.88	$d_{28}=11.51$	5.76	$d_{41}=7.19$	3.60
R_i	$d_{32}=15.79$	7.90	$d_{25}=21.07$	10.54	$d_{35}=25.20$	12.60	$d_{29}=20.03$	10.02	$d_{40}=18.14$	9.07
(1 r(R)=d/2 rounded to two placements after a comma; r(R)_: t – top, b – bottom o – outer, i – inner										

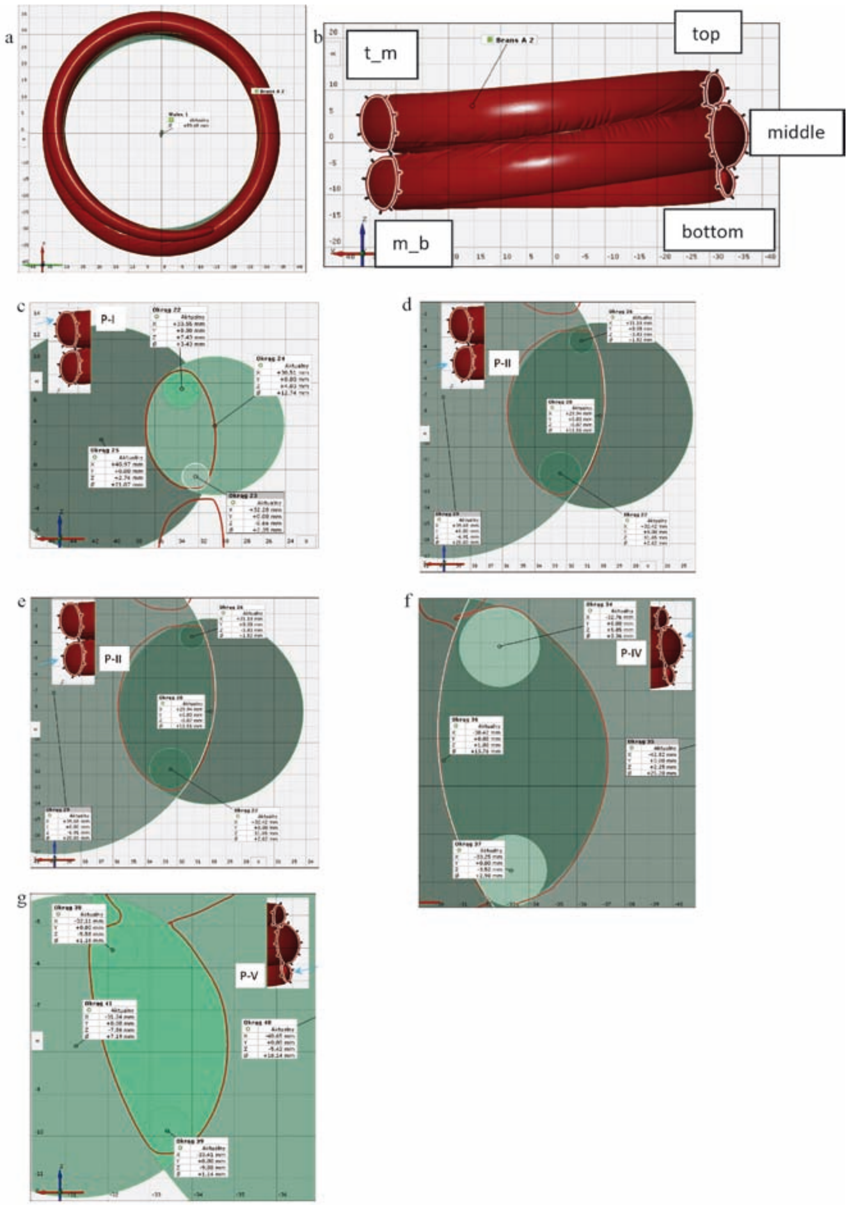

Fig. 10. Measurements of bracelet A geometry in GOM Inspect software: a – auto-fitting cylinder of the inner-side of the bracelet with diameter D=59.7 mm, b – bracelet cross-section lines in ZX plane, c – measurements of radius of curvature in P-I cross-section (circles from 3 points): d22-d25, d – measurements of radii of curvature in section P-II (circles of 3 points): d26-d29, e – measurements of curvature radii in section P-III (3 point circles): d30-d33, f – measurements of curvature radii in section P-IV (3 point circles): d34-d37, g) measurements of curvature radii in section P-V (3 point circles): d38-d41.
Prepared by B. Pisarek

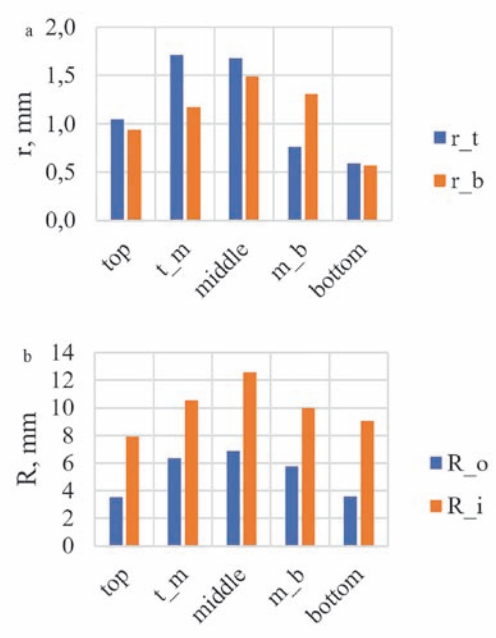

Fig. 11. Characteristic tendencies of changes of curvature radius in the geometry of bracelet cross-sections. Prepared by B. Pisarek

a maximum for the "middle" position (Fig. 11: a, b). Only the radius of curvature r_t does not have a preserved tendency to change, as in the case of the above mentioned radii, the maximum value of the radius is shifted to the area t_m (Fig. 11: a).

In order to verify the first hypothesis, the process of casting a simple tin bronze rod was traced by simulating the casting and solidification of the bronze in a mould using the MAGMA software. Three technological variants of the arrangement of the casting of the bar and the gating system were proposed. The gating system was designed using information contained in the literature (Nessel 2012). Figures 12-14 (a-d) show, respectively, the mould model (a), quality of the differential mesh (b), location of hotspots (c), and as a result of their lack of feeding, location of shrinkage cavities in the casting, location of gas and shrinkage porosity in the bar casting (d).

According to variant III (Fig. 14), a rod with geometry close to the curvatures in the analysis cross-sections of the bracelet was cast. The prepared mould made of Green Sand and Facing Sand (mullite clay) was poured with CuSn3 bronze.

The surface of the cast was polished and then on the surface prepared in such a way an ornament was made in a shape characteristic for those observed on the bracelet. Due to the relatively high hardness of the alloy it was not possible to made the ornaments on the surface of casting with use a cold chisel with a blade with an angle close to 90° and hammer.

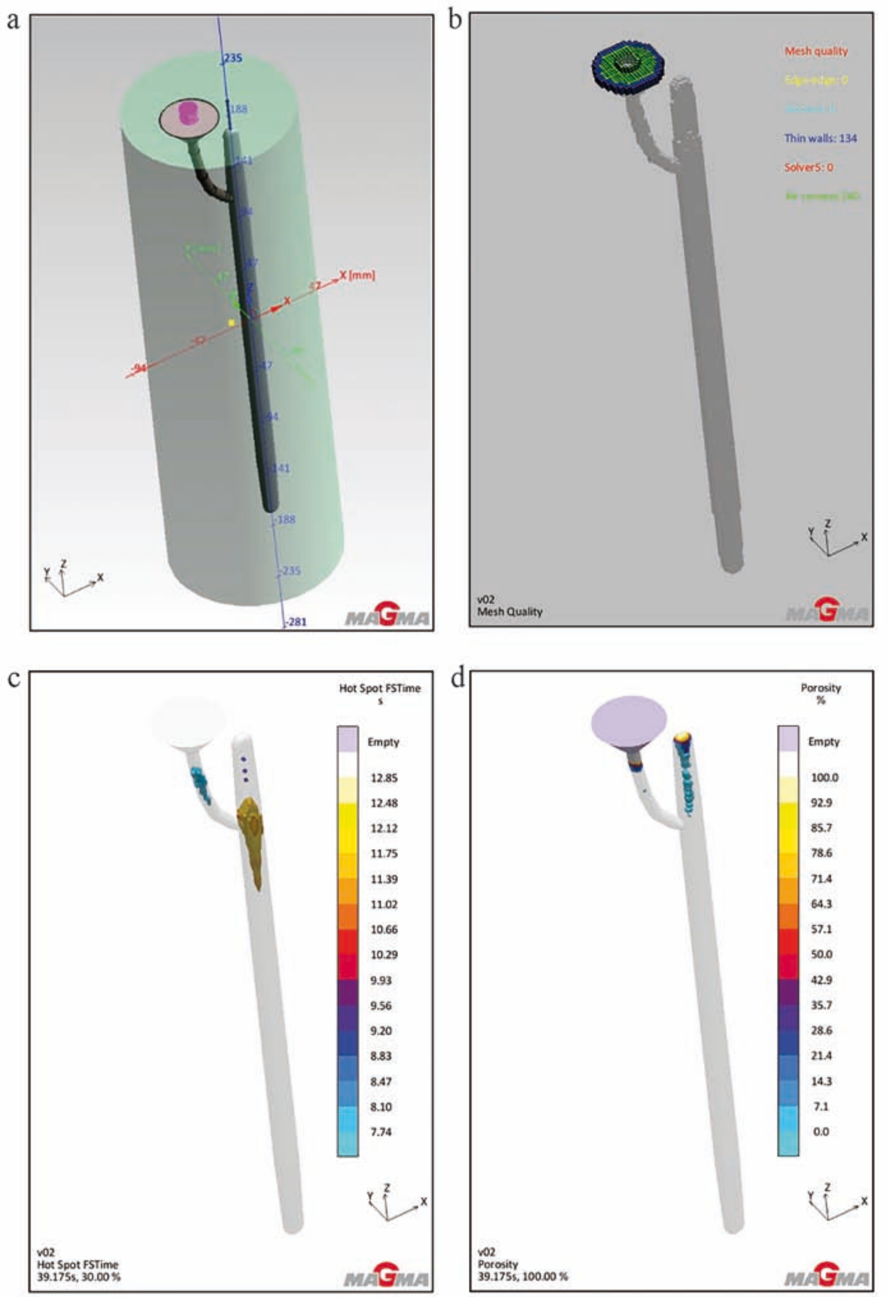

Fig. 12. Casting of tin bronze bar – technology variant I: a – position of the casting in the mould, b – quality of the differential mesh, c – position of the shrinkage cavity, d – the distribution of shrinkage and gaseous porosity. Prepared by B. Pisarek

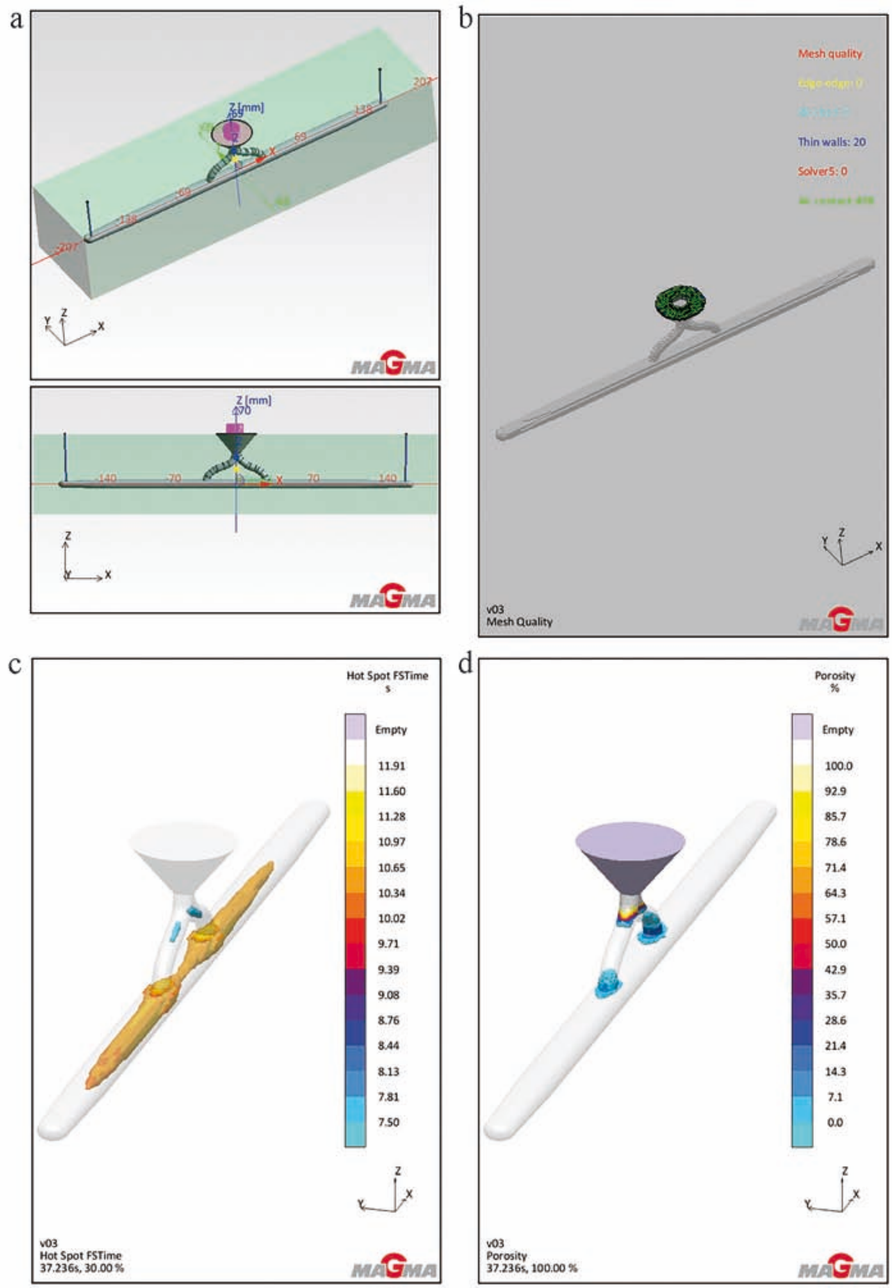

Fig. 13. Casting of tin bronze bar – technology variant II: a – position of the wax model in the mould, b – quality of the differential mesh, c – position of the shrinkage cavity, d – the distribution of shrinkage and gaseous porosity. Prepared by B. Pisarek

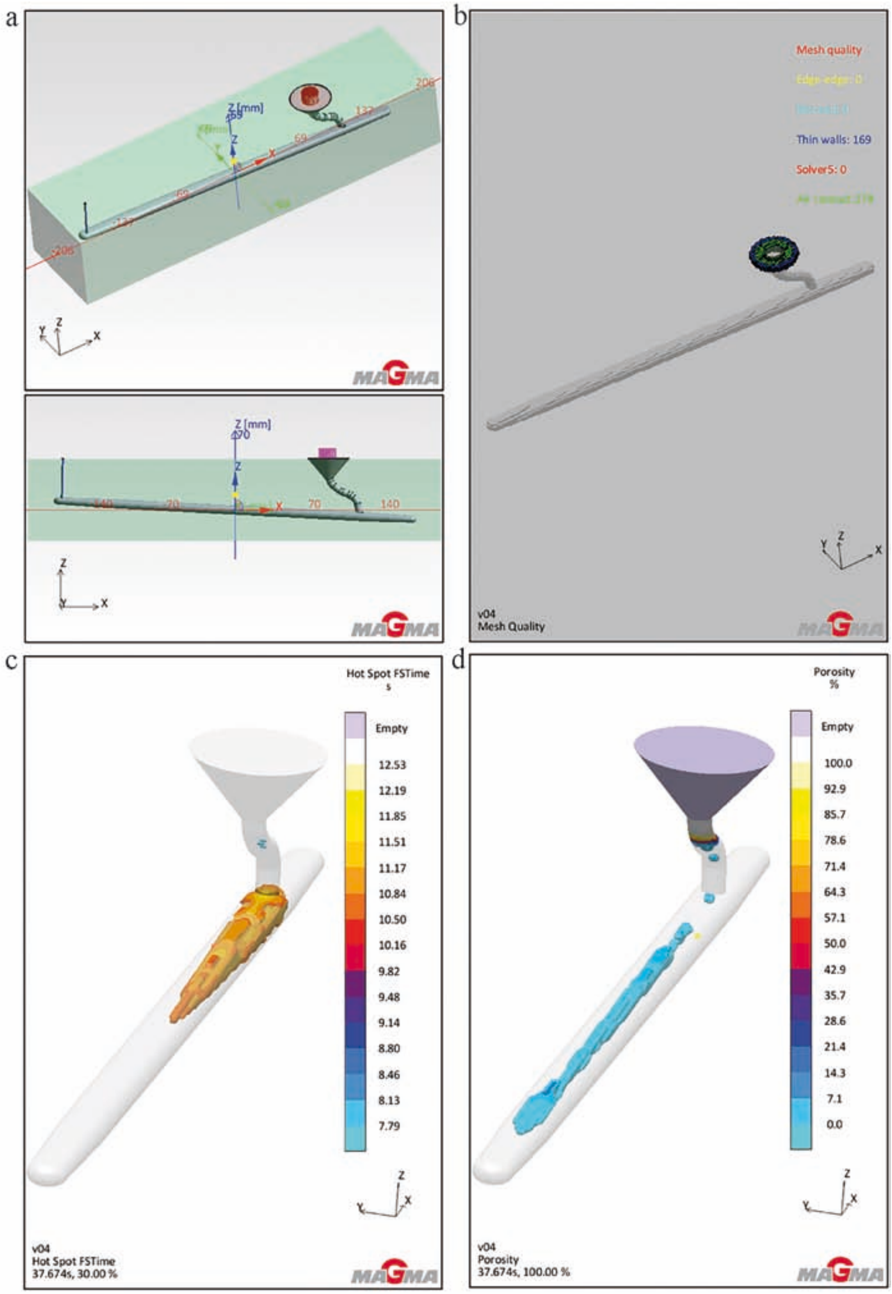

Fig. 14. Casting of tin bronze bar – technological variant III: a – position of the wax model in the mould, b – quality of the differential mesh, c – position of the shrinkage cavity, d – the distribution of shrinkage and gaseous porosity. Prepared by B. Pisarek

An attempt to apply the ornament on a casting with this method required a lot of energy of hitting the chisel with a hammer, which caused plastic deformation on the opposite side of the bar. For this reason, a notch was made on the casting of the bar by file, in the shape of a ornament like observed on the bracelet. Then the bar was coiled into the shape of a bracelet in the process of cold working at ambient temperature (t_{amb}= 23°C). Figure 15 (a-d) shows, respectively: the cast bar (a), its surface after polishing (b), the shape and arrangement of the ornament (c) and the bracelet coiled from the casting of the bar (d).

Compared to the polished bar (Fig. 15: c) with the ornament made on its surface, the following changes were observed as a result of plastic deformation on the surface of the coiled bracelet:

• the surface of the bracelet has become matt (Fig. 15: b, d),

• as a result of exceeding the bending strength of the alloy on the surface of the bracelet, cracks are formed (Fig. 15: d),

• the ornament has deformed, the distance between the lines of ornaments observed from the centre to outside of the bracelet increases – initially parallel lines spread (Fig. 15: c, d).

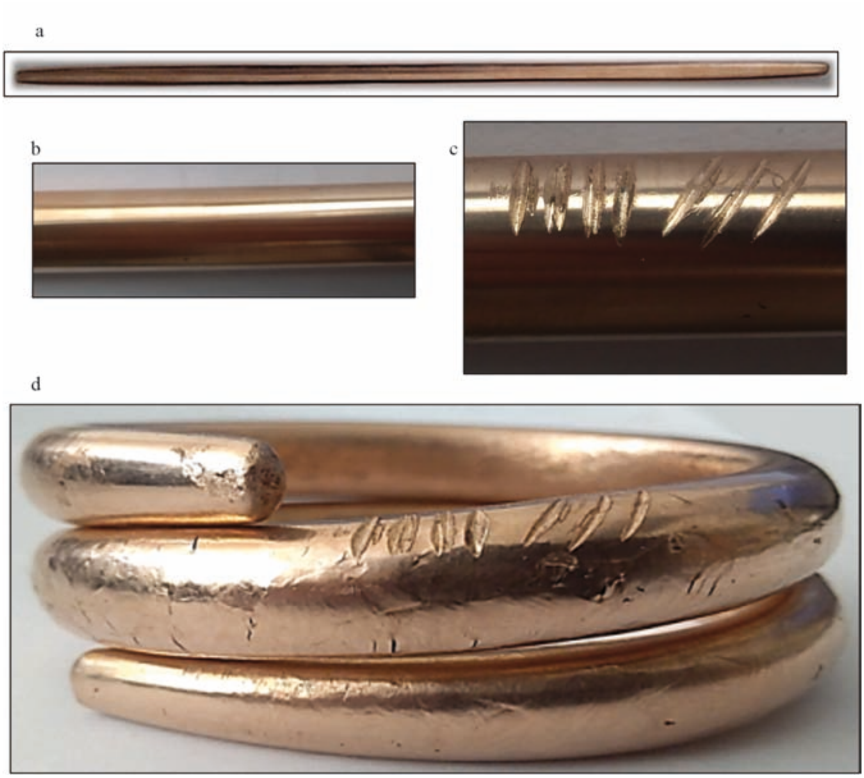

Fig. 15. CuSn3 alloy bracelet: a – casting of the bar, b – surface of the bar after polishing, c – the shape and arrangement of the ornament, d – a bracelet wrapped from casting bar. Prepared by B. Pisarek

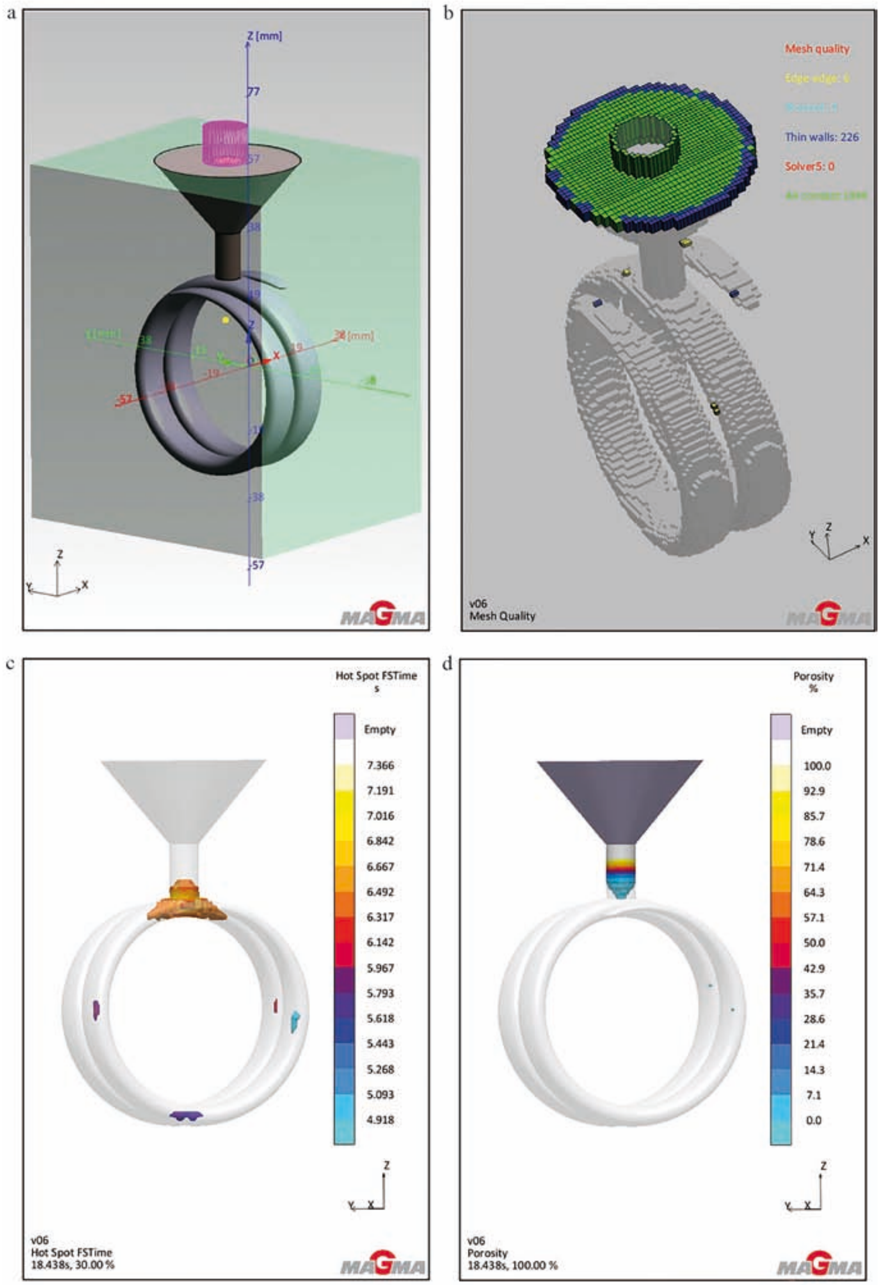

Fig. 16. Casting of tin bronze spiral – technology variant I: a – position of the wax model in the mould, b – quality of the differential mesh, c – position of the shrinkage cavity, d – the distribution of shrinkage and gaseous porosity. Prepared by B. Pisarek

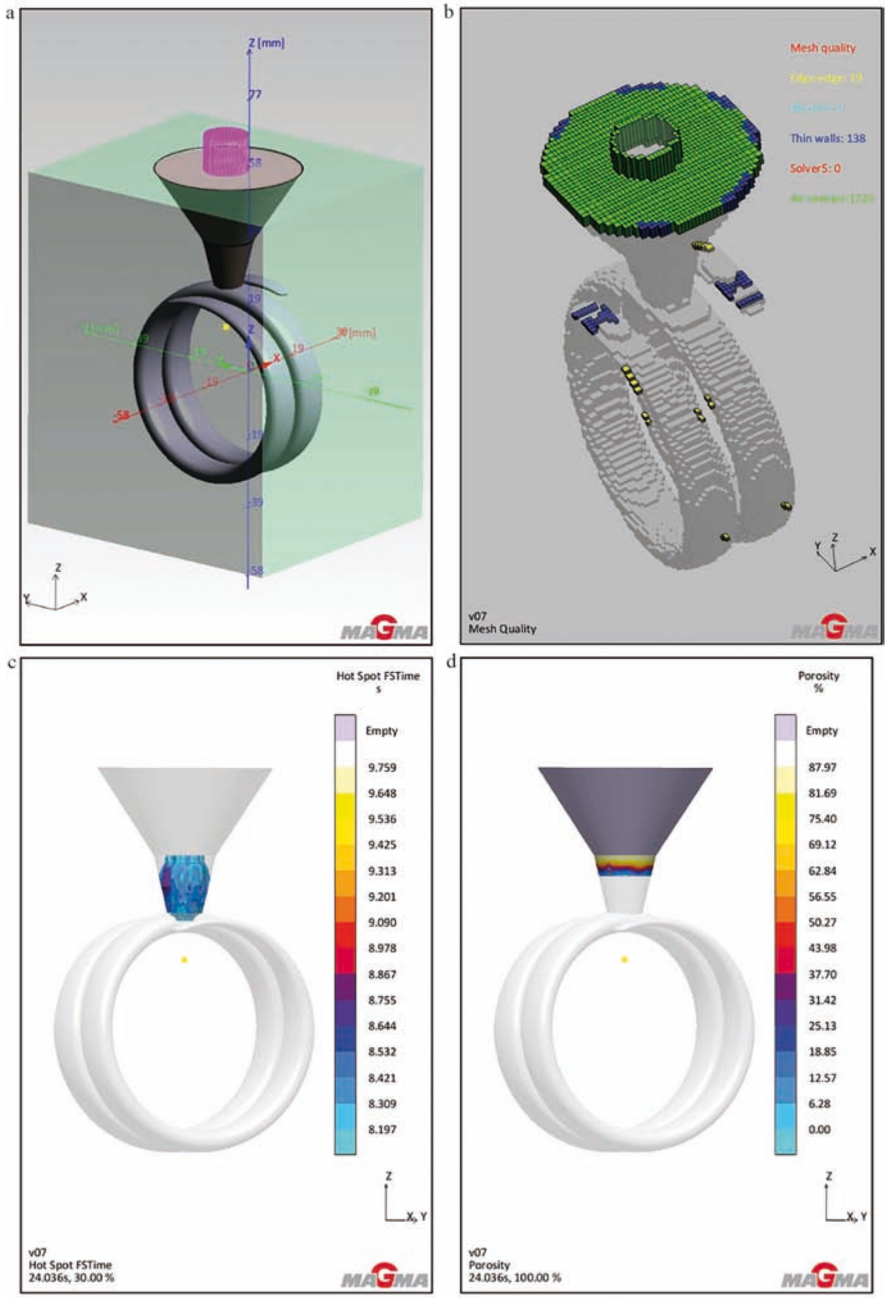

Fig. 17. Casting of tin bronze spiral – technology variant II: a – position of the wax model in the mould, b – quality of the differential mesh, c – position of the shrink cavity, d) the distribution of shrinkage and gaseous porosity. Prepared by B. Pisarek

On this basis it can be concluded that the ornament had to be made on a wax model and not on a finished casting in the form of a bar. The observed phenomena strengthen the conviction that the ornament was made directly on the wax model of the coiled bracelet. Especially, that the bracelets do not show any traces of cold working or other smithing work, even if it was, on a limited surface, *e.g.* after cutting off the gating system – which makes the second hypothesis about the bracelet technology realistic.

To support the selected hypothesis, the process of casting the coiled tin bronze spiral was traced by simulating the casting and solidification of tin bronze in a mould using the MAGMA software. Two technological variants of the arrangement of the spiral as a casting, and gating system were proposed. Also in this case the gating system was designed using the information contained in the literature (Nessel 2012). Figures 16-17 (a-d) show, respectively, the mould model (a), quality of the differential mesh (b), location of hotspots (c), and as a result of their lack of feeding, location of shrinkage cavities in the casting, location of gas and shrinkage porosity in the bar casting (d). It results from the conducted simulations that it was possible to cast the spiral – bracelet by appropriately modifying the gate supplying liquid metal from the pouring basin to the cavity which shaping casting. This change consisting of changing the shape of the gate from cylindrical (Fig. 16: a) to conical (Fig. 17: a) makes it possible to obtain a casting of bracelets without internal defects in the form of shrinkage cavities or porosity (Fig. 16: c, d; 17: c, d). Both the pouring basin and the gate supplying the alloy to the moulding cavity of the coil as a casting together form a so-called feeder, effectively compensating for the volumetric shrinkage of the solidifying liquid tin bronze.

The high quality of the differential meshes (Fig. 12; 13; 14: b; 16; 17: b) – the lack of almost any faulty cell arrangements of the so-called thin walls, edge-edge or blocked types – in the area of the differential elements of the casting allows us to claim a very high probability of the crystallization process and formation of defects in the analysed castings according to the presented simulation results.

THE DEPOSITS FROM NIEWIERSZYN SET IN TIME...

Determining the deposition time for the bracelets may be problematic. This is due to the presence of only two items in the deposit, which are basically not different in terms of form and ornamentation. On the other hand, it is the presence of two ornaments of the same type in the deposit that could indicate the time of their manufacture. According to Blajer (2001, 179), such a phenomenon was supposed to be characteristic of phase BrB2-BrD.

An important premise concerning the chronology of the deposit is the formation of its ornaments. It should be stressed that these ornaments are similar to pairs of ornate bracelets from a deposit in Sieniawa, Przeworsk district (Blajer 1999, 200, pl. 160: 3, 4) or in Maćkówki, Przeworsk district (Blajer 1999, 179, 180, pl. 89: 5, 6; 90: 5, 6; 91: 4, 6). Even though the bracelets from Niewierszyn have two coils, the overlapping of the ends is clearly visible. Such an orientation of the ends in ornaments of this type in relation to each other has not often been encountered in Poland. In light of the comments noted on the above-cited Sieniawa and Maćkówka deposits (Blajer 1987, 129; 1999, 59-60; 2008, 21, 23), the frequency of this manner of positioning the endings in relation to each other would only increase from the HA1 phase. At the same time, hoop ornaments of the Sieniawa type were identified as a group characteristic of the early stage of development of the Tarnobrzeg group of the Lusatian culture.

Another feature linking the objects from Niewierszyn and Maćkówka is also worth noting. It concerns the weight of two bracelets from the Maćkówka deposit (Blajer 1999, 180, tables 89: 5, 6). The weight of these artefacts was 170 g and 155 g, respectively. For comparison, the weight of the artefacts from Niewierszyn was 175 g and 150 g. These data points may seem interesting, but it is impossible to draw too far-reaching conclusions. Another feature that connects the bracelets from the deposits compared here is their lenticular cross-section (Blajer 1987, 126, pl. 11: a, b).

In contrast to the formation of the bracelets from Niewierszyn, the ornamentation placed on them differs from the manner of adornment of the Sieniawa type artefact. First of all, it lacks regularity and repeatability. When compared to similar groups, such a decorative motif should be considered extremely rare. The ornamentation in the form of diagonal lines on the edge of the rim was represented on an epaulette with spiral shields from an unknown locality in Silesia. In this case, it was only a complement to the transverse lines, and it was placed only in the area of contact between the ends of the rim and its transition into the shield. This epaulette was classified as of the Miłosław type (Ludów variant), and the time of its occurrence would most likely be set in the BrB2 phase (Blajer 1984, 23, 24, 27, pl. 15 :45; 1999, 80).

It should be noted that the condition of the outer surface of the bracelets did not show any signs of wear/destruction that could lead to the survival of the ornamentation only in vestigial form, at the edges of the rod. This is most likely the effect of a deliberate action. However, since its realization did not refer to the decorative motifs that existed at that time, it is difficult to use this element as a dating feature.

Based on the above data, the creation of the Niewierszyn bracelets should be dated to the HA1 phase. Thus, they extend the list of artefact groups classified as the Kutno-Raszew type, attributed to the Konstantynów Łódzki group (Blajer 1999, 121-123).

...AND IN SPACE

When trying to establish the spatial relationship that could have connected the site of the Niewierszyn deposit with the contemporary prehistoric settlement, we can rely almost exclusively on the findings from the AZP (Polish Archaeological Record) research. First, the information concerning areas 77-55 and 77-56 (Błaszczyk 2000, 175-177) was used. The amount of information published is important but modest in quantity. One should take a closer look at the settlements that functioned in the Bronze Age III (some of them also earlier) in the relevant part of the Pilica course.

On the right bank of the Pilica, about 0.5 km south of the deposit's discovery location, there are three sites of the Trzciniec Culture in Szarbsko; Site 1 (77-56/7) was considered a relic of the settlement, dating back to Bronze Age II. The next site in the same town, designated 2 (77-56/8), probably corresponds to a cemetery of similar chronology. However, it was also emphasized that the relationship of this site with the Trzciniec culture was not certain. The third site in Szarbsko, designated 6 (77-56/62), was considered a prehistoric settlement trace (without specific dating).

A little further, towards the south-east, there were two sites in Dąbrówka: 2 (77-56/35) and 4 (77-56/37), both considered relics of Trzciniec culture settlements from the Bronze Age II. Due to the small distance between them and the identical dating, it can be assumed that they originally constituted one larger settlement.

In turn, on the left bank of the Pilica River, opposite the place where the deposit was laid, there are three other attention-worthy sites. Two of them, Winduga Site 1 (77-56/23 – burial ground?) and Winduga Site 5 (77-56/66) are dated to Bronze Age II/III and Bronze Age II, respectively. In the case of the latter site (settlement), its connection with the Trzciniec culture has raised some doubts. The second settlement in Winduga, at Site 2 (77-56/24), was only generally dated to prehistory. South of the site complex in Winduga, there is a settlement trace of the Trzciniec culture in Przewóz at Site 3 (77-56/3), which dates to Bronze Age II.

The picture of the settlement that can be associated with the deposit in Niewierszyn is complemented by two sites in Stobnica. The first is the cemetery at Site 1 (77-56/13), the use of which falls in Bronze Age III (Wiklak 1964; Kaszewski 1975, 126). One hundred graves were discovered in this necropolis. The second is the settlement in Stobnica at Site 2 (77-56/14). As a result of the excavations carried out there, it was found that it was established in the same period (Wilkak 1984; Kaszewski 1975, 126). Both the settlement and the cemetery were assigned to the population representing the Konstantynów Łódzki group. In this part of the cluster of settlements, the presence of the Trzciniec culture settlement from Bronze Age II at Site 22 in Stobnica (77-55/13) should also be indicated. It was located west of Site 2.

The above description suggests that the cultural landscape of the part of Pilica situated between Niewierszyn in the north and Stobnica in the south was dominated by the relics of settlement of the Trzciniec culture. However, during the AZP research, doubts arose as to the function and chronology of the sites. The youngest and, at the same time, the only ones examined by excavations are two sites of the Konstantynów Łódzki group: the cemetery and the settlement in Stobnica, which can be dated back to the Bronze Age III. In his work, Wiklak (1964, fig. 2) indicated the presence of materials from the Konstantynów Łódzki group at two sites in Szarbsko and Winduga. At this time, it is difficult to identify them with any of the above-mentioned sites in these locations. However, a question should be asked whether the ceramic material, often sparse, discovered on the surface of the sites, should really be associated with the Trzciniec culture? [The authors of this publication have had multiple opportunities to compare pottery of the Trzciniec culture and products classified in the Konstantynów Łódzki group, which allowed identification of many common characteristics (*e.g.*, production technology, treatment of the outer surface) between these historical artefacts (see Wiklak 1964, 60). This could have been the basis of the unrealistic classification of vessel fragments found on the surface of the sites. The condition of such ceramics, the degree of their fragmentation, and the lack of ornamented fragments should also be taken into account]. Or maybe some part of these sites should be included in the clusters of the Konstantynów Łódzki group? Under no circumstances should this suggestion be treated as an objection to the author of the study results of the AZP research. One should also remember about other "weaknesses" of the results of the AZP research and their use in studies on the settlement network in prehistory. Recently, such remarks were included in the monograph of four bronze deposits from Karmin, Milicz district (Baron *et al.* 2019, 104-108). On the other hand, the one hundred burials in the cemetery in Stobnica are an important indication of the greater settlement potential of the Konstantynów Łódzki group in this specific area.

Nevertheless, in light of the collected information, the deposit from Niewierszyn should be associated with cultural phenomena contemporary with those included in the Trzciniec horizon 7 (HT7) in the case of Kujawy (Makarowicz 1998, 52). That complex was supposed to combine elements of the late Trzciniec culture and the initial phase of the Lusatian culture. Further considerations on this subject go beyond the scope of this study. It is hoped that in the future, archaeological research will allow verification of the findings regarding the settlement background accompanying the deposit in question.

The result of the chemical composition analysis of the bronze from Niewierszyn permits stating that stannite was used for their production. This raw material is found in the area of eastern Slovakia (Zlatá Baňa, Prešov district) and northern Hungary (Gyöngyösoroszi, Heves county, Alsó-Rózsa, Pest county). Another area of occurrence of this raw material is in Western Bohemia (Bozi Dar, Vernerov, Horní Slavkov, all of the Karlove Vary region), but also in the area of south-eastern Saxony (see *Mineralatlas*). The data presented here may only indicate the potential source of the raw material from which the Niewierszyn artefacts were made. Obviously it remains a hypothetical assumption whether this raw material reached the area around the Pilica River, for example, through intercultural connections from earlier times and functioning at the time corresponding to the existence of the Konstantynów group. In the case of the Trzciniec culture, the possibility of obtaining bronze material from the areas occupied by the settlement of the Otomani-Füzesabony culture has been suggested (Dąbrowski and Hensel 2005, 18; Makarowicz 2010, 165). From this perspective, the identification of Slovak and Hungarian ore deposits might be acceptable. The authors are aware of the fact that the presented hypothesis requires further studies. We must note that the work on the correction of this publication took place in the summer of 2020, in conditions of limited access to the library collections caused by the SARS-Cov-2 virus pandemic.

The small percentage of tin in the alloy (approx. 3%) allows for the classification of the bracelets into the group of low-tin bronzes. It can only be noted that objects with such alloying parameters were part of the products of the Trzciniec cultural circle (Makarowicz 2010, pl. 3.11), as well as the deposits of the Lusatian culture (Baron *et al.* 2019, 95).

AIRBORNE LASER SCANNING DATA ANALYSIS

The analysis of data from Airborne Laser Scanning measurements was carried out using ready-made LiDAR products in the form of rasters in the asc format made available by the Head Office of Geodesy and Cartography. The measurements were made and classified according to the methodology of the ISOK program (IT System for the Protection of the Country against Extraordinary Threats; http:/www.isok.gov.pl, see: Banaszek 2015; Zapłata and Ptak 2015, 102-105). Aware of the weaknesses that sometimes result from the classification of point clouds not adapted to the needs of archaeology (*cf.* Kiarszys and Szalast 2014), in this case the data were assessed as sufficient for the purposes of preliminary analysis. Geographic Information Systems software was used for this task: SAGA GIS (http://www.saga-gis.org) and Qgis (http://qgis.org) and RVT (Relief Visualization Toolbox, http://iaps.zrc-sazu.si/en/rvt#v) and Planlauf/Terrain (https://planlaufterrain.com). The used raster images (Digital Terrain Models) had a resolution of 1 × 1 m. During the analysis, a number of data visualization techniques were utilized: analytical hillshading, hillshading from multiple directions, slope gradient analysis, local dominance, simplified local relief model, sky-view factor, positive and negative openness (Kokalj and Hesse 2017).

As a result of the analysis, a significant number of features related to the Great War, and more specifically the Russian-Austrian battles in 1914, were recorded in the form of lines of trenches and tranches, fire posts, bunkers, dugouts and post-explosion craters. On the left bank of the river, in the upland area, at the height of the archaeological sites of Winduga, a significant number of regular mounds have also been recorded, which should be interpreted as the remains of late medieval and modern charcoal mounds. A connection with prehistoric settlements can be suggested with regard to a small group of earthworks, probable mounds, located 300-420 m north of the place where the deposit was hidden. 10 mounds with a diameter of approx. 13 to nearly 20 m, with a preserved height not exceeding 0.8 m, are located on the upper terrace of the Pilica valley, on the right bank of its current course, similar to the place where the deposit was hidden. A second presumed grouping of mounds was recorded in the vicinity of Site 1 in Winduga. Here, the potential mounds are much smaller and less preserved. They have a diameter of about 5-7 m and a height not exceeding 0.28 m. In the latter case, it is particularly interesting that the mounds are located in the vicinity of the archaeological site, defined as the presumed cemetery of the people of the Trzciniec culture (see Wiklak 1962).

VISIBILITY ANALYSIS

Although the reasons for the deposit of bronze items in this spot and not elsewhere are likely to never be fully elucidated, it appears that the influence of a particular location may have been due to the settlement context and the way the landscape is perceived and experienced (see Bradley 2017). This direction has been taken by research studies related to the so-called Landscape Archaeology (David and Thomas 2008; Iwaniszewski 2012; Banaszek 2015, 18-31). The perception of the landscape is modelled using a tool such as GIS and the visibility analysis generated by it (viewshed). Visibility analysis allows, as a model, the determination of the area potentially visible from a given place (Wheatley and Gillings 2000; Gillings and Wheatley 2020). Visibility analyses are still relatively rarely used, although several works have already been published in which an attempt was made to reconstruct the perception of prehistoric or early-historical communities by members of prehistoric or early-historical communities (see Zapłata 2009; Banaszek 2015; Łuczak and Piekalski 2017; Duma and Łuczak 2017; Baron *et al.* 2019, 127-157). In this analysis, the Qgis 3.14 software and the Visibility Analysis 1.2 plug-in (Čučković 2016) were used. The basis for the calculations were raster DEM files from ALS measurements, with a resolution of 1 × 1 m, provided by the Head Office of Geodesy and Cartography. The observer's viewpoint was set at 1.65 m, which is a standard practice in this type of study. The height of the observation point was set at 0.5 m. Shots corresponding to various scenarios were made:

– Visibility from the deposition point of the bronze items, thus modelling the potential range of sighting by the person or persons burying these items (Fig. 18).

– Visibility from the area of the nearest settlements, which correspond to the surface-located archaeological sites in Winduga, Sites 2 and 5 (Fig. 19; 20). In this way, we model the possibility of observing the deposition process or the place of deposition by the person/persons in the settlement area (remembering that at least a partial obstruction here could have been the above-ground buildings of the settlement).

We realize that there are a number of problems connected to visibility analyses generated in GIS. These include issues related to the accuracy of the Digital Terrain Model used, reciprocity of view (the fact that point B is visible from point A does not always mean that point A is visible from point B), the suitability of information about the contemporary terrain for modelling phenomena occurring in the past or problems with the absence of vegetation in the models used, which may have limited visibility (see Gillings and Wheatley 2001). Although researchers using visibility analyses sometimes use the results of paleoenvironmental analyses to argue, for example, the irrelevance of the forest cover factor

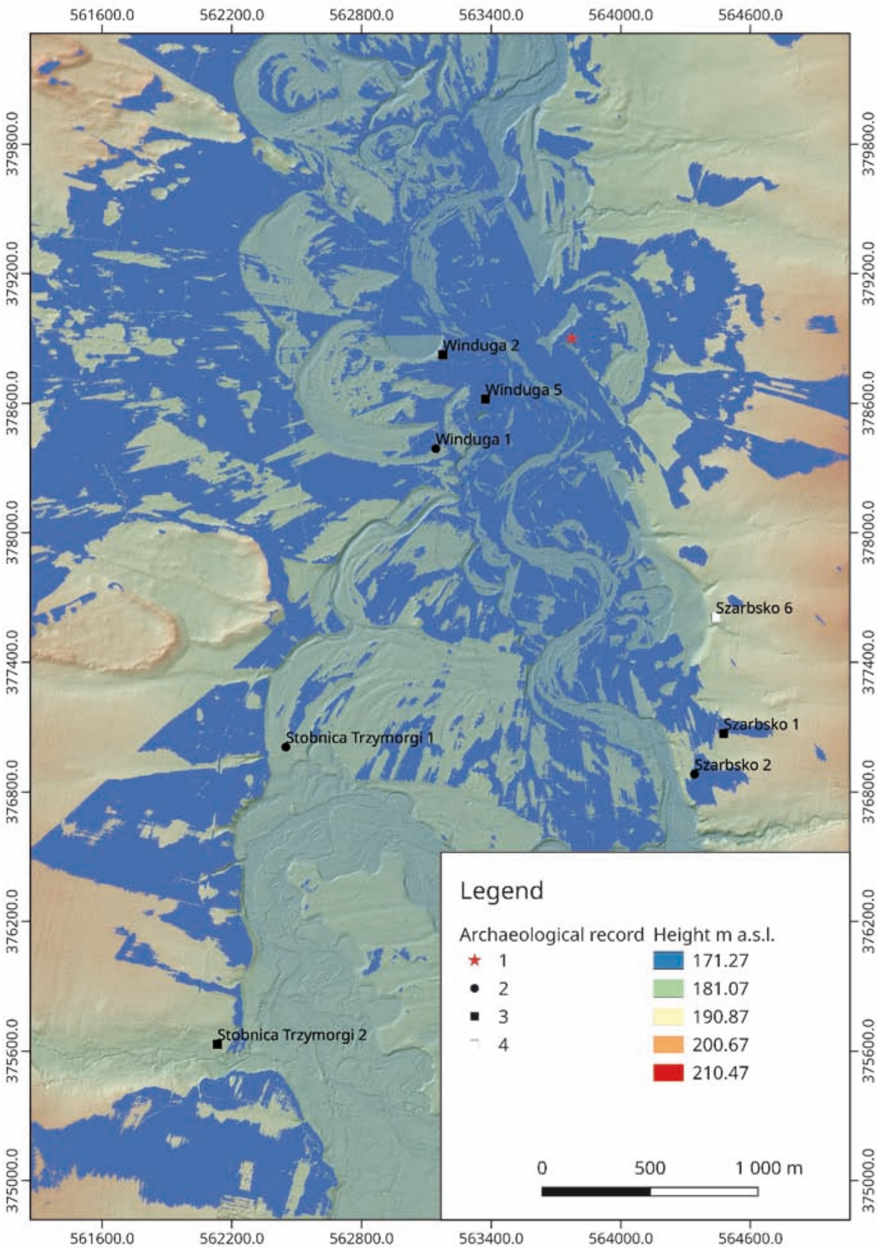

Fig. 18. Visibility from the place where the bronze items were deposited (1 – deposit; 2 – cemetery/burial ground; 3 – settlement; 4 – settlement trace). Based on the shaded Digital Terrain Model based on ASL measurements from GUGiK resources. Prepared by J. Sikora

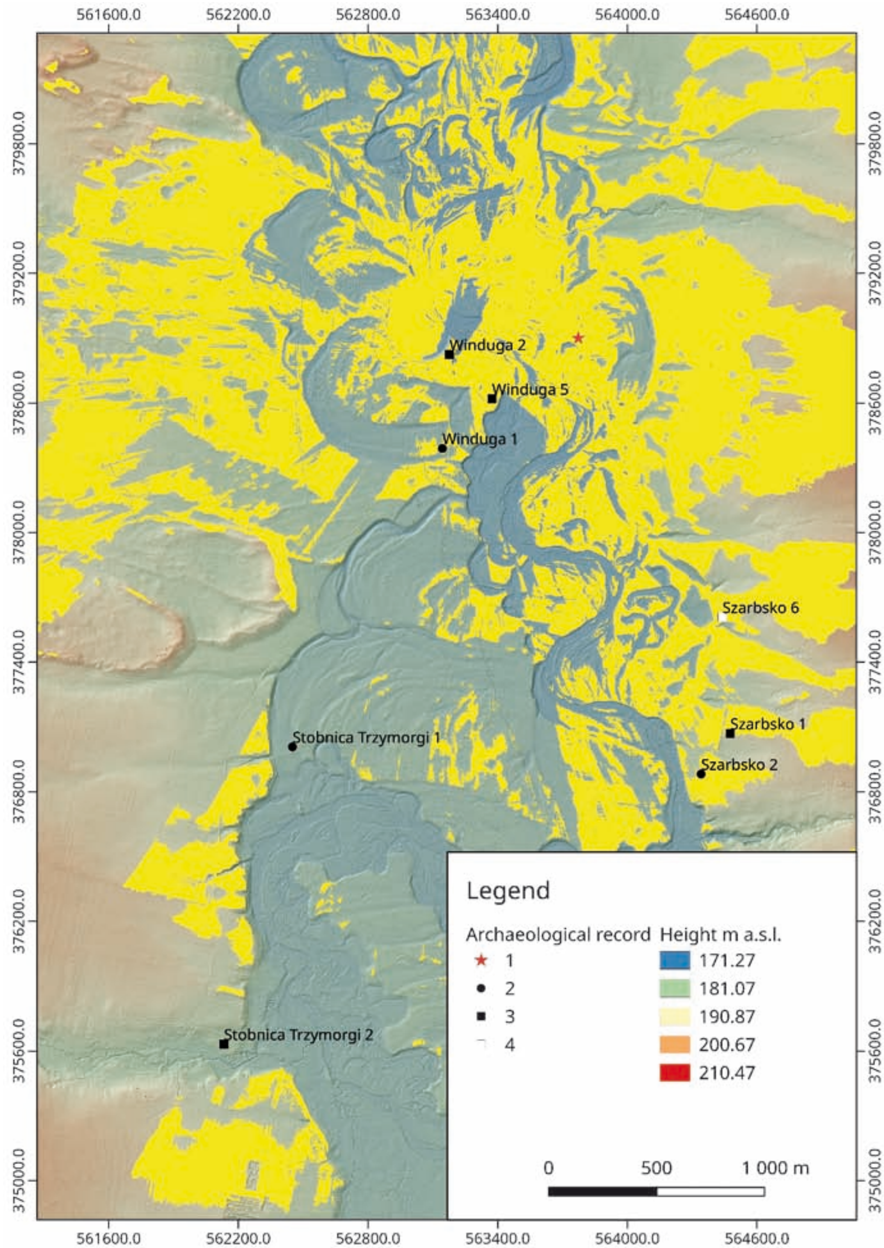

Fig. 19. Visibility from Site 2 in Winduga
(1 – deposit; 2 – cemetery/burial ground; 3 – settlement; 4 – settlement trace).
Based on the shaded Digital Terrain Model based on ASL measurements from GUGiK resources.
Prepared by J. Sikora

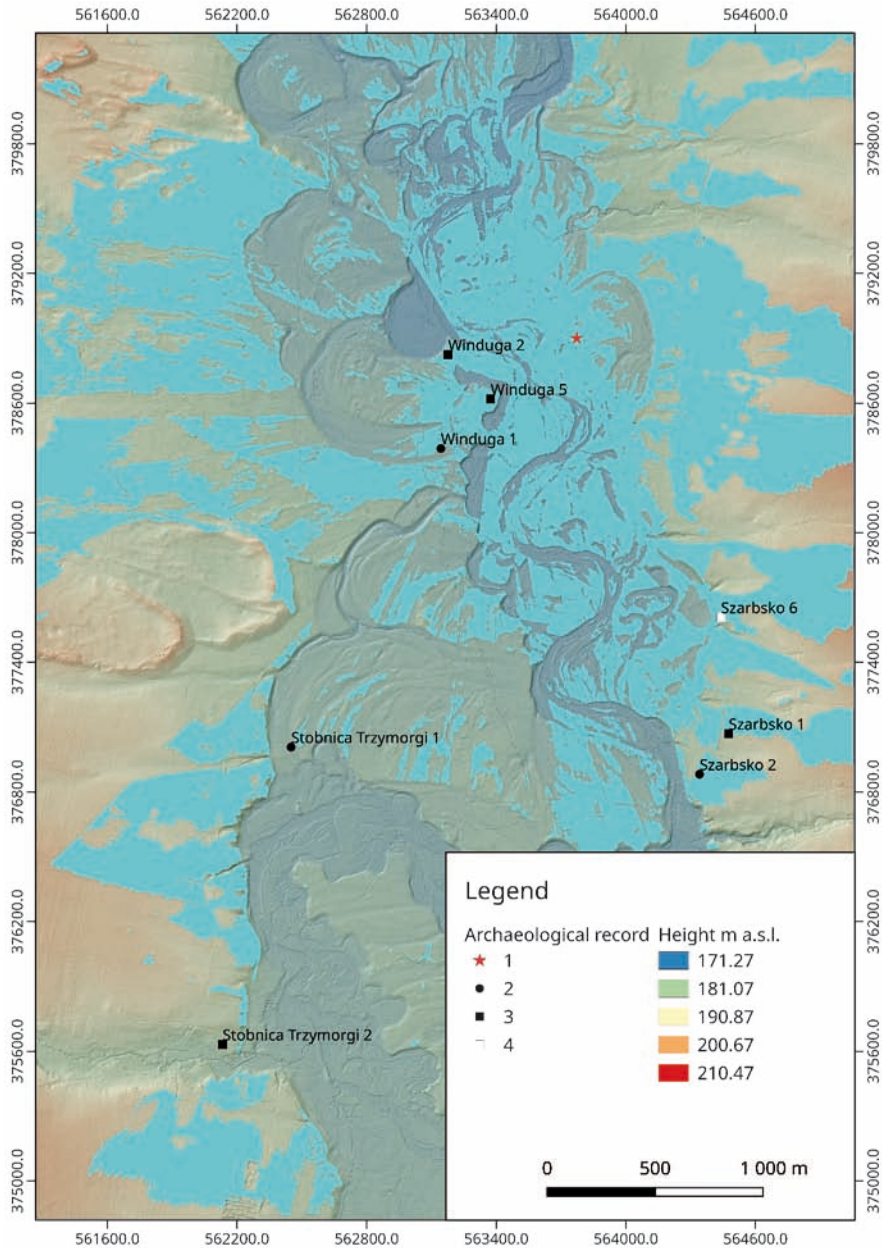

Fig. 20. Visibility from Site 5 in Winduga
1 – deposit; 2 – cemetery/burial ground; 3 – settlement; 4 – settlement trace).
Based on the shaded Digital Terrain Model based on ASL measurements from GUGiK resources.
Prepared by J. Sikora

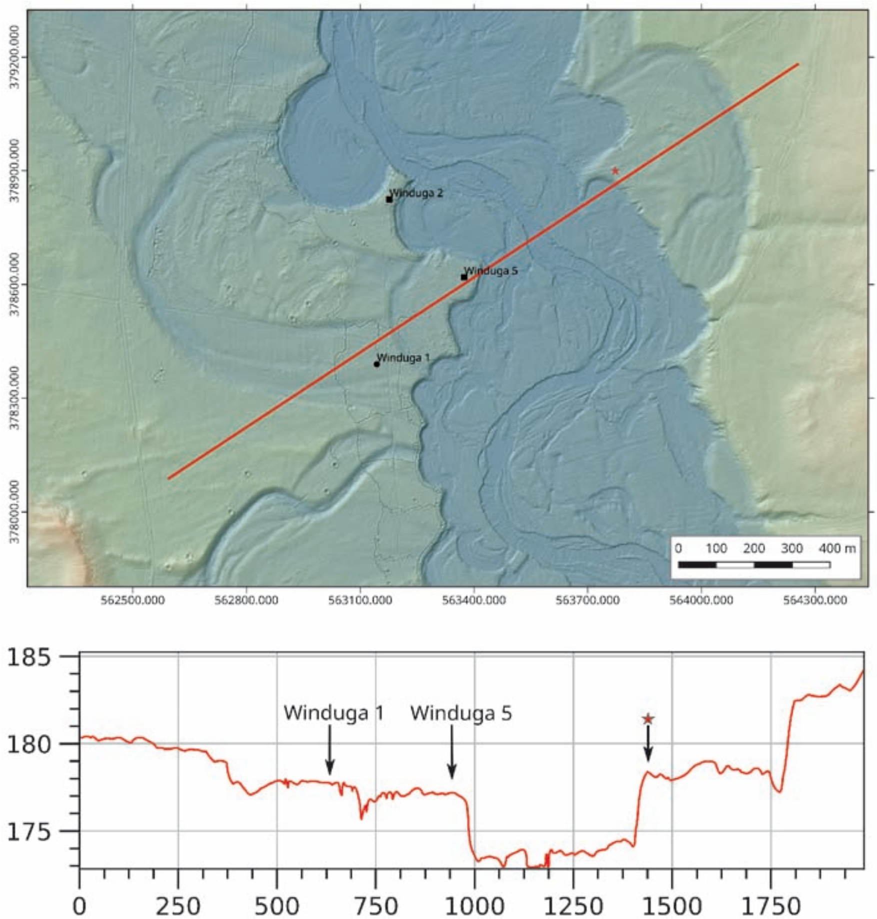

Fig. 21. Profile of the bottom of the Pilica valley in the area of the settlement complex in Winduga and the place where the bronze objects were deposited, based on the Digital Terrain Model from ALS measurements, from the GUGiK resources. Prepared by J. Sikora

(*e.g.* Friedman 2009), such studies, usually based on macroremains or pollen analyses, are not able to help locate specific trees that could obstruct visibility. An additional problem in this case is the use of data about the site location resulting from surface research carried out as part of the Polish Archaeological Record. The specificity of obtaining and the nature of these data do not allow for their precise dating. Therefore, the results should be treated as a model. They define potential visibility.

By analyzing the visibility from the place where the bronze items were deposited, we can assume that for the individual(s) laying the hoard in the ground, the complex of sites located on the left bank of the Pilica river (Fig. 21), within the raised terrace, in Winduga

Sites 2 and 5 (probably relics of settlements) and 1 (alleged burial ground, possibly containing mounds) was potentially clearly visible. The embankments of mounds located to the north of the deposition site, on the same bank of the river, should also have been perfectly legible, of course provided that they chronologically precede the deposit. Also, the sites in Szarbsko, Sites 1 and 2, located further south (from 1.45 to 2.1 km) on the same bank of the river, could have been visible. The possible visibility of the site complex in Stobnica Trzymorgi cannot be ruled out either. Therefore, it should be emphasized that a place with a very good potential sight of the cultural landscape of the Pilica valley in prehistory was chosen for the deposit of the bronze objects. Of course, we do not know to what extent this visibility could have been limited by various obstacles, such as vegetation or buildings.

From the area of the presumed settlements in Winduga Sites 2 and 5, the deposit site for the bronze items is also potentially well visible, as is the grouping of about ten mounds with an alleged burial function, located thanks to the analysis of ALS data and verified in the field. Taking into account the fact that the distances between the individual elements of this settlement complex are within 600-1100 m, it can be suggested that depositing the bronze objects could have been an element of building a whole, complex system of meanings and symbols in the ecumenical space.

CONCLUSION

The chronological position of the hoard from Niewierszyn, falling in the HA_1 phase, allows it to be associated with the horizon of the Kutno-Raszew hoards. In Central Poland, this horizon is connected with the Konstantynów Łódzki group. The two bracelets that are part of the hoard, are linked by form, ornamentation, similar parameters, and weight. In addition, they have a similar chemical composition. All these features lead to the conclusion that both bracelets were made in the same bronze workshop, probably within a short period of time.

The real reasons for depositing two bronze bracelets in the ground on the edge of the Pilica valley are probably beyond our ability to discern. It should be noted, however, that this hoard was relatively far from the settlement-cemetery complex of the Konstantynów Łódzki group, with which it was probably contemporary. At the same time, its location clearly refers to a small group of sites assigned to the people of the Trzciniec culture. It will remain an open question whether it was the presence of chronologically older settlements (and probably also graves) in this part of the Pilica valley that was the decisive factor in placing the deposit in this location.

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LOGBOAT DISCOVERED IN LAKE LUBANOWO, WESTERN POMERANIA

ABSTRACT

Kontny B. 2021. Logboat Discovered in Lake Lubanowo, Western Pomerania. *Sprawozdania Archeologiczne* 73/2, 203-220.

The paper presents a logboat found by an expedition from the University of Warsaw in Lake Lubanowo (north-western Poland) during an underwater archaeological survey in 2020. It is the first logboat made of beech wood (Fagus sylvatica) registered in the area of Poland. The conventional radiocarbon date is 2350±30 BP; thus, the vessel may be attributed to the Jastorf or Pomeranian culture, as it was found in the border area between the territories of both units. Only a few logboats are known from the period preceding the Middle Ages in Poland. Other untypical traits are a transom, and a carefully formed beak-shaped bow. In the prow there is a rectangular hollow with a circular perforation inside of unclear function. One may consider it a fastening of an outrigger or other kind of floating attachment but also perhaps that the bow slot was intended either for a figurehead, for mooring, or to hold a torch during night-time fishing, or even functioned as a 'stick-in-the-mud' – type anchor.

Keywords: logboat, underwater archaeology, Lake Lubanowo, Jastorf culture, early Iron Age
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THE SITE

Since 2014, a team of scholars and students from the Institute of Archaeology, University of Warsaw (now: Faculty of Archaeology) has been conducting an underwater survey in Lake Lubanowo (former Herrn-See) in Lubanowo (ex-Liebenow), Banie commune in Western Pomerania. Initially the research was done in collaboration with the Institute of Archaeology and Ethnology, Polish Academy of Sciences. The expedition was initially led by Tomasz Nowakiewicz, and since 2018 by Bartosz Kontny (both from the University of Warsaw). During the underwater research, weapons, potsherds, tools, and horse harness elements (including chain reins) have been found. The earliest finds date to the Bronze Age (the Lusatian culture – splintered flake) but most of them to the Roman Period and the Middle Ages (Early, High, and Late); some peculiar modern finds were also recovered, *e.g.* a copper cauldron from *ca.* 1600 AD, in which a group of painted plates had been deposited. Some of the Roman Period items bear traces of ritual destruction. The parallels to the weapons may be found in Central European *Barbaricum* (the Przeworsk culture) and, to some extent, also in Scandinavia. The site should be considered as a sacrificial military deposit, known generally from northern Europe, but almost unknown in the lands to the south of the Baltic Sea. Its extraordinary character is also manifested by the fact that so far it is the only site of that type known that is still in its 'lake stage', *i.e.* not a marsh or bog, into which ancient lakes have evolved due to the process of eutrophication. Most probably the site was used by local inhabitants, *i.e.* the people of the Lubusz group. The medieval finds also seem to be very important if one considers both new and old but re-interpreted finds dated to that period. The discoveries from Lake Lubanowo document not only sacrificial activities, but also the daily life of common folk, *i.e.* by the items they had lost, *e.g.* net weights, pots, tools, *etc.* Altogether, the recent research reveals a fascinating picture (Kontny *et al.* 2015; Nowakiewicz 2016; Kontny 2019a; 2019b; 2021).

In the larger part of the water basin, the artefacts lie shallowly in the sandy or stone-clayish bottom, covered with an organic sediment that is relatively shallow until a depth of about four metres (an exception is southwestern part of the basin, where, on a rather wide plateau, the layer of silt of a significant thickness overlies the lakebed right from the shore).

METHODS OF RESEARCH

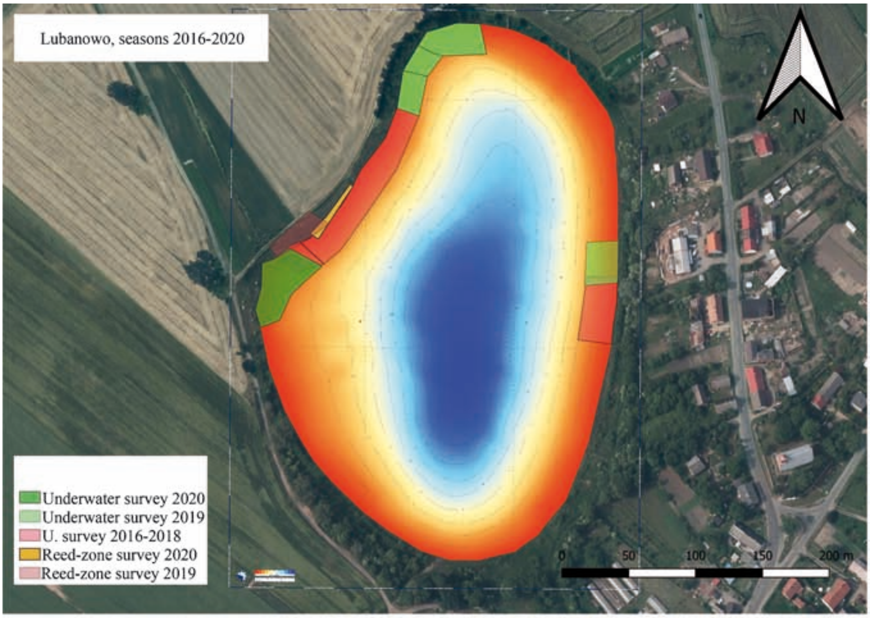
The lakebed is surveyed systematically; sectors are defined by a guide line, spread between the parallel main lines, being successively extended parallel to the shore. Scuba divers with metal detectors move along the guide line and after particular sector is surveyed, the rope is moved on one end for about 0.5-1 m (depending on the visibility); in this way a zig-zag route covered by a scuba diver allows surveying the same surface of the lakebed twice. The survey is conducted with a use of metal detectors, and signals are precisely localized with a pinpointer. Their position is established on the water surface with a Total Station, which allows developing a plan of artefact distribution across the site (Brzóska and Kontny 2016).

DISCOVERY

During the 2020 summer fieldwork, in the southwestern part of the basin, on the 21st of July, the researchers encountered a logboat (inv. no. 40/2020), located in the silt bottom at a depth of 1.5-1.6 metres (Fig. 1). Inside, there was an uncharacteristic sherd of a hand-shaped pottery (inv. no. 39/2020; greyish orange on the inside, and on the outside – greyish brown, with a relatively small amount of fine crushed-stone temper). According to Bartłomiej Rogalski from the National Museum in Szczecin, it is most probably a fragment of a vessel from the protohistoric period (hereby I would like to express gratitude for the consultations). The logboat was uncovered from the overlying sediment, which confirmed that it is not complete (there were large pieces missing from the aft and on the side, especially in the middle part). A series of cracks, especially transverse, were also seen in the central part. The wood is sponge-like. Observable was also the transverse groove in stern, where the transom was originally mounted. The vessel was aligned on a SSW-NNE axis (azimuth 220°), bow pointing towards the SSW. Due to the bad state of preservation, after the consultation by telephone with the Regional Heritage Office in Szczecin, the decision was made to secure the object, and initiate documentation activities after acquiring necessary means for the eventual surfacing, transport, and conservation of the boat. Beforehand, an attempt had been made to document it with a GoPro camera, using the use of Structure from Motion technique. The acquired documentation turned out to be insufficient due to the abundance of organic matter suspended in the water (algae bloom). The object was covered with silt and plastic sheet in the place of discovery, with the intention of returning to it in more beneficial weather conditions (better visibility), which would enable the preparation of more adequate documentation.

WOOD ANALYSIS

A fragment of wood was taken from the aft part for the radiocarbon analysis (Fig. 2). The analysis was conducted with the LSC method in the Laboratory for Absolute Dating (*Laboratorium Datowań Bezwzględnych*) by Professor dr habil. Eng. Marek Krąpiec (Laboratory no. MKL-5049). The result was surprising for two reasons. Firstly, the kind of wood used for manufacturing the logboat was identified as beech – *Fagus sylvatica*. The use of this wood in the making of logboats has not been registered until now in the area of



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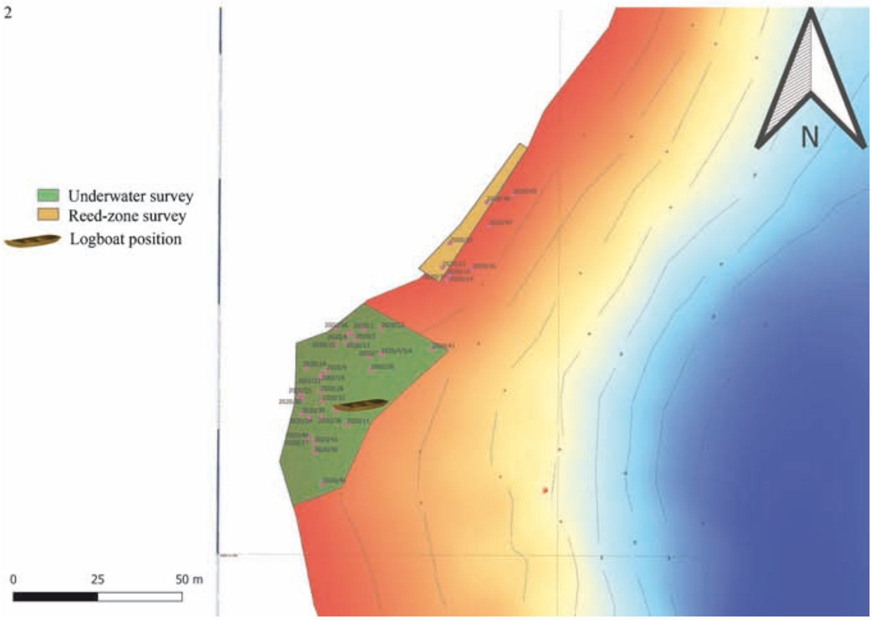


Fig. 1. Lake Lubanowo. 1 – surveyed areas, 2 – location of the logboat. Prepared by Piotr Prejs

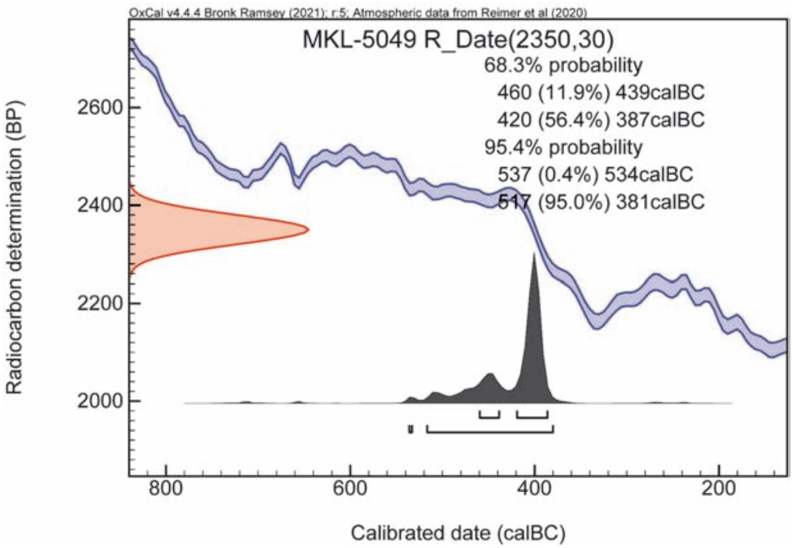


Fig. 2. Radiocarbon dating by the Laboratory for Absolute Dating of the sample from the Lubanowo monoxyle

Poland (*cf.* Ossowski 1999). The second surprise was the conventional radiocarbon date: 2350 ±30BP. After calibration, with the 95% confidence, it gives a date of 515 BC or 375 BC, with a median 400 BC (calibration software – adamwalanus.pl). Only a few similar objects are known from the period preceding the Middle Ages. One cannot overlook the possibility that the date is erroneous, resulting from the proximity of the acquired data to the Hallstatt plateau in the radiocarbon dating, which causes even the most precisely dated and calibrated samples from the time span 800-400 cal BC to appear to be nearly the same (Van der Plicht 2004; Reimer *et al.* 2004). It is a problem to establish the border of the Hallstatt plateau precisely. One cannot fully exclude that the object is in fact even older.

DOCUMENTATION

With such an intriguing dating, a decision was made to prepare the documentation of the logboat as quickly as possible. The work was conducted at the end of February 2021 (it lasted three days) by a team lead by dr habil. Bartosz Kontny, prof. UW, which also included Artur Brzóska, M.A. (both Faculty of Archaeology, University of Warsaw) and Piotr Prejs, M.A. with Tomasz Budziszewski (both from the *Stowarzyszenie Archeologów Jutra*). The choice for the season of the year was dictated by a hope that the underwater visibility would be good enough to perform documentation. The conditions of work in the

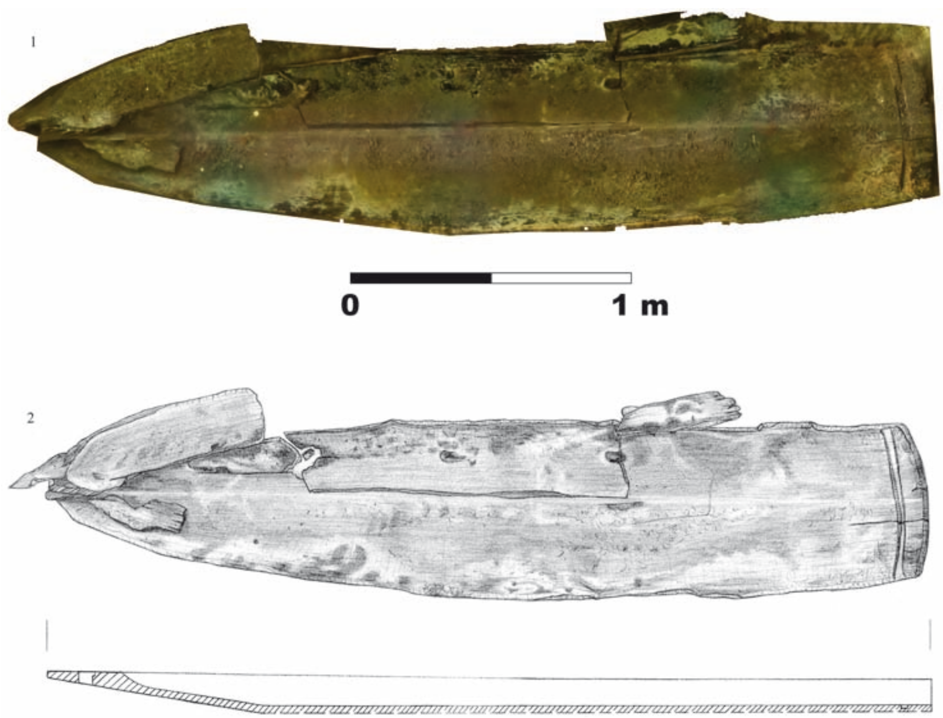


Fig. 3. Logboat from Lake Lubanowo. 1 – photomosaic (by Piotr Prejs), 2 – drawing (by Tomasz Budziszewski)

water basin included 0.5-1 m visibility and ice cover – initially about 10 cm thick (at the end of the work – after some rainfall, and then intensive insolation – it had melted). The location of the wreck was established from the surface of the ice, with the use of GPS. Dives were conducted with proper safety measures: the diver was safeguarded from the surface with the use of a rope, self-emergency equipment (reels with ice screws), and a scuba diver-rescuer ready for assistance. Having uncovered the boat from sediments and removed the protective plastic sheet used in July 2020, the photographic documentation of details was done (camera Canon 550D in a dedicated Ikelite housing and a range of takes with two GoPro cameras, counting on the use of documentation with the Structure from Motion technique (Fig. 3), which this time was a success (the picture was acquired with the application of Meta Shape software). Loose elements (three fragments of the right side and transom as well as the right part of the bow) were brought to the surface for a short time and documented photographically, acquiring the data for the 3D picture (Fig. 4). The surfaced fragments of the logboat construction were put back in the original place and then the entire boat was once again protected with plastic sheet and sand.

DESCRIPTION OF THE LOGBOAT FROM LAKE LUBANOWO

The boat was made of beech wood (*Fagus sylvatica*). It has been preserved to a large extent: there are major missing areas on the right side, especially in the aft section; there is also no transom (it was ultimately found during the summer expedition in July 2021). In addition to that, the state of preservation is poor. The wood is chipped, sponge-like, and delicate, while the bow is broken along the main axis, and its right part is slightly displaced

Fig. 4. Details of the bow fragment surfaced for a short time (by Piotr Prejs)

1

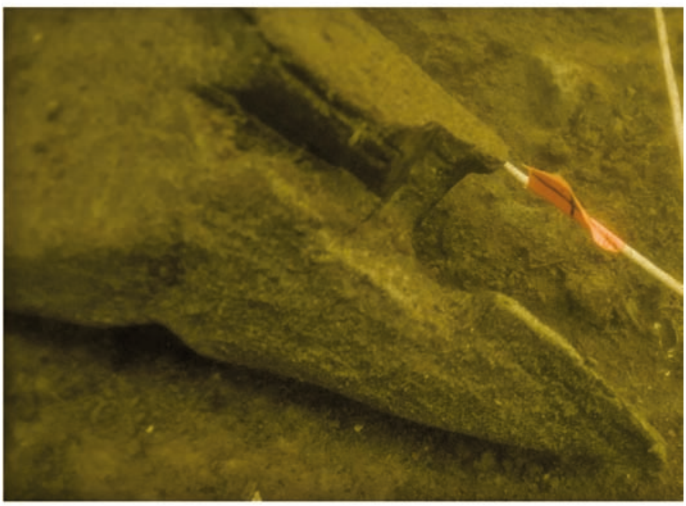
2

3

Fig. 5. Lake Lubanowo – area of the monoxyle find in the late 1960s (1) and today (2–3). 1 – photo from the private collection of Arkadiusz Wiśniewski, 2–3 – photo by Bartosz Kontny

– extracting the vessel as a whole was going to be impossible. The condition might have been influenced by a past incident, described by an inhabitant of the nearby Tywica, Mr Arkadiusz Wiśniewski (Fig. 5: 1 – in the middle, 5: 3 – on the left). While visiting the place of the archaeological fieldwork, he told that in the 1970s, as a child, along with a few of his peers, he had discovered a boat in this part of the water basin (this area had been used as a communal beach). The craft had been located at a shallower depth, and noticed from the

1



2

Fig. 6. Detail of the logboat. 1 – transom groove, 2 – hollow and perforation in the bow (photo by Artur Brzóska)

shore. Children had attempted to make it float and use it, which did not succeed – the vessel had been sinking too quickly. Discouraged, they had abandoned the drowning boat. It is very probable that the craft mentioned in the story is in fact the analyzed vessel; however, this is not certain, because Mr Wiśniewski was not able to describe the construction and did not exclude that the vessel from his story could have been a plank boat. The concurrence of the site of the logboat's discovery and the area where a boat previously retrieved from the lake had been abandoned in the 1970s is however rather intriguing (Fig. 5).

The dimensions of the boat (Fig. 3) are the following: overall length – 320 cm, preserved aft breadth – 55 cm, maximum breadth at the midship – 60 cm. In the aft part there is a groove (three-centimetre-wide and 1-1.5 cm in depth), in a place where the transom (not preserved *in situ*) had been situated (Fig. 6: 1); the hull ends 8 cm further (preserved genuine stern ending). The sides are low (height preserved in the aft part is 12 cm, in the mid-ship and bow – 15 cm) and the bottom is visibly flattened, also in the bow part, where it fluently changes into the flat bilge (Fig. 4). The bow had been narrowed from the underside and both broadsides to form a 'nose'. The 'nose' is accentuated with singular undercuts at its base (at the level 25 cm from the highest point), situated in the upper part – in the place where the sides develop into a bow. Within the bow, in its centre, there is a rectangular hollow (4 cm × 8 cm), inside – at the depth of 4 cm – gradually evolving into a 3 cm × 6 cm perforation (Fig. 3; 6: 2). The thickness of the vessel's sides is diversified – from 2.5 cm to 4.5 cm (the smallest amidships). Inside the hull one can notice the traces of woodworking. Two openings in the bottom, located in the area of a crack, are of a natural character (the effect of decay).

ANALYSIS

The monoxyle from Lubanowo (reconstruction: Fig. 7) can be ranked among the small vessels, type 1 – considering the criteria developed for the finds from the proto-historic period from Slusegård on Bornholm (Crumlin-Pedersen 1991, 173, 174, 183-185, 252, table 1-4).

The function of the side notches and the central opening in the prow is unclear. The former might have theoretically been used for tying the mooring line or towrope at the bow, but such role is usually ascribed to thickened protrusions, left on the bow at the phase of its forming (*cf.* Ossowski 1999, 39, fig. 9: B). They cannot be considered accidental traces of woodworking, because the bow has been manufactured with unusual accuracy (although it is possible to encounter similar examples, see *e.g.* certain expanded logboats from the Roman-period cemetery at Slusegård – Crumlin-Pedersen 1991, 170, fig. 91: 6 – or medieval logboat no I from Lake Lednica – Ossowski 2014, fig. 1). It is not out of the question, that it was specifically carved in order to emphasise the aforementioned 'bowsprit' more distinctly, maybe giving the vessel certain zoomorphic features (an 'animal-snout' form).

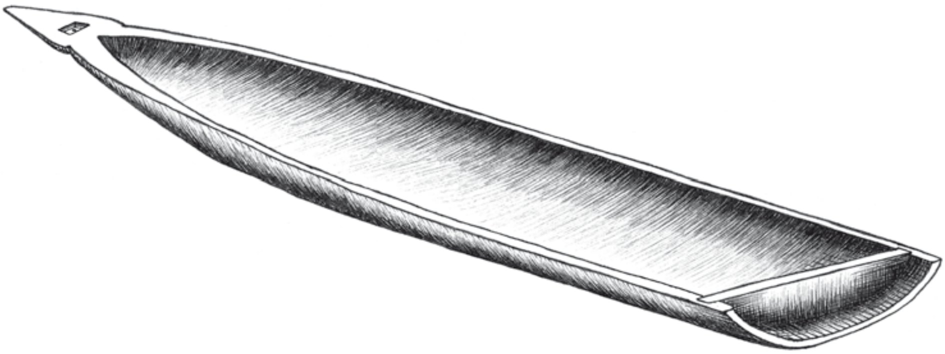


Fig. 7. Reconstruction of the logboat
(drawn by Tomasz Budziszewski, elaborated by Piotr Prejs and Bartosz Kontny)

Fig. 8. Bow of the monoxyle from Loch Arthur in Edinburgh Museum (photo by Bartosz Kontny)

This would not be strange for a watercraft, for example in the Nordic Circle in the Bronze Age, zoomorphic decorations were placed on the stem- or sternpost; one might also recollect the Phoenician *hippoi*, with the horsehead-shaped figureheads, the depictions of eyes placed on ancient warships, or the modern figureheads or painted decorations on the prows of metal-hulled vessels. Zoomorphism/anthropomorphism could have applied also to the logboats, bows were sometimes given animal shapes (see: craft no. 1 from Loch Artur/Lotus Loch – Fig. 8 – in Scotland with a transom and bow of 'animal-snout' form, dated to 101±80 BC), but *oculi* were recorded also in the case of crafts from Errol 2 (485/430±45 AD) and Loch of Kinnordy (735±40 AD) in Scotland (see Mowat 1999, 34-37; Gregory 1997, 105, 106). Naturally, it is hard to settle this question unambiguously (*cf*. a similar discussion on the bow of the early medieval logboat no. I from Lake Lednica – Ossowski 2014, 250, with further literature).

Equally unclear is the function of the hollow in the bow. One should rather exclude the function as a mooring ring (ascribed often to openings placed analogically in other logboats, see Ossowski 1999, 40), due to the diversified shape of the opening's cross-section (redundant in such a purpose) and also the lack of wear traces on the walls of the perforation. In the case of a similarly-made opening in the logboat no. 1 from Kolín in the Czech Republic (Rogers 2011, 177, fig. 4), taken from the Elbe River, dated to the Middle Ages (cal AD 990-1160), it has been suggested that it might have been the place to fit an outrigger attachment, but one cannot exclude that the bow slot was intended either for a figurehead or to hold a torch during night-time fishing (Niederle 1923, 34). However, the first possibility seems improbable, because outrigger booms tend to be placed closer to the midship, not to lose the stability and the benefits of the hydrodynamic shape of the bow, especially visible in the case of the analyzed example. Apart from that, the evidence for the existence of local traditions of using outriggers in middle-European logboats is scarce (however, winged-canoes were built here, having the horizontal balance planks mounted in the lower parts of sides, parallel to the surface of water – Ossowski 1999, 41, 42, fig. 13). It is a similar situation in the case of sails (Szymczak 1997, 107), as fitting a mast on a bow is rather excluded due to questions of stability. Also attaching a figurehead, although tempting (*cf*. Hein 2012, fig. 1), does not have any analogies among the logboats for now, although such possibility has been proposed for a Scottish monoxyle from Errol (Hutcheson 1897, 266, 267). However, if the potential intent to give the bow zoomorphic features is considered, it does not seem out of the question. On the other hand, the idea of attaching a torch is again opposed by the diversified cross-section of the feature, simply not useful for such a humdrum use. It cannot be rejected however in the case of the desire to make here a more durable connection, though because the socket is rectangular, this would exclude rotation of the added part. This does not exclude attaching a figurehead.

It seems that one should also consider the possibility of using the opening for joining a number of analogical hulls into a larger unit in the form of paired hulls, as a catamaran, or a raft, resembling the solutions used by rafters on the Dunajec River in the Pieniny Mountains (southern Poland). The latter solution is known from the territory of Poland in the Roman Period and the beginning of the Migration Period as the 'Lewin type' (Ossowski 1999, 83-88; 2010, 22, 23). The logboats of this type have been confirmed in southern Poland, and they were discovered mostly in the waters of the Eastern Neisse (Nysa Kłodzka) and Oder River. They are distinguished by low sides (in which they resemble the find from Lubanowo), but their afts and bows are wide and flat, which has been initially interpreted for the facilitation of rolling the barrels on board (Ossowski 1999, 88). Attention is also paid to their use for rafting goods or as ferries, possibly for transporting ores in the Brzeg metallurgic region (Pazda 1994; *cf*. Ossowski 2010, 23; Kontny 2016, 206). However, it has to be noted that similar means of transport have appeared not only in southwestern Poland but also in central Germany, as seen in the find from the Late Roman sanctuary SR1 in Oberdorla (Kontny 2019, footnote 7; see Behm-Blancke 2002, 204, pl. 109: 7). A lot of analogical logboats of the ferry constructions (similar to those known from the region of the Pieniny Mountains, but also composed of pairs of hulls, between which a transport platform was placed) from the Medieval and Modern Periods were discovered in the River Main (Kröger 2010; 2011, 116-119), the Weser (Kröger 2011, 119, 120), and also in France (Lagadec 1983), Britain (McGrail 1978, 44, 45), or in Mazovia and south-eastern Poland (Ossowski 1999, 106-108, 155-158, fig. 62, 140). Therefore, those are solutions occurring convergently in various regions and periods. The watercraft from Lubanowo is low, thus of a little water displacement, but significant stability (flat bottom), which makes the above-mentioned idea probable. The doubts, however, are connected with the fact that attaching the boom to the narrow and thin bow would cause a risk of breaking it (unlike in the case of the wide prows of the Lewin-type monoxyles). Moreover, in this case the advantage of the carefully elaborated streamlined shape would be lost. Besides, a function as a ferry on the relatively small Lake Lubanowo does not seem to have a point.

Another use of the openings has been considered too – to hammer in a pole, with the purpose of stopping the vessel in a current or facing it in the desired direction (Ossowski 1999, 40; 2010, 23) or to anchor the craft. Similar accessories have been reported as a 'stick-in-the-mud' anchor, driven through the bottom of the hull into the bed of the river. They are used by the Chinese in river boats and occur, for example in the Dazhi wreck from the Song Dynasty (960-1279 AD; see Kimura 2011, 9, fig. 1.6) so this may serve as a technological parallel. A clear resolution of the matter of the opening's function is, however, impossible.

The portable bulkhead or transom was evidenced in the Polish territories only from the Middle Ages, but in Europe similar examples occur from the Stone Age, for example in the Mesolithic (Hein 2012, 123, fig. 4), and also para-Neolithic examples from the Ertebølle Culture (Bailey *et al.* 2020, 62-64, fig. 3.21). The hitherto lack of finds of logboats with such elements in the area of Poland should be therefore interpreted by the state of research.

Using beechwood for building monoxyle boats is a rarity. In the area of Poland canoes made of this material have not been known until now. In the Stone Age in Europe, different kinds of softwood were preferred, easy in woodworking, such as aspen, linden, or alder, sometimes poplar; in the terminal Neolithic they were still in use, although the oakwood was used more and more commonly, and pinewood was not neglected (Ossowski 1999, 69-71). There are a number of finds from the Bronze Age, including some in the bows of which openings were made (Ossowski 1999, 76-78). Finds from the 1st millennium BC are scarce; actually, only a few examples might be ascribed to this period: a spruce canoe from Biskupin, district Żnin, dated contextually to the Hallstatt period, an aspen boat from Chwalimki, district Szczecinek (^{14}C dates: 3090±90 BP, 3130±80 BP, 2910±35 BP), an oak-made one from Pińczów, district Pińczów (3130±70BP or after 1220 BC), one from

Lake Łaźno, district Szczytno (2930±100 BP – Lanting 1998, 640, table 12), another from an unknown locality – in the collections of the Ethnography Museum (branch of the National Museum) in Poznań, inv. no. MP/E/973 (2750±150BP – Ossowski 1999, 179; probably: 2270±35 – Lanting 1998, 640, table 6). Two more finds might be added to this list, probably from the final stage of the Late Pre-Roman Period, from Kozarze by Ciechanowiec, Wysokie Mazowieckie district (2060±50BP – Ossowski 1999, 179), and an unknown locality, from the collections of the Archaeological Museum in Cracow (2050±130 BP – Ossowski 1999, 180, 181). The finds from the settlement of the Pomeranian culture in Luzino, Wejherowo district, and potentially from the Early Iron Age site at Góra-Orle, Wejherowo district, do not have – in the first case – a confirmed function, and in the second the chronology is unconfirmed (Ossowski 1999, 75-82).

Similarly dated watercraft are not recorded in large numbers also in the area of Europe, in general. A recently published list includes 35 vessels dated in the range 2700-2300 BP, manufactured nearly entirely from oakwood, while none of them is from the area of Poland, and even Eastern Germany or Schleswig (Udovič and Erič 2020, 64-66, table 2, fig. 4). The presented material is, however, not complete (*cf.* Lanting 1998, 634, 635, table 7) since one can indicate similarly dated examples of finds from Drochtersen-Ritsch, Lkr. Stade in Lower Saxony (2245±155 BP) and Garstadt/Bergrheinfeld, Lkr. Schweinfurt (2230 BP, dendrodate – 260 BC), as well as the above-mentioned finds from the Polish territories.

Although the diversification of the wood species used to produce canoes in the Bronze Age and Early Iron Age is significant, one will not find here objects made of beechwood, and this applies also to the subsequent time periods. Scarce beech examples were documented, on the other hand, in Eastern Jutland – Barsø, komm. Aabenraa – 940±65 BP (Lanting 1998, table 6, with further literature), Haddebyer Noor, Kr. Schleswig-Flensburg – Cal 944±47 AD (Kröger 2014, table 1, no. 40), and in Eastern Germany – Salziger See, Lkr. Mansfeld-Südharz – dendrodate: after 1165 AD (Kröger 2014, table 1, no. 61).

The radiocarbon date allows us to associate the logboat from Lubanowo probably with the Jastorf culture and its Oder Group, sites of which on the right bank of the Oder River (phase Ib) are dated from the stage Jastorf b to the phase A2a of the Late Pre-Roman Period, matching stadium Seedorf I (Wołagiewicz 1981; 1992, 11-13, fig. 1, 4). Lubanowo is located close to the southern limit of this group (a few kilometres further to the southwest, in Żarczyn, Gryfino district, a grave of the Jastorf culture was discovered, dated to the turn of the Early and Late Pre-Roman Period – see Rogalski 2010, 420, with further literature), in the zone where the elements of the Pomeranian culture from the middle Oder might have occurred (*cf.* Rogalski 2010, 257-259, map 6; Lewczuk 2011, 49). Mechanically, one should ascribe the boat to the Jastorf c phase, according to Georg Schwantes (1950), the turn of LT A and LT B, or Jastorf Ib/c, that is the end of the Marianowo phase, cumulating elements of the Lusatian, Pomeranian, and Jastorf cultures (Wołągiewicz 1989, 314; Rogalski 2018, 53).

However, in the present state of research, it is hard to find analogies to the logboat from Lubanowo, as similar finds from the Early Iron Age are scarce. One can only assume that, due to the used material (beechwood) the Jutland and Eastern German connotations are promising; however, it is impossible to explain this fact clearly by the connections with that territories of the Jastorf culture, as the analogies are dated to much later times.

Without doubt, the discussed vessel is exceptional, not only due to the dating and material, but also the technical details, such as the presence of the movable transom, the careful elaboration of the bottom and prow, and finally: the aperture of an unknown function in the bow part of the boat. Hopefully, future discoveries will allow the determination of a wider cultural-typological context for the discovery from Lubanowo.

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BURIAL OF A MOUNTED WARRIOR WITH *RINGKNAUFSCHWERT*-TYPE SWORD FROM THE NECROPOLIS IN OSTRÓW, PRZEMYŚL DISTRICT

ABSTRACT

Stempniak-Kusy S. and Lasota-Kuś A. 2021. Burial of a mounted warrior with *Ringknaufschwert*-type sword from the necropolis in Ostrów, Przemyśl District. *Sprawozdania Archeologiczne* 73/2, 221-249.

During the excavation of the Przeworsk culture necropolis at Site 21 in Ostrów, Przemyśl District, a richly furnished burial of a mounted warrior was found. The burial, which can be dated to the developed stage of the Early Roman period based on the grave goods, stood out through the lavishness of its grave inventory. Among other objects, the grave goods included a sword with a ring-like pommel, known as a *Ringknaufschwert*, two spearhead, one of them with punched decoration, and elements of horse tack. There also were ornaments and dress items, particularly noteworthy among them a gold pelta-shaped pendant decorated with granulation.

Keywords: *Ringknaufschwert*, sword, weaponry, horse harness, Przeworsk culture, Early Roman period
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GRAVE 50 FROM THE CEMETERY IN OSTRÓW

The growing number of Roman period sites excavated recently in south-eastern Poland is gradually starting to change the picture of cultural relations of the populations inhabiting this area. This region has been seen as particularly poor in finds of objects imported from the Roman Empire (Madyda-Legutko 1998, 29, fig. 1; Bochnak and Opielowska, in print). Archaeological sites recently discovered in the upper and middle San basin allow this view to be challenged. For example, in a necropolis explored in Prusiek, Sanok District, Site 25, as many as four of the 41 graves discovered contained imported Roman swords (Madyda-Legutko *et al.* 2007, 64). Situated in the same zone, the cemetery at Site 33 in Pakoszówka, Sanok District, yielded several objects of Roman provenance (Bulas *et al.* 2019, 97 and personal information). The ongoing comprehensive analysis of grave inventories from the cemetery at Site 21 in Ostrów (Przemyśl District, Podkarpackie Voivodeship), situated in the middle San basin, has revealed the presence of a number of important artefacts that were Roman imports. This applies, among other objects, to the four swords discovered there. Of particular note among them are a sword of the *Ringknaufschwert* type and the remaining objects discovered in Grave 50.

The cemetery in Ostrów is situated approx. 1 km from the San River. It occupies a left-bank terrace falling quite steeply to the SW, near a large bend in the San. Archaeological supervision of construction works in 2013 revealed a Przeworsk culture cemetery, resulting in a decision to conduct excavations (*cf.* Lasota and Stempniak 2015, 226; Lasota 2018; Lasota-Kuś and Stempniak-Kusy 2019, 78).

In the case of Grave 50, a poorly detectable outline of the grave cut was identified beneath the topsoil and subsoil layers at a depth of approximately 60 cm. Thus, the grave was dug deeper than the remaining burials in the site, with their ceilings typically recorded around a depth of 30 cm. At the level of discovery, a gold pendant was found in the central part of the pit. After some 10 cm of the fill was explored, the grave became a regular oval 105 × 80 cm in size. This top layer contained single sherds and tiny fragments of burnt human bone. Below, an urn was found, with numerous metal artefacts forming a cluster to the west of it. In cross-section, the grave resembled a hollow, some 40 cm deep and with clearly legible boundaries (Fig. 1). The fill was homogenous and consisted of soil of grey-brown colour. Inside the urn, two patinated flint blades, a fragment of an antler comb, and a bone pin were found among cremated human bones.

GRAVE GOODS

1. Iron double-edged sword with crossbar and ring-like pommel, of the *Ringknaufschwert* type, intentionally broken in two. The blade is faceted in section, very long, tapering evenly towards the point. The point is short, ogival. The crossbar is rectangular is

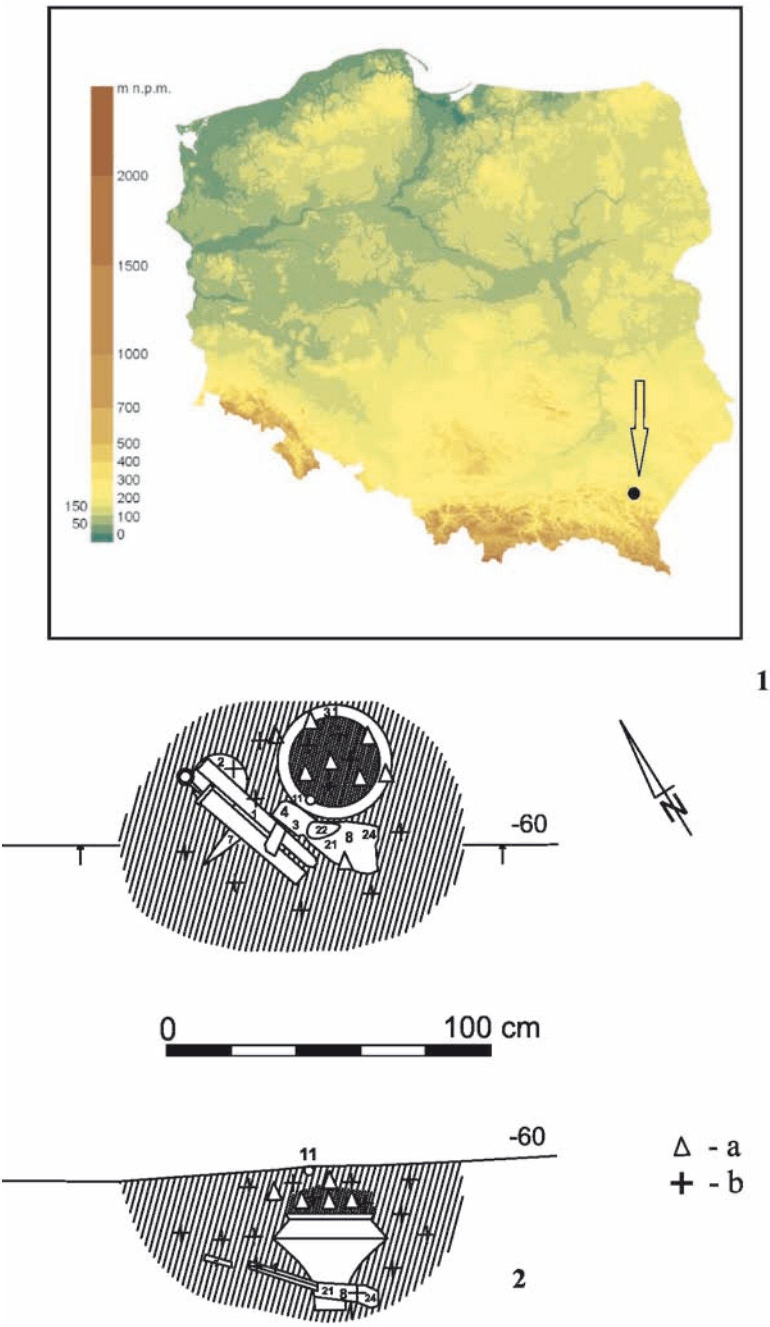


Fig. 1. Ostrów, Site 21. 1 – location of the site (drawn by Anna Lasota-Kuś),
2 – Feature 50: plan and profile; a – pottery; b – cremated bones (drawn by Sabina Stempniak-Kusy)

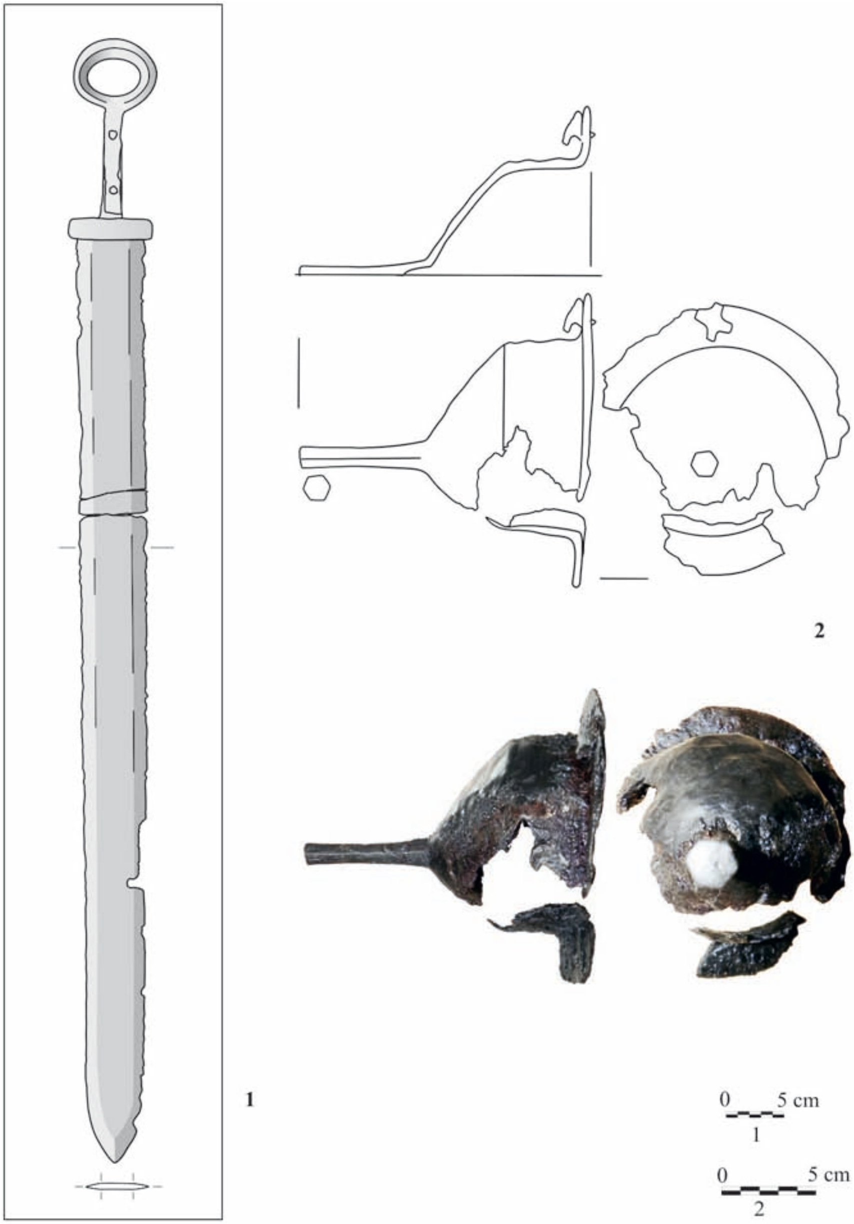


Fig. 2. Ostrów, Site 21, Feature 50 – metal elements of the grave furnishing
1 – iron sword of the *Ringknaufschwert* type), 2 – iron shield boss
(1 – illustrated by Marcin Biborski, 2 – illustrated by Urszula Socha)

section, and the oval ring, 7.0 × 5.8 cm and 1.1-1.5 cm thick, is attached to the tang with two rivets. Dimensions: total length of the sword: 96 cm; blade length: 77.8 cm; tang length: 23.1 cm; point length: 11.4 cm; width: 6.2-5.9 cm; weight: 725 g (Fig. 2: 1).

2. Iron shield boss, type 7a after M. Jahn (1916), with long, blunt spike, badly corroded and preserved fragmentarily. The spike is hexagonal in section, slightly narrowing in the middle part, 1.1 cm in diameter. The extant rivet has a flat, cruciform head made of sheet metal, approx. 2 × 2 cm in size, and the surviving length of the shaft is 1.1 cm; the other rivet had a trefoil head (it was damaged in conservation). Dimensions: boss diameter: approx. 16.5 cm; flange height: 4 cm; total height: approx. 15 cm, including spike height: approx. 6.2 cm (Fig. 2: 2).

3. Iron hafted weapon head, type VIII variant 3 after P. Kaczanowski (1995), bearing no traces of deliberate damage, with a massive blade and poorly marked spine, punched decoration, and with a very long round-sectioned socket slightly tapering towards the blade. Dimensions: length: 19.0 cm, including shaft length: 8.5 cm; blade width: approx. 3.4 cm (Fig. 3: 1).

4. Iron hafted weapon head, type XIII after P. Kaczanowski (1995), bearing no traces of deliberate damage, with a narrow blade with pronounced spine with the point broken off, and long round-sectioned socket slightly tapering towards the blade. Dimensions: preserved length: 27.0 cm (reconstructed length: 28.6 cm), including socket length: 10.5 cm; blade width: approx. 4.5 cm (Fig. 3: 2).

5. Iron shield grip of type 9 after M. Jahn (1916), fragmentarily preserved, with trough-shaped bar and trapezium-shaped rivet plates, with centrally placed rivets preserved. The rivets have small flat heads approx. 0.6 cm in diameter, and the surviving shaft lengths of 0.8 and 1.2 cm. Dimensions: bar width: 1.9 cm (Fig. 3: 3).

6. Iron scabbard slide (originally tied to the scabbard without using rivets), with the ends damaged. Dimensions: length: 12.9 cm; width: 2.3 cm (Fig. 4: 1).

7. Iron knife with the tang offset from both sides. Dimensions: tang length: 5.0 cm; reconstructed total length: approx. 15 cm (Fig. 4: 2).

8. Iron shears of type I after A. Knaack (1978). One blade is fully preserved and the other is partly preserved. One blade meets the bow at a right angle, and the other at an obtuse angle. Dimensions: blade length: approx. 9.0 cm; maximum blade width: 2.0 cm; maximum bow width: 1.0 cm (Fig. 4: 3).

9. Iron spur of type E2 after J. Ginalski (1991). Low, triangular-sectioned yoke with buttons for attachment. The shank is massive, full, and cone-shaped, octagonal in section. Dimensions: shank height: 1.7 cm; yoke span: approx. 5.2 cm; yoke height: approx. 1.5 cm; shank base dimension: 1.5 cm (Fig. 4: 4).

10. Iron trapezium-shaped bar, perhaps fragment of a firesteel. Dimensions: width: 1.6 cm; length: 9.7 cm (Fig. 5: 1).

11. Pelta-shaped pendant made of thin electrum foil (gold 60%, silver 38.94%), in the shape of an elongated rectangle whose one narrower end had the corners cut into an

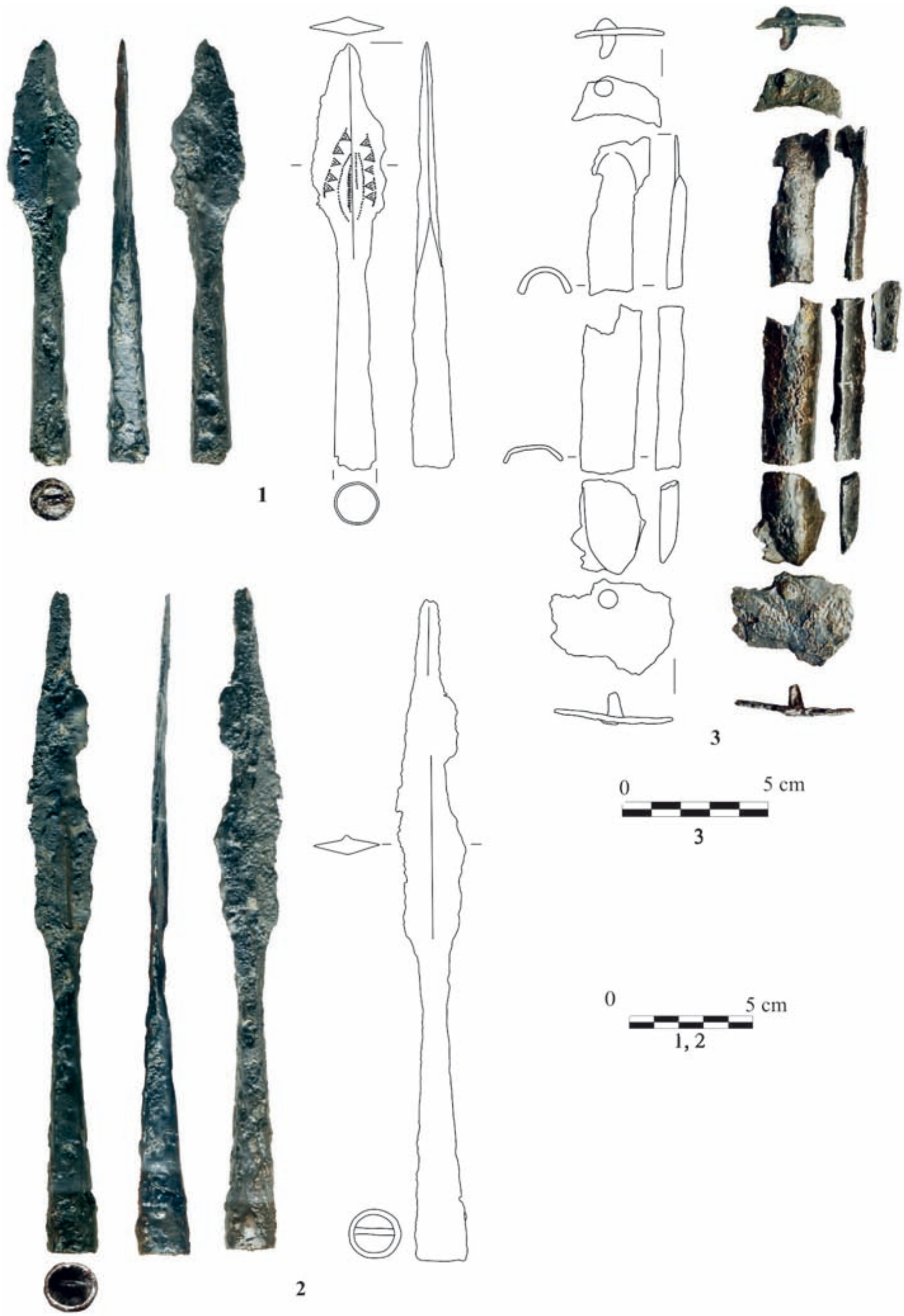


Fig. 3. Ostrów, Site 21, Feature 50 – metal elements of the grave furnishing.
1-2 – iron spearheads, 3 – iron shield grip (illustrated by Urszula Socha)

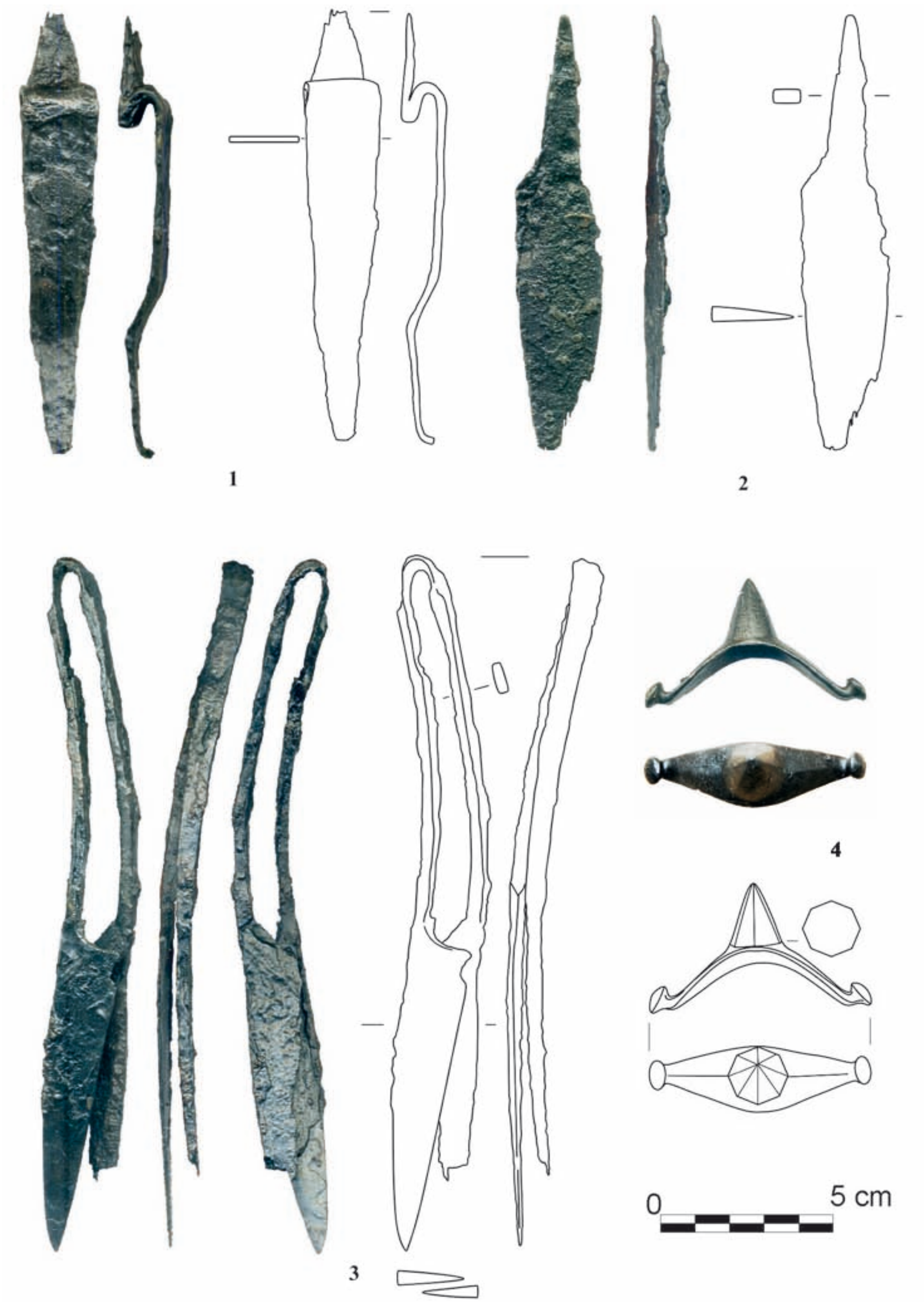


Fig. 4. Ostrów, Site 21, Feature 50 – metal elements of the grave furnishing.
1 – sword scabbard pendant, 2 – iron knife, 3 – shears, 4 – iron spur (illustrated by Urszula Socha)

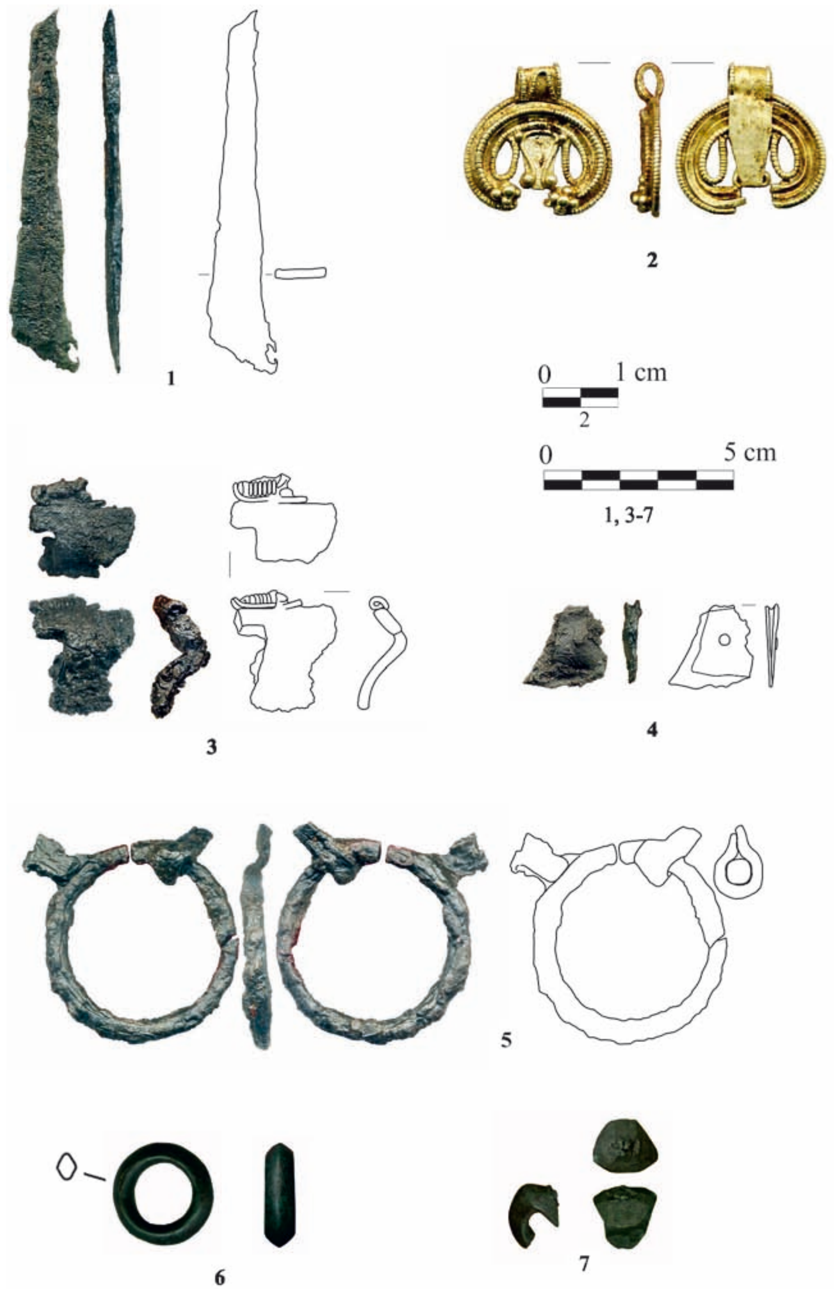


Fig. 5. Ostrów, Site 21, Feature 50 – metal elements of the grave furnishing.
1 – iron fire striker (?), 2 – electrum pendant, 3 – iron fibula, 4 – fragment of a belt fitting (?), 5 – iron bit, 6 – bronze ring, 7 – bronze fragment of horse harness (illustrated by Urszula Socha)

isosceles trapezium, while the other end was rolled into a loop. The middle part of the rectangular plate had two very thin ribbons of gold foil soldered to it, which were then bent into an arch forming the pendant's arms. This entire construction was then used as a framework to which tiny filigree wires, twisted and hammered down, were soldered. They were placed along the edge and on top of the pendant's arms, and along the edges and in the middle of the loop, where the decoration resembles the Greek letter omega in shape. The centre of the rectangular plate was decorated in the same manner. The ends of the wires were adorned with single granules. The pendant is slightly asymmetrical, leaning to the right-hand side. Dimensions: 2.0 × 1.8 cm; weight: 3.34 g (Fig. 5: 2).

12. Iron brooch of Leonów type, badly corroded, with partly preserved spring, with ribbon like bow; the pin and catchplate have not survived. Dimensions: preserved length: 3.0 cm (Fig. 5: 3).

13. Fragment of what possibly was a belt fitting comprised of two thin iron plates connected by a rivet. Dimensions: 1.5 × 1.7 cm and 2.4 × 2.1 cm (Fig. 5: 4).

14. Elements of horse harness:

a) Fragment of an iron bit – a round bit rings and their ferrules. Dimensions: wire thickness: 0.6 cm; outer diameter of the ring: 5.3 cm; inner diameter: 4.2 cm (Fig. 5: 5).

b) Bronze ring, rhomboidal in section, slightly rounded from the inside (perhaps due to use-wear). Dimensions: outer diameter: 2.7 cm; inner diameter: 1.6 cm (Fig. 5: 6).

c) Fragment of a bronze object bent into a hook, faceted in section, with one end damaged (broken off). Dimensions: height: 1.6 cm; width: 1.5 cm (Fig. 5: 7).

d) Iron fitting. A massive artefact with a ribbon-like semi-circular bow passing into two broad plates set parallel to each other (both are rectangular in outline, with rounded corners) and bound with two rivets with flat, round heads 0.7-0.8 cm in diameter. The bow is round-sectioned, 0.7 cm in diameter. Dimensions: length: 6.6 cm; width: 4.0 cm (Fig. 6: 1, 1a).

e) Iron fitting. A massive iron object with a semi-circular bow passing into two broad plates set parallel to each other (one rectangular in outline, the other triangular with rounded corners) and bound with a single rivet with a flat, round head and a thick shaft; the bow is round-sectioned, 0.8 cm in diameter. Dimensions: length: 7.6 cm; width: 3.5 cm (Fig. 6: 2, 2a).

15. Fragment of an iron fitting consisting of two plates bound with a rivet with a massive round head. Dimensions: rivet head: 1.5 × 1.1 cm; plates: 2.1 × 2.3 × 0.2 cm and 3.1 × 1.7 × 0.2 cm (Fig. 7: 1).

16. Bronze rivet, type F after Zieling (1989), with a domed head and a round-sectioned shaft. Dimensions: head diameter: 11.4 cm; shaft diameter: 0.2 cm; preserved shaft length: 0.6 cm (Fig. 7: 2).

17. Iron buckle with a simple, rectangular frame with a groove running along its entire perimeter, with the base of the prong wound around the frame (after conservation, only a fragment of the frame has survived, without the prong). Dimensions: 5.2 × 4.2 cm.

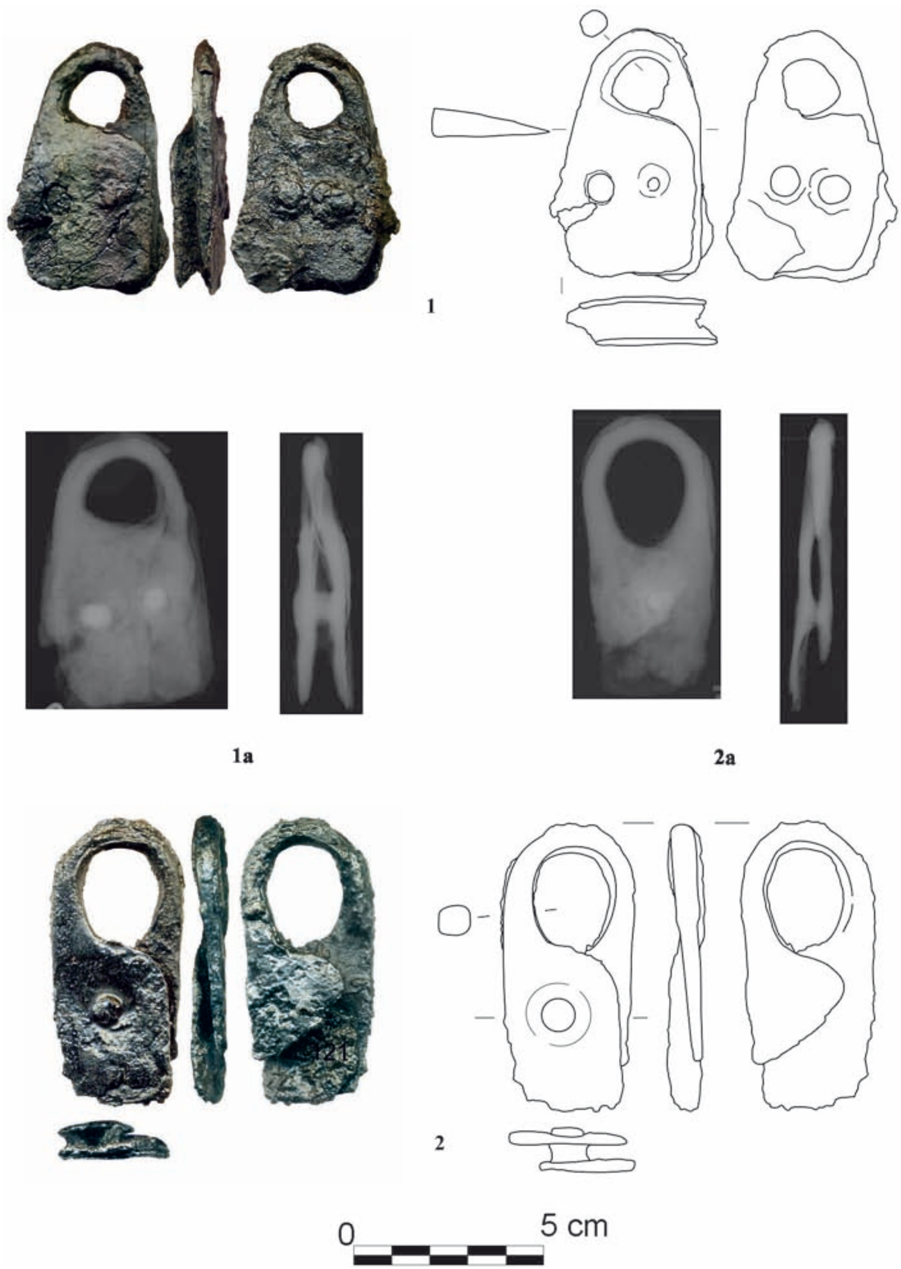


Fig. 6. Ostrów, Site 21, Feature 50 – metal elements of the grave furnishing.
1-2 – iron elements of horse harness (X-ray photos made by Władysław Weker, X-ray Laboratory of the State Archaeological Museum in Warsaw; illustrated by Urszula Socha)

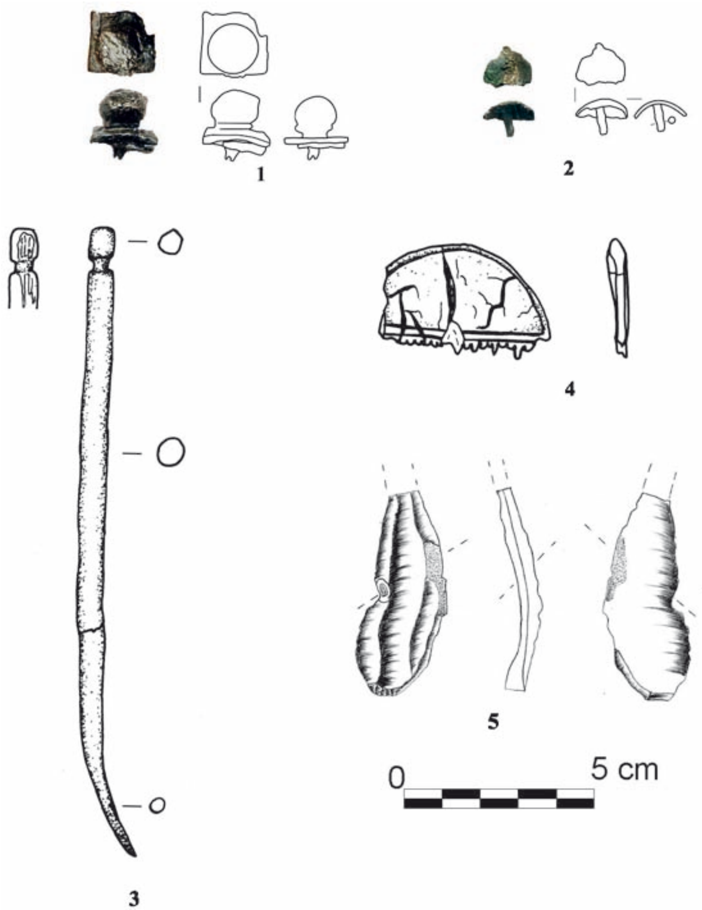


Fig. 7. Ostrów, Site 21, Feature 50 – metal elements of the grave furnishing. 1 – fragment of iron fitting with rivet, 2 – bronze rivet, 3 – bone pin, 4 – antler horn, 5 – flint blade
(1-2 – illustrated by Urszula Socha; 3-4 – illustrated by Anna Lasota-Kuś; 5 – illustrated by Wojciech Mika)

18. Trapezium-shaped sandstone whetstone. Dimensions: length: 10.2 cm; width: 4.2 cm.

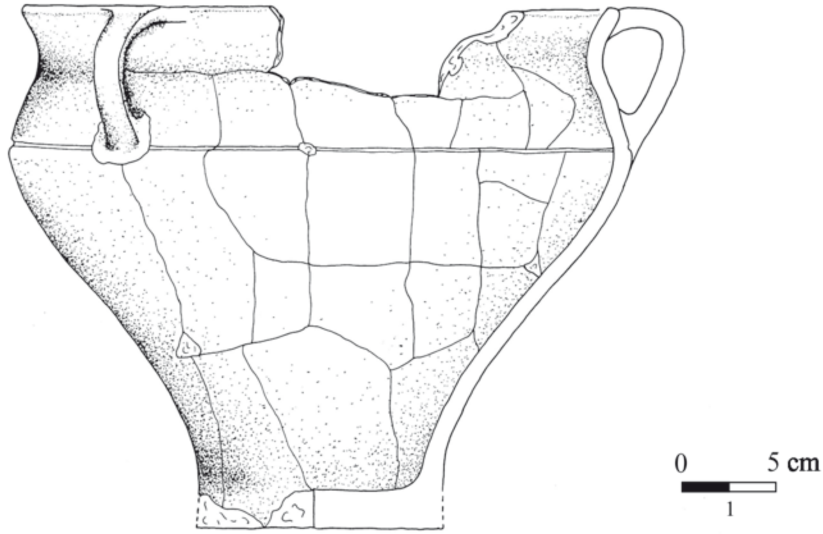
19. Fragment of a round-sectioned iron wire. Dimensions: length: 2.6 cm; diameter: 0.5 cm.

20. Fragment of a ribbon-shaped iron object, rectangular in section, fragmentarily preserved.

21. Fragment of a fitting made of sheet bronze, with 0.3 cm-wide edges bent, with a hole for a rivet.

22. Two bronze sheet fragments, one with a rivet shaft embedded.

23. Iron rivet with a round head and a 1.6 cm long shaft.



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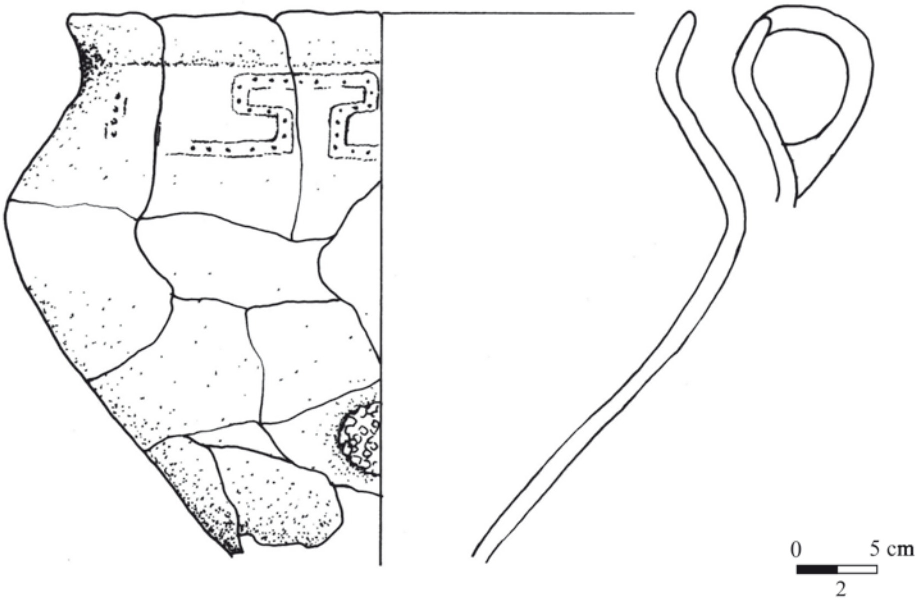

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Fig. 8. Ostrów, Site 21, Feature 50 – clay vessels (illustrated by Anna Lasota-Kuś)

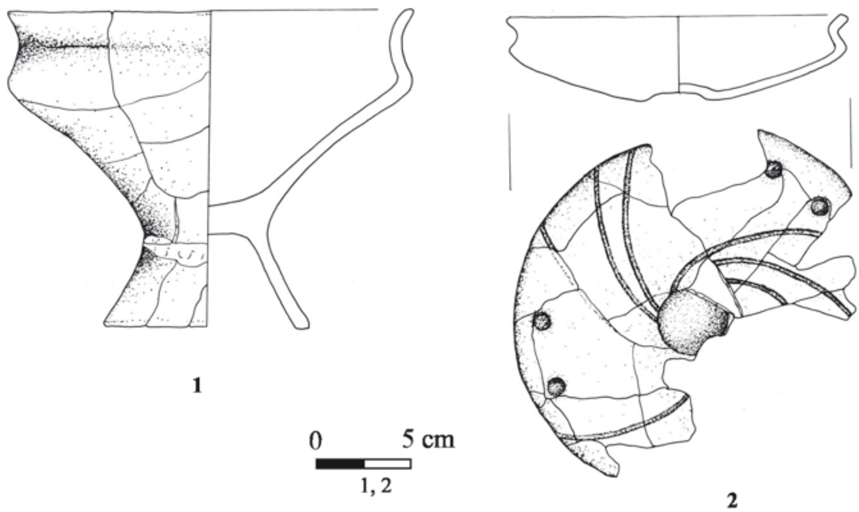

Fig. 9. Ostrów, Site 21, Feature 50 – clay vessels (illustrated by Anna Lasota-Kuś)

24. Three fragments of iron sheet with two rivets (perhaps fragments of a shield grip), Dimensions: 5.1 × 6.5 × 0.1 cm; rivet heads are round and domed, 0.6-0.7 cm in diameter.

25. Fragment of an iron object. Dimensions: 2.4 × 1.0 cm.

26. Fragments of a fitting made of thin iron sheet, with a rivet. Dimensions: 2.7 × 2.7; 3.9 × 3.1; 2.0 × 1.0; 2.3 × 1.5; 2.3 × 2.1 cm; thickness: 0.1 cm.

27. Bone pin with a slightly bent shaft and pronounced head, slightly faceted in section. Dimensions: length: 16.9 cm (Fig. 7: 3).

28. Burnt antler comb of Thomas type IA. Dimensions: width: 4.5 cm (Fig. 7: 4).

29. Flint blade, heavily burnt. Dimensions: length: 4.4 cm; width: 2.4 cm (Fig. 7: 5).

30. Burnt flint blade, preserved in two fragments. Dimensions: length: 5.4 cm; width: 1.9 cm.

31. Ceramic vessels (all of them handmade):

a) Vase (urn) of type II/3 after T. Liana (1970), fully preserved, with everted rim, with the maximum body width clearly pronounced and emphasised by a circumferential incised line, and placed slightly above the middle of the vessel's height; base distinctly smaller than the rim in diameter; the vase has three knee-like handles; the surfaces are smooth, blackened, matt, and the ceramic fabric has no discernible temper. Dimensions: rim diameter – 32 cm; base diameter – 13 cm; height – 27.5 cm (Fig. 8: 1).

b) vase of type II after T. Liana (1970), secondarily burnt to a significant degree, with everted rim, with the maximum body width clearly pronounced; the base part is missing; the vessel has one ribbon handle; decoration in the form of a poorly legible symmetrical meander made of bands of incised lines filled with hollows can be seen on the shoulder; mottled surfaces of brown-grey colour, with pieces of melted glass adhering in places to the inner and outer walls (probably remains of a glass vessel), ceramic fabric tempered with sand. Dimensions: rim diameter – 28 cm (Fig. 8: 2).

c) vase on a high, hollow foot, slightly secondarily burned, nearly complete, with slightly everted rim and the maximum body width clearly pronounced and located above the mid-height; surfaces are smooth and brown; no discernible temper. Dimensions: rim diameter – 21.5 cm; base diameter – 11 cm; height – 16.8 cm (Fig. 9: 1).

d) fragments of a bowl of type VI/2 after T. Liana (1970), slightly secondarily burnt, incomplete, with everted rim, sharply profiled body, and concave base; the body is decorated with groups of three arched incised lines, with the groups separated from each other by two hollows; mottled surfaces of brown-grey colour, no temper discernible in the ceramic fabric. Dimensions: rim diameter – 18 cm; height – 4.5 cm (Fig. 9: 2).

e) fragments of a bowl of type VI/2 after T. Liana (1970), strongly secondarily burnt, deformed, incomplete, with everted rim, strongly profiled body, and slightly rounded base; the surfaces are smooth, mottled, of brown-grey colour, no discernible temper in the ceramic fabric. Diameter: approx. 12 cm.

f) fragments from the lower part of a secondarily burnt vase with the base formed into a high foot with a circumferential rib; the surfaces are smooth, no discernible temper.

g) several sherds, strongly secondarily burnt, including a tiny fragment of a vessel with an everted, rounded rim and smooth, mottled surfaces of brown-grey colour, with no temper discernible in the ceramic fabric.

h) body sherd from a medium-walled vessel with coarse surfaces of grey colour; abundantly tempered with medium-grained crushed stone.

i) body sherd from a medium-walled vessel with coarse surfaces of brown colour, sparsely tempered with medium-grained crushed stone.

j) eight tiny, burnt sherds originating from different vessels, with brown and grey surfaces.

32. Burnt human bones (1306 g) of an adult male.

ANALYSIS OF THE MATERIAL

Weaponry and equestrian equipment

Among the grave goods uncovered in Grave 50, the iron double-edged sword with the grip terminating in a ring and with a rectangular, bar-like crossbar is a unique find. The slightly oval ring, rhomboidal in section, was attached to the tang with two rivets. The sword had been intentionally broken in two and placed next to the urn along with the rest of the furnishings.

Swords of this kind are described in the literature as *Ringknaufschwerter* and are thought to have been products of Roman workshops (Kaczanowski 1992, 27, 28). Other than by their ring-like pommels, these swords do not differ from other weapons of that period, and in typological terms most of them are classed as a gladius, semi-spatha, or spatha (Miks 2017, 118). According to the classification by M. Biborski, the sword from Ostrów should be included in type I of swords with ring-like pommels, dated to phase B2 of the Early Roman period and phase C1 of the Younger Roman Period (Biborski 1994, 86, 87) and sometimes referred to as the Počaply-St. Margrethen type (Biborski 2020, 416). It is worth noting the dimensions of the specimen in question, unique on the European scale for a weapon of that type. While most such swords do not exceed 80 cm in length, the one from Ostrów is no less than 96 cm long.

Roman swords with ring-like pommels are exceptionally rare finds in Przeworsk culture materials. Previously, the only specimen known from the territory of Poland was that discovered in the cemetery at Site 1 in Krupice, Siemiatycze District, in Grave 106 dated within phases B2b-B2/C1 (Biborski *et al.* 1997; Jaskanis 2005, 32, 95, pl. 28: 1). Another sword of the discussed type comes from the Przeworsk culture cemetery in Rankovce, okr. Košice, in south-eastern Slovakia. It was found there in Grave 4, which held the burial of a warrior furnished, among other objects, with what is described as a complete set of weaponry. Apart from the sword, the set included a shield and a spear. As in Ostrów, this was probably the grave of a mounted warrior, as indicated by the presence of two iron spurs (Rákoš 2019, 220).

A *Ringknaufschwert* was also found in a warrior grave in the cemetery in Sekule, okr. Senica, south-western Slovakia (Rajtár *et al.* 2019, 131), where the bulk of the graves date within phases B2-C1. In the Roman period, this area was primarily inhabited by the Quadi. However, it has been demonstrated that a number of artefacts from the Sekule cemetery reveal links with the northern reaches of Central European *Barbaricum*, including with the Przeworsk culture. Graves furnished with such artefacts should be seen as reflecting migrations from the aforementioned areas during the Marcomannic Wars (Rajtár *et al.* 2019, 133).

A recent examination of a *Ringknaufschwert* found on the agora of Paphos, Cyprus, produced interesting results. The analysis indicated that the characteristic Roman pommel had been attached to a blade that most likely was a barbarian product. It was even hypothesised that the sword's owner might have been a warrior originating from the Przeworsk culture area (Biborski 2020, 416).

There is a view in the literature that the impetus for the appearance of swords with ring-like pommels of the discussed type in the Roman army came from contacts with the Sarmatians, who used similar swords (Biborski 1994, 90, 91). Perhaps the design was adopted during the Dacian wars of Emperor Trajan, in which Sarmatian tribes were also involved (Sadowski 2004, 275). However, the Roman version of the grip was not a direct copy of the Sarmatian weapons. As mentioned, the ring was forged independently and

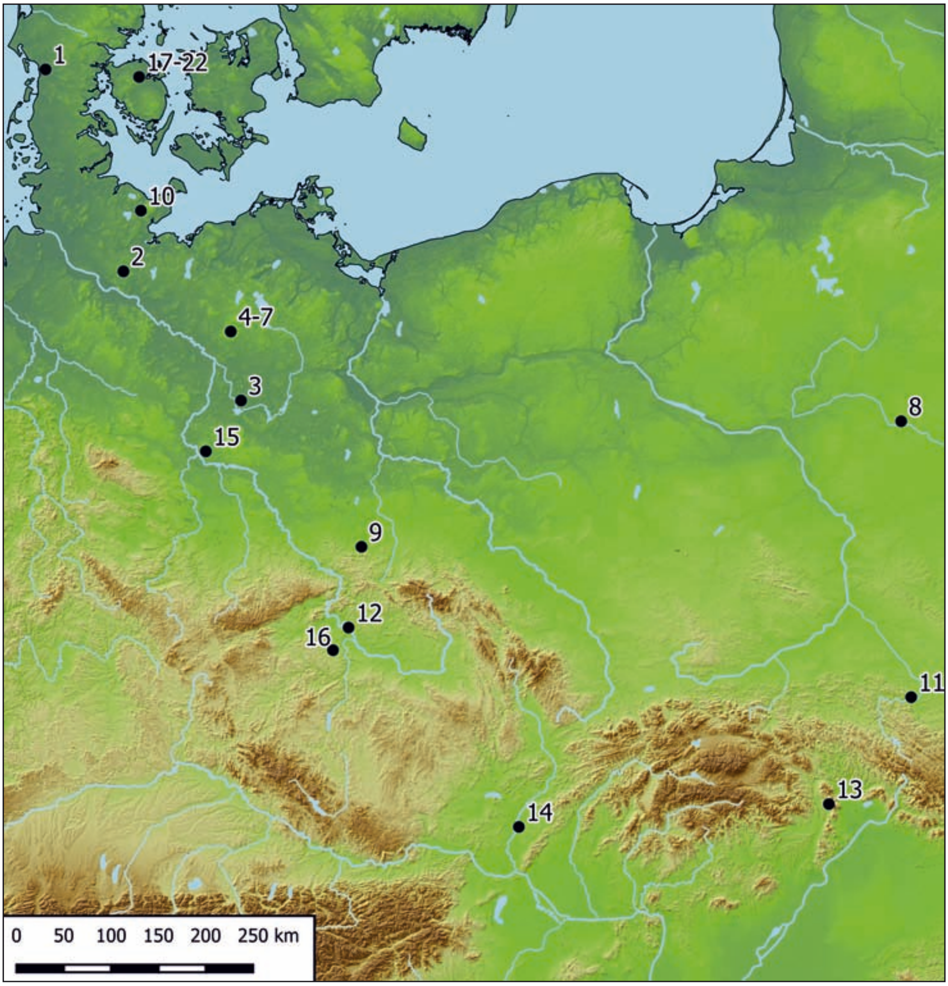

Fig. 10. Distribution of *Ringknaufschwert*-type swords in *Barbaricum*.
1- Brokjaer Mark, Hjortlund, Ribe, grave (Raddatz 1961, 32, fig. 5: 3), 2 – Hamfelde, Kr. Herzogtum Lauenburg, Grave 665 (Bantelmann 1971, 162, pl. 96), 3 – Hohenferchesar, Kr. Westhavelland, grave (Raddatz 1961, 36, fig. 8: 4), 4-7 – Kemnitz, Kr. Potsdam-Land, Grave 430, 455, 508 and destroyed Graves 589-593 (Geisler 1974, 50, 53, 58, 67, pl. 39, 43, 48, 57), 8 – Krupice, Siemiatycze District, Grave 106 (Jaskanis 2005, 95, l. 29: 1), 9 – Litten, Kr. Bautzen (Meyer 1971, 144, fig. 80), 10 – Malente-Krummsee, Kr. Ostholstein, Grave 79 (Raddatz 1961, 28, fig. 1: 1), 11 – Ostrów, Przemyśl District, Grave 50, 12 – Počaply, okr. Melnik (Schranil 1928, fig. 9: 6), 13 – Rankovce, okr. Košice, Grave 4 (Rákoš 2019, 220, fig. 3), 14 – Sekule, okr. Senica, Grave K (Rajtár *et al*. 2019, 131), 15 – Töppel, Kr. Zerbst (Mildenberger 1949, 25, fig. 1), 16 – Třebusice, okr. Kladno, grave (Keller 1966, 196), 17-22 – Vimose, Odense, Funen, swamp find (Engelhardt 1869, pl. 19: 5; Hundt 1953, 109, 110, pl. 8: 3-7; Kaczanowski 1992, 85) (illustrated by Aleksandra Sznajdrowska-Pondel and Anna Lasota-Kuś)

attached to the tang with rivets, meaning it could be attached to any type of blade (Miks 2017, 118). The sword from Paphos provides a perfect illustration here.

In *Barbaricum*, most of the *Ringknaufschwerte* appeared during the Marcomannic Wars in the northern part of the Elbe Germanic complex, Schleswig-Holstein, and Denmark (Raddatz 1961, 26ff; Kaczanowski 1992, 27-30), as well as in the Czech Republic (Droberjar 1999, 5, pl. 17) (Fig. 10). At least one specimen is known from the Hamfelde cemetery in Schleswig-Holstein, from Grave 665 (Bantelmann 1971, pl. 96: 665a), while those discovered in Graves 277, 302, and 403 are considered Germanic imitations (Bantelmann 1971, 23, 112, 115, 129, pl. 36: 277a, 40: 302g, 61: 403a; Kaczanowski 1992, 27, 28).

In the analysed Grave 50 from Ostrów, the sword was accompanied by an iron ribbon-like scabbard pendant, which makes a Roman provenance of the scabbard likely (Fig. 4: 1). The pendant finds closest analogies in Kaczanowski's type VI of scabbard slide, occurring in the Central European *Barbaricum* during phases B2 and C1 (1992, 40, 41, fig. 10: 2).

The grave also contained shield parts: a boss and a grip. The boss, with a blunt spike, represents type J7a1 after T. Liana (1970) (Fig. 2: 2). It is worth noting the presence of rivets of different head shapes: one cruciform and one resembling a trefoil. This difference can be assumed to reflect repairs, possibly involving the replacement of rivets. Boss and grip rivets with cruciform or star-shaped heads are extremely rare in the Przeworsk culture area. Such rivets were found with a J7a boss in Grave 20/1938 in Tarnów, Opole District, Site 3 (Godłowski and Szadkowska 1972, pl. 29: 8), and rivets with irregularly formed heads nearing the shape of a cross were found with a conical boss from Grave 82 at Site 1 in Opatów, Kłobuck District, dated very precisely to phase C1a (Madyda-Legutko *et al.* 2011a, 46; 2011b, pl. 11: 12).

The shield grip discovered in Grave 50, with separated plates and with preserved rivets with small, round, flat heads, represents type J9, particularly characteristic of the developed stage of phase B2 (Liana 1970, 453; Godłowski 1992,72).

The hafted weapon heads from Grave 50 differ significantly in size (Fig. 3: 1, 2), which probably indicates their different functions (one belonged to a spear and the other to a javelin). It has been observed that the custom of placing two different heads in a grave is especially clear in phase B2b (Kontny 2019, 29). The larger specimen (29 cm) represents type XIII in Kaczanowski's classification. Such artefacts essentially occur in the developed stage of phase B2 and are incidentally found in assemblages from the beginnings of the Younger Roman period (Kaczanowski 1995, 22).

The second head, smaller, belongs to type VIII variant 3 acc. to Kaczanowski, occurring in assemblages from the developed stage of phase B2, but sometimes also in phase C1a (Kaczanowski 1995, 19, 63, pl. 9: 5). On one side of the blade, near the centre, there is a decoration in the form of punched isosceles triangles pointing towards the spine and framed by punched semicircles. Traces of lines (one single and one double) have also survived along the spine. In the past, the ornament of negative triangles tended to be interpreted in the literature as a manifestation of Wielbark culture influences in the eastern zone of the Przeworsk culture (Kaczanowski and Zaborowski 1988, 236). This view was recently challenged based on new finds that confirmed that spearheads with such decoration also occurred in the western range of the Przeworsk culture and in the Baltic area. The specimen from Ostrów is most akin to Kontny type 1 (Kontny 2017, 195, 198, 199 – here a full list of spearheads decorated with negative triangles), whose chronology was determined as phase B2b and the very beginning of the Younger Roman period (Kontny 2017, 198).

The iron spur of Ginalski type E2 found in Grave 50 is characteristic of phase B2 of the Early Roman period and phase C1a of the Younger Roman period (Ginalski 1991, 62). It should be noted that it was precisely at the beginning of the Younger Roman period when the custom of placing spurs in a grave reached the peak of its popularity in the Przeworsk culture, and these were most often single specimens, as in Ostrów (Kontny 2009, 100-102).

Elements of horse harness

As mentioned above, the objects found in the discussed grave from Ostrów included elements of horse harness. It needs to be emphasised that such artefacts are very rare finds in graves of Przeworsk culture warriors (*cf*. Kontny 2009). In the developed stage of the Early Roman period and in the Younger Roman period, the custom of placing horse tack pieces in male burials was popular in the Sarmatian milieu. The contacts between the Przeworsk culture population and this milieu have already been confirmed in the literature (Dobrzańska 1999).

The iron ring with fragmentarily preserved ribbon fittings (Fig. 5: 5) found in Grave 50 should be interpreted as a fragment of a horse bit. It refers to the type 2C of M. Ørsnes (1993). Similar forms, made of non-ferrous metals, are known from the bog site in Thorsberg (Lau 2014, pl. 4-7). Fragments of a bit of similar construction were found in the burial of a Sarmatian warrior from Kobyakovo on the lower Don River, dated to the second half of the 2nd century AD (Guguev and Bezuglov 1990, fig. 3: 8-10).

The two massive iron fittings in the form of a bow passing into two plates bound by rivets (Fig. 6: 1, 2), interpreted as elements of horse harness, find no analogy among Przeworsk culture material. Somewhat similar artefacts incidentally occur in Sarmatian sepulchral assemblages, with examples known from the Great Hungarian Plain, among other places. In male Grave 28 in Hévízgyörk, Pest District, analogical fittings co-occurred with other elements of horse harness, including a bit (Dinnyés 1991, pl. 14: 18; 15: 17). In addition, two such fittings made of bronze were discovered in Barrow Grave no. 4 in Vizesdpuszta (today Vizejdia, Romania), where the grave goods also included a sword and elements of horse harness (Vaday 1986, fig. 1.1: 15, 16). Outside the Great Hungarian Plain, in the Sarmatian milieu such artefacts also occur in graves of warriors from the Azov cemetery in the lower Don basin, which are dated to the close of the 2nd century and the early 3rd century AD (*cf*. Istvánovits and Kulcsár 2003, 232, fig. 5: g). This group of burials defines a specific Hévízgyörk-Vizesdpuszta-Azov horizon of archaeological finds, dated to the second half of the 2nd century to the third quarter of the 3rd century AD (Grumeza 2016, 446-448), which in terms of relative chronology of Central European *Barbaricum* corresponds to Eggers' (1955) phases C1a-C2. Apart from the area discussed above, analogical artefacts are known from the 3rd-century AD Grave 222 in Neyzas cemetery in Crimea, where they were found among other elements of horse harness (Khrapunov 2006, fig. 2: 18, 19).

Referring to the discussed fittings, Hungarian archaeologists use the term "harness buckle without spike". According to reconstructions created by A.H. Vaday, they belonged to a leather strap being part of a bridle (Vaday 1986, fig. 6: 7). It is worth noting, however, that the finds from Ostrów were more massive, so they may have had some other function in horse harness.

It is also worth noting two small artefacts of analogical construction discovered in the princely grave in Mušov in Moravia. They escaped the attention of the authors who published that assemblage, although a drawing of one of them features in one of the plates (Peška 2002, fig. 7c: G18). Apparently, they were mistakenly interpreted as elements of furniture (Peška 2002, 14 – here as ivory artefacts). However, in light of the above, they should likely be seen as horse harness pieces of Sarmatian provenance. In this context, it is worth noting that three artefacts from the Mušov grave, two belt appliques and a spearhead, feature motifs that were recently proposed to be interpreted as Sarmatian tamgas (Voroniatov 2012, 185-189).

Another artefact probably related to horse harness is the bronze ring of roughly rhomboidal section (Fig. 5: 6), akin to type 2a of horse harness rings in Wilbers-Rost's (1994) classification. According to Wilbers-Rost, such rings, while very rarely found, should essentially be linked with phase C1 of the Roman period (Wilbers-Rost 1994, 57). The small fragment of unidentified bronze object of faceted section may perhaps also be an element of horse harness (Fig. 5: 7).

Ornaments, dress items and personal equipment

The analysis of the chemical composition of the richly decorated pelta-shaped pendant revealed that the artefact is made of electrum (gold 60%, silver 38.94%; the analysis was performed by M. Biborski in the Laboratory of Archaeometallurgy and Conservation, UJ Institute of Archaeology).

Such artefacts are referred to in the literature alternatively as kidney-shaped (Pinar *et al.* 2007, 580; Krupiewski and Lewandowska 2013, 186), heart-shaped (Rudnicki 2009, 422), crescent, or pelta-shaped pendants (Tempelmann-Mączyńska 1986, 378; Rodzińska-Nowak *et al.* 2021), or lunulas (Biborski and Kazior 1997, 115). Each of them has its individual shape and decoration, and it is difficult to find two similar pieces. Pelta-shaped, three-way/horned lunulas are known throughout Europe, as far as the Urals (Åberg 1919, 102, 103; Kropotkin 1978, 157; Shukin and Sherbakova 1986, 198, 199; Tempelmann-Mączyńska 1986; Werner 1988, 275-277; Ambroz 1989, 100, 118, 120; Kargopoltsev and

Bajan 1993; Rudnicki 2009). As with other crescent ornaments, they are dated from the Roman to Early Medieval period (*cf.* recently Rodzińska-Nowak *et al.* 2021 – with complete literature for sites from the territory of Poland).

It is worth mentioning that Roman-period electrum artefacts are very rare finds in Poland (Madyda-Legutko *et al.* 2010, fig. 2; Natuniewicz-Sekuła 2020, 40). In this context, their relative concentration in south-eastern Poland is noteworthy. Apart from the artefact from Ostrów, a spherical pendant and another one in the shape of an axe were discovered in the Gać cemetery in Przeworsk District, Site 1 (Lasota-Kuś and Madyda-Legutko 2018, 298, 301).

The position of the pendant in the grave, at some distance from the remaining artefacts, and the absence of any mechanical or thermal damage (revealed by other elements of the grave assemblage) may indicate that the artefact did not belong to personal equipment of the deceased, and was instead a kind of gift from the world of the living (Madyda-Legutko *et al.* 2005, 185; Błażejewski 2007, 101, fig. 64; Skóra 2008, 7). There is a view in the literature positing that the Roman period gold pendants known from Poland were indicators of high social status (Rodzińska-Nowak *et al.* 2021, 350).

The iron ribbon-like brooch should be seen as a specific variant of group V series 11, known as the Leonów type (Fig. 5: 3). This type is regarded as a form characteristic of the western range of the Przeworsk culture, where such brooches occur primarily in warrior graves dated to the close of phase B2 (Jamka 1963, 70ff; Godłowski 1977, 22f).

The antler comb found inside the urn (Fig. 7: 4) represents type IA in S. Thomas's (1960) classification, very common in Przeworsk culture grave inventories. On both sides, it is decorated with two parallel incised lines above the teeth, and a single incised line runs along the edge. Combs of the discussed type essentially occur in the Early Roman period (Liana 1970, 450).

It is worth noting that the bone pin, also found inside the urn, does not bear clear traces of burning (Fig. 7: 3). Its potential exposure to fire is only indicated by insignificant bending of the shaft. This is a massive specimen with a slightly faceted head, which finds no parallels in the typology of bone and antler pins developed by A. Dulkiewicz (2009). It shows some resemblance to the massive pins from the settlement in Jakuszowice Site 2 (Godłowski 1991, 670, fig. 5: 7-9), although the context in which the latter was discovered points towards a different chronology.

The two burnt flint blades found inside the urn had probably been deliberately placed there. The question of fragments of flint tools, flint blades and flakes appearing in Roman period sites has recently been addressed in the literature in the context of the discussion of such finds originating from graves from the Nejzac cemetery in Crimea. The results of that research, which included traseological analyses, indicate that those flint objects were used for striking fire (Mączyński and Polit 2016, 187-190), and this is how we should probably interpret the finds from Grave 50 in Ostrów as well. Grave 50 also contained a fragment of a bar-like firesteel, probably part of a fire-striking set together with the flint blade. In the

Przeworsk culture, a set consisting of a flint blade and an iron firesteel has so far been found in the cemetery in Czarnocin, Piotrków Trybunalski District, in Grave 8 dated to phases B2/C1-C1a (Mączyńska and Jagusiak 2002, 356, 360, pl. 4: 21, 22) as well as in the cemetery in Zapowiednia, Września District in Grave 2, belonging to this same chronological phase (Ciesielski 2008, 270).

Another noteworthy find from Grave 50 is the shears, another artefact that can be seen as a status indicator.

Ceramic vessels

The vessels found in Grave 50 represent forms frequently met in Przeworsk culture assemblages during the Early Roman period and the beginnings of the Younger Roman period. Nevertheless, some references to the stylistic characteristic of the eastern range of that culture are evident. They can be seen in the presence of large vases (Fig. 8: 1, 2), including one provided with three knee-like handles (*cf.* Andrzejowski 2001, 80). A beaker on a high, hollow foot (Fig. 9: 1) finds no analogies in T. Liana's typology (1970), but such vessels, including examples with openwork feet, are known from some sites on the upper Vistula and on the upper and middle San (Madyda-Legutko *et al.* 2006, 397; Podgórska-Czopek and Czopek 1991, 107, fig. 15; Lasota-Kuś in print).

CHRONOLOGY AND CONCLUDING REMARKS

In light of our findings, the analysed grave assemblage from Ostrów should be dated to the developed stage of the Early Roman period, i.e. phase B2b. The horse harness elements discovered in the grave are of importance to studies on funeral customs of the Przeworsk culture population. The small number of such artefacts previously known from sepulchral contexts suggested a marginal role of the horse in the funeral rite (*cf.* Kontny 2009, 98). The discovery of harness elements, spurs, and an exceptionally long sword indicates that Grave 50 held the burial of a mounted warrior. However, it is not easy to determine how the *Ringknaufschwert* found its way to the grave. It is widely known that the sale of weapons beyond the Roman Empire borders was formally prohibited (Dąbrowski and Kolendo 1967, 419-421). Perhaps the appearance of the sword in question should be linked with a period of turmoil in Central European *Barbaricum* pre-dating the Marcomannic Wars.

The presence of artefacts revealing connections with the Sarmatian milieu is a separate issue. As we know, Przeworsk-Sarmatian contacts in the upper Dniester basin are confirmed as early as the close of the Late Pre-Roman period (Kokowski 1999, 37-40). That these contacts continued in the Early Roman period is evidenced, among other things, by discoveries from south-eastern Poland (recently Kontny *et al.* 2019, 379-381). They became particularly intensive in the second half of the 2nd century and in the first three decades of the 3rd century AD (Shchukin 1994, 486, 491; Dobrzańska 1999, 85, 86; Istvá-novits and Kulcsár 2017, 258-289), which is also when the cemetery in Ostrów was in use. Apart from the horse harness elements discussed above, this direction of contacts is also suggested by a spearhead decorated with tamga symbols (signs typical of the Sarmatian culture) discovered in another grave in Ostrów.

As has already been demonstrated in the literature, connections with the so-called eastern range of the Przeworsk culture are also evident in the cemetery (Lasota-Kuś and Stempniak-Kusy 2019, 85; Andrzejowski 2020, 20, 21). In Grave 50, stylistic traits characteristic of that zone are revealed in particular by the three-handled vase used as the urn. The electrum pelta-shaped pendant decorated with granulation and filigree also deserves particular attention here. The artefact bears no traces of burning, and the place where it was discovered (top part of the grave) suggests the pendant was an offering rather than the personal property of the deceased.

Summing up, it is worth emphasising once again that the artefacts discovered in Grave 50 indicate that the warrior buried there enjoyed a unique status in his community.

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THE CHERNIAKHOV CULTURE IN OLBIA PONTICA IN THE LIGHT OF POLISH-UKRAINIAN EXCAVATIONS 2016-2018

ABSTRACT

Twardecki A. and Buiskikh A. 2021. The Cherniakhov Culture in Olbia Pontica in the light of Polish-Ukrainian excavations 2016-2018. *Sprawozdania Archeologiczne* 73/2, 251-273.

In the paper will be presented the results of archaeological research done by a Polish-Ukrainian team in the years 2016-2018 at the archaeological site Olbia Pontica. The main result of this excavations is the thesis, strongly documented in the archaeological finds, that the last inhabitants of Olbia left this place at the beginning of the 5th century AD and that during the last period of its existence Olbia was strongly connected with the Cherniakhov culture. Additionally, thanks to major concentration of animal bones, the finds allowed research into the meat diet of the inhabitants of Olbia in the 4th century AD. The bone finds also seem to confirm a climate change in that century too.

Keywords: Olbia Pontica, Cherniakhov Culture, Black Sea, Northern Black Sea, Classical Archaeology, Huns

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INTRODUCTION

In 2016, the Polish Archaeological Mission "Olbia" of the National Museum in Warsaw (NMW) began its first excavation season at Olbia Pontica (just south of Parutyne, Mykolaiv Oblast, Ukraine) in cooperation with the Institute of Archaeology of the National Academy of Sciences of Ukraine (IA NASU) as a part of the project "Antiquities of the Black Sea" fully financed by the Polish Ministry of Culture and National Heritage. Preliminary reports and the database of the finds are regularly published on the website of the project (https://blackseaproject.mnw.art.pl/en) There too can be found further basic information about the expedition, this text is partly based on these reports. Since 2019, the project has been continued from the Polish side by Institute of Archaeology and Ethnology of the Polish Academy of Sciences (IAE PAS) under the same personal lead. Since the NMW excavations in Olbia began in 2016, this paper is intended to present the first interesting results after 3-year of research.

The first season was conceived as introductory work. The humus layer was removed, two mounds were partly cleared which, at the end of the season, uncovered a layer of rock rubble visible more or less along the east-west axis and concentrated along the central part of the trench and revealed traces of a functional layer (light-yellow, solid clay surface). There was very large concentration of artefacts in the analysed layers in spite of the relatively small volume of explored soil. There were several tens of thousands of mass finds and 324 objects with particularly scholarly value. The discovered objects represent all periods of the activity of the city – from the beginning of 6th century BC to the end of the 4th century AD and even beyond.

Based on these results, we checked in the field the procedures and field methods both sides of the project were practicing. This was a crucial and very important moment since we have to make documentation in both the Polish and Ukrainian languages. Unification of documentary procedures was therefore crucial for the general process of research at the site. After this first year of common field work, both sides agreed to make minor changes in the originally designed procedures that allow harmonic cooperation at the professional level of these collaborative activities.

It should be mentioned here that field reports are published on the website of the project (see above). Also all objects discovered during three years activity of the NMW mission in Olbia are separately and preliminarily published on the researchable database on the project website (https://blackseaproject.iaepan.edu.pl/en/discovery). A brief preliminary report information is published also regularly in the several publications – especially in *Arkheologichni Doslizhdennia v Ukrayini* (*e.g.* Twardecki *et al.* 2017, 45-52; Buiskikh *et al.* 2020, 124-128).

The Polish mission was a part of the Ukrainian Olbian Expedition headed by Dr Alla Buiskikh (IA NASU) and was directed by Dr Alfred Twardecki (IAE PAS). The most important part in the excavations was always played by the Ukrainian and Polish trench supervisors: Dr Maria Novichenkova (IA NASU) and Dr Piotr Jaworski (Warsaw University). The rest of the team consisted of mixed Polish and Ukrainian archaeologists from different Polish and Ukrainian institutions that were being employed by NMW. During all seasons, the survey and field documentation was done by Ms Magdalena Antos and the documentary team was supervised in 2016 by Dr Inga Głuszek and in seasons 2017-2018 by Ms Diana Święcka. Interpretation of ceramic finds, so crucial for dating of the whole site, was in hands of Dr Sergei Didenko, the glass was processed by Ms Olga Puklina and the huge and very interesting bone collection by Dr Evgeniya Yanish. Another extremely important kind of finds – the coins – were interpreted by Dr Piotr Jaworski. The study of the lamps was in the charge of Dr Irina Sheiko and metal finds, especially remains of armour, were described by Dr Maria Novichenkova, glass beads were described by Dr Andzhelika Kolesnichenko. The interpretation of the painted pottery was shared between Dr Alla Buiskikh and Dr Inga Głuszek. The very small number of fragments of inscriptions was analysed by Dr Alfred Twardecki and finally all *dipinti* by Dr Pavel Diatroptov. The drone aerial photos were taken mainly by Dr Szymon Lenarczyk with the occasional addition of Dr Alfred Twardecki. Dr Szymon Lenarczyk is also responsible for the final orto-photographical processing of the photos.

We would like stress that the Polish expedition would not have been a success without the support of trainees and students from the Ivan Franko National University of Lviv (headed by Dr Anastasia Baukova), from the "Odarennost'" School of Fine Arts of the Kharkiv District Council (headed by Dr Mikhail Fomin) and from the Berdyansk State Pedagogical University (headed by Dr Valentina Papanova) as well as a number of Ukrainian volunteers. Last but not least both authors would like express special thanks to Mr Sergei Shein, acting director of the National Historical and Cultural Reserve "Olbia" of NASU for friendly assistance.

The strategic aim of the Polish expedition was to open a new trench in the area of the Roman Citadel very close to the area of the earlier Trench R-25. The Roman Citadel is located in the southern part of ancient Olbia, right next to the edge of the promontory cutting over 30 metres into the Boh Estuary, or liman. It is this part of the city that was settled since the 6th century BC to the 4th/5th century AD, when the city was finally abandoned. So, we have there the opportunity to research practically all cultural layers of ancient Olbia Pontica. Moreover, there are several earlier trenches in its vicinity (R-25, L, L-1). Additionally, it is the largest area with relative flat profile, which is important in the research process. This gave us the opportunity to make excavations in a relatively untouched area and the results are easy to compare with the earlier results of trenches excavated nearby. Summing up – we hoped to dig an area with a relative clear stratigraphic situation and get a synergetic effect after studying the joint results of research made in other trenches situated in the closest neighbourhood.

The location of trench R-23 (Fig. 1) was selected based on the results of geophysical research done at the very beginning of the 2016 season by Mr Tomasz Herbich (IAE PAS)

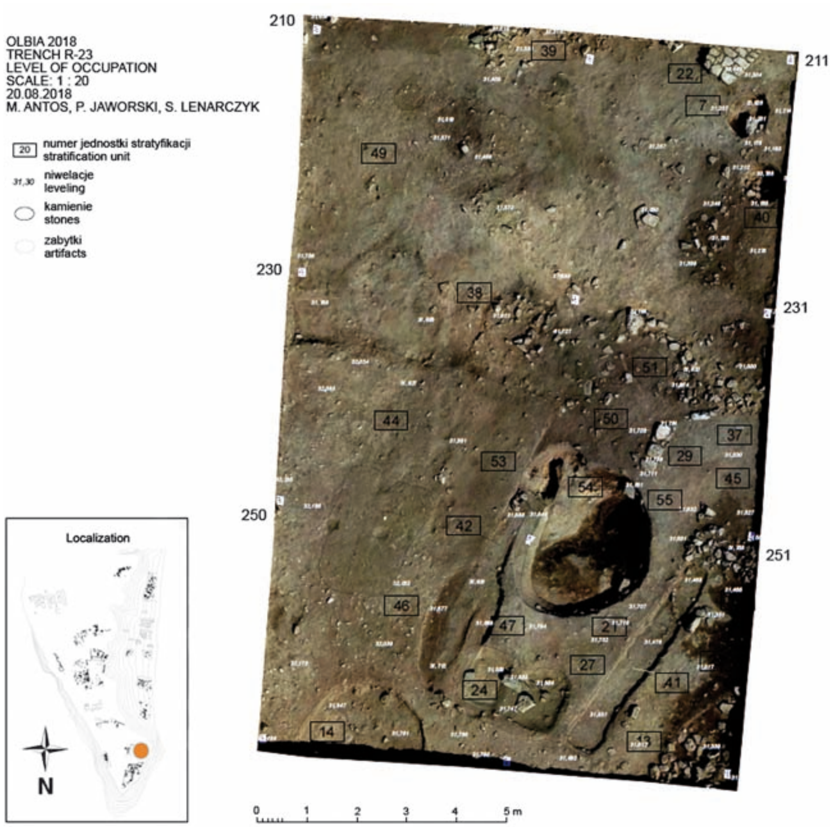


Fig. 1. Ortophotoplan of Trench R-23. General view of the trench at the end of the 2018 season

and, as mentioned above, analysing the topography of the site, especially after taking into consideration the location of several earlier explored trenches in the vicinity. Most important is the trench R-25, located to the south and which has been explored for many years by the mission of the IA NASU. Trench R-23 has been marked out so as to form part of the local site grid that has already been in use for a long time, whose lines follow the north-south and east-west axis. This grid is based on a division into 100 × 100 m squares, which are in turn divided into smaller 5 × 5 m squares. In the first season, we opened four squares (no. 210, 211, 230 and 231). In the second season we added two more squares to the south (nos 250 and 251). In the third season, we did not enlarge the trench, so, after three years the trench area was 150 m^2 (Fig. 2). While marking out the trench, we discovered certain inaccuracies of the existing local grid, which were systematically verified and corrected by Ms Magdalena Antos using an electronic total station. Back dirt piles –

separate ones for soil and stones – were located around 15 m south of the trench, in the hollow of a former trench.

Archaeological research in trench R-23 in the Roman citadel of Olbia was preceded by a thorough survey of archives and bibliographic research, an investigation of the site and precise geophysical surveying of the research location, so as to ensure that results obtained in the future would meaningfully enrich the current state of knowledge on Olbia's history.

A Leica TS06plus electronic total station was permanently present at the trench and used in topographical and documentation activities. The total station served to measure the exact location of the majority of discrete artefacts. A DJI Inspire 1 Pro drone with an attached camera proved to be an invaluable asset in topographical and documentation activities, enabling us to take high-quality vertical and angular photographs. Owing to the

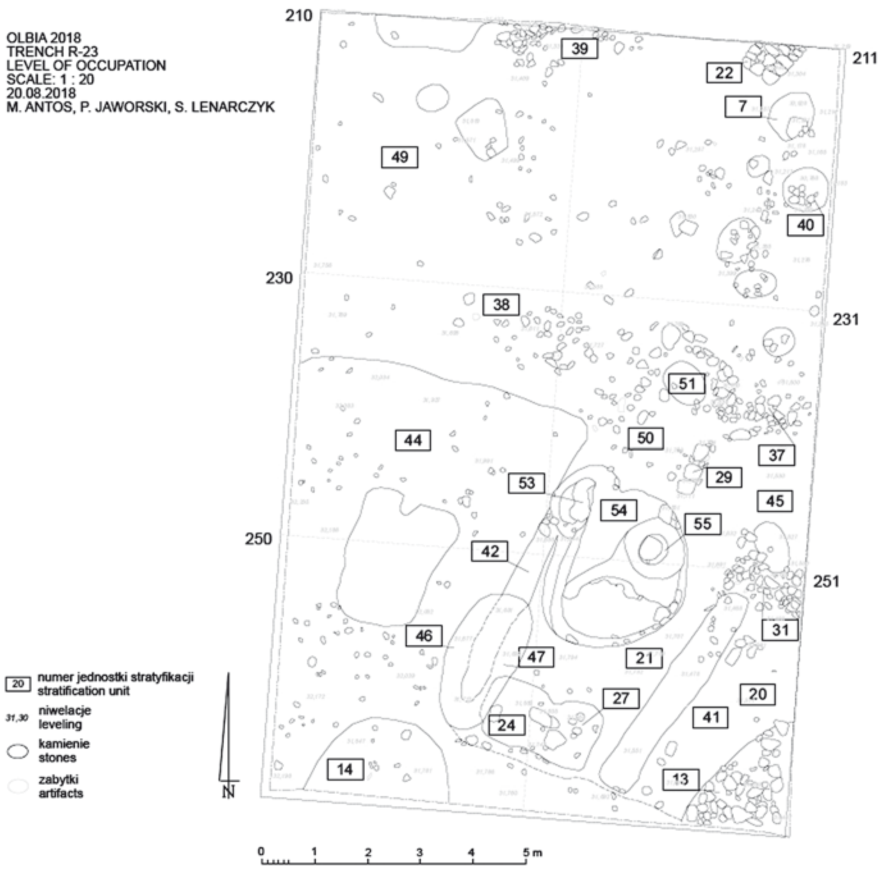


Fig. 2. Plan of Trench R-23 showing situation at the end of the 2018 season with the construction structures from the 4th-5th centuries AD

permanent presence of technically advanced measurement and documentation equipment, it was possible to execute orthophotomaps of the trench at individual stages of excavation work, as well as photogrammetric trench profiles at the end of field work in each season.

Archaeological excavations were conducted based on the stratigraphic method, and particular care was exercised to preserve the proper order of exploring the existing system of layers. The surveying of elevations in the trench was performed on a daily basis, along with a number of additional measurements. Plans of the entire trench were also drawn up at every stage of the work. All discrete artefacts were additionally measured using the total station and then, furnished with a label containing their description, packed and entered into the inventory. A Fisher Lab F70 metal detector proved to be extremely helpful in searching for metal artefacts. It was also used to regularly analyse the spoil heap, leading to the recovery of around a dozen artefacts. In addition to that, soil from the explored layers was meticulously sifted on an on-going basis. Mass objects, mainly ceramics, were laid out on a special patch, where they were systematically classified, described and counted. Fragments of high diagnostic value were moved to the group of discrete artefacts, and the remaining ones were stored in a separate pile of ceramics.

After the end of each year's work, the decision was made to secure the trench against devastation. Such actions are necessary, as the practice of looting the remains of ancient Olbia is currently widespread, as testified, among other things, by the (luckily minor) losses revealed in the central part of the rubble layer on 29 July 2016. The bottom of the trench was secured with plastic sheet, and then covered with two layers of loose soil.

Descriptive documentation – a site notebook, a notebook of topographical measurements and a notebook of stratigraphic units – was systematically kept throughout the archaeological work. Discrete artefacts, particularly ceramics and glass, but also selected stone and metal finds, were documented using drawings. The remaining finds were photographed. Coins were cleaned and then provided with specialist documentation drafted by a numismatist. All discrete artefacts were entered into the computer database. The research documentation is supplemented with a list of drawings and an inventory book.

RESULTS

General Remarks

In the 2018 field season, horizons were reached across the entire surface of the trench that form a part of the unearthed fragment of a settlement level, and whose common feature is their similar chronological age and the mutual spatial dependence of individual stratification units. Based on the state of our knowledge, they form the youngest cultural layer on the site. The unearthed surface can be divided into three zones that differ in soil consistency and probably also in their original functional purpose (Fig. 3).

Utility Area

In the southwest corner of the Trench was what may be interpreted as a utility area. This comprised a deposit of solid light-yellow clay, containing significant amounts of small stones and fragments of ceramics. It forms a working surface falling gently to the north-east. It encompasses the southern part of square 230, the majority of square 250 and the lower edge of square 251. On the eastern side it is bordered by what is interpreted as a residential zone, and on the north both is bounded by another utility horizon (see below). In the southern part of square 250, the continuity of the solid utility area was interrupted by digging a hole (passing under the southern profile of the trench), containing, among other things, numerous fragments of ceramics and an imitation of an Alexander Severus denarius with perforation (inv. no. 89/2018). The homogeneous nature of the deposit and low thickness of the aggradation layer on the top of the earthen floor seems to indicate that in antiquity, cleaning activities were undertaken over the area of used land.

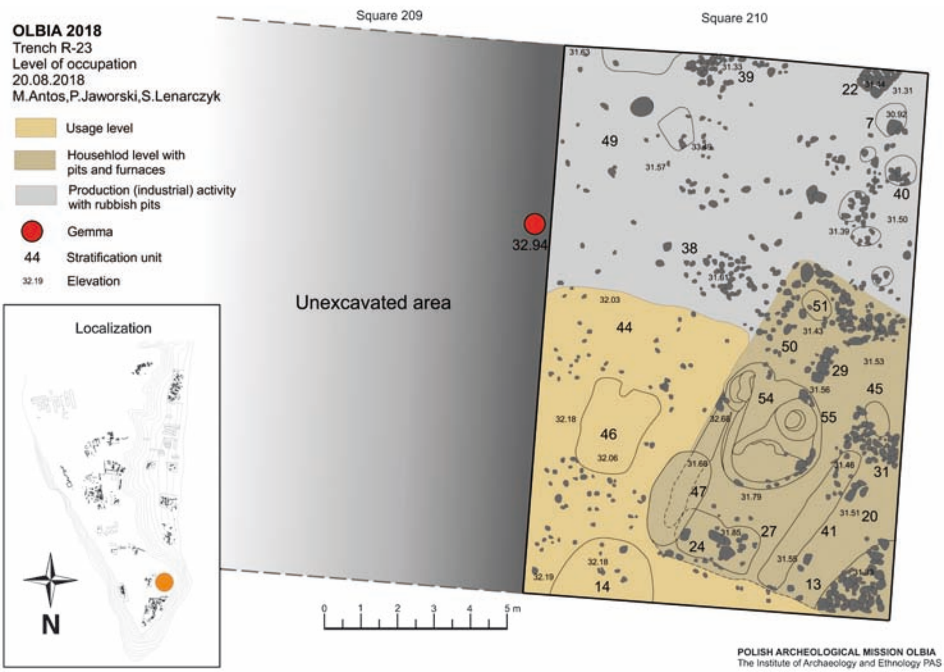


Fig. 3. Plan of Trench R-23 with levels of occupation and the findspot of the gem outside the trench area

Structure and associated layers

To the east of the yellow clay floor is what is interpreted as a residential and utility horizon with pits and furnaces (see Fig. 3). Within this are at least two main groups of stratigraphic units. The first group lies on the west side and consists of an area of about 3 m in width (so-called Room 1), separated by two walls aligned along a southwest – north-east axis (stratigraphic units 18, 19; 41 and 42), preserved in the form of robber trenches (Fig. 4). Southern part of the remnants of the western wall was destroyed, together with the western edge of the furnace (unit 24) and the eastern edge of the earthen floor horizon, by means of a pit presumably aimed at excavating the stones lying on the base of the wall filling (remnants of the foundation?). Such an interpretation of the purpose of this feature is supported by the presence of a significant number of stones in the northern part of the wall trench (unit 42) that was outside the boundaries of this pit. It seems that the original stone fill of the eastern wall has not been disturbed; an Olbian coin (inv. no. 91/2018) and a coin of Geta from the turn of the second and third centuries were found on its base (inv. no. 461/2018). On the southern side, the discussed area ends with a double furnace feature (units 24 and 27). On the northern side, it probably ends about 2 m beyond the northern edge of Pit 1, with a stone rubble layer running crosswise (unit 37), which may be a remnant of a wall structure (this needs to be verified later, first of all by extending the trench in the eastern direction). In contrast to the solid clay floor of the utility level located in the western part of the trench, the area in question, separated by walls, was formed by a layer of compacted soil lying almost horizontally. In the sediments of this part of the site, there

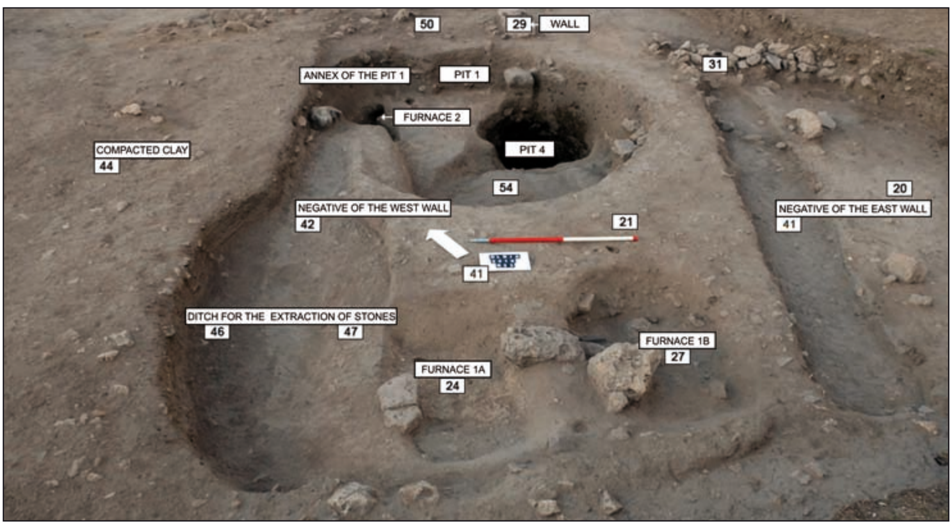


Fig. 4. Photo of the structures with 'Room 1' dated to 4th-5th centuries AD
(illustrated by Piotr Jaworski and Alfred Twardecki)

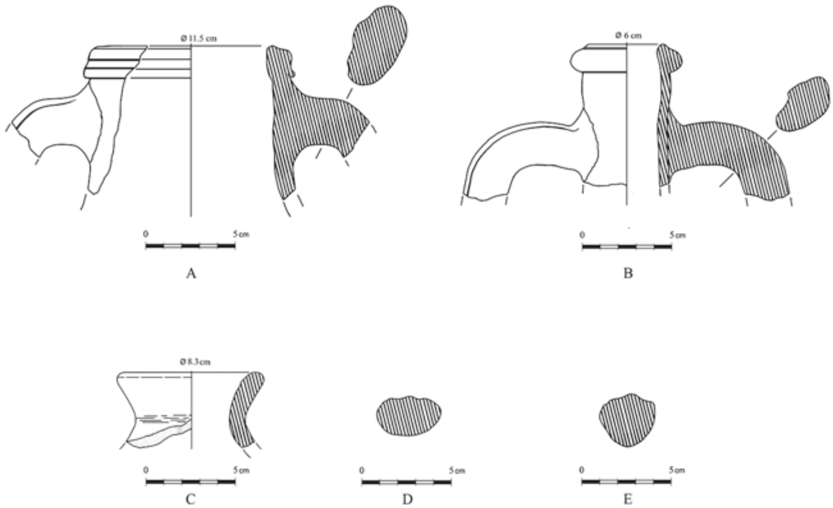


Fig. 5. A – Zeest type 100 amphora; B – Shelov type F amphora; C – Rim of amphora 4th/5th centuries; D – Shelov type F amphora; E – Shelov type E amphora – markers for the dating of the cultural level reached in the trench (illustrated by Serhii Didenko)

were numerous fragments of ceramic material and burnt stones, suggesting that the structure here might have been abandoned as a result of fire. In the central part of the room, a large pit (Pit 1) measuring approx. 2.5 × 3 m was dug out with an annexe, located to the north-west. After they had gone out of use, they had both been backfilled with a homogeneous filling. The bottom of the pit and the annexe, located about 0.5 m below the level of the surface between the walls, in the northern part is formed by a deposit of solid clay and in the southern part compacted soil (unit 54). In the northern profile of the cavity there is a flat, large stone block, possibly forming a part of the original structure of Wall 2. At the junction of the annexe and Pit 1, at the level of the earthen floor of both features, a Roman denarius of Geta was found (inv. no. 461/2018). In the northern part of the junction between the two features, a rectangular outline (approx. 10 × 10 cm) of a posthole seems to indicate the existence of a wooden structure in the pit (roofing?). In the northeastern part of the pit, a smaller Pit 4 with a diameter of about 1.2 m was dug from this level (unit 55), with a stone slab at the bottom. Also, in the annex situated in the northwestern part of Pit 1 – a furnace was found (unit 53), containing numerous pieces of heavily burnt ceramic material, including fragments of amphorae dating back to the 2nd quarter of the 4th century – beginning of the 5th centuries (Fig. 5). Across the pit, a drain running into Pit 4 was cut out from the level of compacted soil. The chronological and functional link between the above-mentioned features of Pit 1 indicates their simultaneous use in late antiquity. The purpose and use of the large pit complex is not entirely clear. Both residential and production functions should be considered. On the surface of the backfill of Pit 1 there is a fragmentarily preserved earthen floor (unit 28), which seems to indicate that this area of the site was utilised after the pit had gone out of use. It should be stressed, however, that at the time of discovery, Pit 1 was a closed feature, containing deposits not disturbed by subsequent destructive processes taking place on the site, and therefore the historical material originating from the pit is key for the dating and interpreting of not only the discussed horizon but also the whole settlement level covered by trench R-23.

The second group of stratigraphic units in this part of the Trench lies to the east of the eastern wall (Fig. 3). This consists of a second utility area (unit 20) whose surface is composed of sediments that are difficult to separate, which indicates heavy use of the space. In 2017, near the wall, a complete, storage pot bearing the features of vessels typical of the Cherniakhov culture was found lying on its side. Several similar specimens were discovered a little further north, in the settlement and production horizon in the northern part of the Trench (see below). The discussed utility level is limited on the north by an adjacent linear layer of stone rubble (wall?) that is perpendicular to the rubble of the western wall and passes under the eastern profile of the trench (unit 31). On the southeastern side, the utility level in question is limited by a pit (unit 13) filled in tightly with stone rubble, which goes beyond the boundaries of the trench, in the southeastern corner of square 251. It is to be hoped that more light will be shed on the discussed eastern part of the residential and utility horizon in the following field seasons as a result of the planned extension of the trench towards the east.

Settlement and production horizon

The settlement and production horizon with pits and rubbish layers (see Fig. 3) is located in the northern part of trench R-23 (Squares 210 and 211 and the northern parts of 230 and 231). To the south, it is limited by the edge of the yellow clay surface of the utility area, and the units comprising the structures discussed above and associated layers. A characteristic feature of this area is the complicated stratification, composed of numerous sediments that are hard to define. These may be the outcome of either intensive human activities in antiquity or several post-deposition geological factors resulting from the location of the trench near the edge of the slope and the gentle descent of the area to the east, or perhaps of both. Within this zone two groups of deposits may be recognised.

The first group (Sediment Deposit Set 1) in character resembles a dump, containing traces of bone artefact manufacturing. It is located in square 210, in the western part of square 211, and along the northern edge of squares 230 and 231 (see Figs 1-3). This series of deposits contains three distinct stratification units. Along the north side of the Trench and only partially visible, is unit 39, which has a limited extent and seems to surround a patch of stone rubble of unclear function. To the south, Unit 49 forms a wide strip across the middle of square 210 in the direction of square 211. This contains sediments that probably

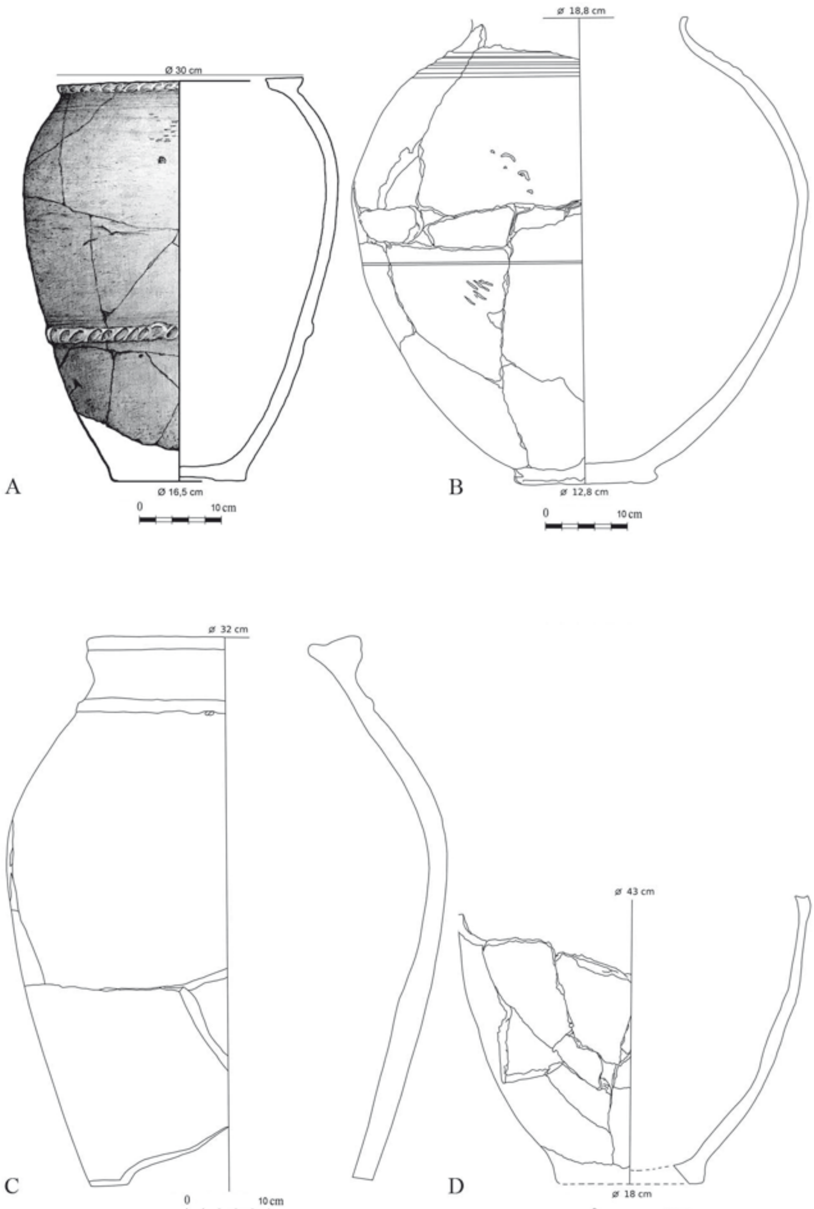
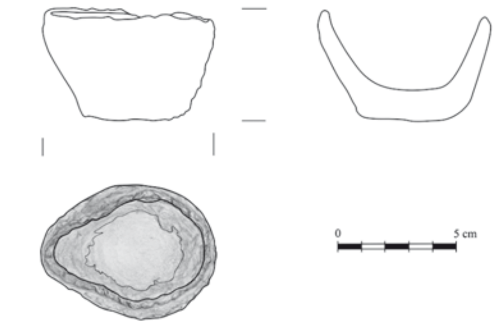
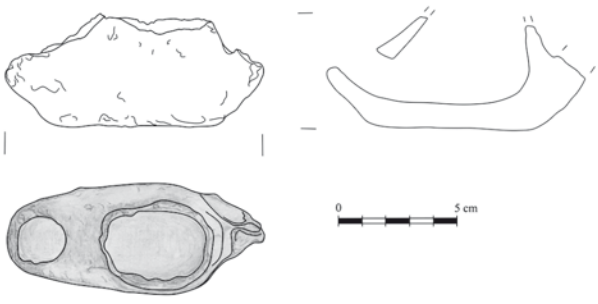


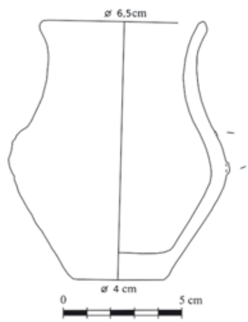
Fig. 6. Large storage vessels typical for Cherniakhov culture – markers for the cultural identity of the inhabitants of the site in the last period of settlement activity (illustrated by Katarzyna Dejtrowska, Angelika Bogusz and Maria Pronobis)



A



B



C

Fig. 7. Ceramic hand-made lamps and pottery vessel typical for the Cherniakhov culture – markers for the cultural identity of the inhabitants of the site in the last period of settlement activity (illustrated by Sylwia Groń and Maria Pronobis)

are the result of intensive use of the surface and frequent levelling performed as part of a cleanup of the utility area. This layer contains large quantities of ceramics (including items dated to the 4^{th} – early 5^{th} centuries A.D. – amphorae of the types Shelov F and Shelov E), as well as burnt lime mortar. To the south of this is unit 38. This lies adjacent to

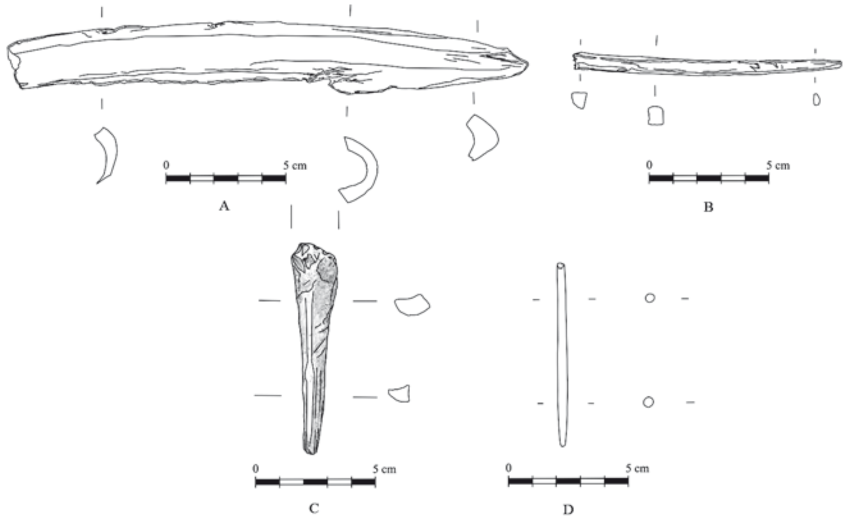


Fig. 8. Bone artefacts found at the place of deposit of *c.* 6000 animal bones (bone workshop): stylus and a bone perforator (illustrated by Maria Pronobis and Katarzyna Dejtrowska)

the north edge of the utility horizon in the southwest corner of the Trench. It stretches both to the north and to the south of another patch of stone rubble. This unit is elongated east-west axis and measures approximately 4 × 2.5 m. In the northern part of this sediment deposit, five large storage pots of the Cherniakhov culture were discovered in the 2017 season, which were re-documented in 2018 after their partial reconstruction and conservation in the winter season (inv. no. 2-5; Fig. 6), as well as two hand-made lamps (inv. no. 2017/162 and 2017/163; Fig. 7: A, B) and a pitcher (inv. no. 2017/242; Fig. 7: C). The latter rested next to a flat stone slab with an almost square cross-section, perhaps serving a utilitarian function (seat?).

In the 2018 season, numerous fragments of raw bone material, as well as semi-finished and finished bone artefacts were discovered here (including piercing tools, a bone pin, inv. no. 34, 35, 142 and 200; Fig. 8), which seem to provide evidence for the manufacture of bone artefacts within this settlement level. The sediment deposits that make up the stratification unit are characterized by a loose, powdery structure with high ash content and traces of burning (fire?). This unit can be interpreted as a rubbish layer, created as a result of piling up and spreading scraps as part of cleaning activities.

The second group of deposits (which may be collectively labelled 'Utility area with small pits 2') was associated with the use of a series of small pits in the eastern part of the trench, in squares 211 and 231 (Fig. 9), covered with a sequence of sediment deposits on a light-yellow solid clay earthen floor, the level of which has been reached so far only in the north-eastern corner of square 211 between Wall 1 (unit 22) and Pit 2 (unit 7). The

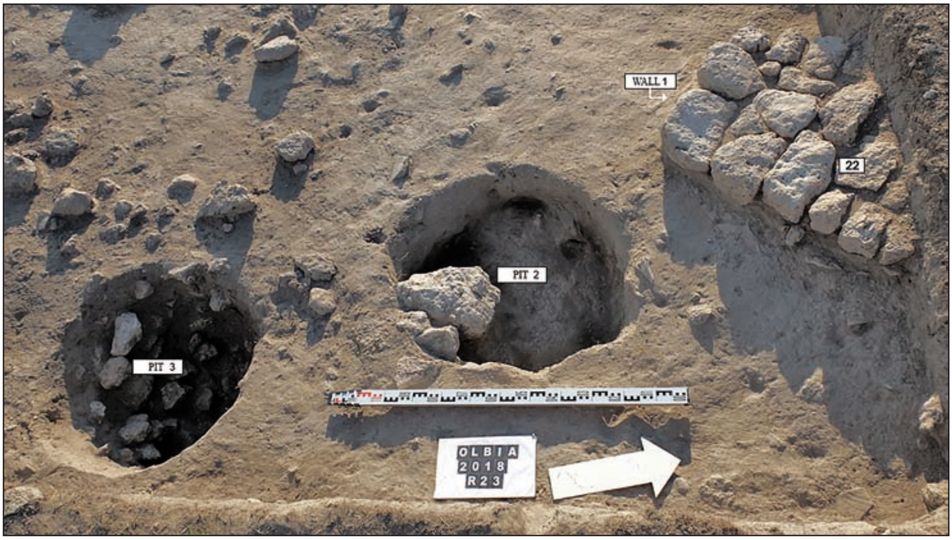


Fig. 9. Wall 1, Pit 2 and Pit 3 situated at the north-eastern corner of the trench – part of the utility area (illustrated by Piotr Jaworski and Alfred Twardecki)

historical material from the two pits (2 and 3) explored so far is not very abundant and contains fragments of Roman and late-antique vessels.

DATING

The main method of dating the site involves ceramics, supplemented by coins. The pottery found in the trench was studied, described and catalogued by Dr. Sergei Didenko (National Museum of Ukrainian History in Kyiv) and the numismatic material was analysed by Dr. Piotr Jaworski (Institute of Archaeology, University of Warsaw).

The archaeological work carried out in the 2018 season, and especially the research conducted within several features selected for exploration, helped confirm preliminary conclusions formulated in the previous season, particularly with regard to the chronology and function of the studied area. Particularly relevant were the findings formulated on the basis of exploration of the horizon of a separate space called Room 1, containing a large pit (Pit 1) with a fairly complex structure (which, as a closed context, was highly representative and useful for the dating of the remaining elements of the uncovered settlement complex from the same period).

Data from stratigraphic analysis and preliminary analysis of the finds indicate that one common settlement level was reached within trench R-23, no earlier than the beginning of the 3rd century (Geta denarius at the bottom of Pit 1), and most probably much later, related to settlements bearing features associated with the Cherniakhov culture. For example, there was a significant percentage of amphorae dating back to the 2nd quarter of the 4th – early 5th centuries A.D. in the fillings of individual components of the closed context of Pit 1 and several whole forms of storage vessels typical of the Cherniakhov culture found in the vicinity (unit 20), as well as a perforated imitation of Alexander Severus denarius, typical for *barbaricum* found in a depression near the room.

Dating based on ceramics (Figs. 5 and 10)

On the basis of Dr. Sergei Didenko's findings, it can be concluded that the late Roman ceramics found in the trench, and in particular the amphorae, dating back to the 4th – first quarter of the 5th century A.D., appeared in most stratigraphic contexts unearthed in 2018.

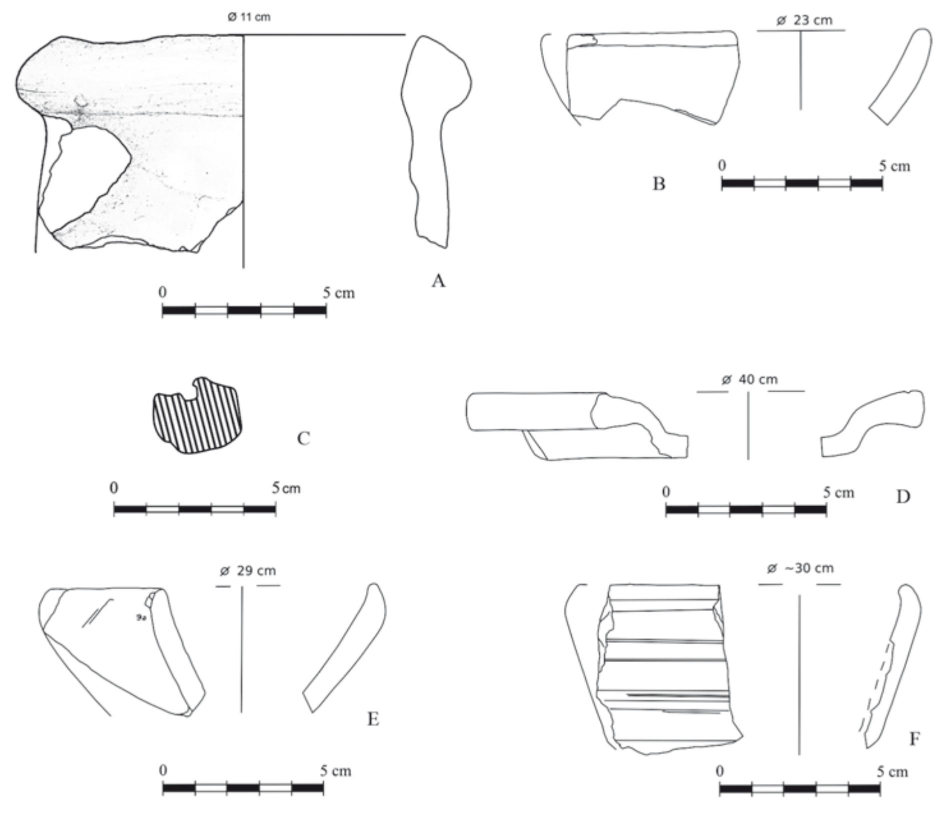


Fig. 10. Imported pottery: A – fragment of an amphora, B – fragment of a red slipped vessel, C – fragment of a handle of a Lirey LRA 1 type amphora, D – fragment of a red slipped plate, E – fragment of red slipped bowl, F – fragment of red slipped bowl – markers for the dating of the cultural level reached in the trench (illustrated by Katarzyna Dejtrowska, Sylwia Groń, Serhii Didenko and Angelika Bogusz)

The main finds are amphorae from Heraclea Pontica, Shelov types E (third quarter of the 4th century – first half of the 5th centuries) and F (second-third quarter of the 4th century), as well as redware vessels from Sinope, Zeest type 100 (4th to 5th centuries A.D., with their production reaching its peak in the second half of the 4th century and the beginning of the 5th century) as well as vessels from centres located on the northern shores of the Black Sea type 1.5 Bettera, Charaks, Abramov's Burial 33 (second half of 4th century – beginning of the 5th century) and eastern Mediterranean amphorae type LRA 1 Benghazi, Railey (end of the 4th – middle of the 7th centuries) which are extremely interesting in this context; an amphorae with a folded rim of unknown origin, dated to the end of the 4th-5th century, according to the stratigraphic context of excavations in Tanais. During the 2018 field season, a significant number of red slip utility vessels of Pontic origin were also found, especially of K. Domżalski's Pontic Red Slip Ware types 1 and 2, which are found in the entire Black Sea basin and are particularly common in Crimean complexes dated to the 4th and 5th centuries (Arseneva and Domżalski 2002, 422-428). In Tanais, this type of ceramic is dominant among red slip ware in layers dated to the 4th to the middle of the 5th centuries. Among numerous ceramic fragments found on site, there was a rim of a Hayes form 67 red slip vessel from the African Red Slip Ware category dated to the 4th – first half of the 5th centuries and produced in North Africa – mostly in the area of contemporary Tunis.

Comprehensive analysis of the ceramic material found during excavation work suggests that the site, including the architectural structure incorporating the so-called Room 1, was still in operation at the end of the 4th and at the beginning of the 5th century.

In this context, one find is especially worthy of notice. The fragment of Benghazi LRA 1 type vessel is of a vessel form that was produced over a relatively long period, from the end of the 4th century to the mid-7th century. If it was in use and deposited at Olbia in the earliest years of its commercial availability in accord with the dating of most of the late antique ceramic material from this Trench, it would not constitute a chronological anomaly in the presented material. However, it is tempting to consider whether such an artefact could provide evidence of some activities taking place in Olbia also in the Byzantine period. For the time being, we leave this issue to be settled later.

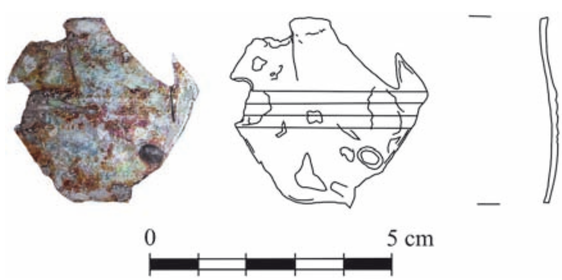


Fig. 11. Glass vessel, photo and drawing – marker for the dating of the cultural level reached in the trench (illustrated by Angelika Bogusz)

Dating based on glass items (Fig. 11)

Among the various glass fragments, a piece of a cup decorated with a blue glass button (unit 48, inv. no. 169) stands out. Glass vessels of this type appeared in the 4th century and were made in the workshops of the Rhine Valley.

Dating based on coins

Numismatic finds (eight coins) helped clarify the dating of some features at the site. The latest dated bronze coin minted in the local mint comes from the 2nd/3rd century (inv. no. 91, Fig. 12) and was found under a layer of stones on the bottom of the southern part of the robber trench of the eastern wall of the so-called Room 1 (unit 41). Two Roman denarii come from the same period: a Geta denarius (200-202 A.D., inv. no. 269, Fig. 13) and a cast imitation of denarius of Alexander Severus (original – 222-228 A.D., inv. no. 89, Fig. 14) with a hole drilled in the right field of the obverse. The Geta denarius was found at the bottom of the annex to Pit 1 (unit 52), on the edge of a small furnace shared with Pit 4,

Fig. 12. Latest coin from local mint (2nd-3rd centuries AD) found in the trench – marker for the dating of the cultural level reached in the trench (photo by Szymon Lenarczyk)

Fig. 13. The Geta denarius (200-202 AD) – marker for the dating of the cultural level reached in the trench (photo by Szymon Lenarczyk)

Fig. 14. Pierced Alexander Severus denarius (222-228 AD) – marker for the dating of the cultural level reached in the trench as well as for the cultural identity of the inhabitants of the site in the last period of settlement activity (photo by Szymon Lenarczyk)

which was located in the eastern part of Pit 1. The second coin was found at the bottom of a depression situated to the southeast of this complex (unit 14).

The Olbian coin and two Roman denarii are the first coins discovered in trench R 23 in these closed archaeological contexts and they set the *terminus post quem* of the room to the middle of the third century.

Cultural identification – Cherniakhov Culture

Cultural identification of the population inhabiting the area studied by the Polish mission back in the 4th – early 5th centuries A.D. can be based on a comparative analysis of the artefacts found during the expedition and the artefacts previously described and classified on the basis of their archaeological context as typical examples of the Cherniakhov Culture.

Metal objects (without coins)

Among fragments of metal objects, a bronze tongue of a belt buckle stands out (unit 34, inv. no. 88; Fig. 15: A) as well as a fragment of a bronze, two-part fibula with an iron spring (Pit 3, unit 40, inv. no. 86; Fig. 15: B). Similar belt buckle tongues can be found in products of the Cherniakhov Culture typical for phases III-V (Gorokhovskiy 1988, 34-46) – second quarter of the 4th century – first quarter of the 5th century). Similar fibulas are typical markers of phase III and stage C3 (second and third quarter of the 4th century) in Godłowski's chronology (Godłowski 1970). A fragment of an iron object should be probably included in the same period (unit 34, inv. no. 84, shovel fitting?; Fig. 15: C). Although no analogy has been found yet, similar elements were used to fix the iron edges of wooden shovels in Kievan Rus.

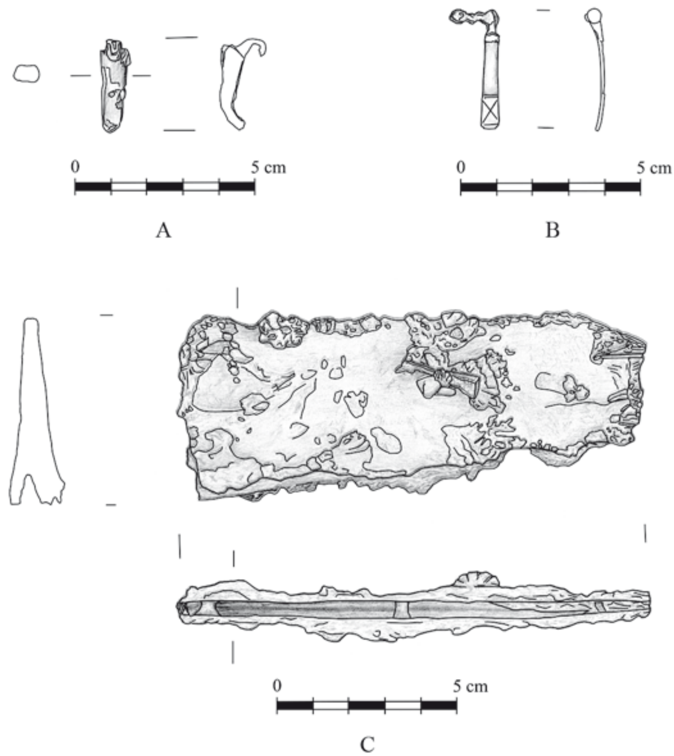


Fig. 15. Metal objects: A – fragment of a buckle; B – fragment of a fibula with an iron spring; C – fragment of the iron edge of a wooden shovel – markers for the cultural identity of the inhabitants of the site in the last period of settlement activity
(illustrated by Katarzyna Dejtrowska, Angelika Bogusz and Maria Pronobis)

Coins

Eight ancient coins were found during field work carried out in 2018. This is a much smaller number when compared to the numismatic finds of the previous seasons. This was due to the fact that the excavation work was limited to previously unearthed squares and the surface of the trench was cleaned to achieve more or less the same chronological level over the entire area. Five of the coins are Olbian issues made in the local mint between the 5th century B.C. and the 2nd/3rd century A.D. The remaining three coins are of Roman origin – two denarii from the first half of the 3rd century and one, heavily worn bronze coin from the 2nd century A.D. (compare inv. nos 91, 89, 269 above). Both denarii and the youngest bronze Olbian coin perfectly support the dating of the uncovered complexes (see above), while the cast denarius no. 89, together with similar numismatic finds from previous years, provide very strong support for the thesis concerning the links of the settlers using the unearthed utility areas with the Cherniakhov Culture. Dr Piotr Jaworski will publish a separate paper on the Olbian coins found during excavation work in the broader context of the material from the neighbouring trenches.

Ceramics

Late-antique ceramics are represented mainly by fragments of grey-polished pottery (cups and bowls), as well as kitchen ceramics characterized by high level of impurities in the ceramic clay, rough surface and traces of undercuts in the lower part (above the foot) of the vessels. Fragments of high capacity greyware vessels (*pithoi*) (unit 20, inv. no. 244;

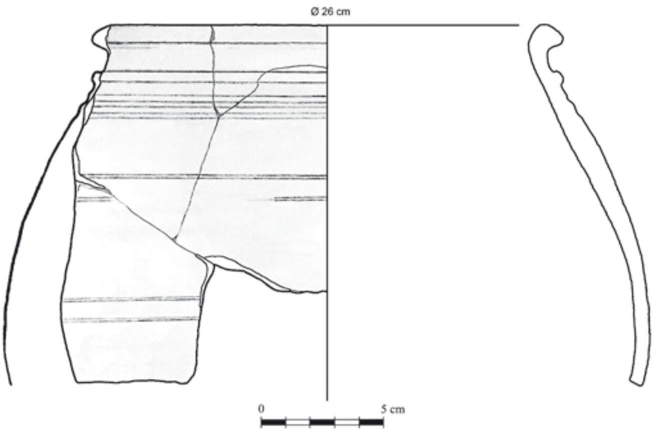


Fig. 16. A high capacity greyware vessel (*pithos*) – a marker for the cultural identity of the inhabitants of the site in the last period of settlement activity (illustrated by Sylwia Groń)

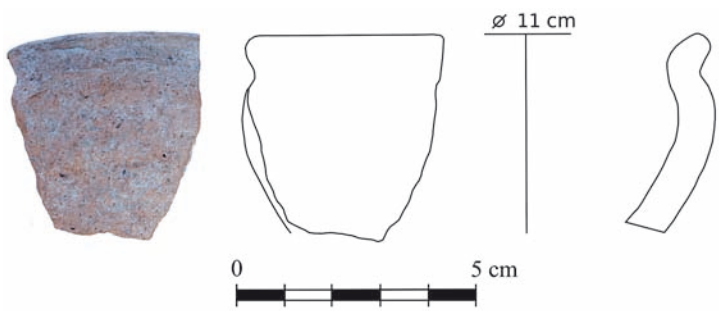


Fig. 17. Sherd of handmade pottery close to that of the Wielbark or Przeworsk cultures, of a type often found at Cherniakhov Culture sites – a marker for the cultural identity of the inhabitants of the site in the last period of settlement activity (illustrated by Szymon Lenarczyk and Sylwia Groń)

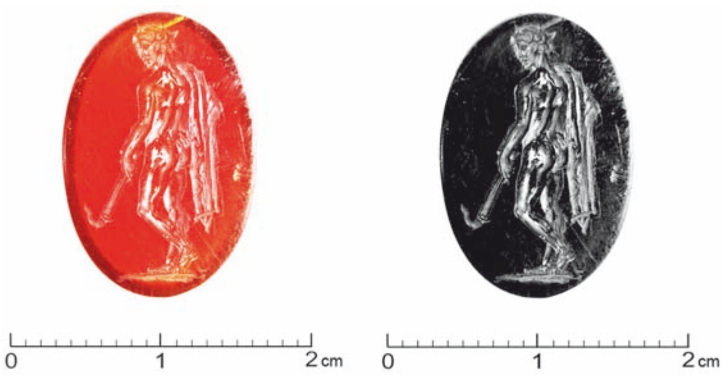


Fig. 18. The intaglio gem with the representation of a youth holding a lowered torch – chance surface find (photo by Szymon Lenarczyk)

Fig. 16) were also found. The greyware vessels have their closest analogies in vessels of the Cherniakhov and Sântana de Mureş cultures dated to around 230 A.D. to the beginning of the 5th century. The forms of the vessels found in the trench are typical for phases III-V; 350-430 BC (Gorokhovskii 1988, 34-46). It should also be noted that only relatively few fragments of hand-made ceramics have survived – mainly flat-bottomed pots. However, among these finds, a fragment of a bowl stands out, which undoubtedly is a piece of a vessel attributed to the Wielbark or Przeworsk culture (unit 34, inv. no. 58; Fig. 17).

Special finds

The gem (Fig. 18)

The most valuable find of the 2018 season is without a doubt an intaglio gemstone with the depiction of a young man holding a lowered torch (inv. no. 245). It was initially dated to the period of Augustus and should be classified as an object of the highest artistic value. It was found accidentally, just outside the boundaries (Fig. 3) of the trench after heavy rainfall, when it was most likely washed out of the turf by rainwater. The context of this find, despite its significant artistic value, adds nothing new to the dating of the cultural layers explored in the trench in 2018. Comprehensive information concerning the gemstone will be available in a separate article by Paweł Gołyźniak and Alfred Twardecki.

The bones

During the three field seasons, a large number of animal bones were found in the excavation area. However, it was the 2018 season that brought a significant discovery in this regard – a bone deposit that is probably a remnant of a craftsman's workshop where bone artefacts were made. Overall, around 6,000 pieces of bone were found during the last season. Such an amount of reasonably well dated (according to stratigraphic context) bone remains provided an opportunity for analysing the meat diet of the last Olbia inhabitants as well as offered a contribution to discussions concerning the process of steppe formation in this area and possible climate changes (as the bones belonged to animals typically inhabiting steppe biomes). The results of this research are presented in a separate publication by Alfred Twardecki and Evgeniya Yanish in *Ancient Civilisations from Scythia to Siberia*, 2022.

FINAL REMARKS

In 2018, the same chronological horizon was reached over the entire excavation area. The unearthed cultural layer is, so far, the youngest cultural layer identified in Olbia. The analysis of material from archaeological work carried out in the years 2016-2018 shows that the latest cultural strata uncovered in trench R23 date to the end of the 4th and the beginning of the 5th century A.D., when the area explored by the Polish mission was finally abandoned by its last inhabitants. Relics of material culture found during excavation work are evidence that the last inhabitants of Olbia had strong ties with the Cherniakhov culture.

In previous years, a connection with the Cherniakhov culture was established for the last phase of the settlements of Olbia's *chora* on the basis of an analysis of the findings from the settlements around Olbia (Buiskikh *et al.* 2006, 289-352).

For Olbia itself, only ceramic fragments of this culture stood out (Magomedov 2007, 47-54; 2020, 219-226), however, for a long time they were not considered in the context of specific construction activities. The publication of the latest finds has so far been far from being fully carried out, and their connection to the Cherniakhov culture was denied for a long time (Krapivina 2013, 77-94). Therefore, in historiography, there was a certain dissonance in the study of the late Roman period – there were settlements of the Cherniakhov culture in the *chora*, but they were absent in Olbia itself. The merit of the first three years of our joint project is the identification of a significant housing and economic complex at the same stratum, in which a representative complex of material culture was discovered, indicating the long-term residence of the carriers of this culture.

It seems to us that the considerations expressed in this work regarding the cultural attribution of the remains of the explored part of the site as a part of the Cherniakhov culture, have not only confirmed the preliminary conclusions made earlier, but also opened the way to study the later cultural layers of Olbia at a new level.

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ARCHAEOBOTANICAL RESULTS FROM EARLY MEDIEVAL RADOM, CENTRAL POLAND, WITH A SPECIAL EMPHASIS ON THE OLDEST FINDS OF BOG BILBERRY (*VACCINIUM ULIGINOSUM*)

ABSTRACT

Skrzyński G. 2021. Archaeobotanical results from early medieval Radom, Central Poland, with a special emphasis on the oldest finds of bog bilberry (*Vaccinium uliginosum*). *Sprawozdania Archeologiczne* 72/2, 275-286.

The article presents one of the most interesting results of an archaeobotanical analysis of material from the early medieval settlement complex in Radom. These results provided data on useful plants and the paleoenvironment of the site. In the case of two species, it was possible to designate specific sites of their origin.

The most interesting species mentioned above are *Origanum vulgare* and *Vaccinium uliginosum*. The first one could only grow at one site, slightly away from the settlement. Regarding the second species, the closest sites of occurrence of *V. uliginosum* can presently be found 40 km from the excavated site. This is quite a long distance from the point of view of early medieval man. It is worth emphasising that the finds of bog bilberry are the oldest remains of *V. uliginosum* that have been discovered at a Polish archaeological site.

Keywords: archaeobotany, *Vaccinium uliginosum*, bog bilberry, early medieval Radom, ethnobotany
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INTRODUCTION

The early medieval settlement complex in Radom consists of the 'Piotrówka' stronghold (Site 1), five open settlements (Sites 2, 3, 4, 5 and 6) and the burial ground (Site 4) (Fig. 1). This complex was explored and partially examined in the second half of the 20th century as part of archaeological work conducted in the town by the Institute of the History of Material Culture of the Polish Academy of Sciences (now: Institute of Archaeology and Ethnology of the Polish Academy of Sciences) over a period of at least a dozen years (Skubicha 2010, 106-112). Unfortunately, the results of these excavations have never been fully processed. Apart from some brief reports (Gąssowski 1951; Kierzkowska 1966; Kierzkowska-Kalinowska 1970; 1979; Kierzkowska and Kierzkowski 1961), they were not published till the years 2016 (Kurasiński and Skóra 2016) and 2019-2020 (Baranowski and Skrzyńska 2019; Baranowski *et al.* 2020).

In the excavation seasons 2009-2012, new archaeological work was conducted as part of the revitalisation project of the municipal cultural park 'Old Radom'. Its main aim was to revitalise the stronghold area and its surroundings. The whole settlement complex at

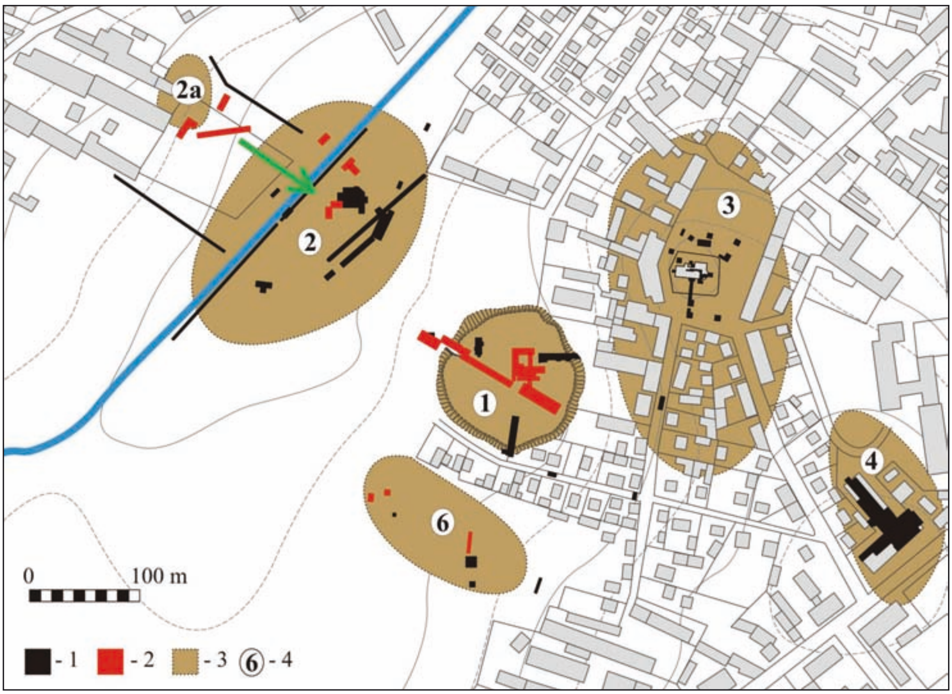

Fig. 1. The Radom settlement complex with the location of Feature 1 (green arrow).
1 – trenches from the 20th century, 2 – trenches from the 21st century, 3 – extent of site, 4 – site number.
Drawing by M. Trzeciecki, modified

this site was explored again (Auch and Trzeciecki 2011; Trzeciecki 2010; Solarska and Trzeciecki 2011; Kalaga and Wajda 2011; Zapłata 2011), including Site 2, where soil samples for macroscopic examination of plant remains were taken.They were collected mainly to determine the taxa used by the early medieval inhabitants of the settlement.

A second batch of material was obtained in 2016. The aim was to obtain the remains for reconstruction of the palaeoenvironmental background of the colonization process (for this purpose, also other samples were taken from the area of the entire settlement complex (Skrzyński, unpub.) and for ^{14}C dating.

MATERIAL AND METHODS

The results of archaeological examination define Site 2 as an open settlement of auxillary function in relation to the stronghold. The site occupies an area of approximately 5 ha and extends on the both banks of the Mleczna River (Solarska and Trzeciecki 2011, 116). In 2011, archaeological excavations were undertaken to evaluate the state of preservation of the wooden structures discovered there in the 1960s and 1970s, and to obtain wood samples for dating of the settlement complex. Parts of a wooden building (Feature 1) were excavated in the trench situated in the central part of the site (Figs 1, 2). Archaeologists established

Fig. 2. Remains of early medieval building (Feature 1). Photo by S. Wajda

Table 1. Results of Accelerator Mass Spectrometry radiocarbon dating

Inside of the building			Otside of the building		
Sample	Sample ID	Result	Sample	Sample ID	Result
Rdm/11/01	Poz-98812	869AD-1013AD (94.2%)	Rdm/16/17	Poz-98814	769AD-901AD (87.5%)
Rdm/11/02	Poz-99361	773AD-906AD (71.8%)	Rdm/16/18	Poz-98815	776AD-971AD (95.4%)

the building had an interlocked-corner log structure with remains of wooden planks at the bottom layer that most likely formed the floor. Unfortunately, the condition of the wood was very poor and the ground water obstructed the full examination of soil strata in the trench. Cultural layer 3 was identified as the oldest floor level. Based on analysis of archaeological material sampled from this strata (mainly pottery, bone artefacts), the building can be dated to the 9th-11th centuries (Auch *et al.* 2012, 31). This layer was the source of the soil samples for the analysis of macroscopic plant remains. Eight soil samples (each of volume approximately 2 dm^3) were obtained during the excavations. Part of them were examined in 2012 (Skrzyński 2013; 2018). To verify the data obtained from the structure, as a part of the new research conducted in 2015-2018, supplementary samples were taken by drilling the cultural layer outside the building. Each of 3 additional samples gained (using a Russian borer: 'Instorf' sampling probe) was about 1 dm^3 volume. Due to the nature of the sampled layer (organic remnants with a slight admixture of mineral fraction), each soil sample was initially macerated in a 10% solution of KOH to obtain adequate particle break-up. Material was then washed on sieves with 2.0-0.2 mm mesh size in order to isolate the plant material. Analyses of macroscopic plant remains were done by using an Olympus SZ30 binocular microscope at 9-80× magnification range.

To verify the results of archaeological dating, the selected plant remains were dated by Accelerator Mass Spectrometry (in the Poznan Radiocarbon Laboratory). Unfortunately, only charred remains gained in 2011 from Feature 1 were suitable for radiocarbon dating because waterlogged ones had been preserved and stored in a glycerin-thymol solution. So, a caryopsis of *Triticum aestivum* (sample Rdm/11/01) and an achene of *Fallopia convolvulus* (sample Rdm/11/02) were selected from inside of the building construction. Plant materials from the cores were not contaminated by synthetic organic compounds therefore waterlogged wood of *Alnus* sp. was chosen (sample Rdm/16/17). A second sample for ^{14}C dating from the exterior cultural layer was an achene of *Polygonum lapathifolium* ssp. *lapathifolium* (sample Rdm/16/18).

Taxonomic determination were carried out using the set of publications and keys for taxonomic identification of plant seeds and fruits (Cappers *et al.* 2006; Körber-Grohne 1964; 1991; Kulpa 1984; Marek 1954; 1958; Rudnicka-Sterna 1972). For wood identification, F. Schweingruber's key was used (Schweingruber 1978). The carpological collections of the Department of Paleobotany of the W. Szafer Institute of Botany in Cracow and the author's own reference collections were also used. The names of plants are given according the Polish botanical nomenclature (Mirek *et al.* 2002). The simplified ecological affiliation of the determined taxa was prepared on the basis of W. Matuszkiewicz's publication (2001) and empirical data. The results of ^{14}C dating were calibrated using the OxCal v4.2.3. The accuracy of dating was set on 95.4 % probability (Tab. 1).

RESULTS

In total, 818 macroscopic plant remains were gained during the analytical process. Most of them (728) came from the strata located inside the building, while 90 were found in samples from the exterior cultural layer. Both sources provided both waterlogged and charred remains. Detailed results of the analyses are presented in the list of determined taxa with their ecological affinity (Tab. 2).

The largest group of remains represent crop weeds and ruderal plants. From this group only two species are cereal weeds (*Rhinanthus* cf. *serotinus*, *Vicia tetrasperma*), the rest are highly nitrophilous and ubiquitous plants. The second large group of taxa are meadow and pasture plants. It is possible that these plants appeared in the fresh, semi-anthropogenic meadows of the Mleczna River valley in the Middle Ages. In the case of the wetland plants, most of them could have entered the area of the archaeological site as the result of

Table 2. List of determined macroscopic plant remains and their ecological affiliation

Ecological classification	Taxa	Feature 1		Core 16/17		Core 16/18		Core 16/19	
		Number of charred/waterlogged remains							
Crops	*Brassica* cf. *rapa*		1						
	Lens culinaris	2							
	Panicum miliaceum		17	1					
	Secale cereale	8						1	
	Triticum aestivum	4	1						
Meadows and pastures	*Achillea millefolium*	7	3						
	Juncus conglomeratus		11						
	Origanum vulgare		4						
	Poa trivialis			1					
	Potentilla anserina		47						
	Ranunculus acris		7						
	Ranunculus repens	2	5						
	Rumex acetosa	4	3					1	
	Stachys palustris		4						
	Veronica serpyllifolia	5	8						

Ecological classification	Taxa	Feature 1		Core 16/17		Core 16/18		Core 16/19	
		Number of charred/waterlogged remains							
Weeds and ruderal plants	*Ballota nigra*		3						
	Carduus nutans		6						
	Chenopodium album	7	31	1	2	1	3		4
	Cichorium intybus	11	2						
	Cirsium arvense	14	17	1			1		1
	Digitaria sanguinalis	7							
	Fallopia convolvulus	5	2	2					
	Galium aparine	15	12	1					
	Galium spurium	8	9					1	
	Melandrium album	10	21						
	Poa annua							1	
	Polygonum aviculare	3			1				
	Polygonum lapathifolium ssp. *lapathifolium*	12	4			1			
	Polygonum lapathifolium ssp. *pallidum*		7						
	Polygonum persicaria							1	
	Rhinanthus cf. *serotinus*	1							
	Rumex acetosella	9	4						
	Stellaria graminea			-			1		
	Stellaria media		9						
	Urtica dioica	2	19	1		1	3	1	
	Urtica urens							1	
	Vicia tetrasperma	4							
	Herniaria sp.		2						
Forests and clearings	*Pinus sylvestris*								
	Rubus idaeus		35		1		1		2
	Sambucus nigra		14						
	Sorbus aucuparia		5						
	Alnus sp.	130	14	1	2		1	1	1
	Rubus sp.				1				
Wetlands	*Juncus bufonius*		23				4		2
	Ranunculus sceleratus		25						
	Vaccinium uliginosum		11						
	Typha sp.		43						

Ecological classification	Taxa	Feature 1		Core 16/17		Core 16/18		Core 16/19	
		Number of charred/waterlogged remains							
Unclassified	*Carex* sp.				1				
	Juncus sp.				1	3		1	
	Galium sp.			1					
	Caryophyllaceae						1		
	Chenopodiaceae				2	1			
	Cyperaceae						1		
	Lamiaceae						1		
	Poaceae			2		1			1
	Polygonaceae								1
	Indeterminate	11	18	2	4	4	7		2

periodic floods. The discovered plant remains could also have come to the site through human activity consisted of exploitation of riverside areas. There are also some plant remains that represent forest and forest clearing communities – i.e. areas which were probably exposed to high anthropopression. The samples collected from layer 3 of Feature 1, apart from the remains of edible fruits of wild plants, also contained seeds and fruits of cultivated plants. The plant material contained seeds of turnip *Brassica* cf. *rapa* and lentils *Lens culinaris*. Cereals were represented by common millet *Panicum miliaceum*, common wheat *Triticum aestivum* and rye *Secale cereale*. Almost all remains of cultivated plants were charred, only one caryopsis of *T. aestivum* was waterlogged.

DISCUSSION AND CONCLUSIONS

The results of AMS confirm the dating based on the archaeological analysis of the artefacts. They are also convergent with the dendrochronological data, which showed that the trees used to make the wooden well found in another part of the site were felled in 888 AD (Zapłata 2011). Moreover, they coincide in their scope with the results of dating of the other organic samples from cores gained from the settlement complex and also plant materials found during the excavations in the 1960s and 1970s (Skrzyński unpub.). The AMS also confirmed that the waterlogged remains came from the same period as the charred ones found in the same cultural layer.

All plant remains show the main basic plant communities of areas used by human. The main group of plants which had economic value are crops. Their presence is indirectly evidenced by the fruits and seeds of segetal weeds and weeds of root crops, as well as the remains of the crops themselves. The most common cereals in Poland during the entire Middle Ages are common wheat *T. aestivum*, common millet *P. miliaceum* and rye *S. cereale*

(Lityńska-Zając and Wasylikowa 2005, 492, fig. XIX-7), which were also grown in Radom. Other crops found at Site 2 are lentils *Lens culinaris* and probably a turnip *Brassica* cf. *rapa*.

It should be noted that the listed plants have different habitat requirements and most probably were not cultivated in the same areas. *P. miliaceum* and *S. cereale* were sown on poor soils, but *T. aestivum* needs more fertile soils. The same as the cultivation of *L. culinaris* and *Brassica rapa* that also require better soils. Therefore it is possible that less demanding cereals were grown in areas slightly distant from the settlement, while the plants with higher trophic requirements were grown on the terraces of the Mleczna River built of fertile peats. The fertile flooded areas were also covered by meadows that probably were a reservoir of fodder for animals kept in the settlement complex.

Ruderal plants are directly related to the functioning of the settlement itself – they develop on nitrogen-rich soils of roadsides, dumps and other similar areas transformed by human. Hence, their presence may indicate the relatively advanced development of the settlement.

Other evidence of the economic use of plants are numerous charcoal finds and seeds of plants from forest clearings. They are evidence that the inhabitants of the settlement conducted forest management providing building material and fuel. This is confirmed by the finds of alder *Alnus* sp. and Scots pine *Pinus sylvestris*. Also the development of light-requiring plants such as rowan *Sorbus aucuparia*, black elder *Sambucus nigra* or raspberry *Rubus idaeus* is indirect evidence of deforestation. On the other hand, the presence of these species may be evidence of the occurrence of ecotone plant communities. Apart from the presence of these trees and shrubs in the forest clearings and/or on forest margins, the accumulation of their seeds inside of Feature 1 probably illustrates the process of collecting their fruits for consumption (Szubert 1827; Łuczaj 2004).

Moreover, there were other noteworthy wild plants that would have been valuable for the early medieval economy. Among the identified taxa, there were plants whose green parts were probably consumed during periods of famine. The most important of them are sorrels *Rumex acetosa*, *R. acetosella* and goosefoot *Chenopodium album* (Maurizio 1926, 111, 113). The fruits of herbs such as chicory *Cichorium intybus*, yarrow *Achillea millefolium* and silverweed *Potentilla anserina* have also been found. However, considering the validity of the hypothesis about consumptional usage, it should be pointed that it was formulated mainly on the basis of the ethnobotanical data and the fact of presence of these species. Due to the lack of preservation of their vegetative parts, there is no direct evidence that supports that hypothesis.

It seems that the most interesting of the collected wild plants are wild marjoram *Origanum vulgare* (Fig. 3) and bog bilberry *Vaccinium uliginosum* (Fig. 4).

O. vulgare is a commonly known spice plant and herb. In folk medicine, it was considered as an effective sedative "in some psychiatric disorders such as hysteria and erotomania" (Ożarowski 1982). This perennial plant has specific habitat requirements – it grows in

Fig. 3. Seed of *Origanum vulgare*. 1 mm scale
Photo by Katarzyna Cywa

Fig. 4. Seed of *Vaccinium uliginosum*. 1 mm scale
Photo by Grzegorz Skrzyński

alkaline soils rich in calcium carbonate (Zarzycki *et al*. 2002, 86). In the vicinity of the site, such soils, formed on cretaceous limestones, are found only in Jeżowa Wola (now a district of Radom), near the Mleczna River, about 5 km from the studied settlement complex (Jaśkowski *et al*. 2014, 16).

The most interesting of all the finds, however, are the seeds of bog bilberry. Eleven partially humified seeds of *V. uliginosum* were found. So far, this species has been found in archaeological deposits in only in three large Polish cities – Kołobrzeg (Latałowa and Badura 1996), Cracow (Tomczyńska and Wasylikowa 1999) and Gdańsk (Badura 2011), and at the medieval site of Lębork-Rynek (Tomczyńska and Lityńska-Zając 2014). It is important to note that the finds from Radom are the oldest such remains found on the territory of Poland.

Vaccinium uliginosum is a 75-100 cm or sometimes taller, winter deciduous shrub featuring ground-laying main sprouts and raised twigs. The fruit is a spherical or elliptic multiple-seed berry with a bluish hued dull surface. Typically, the plant can be found in wet or swampy forests with acid soils and transient and raised bogs. The species is characteristic for the *Vaccinio uliginosi – Pinetum* association, *i.e.* the swampy forest (Matuszkiewicz 2001, 352, 353). Today the plant can be found approximately 40 km to the north and west of Radom (Matuszkiewicz 2008: chart C3), and it was probably also the same in the early Middle Ages. The bog bilberry in local dialect is named *pijanica* or *durnica* which in free translation means: *drunk berry* or *foolish berry* (Jundziłł 1811, 127, 128; Szubert 1827, 277, 278). It is supposed to cause a slightly intoxication effect because the surface of the fruit is colonized by a saprophytic fungus (Łuczaj 2004, 40, 41).

The seeds of *Vaccinium uliginosum* that were found in Radom may be evidence of trade-connections between the Radom population and inhabitants of the areas where the bog bilberry naturally occurred. It is also possible that the inhabitants of the settlements located near the 'Piotrówka' stronghold had more direct contact with the 40 km distant swampy forests. The bog bilberry fruit was most probably foraged for consumption. But the question whether these berries were treated as a foodstuff or sought for their intoxicating properties remains open.

The results of archaeobotanical analyses presented here have shed new light on the early medieval settlement complex located in the Mleczna River valley in Radom. Both the results of archaeological research and these archaeobotanical analyses have contributed to a widening of the knowledge of the historical and cultural realities of human existence and about the mechanisms of the functioning of early medieval proto-town communities.

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VEGETATION ON THE WAWEL HILL, CRACOW (POLAND) IN THE EARLY MIDDLE AGES BASED ON THE FRAGMENTARY POLLEN RECORD. ARCHAEOLOGICAL RESEARCH EXCAVATION IN THE BASEMENT OF BUILDING NO. 9

ABSTRACT

Nalepka D., Kukliński A., Walanus A. and Cywa K. 2021. Vegetation on the Wawel Hill, Cracow (Poland) in the early Middle Ages based on the fragmentary pollen record. Archaeological research excavation in the basement of building No. 9. *Sprawozdania Archeologiczne* 73/2, 287-311.

Palynological research was carried out on layers archaeologically dated to the early Middle Ages in the basement of the former Austrian hospital at Wawel. The interpretation was based on the sparse number of sporomorphs presented in the samples, not on the percentages.

At the end of the first millennium, on the Wawel Hill and in its vicinity, an open landscape developed with a mosaic of plant communities, including ruderal ones, fields, pastures, and meadows, as well as bushes and forests. Sporomorphs reached the analysed area partially naturally, with pollen rain from plants growing at sites in the Wawel Castle itself and from the immediate or further surroundings of the Wawel Hill. Some sporomorphs reached the examined layers because of human activity: partly accidentally during normal life activities, and partly with material goods brought to Wawel for utility purposes. The interpretation is consistent with the results of palaeobotanical studies from other analysed sites in Wawel (Wasylikowa et al. 2006; Nalepka 2009).

Keywords: palynology, anthracology, archaeology, early Middle Ages
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INTRODUCTION

The Wawel Hill in Cracow (Fig. 1A), together with the buildings on its slopes and on its top, has undergone numerous changes in the past, including random natural events and planned or accidental human activity, involving intervention in the geological structure, living nature, and the material that it creates (construction and reconstruction).

Palaeobotanical research on the Wawel Hill commenced after the end of World War II in the 1950s, and continued in the 1970s, always conducted alongside archaeological research (Wasylikowa 1978a; 1978b), when uncovering successive historical layers that could contain plant debris, established cooperation with palaeobotanists. It should be mentioned that the material collected on the Wawel Hill has not always been completely examined, and only some of it has been included in publications along with other palaeobotanical studies. This happened, for example, with the results of palynological investigations from one of the Wawel sites previously studied (at the turn of the 1960s and 1970s) by Wanda Koperowa that were published only in a paper by K. Wasylikowa (Wasylikowa 1978a). However, the principal reason for the lack of paleoenvironmental research is, of course, the inability to collect materials when this would irreversibly destroy the tissue of artefacts. On the Wawel Hill and at Wawel itself, another reason is the absence of layers and sediments containing microscopic organic plant remains (pollen grains and spores). There are usually few of these on archaeological sites, due to the specific requirements enabling the preservation of such remains. The main factor destroying organic residues is aeration under aerobic conditions (Nalepka 1999; Makohonienko and Nalepka 2007).

In analysing palaeobotanical materials from archaeological sites, their specific nature must be considered: not only their potential, but above all their limitations. These, especially the latter, have been described in detail in textbooks, and are summarised, among other places, in published chapters (Makohonienko and Nalepka 2007; Makohonienko 2014). The conclusion is generally the same: "in spite of the limitations resulting from restricted preservation of sporomorphs in sediments, lower concentration values, selective decay and more complicated depositional processes at terrestrial habitats, pollen evidence from archaeological sites is a useful source of archaeological and environmental interpretation" (Makohonienko and Nalepka 2007, 189).

The results of palaeobotanical research have been published from four sites on the Wawel Hill (Fig. 1B). These are the upper terrace of the restored Renaissance Royal Garden (Nalepka 2009) (Fig. 1B: 1), the Early Medieval culture layer analysed by Koperowa (published in Wasylikowa 1978a) (Fig. 1B: 2), the Medieval culture layers analysed by Wasy-

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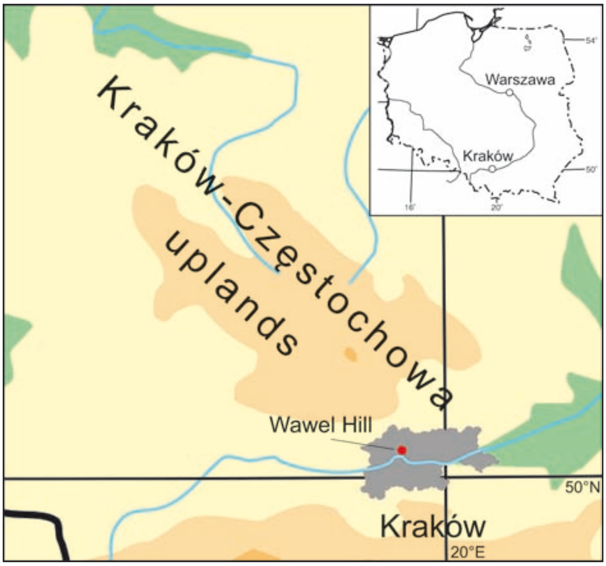
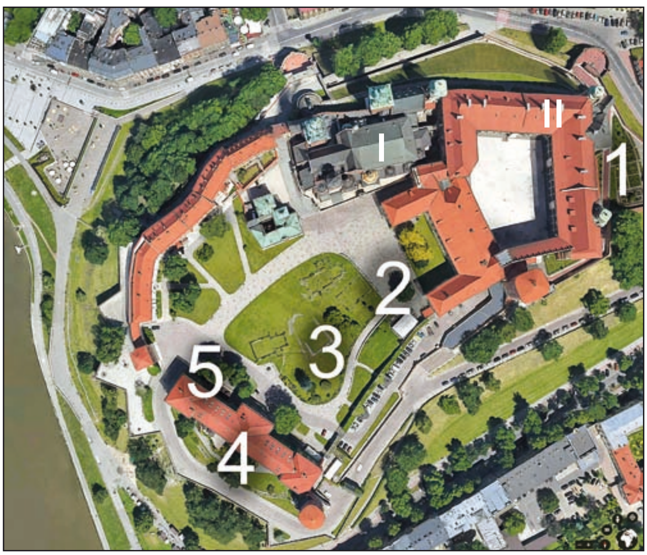


A



B

Fig. 1. A – Location of the Wawel Hill; B – Historical and sacral buildings on the Wawel Hill (satellite photo by Google): I – the cathedral, II – the Wawel castle. Sites of palaeobotanical research: 1 – the upper terrace of the restored Renaissance Royal Garden (Nalepka 2009), 2 – the Early Medieval culture layer analysed by Koperowa (published in Wasylikowa 1978), 3 – the Medieval culture layers analysed by Wasylikowa (1991a, b), 4 – the soil sample linked to the early medieval fortifications by Wasylikowa *et al.* (2006), 5 (sites described in this article) – soil samples in the basement of the building of the former Austrian hospital (after Nalepka 2009, modified)

likowa (1991) (Fig. 1B: 3), and a soil sample linked to the early medieval fortifications by K. Wasylikowa (Wasylikowa *et al.* 2006) (Fig. 1B: 4).

The previous studies enabled a partial description of the flora and vegetation of the Wawel Hill and Wawel Castle in the Middle Ages, and provided information about the plants used economically. The history of investigation of the past plant cover of Wawel Hill and the history of human impact at that location were summarised in 2009 by D. Nalepka (Nalepka 2009).

This article presents the results of palynological analysis from a site in the southwestern part of Wawel Hill (Fig. 1B: 5), located in the basement of the building of a former Austrian hospital (building no. 9), from which material was taken for palaeobotanical and radiocarbon dating analyses during the archaeological excavations in 2017. The aim of the study was to describe the vegetation existing during the formation of the studied layers and to indicate their relative age based on palaeobotanical analysis.

ARCHAEOLOGICAL INTRODUCTION

The subject of the palaeobotanical study is archaeological excavation 1/17 on the Wawel Hill, made in 2017 in region IX in the basement of building no. 9 (Fig. 2: a), a former Austrian hospital from the mid-nineteenth century. It covered a sequence of layers lying at elevations in the range 220.36-218.93 m above sea level (*i.e.*, at a depth of 105 to 143 cm), between the concrete floor and the rock surface. The preserved stratigraphic system, including the oldest early medieval layers, is a relic of the settlement, originally developing on the surface of the hill, near its southwestern edge. The complex of layers below the basement floor consists of a layer of weathered degraded clay (rock formations) in places on the surface of the rock, an original soil layer (in places of considerable thickness), early medieval layers, and layers from the early phase of the late Middle Ages (V/VI). Fragments of ancient vessels were extracted from the original soil layer. Most represented the late phase of the Lusatian culture. In the uncovered settlement sequence, the negative foundation of the eastern wall of the Gothic house of confessors was highlighted. It reached the surface of the rock. The foundation pit had been completely excavated (building stone removed), most likely by the builders of the hospital. Probably only the oldest part of the early medieval layers is as follows: 1) hearth in a trough pit in the original soil layer (layer VI/9a-b); 2) feature fill (layer VI/8a–b); 3) a layer of hardened charcoal a few centimetres thick (top of layer VI/6); and 4) remains of an unspecified structure (stone cladding and a trench filled with stones that form a foundation), possibly the remains of a residential or production facility (within layer VI/5a-b), preserved in the place of its formation (*in situ*). The remaining layers (V/VI and VI/1-VI/4), in the form of dumped accumulations, were formed during construction work, including levelling of the area carried out here, and perhaps also during the construction of wood and earth fortifications.

Fig. 2. Wawel 2017 site: a – outcrop in the basement of building no. 9; b – the walls in the outcrop; yellow arrows indicate two palaeobotanical sampled profiles: profiles Wawel 2017 NE and Wawel 2017 SE; c – profile Wawel 2017 NW (photo A. Walanus)

The discovered sequence of layers originates from the period between the 7th or 8th century (?) (oldest) and the second half of the 13th century (youngest). The preserved stratigraphy did not develop undisturbed. The stratification did not systematically increase from level to level, but according to the analysis of archaeological finds (based on analysis of their dating), they underwent transformations, levelling or lowering of the ground level, between the 7th-8th (?) and 13th century. Therefore, there are no layers, for example, from the 11th-12th centuries. In the oldest layer (VI/9), a feature (most likely a hearth) is buried in the so-called primary soil. It lies about 21 m (in a straight line) to the north-east of the palisade relics identified in trench 1A/91-92 (region IX), which were originally the inner wall of the rampart, and 14.5 m from the line of the edge of the clay embankment (slopes – see excavation 1B/92-94, region IX) stabilising the palisade from the inside of the castle. The lack of archaeological research between excavations 1A-1B and 1/17, as well as the distance separating them, will make it impossible to determine the stratigraphic relationships, and thus the sequences in time, of the oldest layers in excavation 1/17, with relics of early medieval defensive walls discovered in excavations 1A-1B/91-94 (Kukliński 2016). The stratigraphic context of the object (hearth) found in excavation 1/17 in the original soil layer and remains of the primary soil layer in excavation 1B/92-94 – mostly levelled, in connection with the foundation of wood-earth fortifications (see cross-section wall S of excavations 1A-1C/91-96, region IX; Kukliński 2016, Figs. 2 and 3) – as well as early dating of the site from excavation 1/17 to the 8th century (?), may, however, indicate that the latter is older than the oldest preserved defensive fortifications of the southwestern part of Wawel. Then it would come from before the construction of the stronghold and would be a trace of the original open settlement. At present, this is a hypothesis.

The contemporary location of excavation 1/17, *i.e.*, the deep basement of building no. 9, determines the condition of the cultural layers. Only the portion of the sequence of layers accumulating in prehistory from the rock surface to the surface of the ground in the first half of the 20th century that lies below the basement level, has survived. The remaining layers lying above were partially destroyed during the construction of the foundations of the Austrian hospital, and then during the expansion of the basement rooms in the period between World Wars I and II or during the German occupation (the plans of the hospital building dated around 1860 show that its southwestern range was not originally a basement). Since the construction of the hospital in the years 1854-1855, the preserved layers within the walls have been fully isolated from external influences such as atmospheric precipitation.

MATERIAL

In the summer of 2017, when the archaeological trench was finally dug, a palynologist was invited to take samples for palaeoecological research. Three exposed walls in the trench, approximately rectangular (*c.* 300.0 cm long, *c.* 150.0 cm wide and *c.* 100.0 cm deep) (Fig. 2: a), were sampled. The first profile (Wawel 2017 NE) was located on the north-east wall (fig. 2: b), the second (Wawel 2017 SE) on the south-east wall (Fig. 2: b), and the third (Wawel 2017 NW) on the north-west wall (Fig. 2: c).

The sampled sediment was heterogeneous, dry, partly consolidated and partly unconsolidated. Samples for palaeobotanical analyses were taken from each distinct lithological layer, starting from the middle and bottom layers, which seemed unmixed (Fig. 2: b). Samples for pollen analysis were collected from the deepest to the uppermost layers, directly into plastic tubes (*ca.* 1-4 cm^3), and additional material (a few cm^3 of sediment) was collected in plastic bags. The samples taken were numbered in order from the bottom to the top layer. Next, several additional samples were collected for macrofossil analysis. The thickness of each sample was not greater than 2.0-3.0 cm^3, and the volume was *c.* 0.50 dm^3. Samples were taken by Professor Dorota Nalepka (palynologist, palaeobotanist) in the presence of archaeologist Dr Andrzej Kukliński.

During the analysis of archaeological sources, two radiocarbon dates of charcoal samples taken from the hearth layer (VI/9) and a hardened layer of charred wood debris, possibly part of a destroyed indeterminate wooden structure, which seem to be wattlework (Fig. 3) (Layer VI/6 upper part) were obtained by the archaeologist Dr A. Kukliński, who had them dated by the Radiocarbon Laboratory in Poznań.

Fig. 3. View of the wall of the Wawel 2017 NE profile after sampling for palynological analysis (13-15) with probable fragments of wattlework (photo: A. Walanus)

Drawings were made by Dr A. Kukliński, and photographic documentation by Professor Adam Walanus. From the beginning, the material was kept in the cold store of the Institute of Botany, Polish Academy of Sciences. Part of the collected material was used for palynological and plant macroremains analyses. All of the remaining material was forwarded for further analysis to the geologist.

LABORATORY METHODS

All samples for pollen analysis were prepared using standard procedures. Each sample of 1 cm^3 was treated with Erdmann acetolysis (Faegri *et al.* 1989), together with the addition of a known number of indicator spores of *Lycopodium* (Stockmarr 1971). Mineral components were removed by boiling in 10% KOH, decantation, and boiling in hydrofluoric acid (HF). The hydrofluoric acid procedure was repeated for some of the samples where clay remained, preventing microscopic preparation. Additional mineral elements were removed by treatment with hot tetrasodium pyrophosphate $Na_4P_2O_7$ (sodium diphosphate) and ultrasound disaggregation. Finally, to remove the finest fraction, the material was screened through a sieve with a mesh diameter less than 10 micrometres. The material was then mounted in glycerine (Berglund and Ralska-Jasiewiczowa 1986).

Pollen analysis was performed using a Nikon microscope with phase contrast and magnification from 600 up to 1000. Sporomorphs were counted on at least two slides for each sample. The analysed samples contained very low numbers or badly preserved sporomorphs, and some samples did not include any sporomorphs at all. Along with sporomorphs, silt particles, charred particles, and very small, amorphous dark brown particles (probably organic) were present. During the determination of sporomorphs, atlases (*e.g.* Moore *et al.* 1991; Beug 2004) and the Reference Collection of National Biodiversity Collection – Herbarium KRAM, KRAM P, Palaeobotanical collection, W. Szafer Institute of Botany, Polish Academy of Sciences in Cracow, were used.

Samples for analysis of plant macroscopic remains (carpological and anthracological analysis) were taken from the same levels as the seven samples for palynological analysis: NW:21, NW:19, NW:17; SE:1, SE:9, SE:12, and NE:13. Samples with a volume of approx. 2-3 cm^3 were flooded with distilled water, and after two days they were sieved through a 0.2 mm sieve. The sediment was almost completely decomposed in the water. The residue was removed after the macroscopic remains analysis and anthracological analysis.

In the field of view of the microscope slides, very numerous, dark brown, small (up to 10 microns) fragments of plant tissues were present, mostly amorphous. In one sample from the Wawel 2017 NE: 13 profile, such fragments were slightly larger than the others (up to 30 microns). These could have been charred pieces of wood, but they were still too small to be suitable for botanical determination. Sporomorphs were not present in most of the analysed samples, except for three samples in the upper parts of each profile analysed.

Table 1. Radiocarbon dating (AMS) (Goslar, Report 2019) Given are intervals of calendar age, where the true ages of the samples encompass with the probability of c. 68% and c. 95%. The calibration was made with the OxCal software. OxCal v4.2.3 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer *et al.* 2013)

Layer	Dated material	No of sample	^{14}C BP	Age AD (68.2% probability)	Age AD (95.4% probability)
Top part of the furnace layer (VI/9)	Charcoal samples taken from the hearth layer	2_PB z 68	1140±30	880-970	777-793 802-848 855-981
VI/6 upper part	Hardened layer of charred wood debris, possibly destructible indeterminate wooden structure (wattlework?)	1_PB_10 z 45	1220±30	726-738 768-779 789-870	629-748 762-887

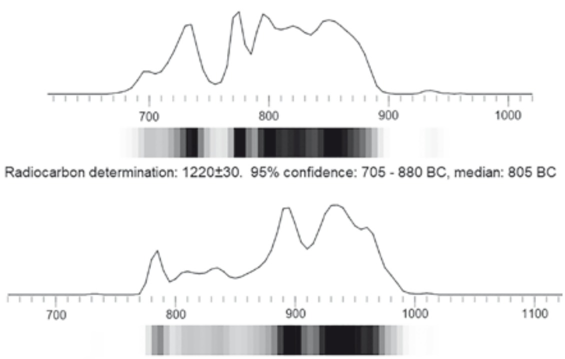


Fig. 4. Visualisation of ^{14}C date calibration results from the Wawel 2017 site (Table 1) (https://adamwalanus.pl/c14cal.html)

The residuum (residue after sludging) consisted of grains of sand and a few small lumps of agglutinated mineral material that crumbled when touched with a preparation needle. Almost no plant remains found in the lumps could be identified. Only one sample, Wawel 2017 NW:19, contained a few charred wood fragments, with dimensions of 0.3-0.5 mm, which were determined (Dr Katarzyna Cywa) and a few smaller, charred plant fragments, not identified due to their small size. Similarly, in samples from the Wawel 2017 NW profile, there were found single, small pieces of burned plant debris, but these were unsuitable for identification due to their small size. Above that, the residuum contained very small, dark brown, indeterminate plant tissue fragments. The material did not contain identifiable plant macroscopic remains in the form of fruit, seeds, or plant tissue residues.

Pollen diagrams and pie plots were created using the POLPAL program (Nalepka and Walanus 2003: https://adamwalanus.pl/Polpal.html).

The hardened layer of charred wood debris, a possibly destroyed wooden structure, which seems to be wattlework (top of Layer VI/6), is dated with a probability of 68.2% to the intervals 726-738 AD (7.3%), 768-779 AD (7.9%) and 789-870AD (53%), and at a confidence level of 95.4% to the ranges 629-748 AD (20.9%) and 762-887 AD (74.5%).

The date of the sample taken from the charcoal hearth layer and the upper part of the furnace layer (VI/9) is between 880 and 970 AD (with a probability of 68.2%), and with 95.4% probability lies in the ranges 777-793 AD (5.5%), 802-848 AD (11.3%) and 855-981 AD (78.6%) (Goslar 2019) (Table 1, Fig. 4).

PROFILE WAWEL 2017 SE

Samples from the Wawel 2017 SE profile were taken from a dark brown, cohesive mineral layer. The layer overlay the calcareous rock, and covered with dry, heterogeneous mineral layers – according to the archaeologist's assessments these were cultural layers (Fig. 5, Table 2).

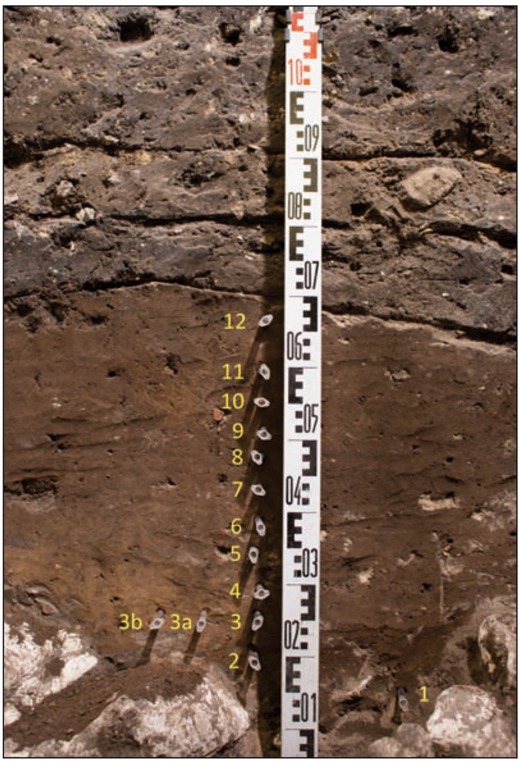


Fig. 5. Wall of the Wawel 2017 SE profile with marked sampling locations for palynological analysis (1-12) (photo: A. Walanus)

Table 2. Description of the excavated profile Wawel 2017 SE

Designation of layer	No of samples	Sediment description
		Mineral, compact brown layer, covered with a heterogeneous mineral
the original soil layer	4-12	Black, non-coherent with scattered fragments of charred plant fragments (?) the cultural layer
	1, 2, 3, 3a, 3b	Homogeneous, compact mineral dark brown, with humus

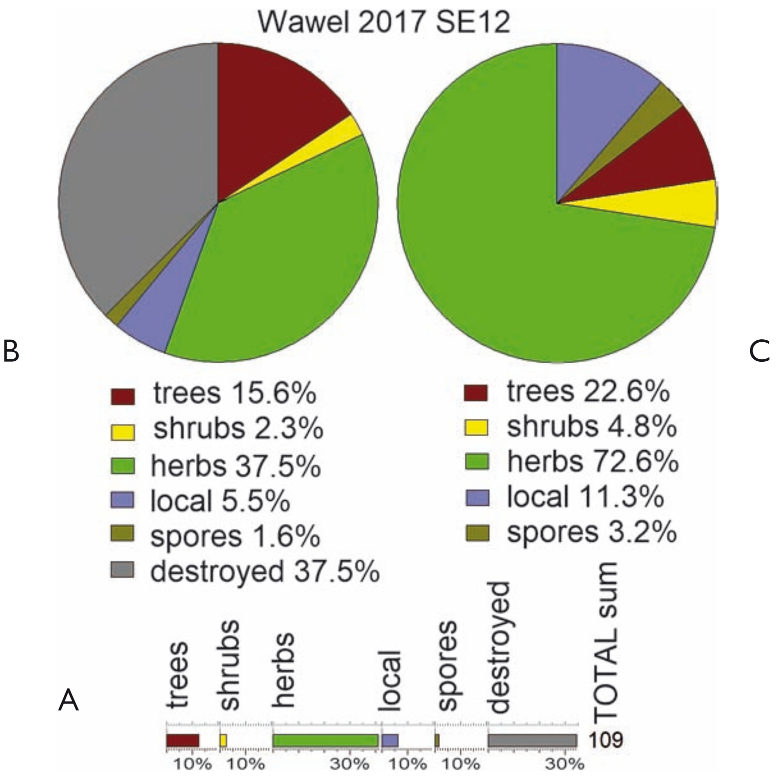


Fig. 6. Results of palynological analysis of sample no. 12 in the Wawel 2017 SE profile. Percentages of sporomorphs in the studied spectrum presented in groups: trees, shrubs, herbaceous plants, local habitat plants, spores of non-vascular plants and unidentified sporomorphs. A – percentage diagram, B – percentage piechart, C – percentage pie graph in relation to the sum of identified sporomorphs (excluding sporomorphs destroyed and impossible to determine)

In the palynological samples SE:1, SE:3, SE:9, few sporomorphs were present (Fig. 6); they represented taxa of herbaceous trees and plants, as well as sporomorphs not identified due to a significant degree of destruction (Corroded).

PROFILE WAWEL 2017 NE

Samples from the Wawel 2017 NE profile were taken from three distinctly different layers. The bottom brown mineral sediment was cohesive. The middle, black, cohesionless sediment (according to expert archaeological assessment: a cultural layer) contained burned plant fragments. Above this was cohesive, brown mineral sediment. The whole profile was covered by heterogeneous mineral sediment (Fig. 7, Table 3).

Table 3. Description of the excavated profile Wawel 2017 NE

Designation of layer	No of samples	Sediment description
VI/8b	15	Brown, mineral coherent
VI/9a	14	Cohesionless, black, with charred plant fragments (?)
Original soil layer	13	Brown, mineral coherent

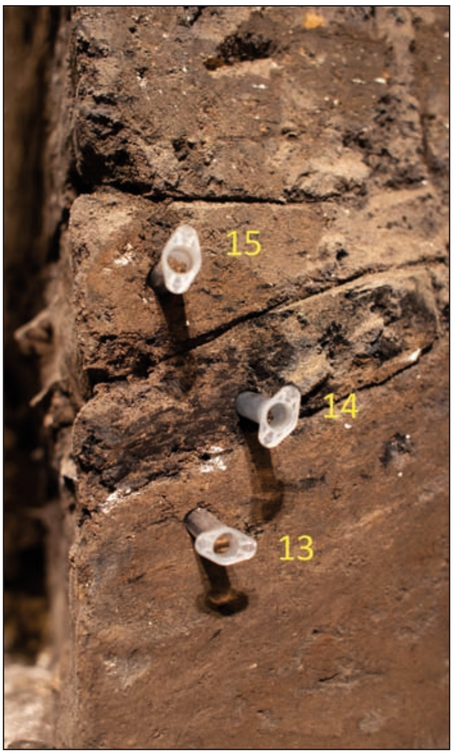


Fig. 7. Wall of the Wawel 2017 NE profile with marked sampling locations for palynological analysis (13-15) (photo: A. Walanus)

In two palynological samples (NE:14 and NE:15) from the Wawel 2017 NE profile, only single pollen grains of *Pinus*, *Tilia*, *Cerealia* undiff., *Poaceae*, *Cichorioideae* and *Asteraceae* were present, as well as sporomorphs not identified due to the significant degree of destruction (labelled as corroded and degraded). In sample NE:13 sporomorphs were not found.

According to the archaeologist, Dr A. Kukliński, the heterogeneous, black layer with white lumps from which sample no. 14 (profile Wawel 2017 NE) was taken, with larger fragments of plants and pottery fragments visible, is probably the remains of a medieval hearth (furnace). Analysing plant residues in the material, no larger plant fragments, including burned wood, were found that could be used for determination.

PROFILE WAWEL 2017 NW

Samples from the Wawel 2017 NW profile were taken from several different layers: from a dark brown, cohesive, compact sediment overlying the calcareous rock, and from another, distinctively mineralised, less cohesive, possibly charred (cultural) sediment. The highest sediment, from which sample no. 21 was taken, was covered with dry, heterogeneous mineral substance (Fig. 8, Table 4).

According to the archaeologist, Wawel 2017 NE and Wawel 2017 NW are the same profile, separated by a research excavation trench. Sample no. 15 (from NE) corresponds to sample no. 21 (from NW). Sample no. 14 (NE) corresponds to sample no. 19 (and maybe 20) from NW.

In the NW:21 palynological sample, 270 sporomorphs were counted (Fig. 9), representing taxa of trees and herbaceous plants, as well as sporomorphs not identified due to a significant degree of destruction (corroded, degraded). In the NW:16 and NW:19 palynological samples from the Wawel 2017 NE profile, only single sporomorphs were present. In the NW:18 sample, no sporomorphs were found.

Table 4. Description of the excavated profile Wawel 2017 NW

Designation of layer	No of samples	Corresponds to the sample no	Sediment description
VI/8a-b	21	15 (NE)	Mineral, homogenous, brown
VI/9a-b	20	14 (NE) probably	Mineral (sand), heterogeneous red, with white mineral inclusions
	19	14 (NE)	Mineral, heterogeneous, black, with charred plant fragments (?)
Degraded clay (rock formations)	17, 18		Mineral, homogenous, light brown
	16		Mineral, cohesive, compact, dark brown
			Limestone rock

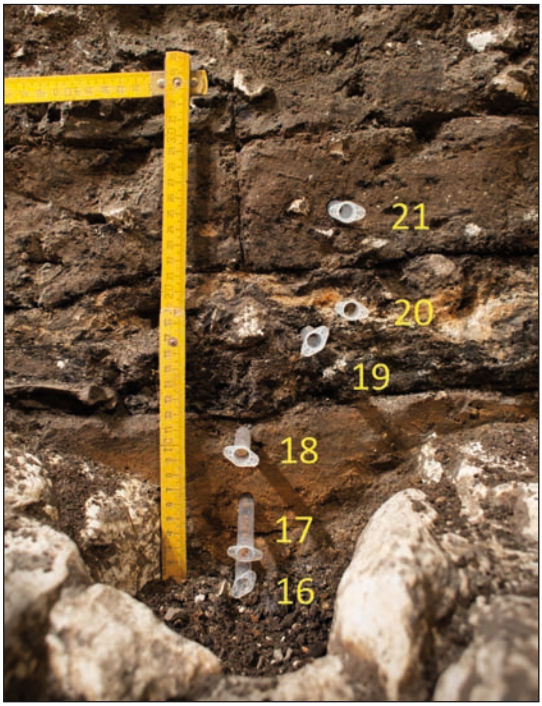


Fig. 8. Wall of the Wawel 2017 NW profile with marked sampling locations for palynological analysis (16-21) (photo: A. Walanus)

In the Wawel 2017 NW profile, from which sample no. 19 was taken, the small, charred wood fragments were identified as oak (*Quercus*) and hornbeam (*Carpinus*). In the palynological sample, hornbeam pollen grains were not identified.

DISCUSSION

Site Wawel 2017

At the Wawel 2017 site, in the two analysed SE and NW profiles, sporomorphs were present only in the upper layers of the excavated profiles from which samples were taken for analysis. These layers are covered with overlaying layers, from which samples were not collected, as it was considered that the material was mixed and may not contain sporomorphs (Figs. 5, 7, 8).

In the composition of the sporomorphs of both profiles, over 30% are damaged sporomorphs, unsuitable for taxonomic determination. Among the identified sporomorphs, herbaceous taxa predominate (over 70%). These are represented by pollen grains from the family Cichorioideae, which due to their highly resistant cell walls (exine) are usually overrepresented in samples from archaeological sites (Makohonienko and Nalepka 2007). Pollen from plants in the families Rosaceae, Asteraceae and Poaceae (grasses) are also present. There are also individual pollen grains of cereals with genus not identified (Cerealia undiff.). The percentages of trees (about 20%) and shrubs (about 5%) (Figs. 6, 9) in both profiles are similar.

The taxonomic composition of the Wawel 2017 NW profile, in which 270 plant taxa were identified, and the Wawel 2017 SE profile, in which 62 taxa were identified, allows a very general description of the vegetation growing near the examined site. Based on the composition of sporomorphs (Table 5), it can be concluded that they originated from a variety of plant communities, among which communities developing in an open (non-forested) landscape dominated. Fresh and moist meadows with *Cirsium*, *Carduus*, *Fili-*

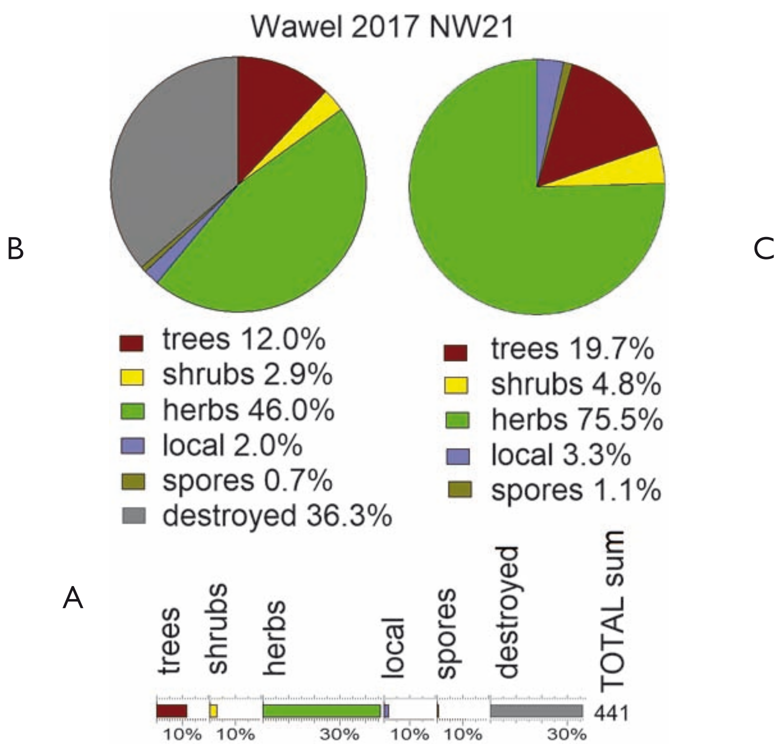


Fig. 9. Results of palynological analysis of sample no. 21 from the Wawel 2017 NW profile. Percentage of sporomorphs in the studied spectrum presented in groups: trees, shrubs, herbaceous plants, local habitat plants, spores of non-vascular plants and unidentified sporomorphs A – percentage diagram, B – percentage piechart, C – percentage pie graph in relation to the sum of identified sporomorphs (excluding sporomorphs destroyed and impossible to determine)

Table 5. List of sporomorphs (pollen grains and spores) identified in the analysed Wawel 2017 NW, Wawel 2017 SE and Wawel 2017 NE profiles.
Palynological taxa arranged in groups depending on the possibility of indicating habitat requirements

Sporomorphs (identified palynological taxa)*	Profile Wawel 2017		
	NW	SE	NE
Taxa determined to the species. Habitat requirements specified exactly			
Fagus sylvatica		1	
Fraxinus excelsior	1		
Pinus sylvestris	1	1	1
Corylus avellana	1	1	
Juniperus communis	1		
Polygonum bistorta	1		
Sanguisorba officinalis	1		
Secale cereale	1		
Solanum dulcamara	1	1	
Typha latifolia	1	1	
Pteridium aquilinum		1	
Taxa determined to the genera. Habitat requirements specified in some approximation, imprecise			
Acer	1		
Alnus	1	1	
Betula	1	1	
Populus		1	
Quercus	1	1	
Tilia	1		1
Salix	1		
Artemisia	1		
Campanula	1		
Filipendula	1		
Lythrum	1		
Thalictrum	1	1	
Cirsium/Carduus	1		

Sporomorphs (identified palynological taxa)*	Profile Wawel 2017		
	NW	SE	NE
Taxa determined to the genera. Habitat requirements specified in some approximation, imprecise			
Rumex acetosa/acetosella	1		
Taxa determined to the family. Habitat requirements specified in a small approximation, imprecise			
Ericaceae		1	
Apiaceae	1	1	
Asteraceae			1
Brassicaceae	1		
Caryophyllaceae	1		
Chenopodiaceae	1		
Cichorioideae	1	1	1
Cyperaceae	1	1	
Poaceae	1	1	1
Rosaceae	1	1	
Equisetum	1	1	
Taxa determined to the group. Habitat requirements specified in a small approximation, imprecise			
Cerealia undiff.	1	1	1
Taxa determined to the palynological type. Habitat requirements defined very general and ambiguous. The range of habitats can vary widely. Some taxa are cosmopolitan habitat			
Aster-type	1	1	
Centaurea scabiosa-type	1		
Centaurea jacea-type	1		
Centaurea mollis-type	1		
Campanula-type	1		
Lychnis-type	1		
Prunella-type	1		
Dianthus-type	1		
Caltha-type	1		
Trifolium-type	1		

Sporomorphs (identified palynological taxa)*	Profile Wawel 2017		
	NW	SE	NE
Mentha-type	1	1	
Carduus -type		1	
Cirsium-type	1		
Galium-type	1		
Anthemis-type	1	1	
Rumex acetosella-type	1		
Rumex acetosa-type	1		
Vicia-type	1		
Sparganium-type	1	1	
Taxa determined to unclassified group. Habitat requirements specified in some approximation			
Filicales monolete		1	
Taxa classified into a systematic group. Habitat requirements specified in some approximation			
Sphagnum	1		
Bryales=Musci	1		
Botryococcus	1		
Undetermined taxa.			
Indeterminable: concealed = Concealed	1	1	
Indeterminable: corroded = Corroded	1	1	1
Indeterminable: degraded = Degraded	1	1	1
Indeterminable: unknown = Varia	1	1	
Other plant microscopic remains			
Charcoal			1

* Palynological taxa: sporomorphs (pollen or spores) with the same set of morphological features, grouping plants of different species, genera or families. Taxa of genus or family rank may include species with different ecological requirements, representing different habitats.

pendula, *Campanula*, *Sanguisorba* and dry meadows with *Centaurea* and *Dianthus* developed here. Growing in wet places and on moist banks of watercourses (rivers/streams) and water reservoirs (old riverbeds, ponds) were alders (*Alnus*) and willows (*Salix*). The presence of cereal pollen (*Cerealia* undiff.) including wheat (*Triticum*) may indicate the existence of arable fields near the Wawel Hill (it cannot be determined whether they were closer or more distant). Cereals were probably not grown on the Hill; their pollen grains could have been brought to Wawel with deliveries of cereals or flour to the court kitchens.

This is a general (not detailed) picture, but it corresponds to the picture outlined based on palynological analysis from neighbouring palaeobotanical sites analysed on the Wawel Hill (Wasylikowa 1978a; 1978b; 1991; Wasylikowa *et al.* 2006, Nalepka 2009).

Pollen from ruderal plants (*Artemisia*) may have come from the immediate surroundings because these plants disperse very quickly (for example, on paths, next to walls) and are not always removed (mowed, plucked) before they bloom and release the mature pollen grains.

The fairly numerous identified sporomorphs indicate the existence of diverse communities growing in habitats with different ecological requirements, since plant pollen from the identified genera classified as (*e.g.*, *Aster* type) or families (Ericaceae, Brassicaceae, Poaceae, Apiaceae) may have come from plants growing in cosmopolitan habitats.

Sporomorphs reached the studied sediment from nearby habitats, located in the closer or more distant surroundings. Due to the location of the site, the preserved sporomorphs may have arrived there by natural deposition in the form of pollen rain from the area around Wawel Hill, including plants grown near the Hill, or may have come from plants growing directly on it. They could also have been brought to Wawel by human agency with the transport of material goods – for example, among plants delivered to the court kitchens as food for people (Wasylikowa 1991) or as food and for agricultural purposes related to the animals present here.

The presented interpretation describing the vegetation during the formation of the studied sediments at the Wawel 2017 site is consistent with the interpretation of the results of previous palaeobotanical studies obtained from the study of other geological sediment profiles from early medieval layers in region IX at Wawel (Wasylikowa *et al.* 2006) and from the Royal Gardens on the upper terrace (Nalepka 2009).

Genesis of the filling and the presence of sporomorphs in the examined site

Analysing the results, the question arises of why pollen is preserved only in the upper layers of each profile studied and has disappeared from the deeper levels.

The heterogeneous nature of the sediment proves the anthropogenic origin of the basin here and its subsequent filling. On the naturally exposed limestone rocks from which the Wawel Hill is built, it was excavated by early medieval people (from the early tribal period?). Later, the contents of this depression were levelled several times, and then the feature was filled again with various materials, such as furnace remains. The sediment filling the depression was uneven (loose), so sporomorphs that may have fallen naturally along with pollen rain would have quickly decomposed under aerobic conditions. After some time, the natural process of growth of vegetation could begin on the surface of the filling. This resulted in a moist organic layer in which sporomorphs could have been preserved, but this layer was backfilled after a short time. This is in accordance with the archaeological description quoted above: The sequence of the feature's fill is covered by a partially humidified sandy layer that covers its entire area (layer VI/8). This layer may be a testimony to the plan of levelling and tidying of the place of operation of the furnace after its use.

The age of the analysed sediment estimated based on relative and absolute dating

Palynological (relative) age

The material taken from profiles at the Wawel 2017 site can be dated to the late Holocene, based on the composition of sporomorphs. This is evidenced by the presence of beech pollen (*Fagus sylvatica*), a so-called "late migrant" (Latałowa *et al.* 2004). Based on the presence of rye pollen (*Secale cereale*), one can point to the Subatlantic phase (Okuniewska-Nowaczyk *et al.* 2004). Based on the pollen analysis, there is no possibility of specifying the age more precisely.

Archaeological (relative) age

The archaeologist, Dr Andrzej Kukliński, based on evaluation of the archaeological artefacts and their position, dated the exposed sequence of cultural layers to no older than the 8th century AD.

Radiocarbon (absolute) age

Radiocarbon dates obtained by the AMS method did not confirm the dating – they indicated that the material is slightly younger, from the 8th and 9th centuries, and in reverse sequence (Kukliński in print). Palynological/palaeobotanical studies did not provide grounds for a precise specification of the age of the examined sediments.

Comparison of palynological data from three sites examined on the Wawel Hill

Another interpretation was based on the analysis of materials taken from three places: (Fig 1B: 4) from the site marked as Wawel IX, from a clump of organic material stuck together with mineral matter (Wasylikowa *et al.* 2006), (Fig. 1B: 1) from the sediments deposited in the Renaissance Royal Gardens at Wawel, which are known to have been

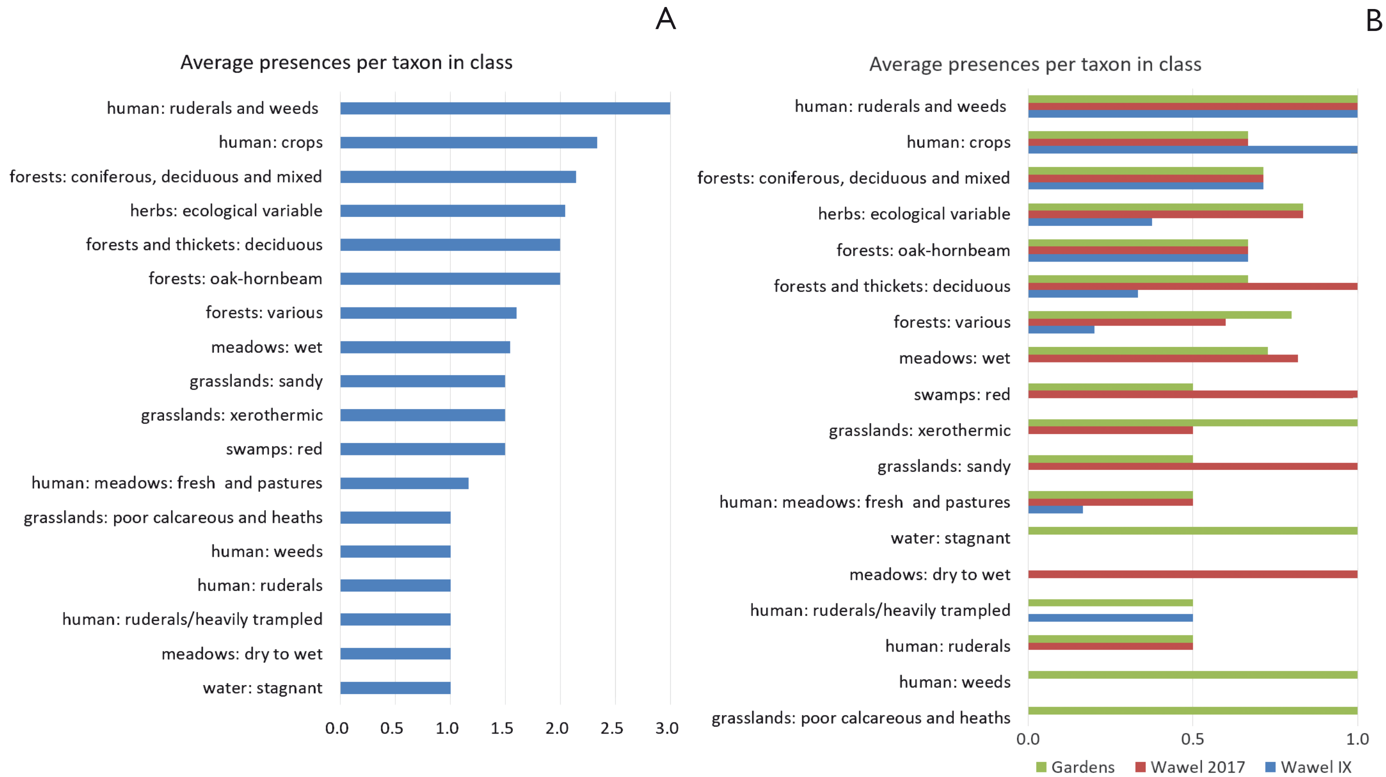


Fig. 10. Average number of groups referring to habitats (classes) per taxon, *i.e.*, number of occurrences in a group divided by the number of taxa observed in the given group. For the three sites globally (A) and individually (B)

transported there in bulk (Gwizdałówna 1995, after Chmiel 1933; Nalepka 2009), and (Fig. 1B: 5) from three profiles located in the basement of building no. 9 (described in this article). The pollen diagram made by Koperowa (Wasylikowa 1978a) is excluded from the discussion, because although the set of palynological taxa of herbaceous plants which she distinguished is very numerous, not all of the determinations have been confirmed using modern literature data.

At the beginning of the work on the pollen data, the interpretation and discussion were based on percentage pollen diagrams/pie charts (Figs. 6, 9) in a standard way (Makohonienko and Nalepka 2007). However, due to the small number of sporomorphs in the samples, raw diagrams/pie charts were prepared based on raw data (*cf.* Nalepka 2009), because the percentage graphs do not meet the methodological requirements. This chapter discusses and interprets the results based on the presence or absence of sporomorphs in the analysed pollen spectra. The sediment from all three examined sites on the Wawel Hill – Wawel IX (Wasylikowa *et al.* 2009), the Royal Gardens (Nalepka 2009) and the basement of building no. 9 (current examination) – did not accumulate as it would have done in, for example, a natural basin.

The interpretation based on percentage calculations or on raw data does not meet the conditions for performing statistical analyses. The deposition of sporomorphs in the studied profiles, and thus in the palynological samples, was not subject to the processes typical of lake or peat sediments. The accidental deposition of sporomorphs and the possibilities of their conservation in the forming profiles played a much greater role here.

For conducting statistical analysis, regardless of biological knowledge, the results obtained in the individual studied profiles were analysed by recording the presence of a given palynological taxon as 1 (absence from the table is denoted as zero). The list of all identified pollen taxa in the studied profiles is presented in Table 5.

Biologically defined classes of taxa contain from 1 to 24 individual taxa. It is obviously interesting how many objects belong to those classes. However, having such a diverse number of taxa per class, it is also interesting to determine how many observations we have on average per taxon. This information is shown in Fig. 10a. The classes are sorted, as is evident from the diagram, according to the average number calculated. In the first two positions are classes named "human", but two other "human" classes are among the last ones. This indicates a high degree of variance, which may be open to interpretation. In Fig. 10b, the average numbers are broken down between the three sites. Visible, to some extent, is the lack of correlation between sites. This is addressed more precisely using the Phi coefficient of correlation. Of the three coefficients, one is almost exactly zero, and the two larger values are of opposite sign; however, both lack statistical significance. The p-value, calculated according to the Chi-square distribution, is 0.2.

CONCLUSIONS

The sources of the sporomorphs (pollen grains and spores of non-vascular plants) present in the examined material from three profiles from the Wawel 2017 site are local habitats around the Wawel Hill and on the Hill itself. At the time, this locality had an open landscape in which a mosaic of communities developed, including wet meadows and thickets as well as ruderal, arable and forest communities, which is consistent with the current picture of the vegetation of the last millennium.

It cannot be excluded that some sporomorphs arrived at the site by human agency accidentally or were transported to Wawel for utility purposes.

Sporomorphs survived only in the upper layer of the two profiles studied (Wawel 2017 NW and Wawel 2017 SE). Probably, the examined sediment was not cut off from air access in the past (it was ventilated, and thus exposed to aerobic conditions), which led to the destruction of sporomorphs under aerobic conditions (combustion, oxidation, decomposition). The presence of sporomorphs only in the upper layer of the studied profiles can be explained by the fact that this level was exposed for a short time, after which it was quickly covered with a layer that cut off the profile from air access.

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TOUCHSTONES FROM EARLY MEDIEVAL CHAMBER GRAVES IN CIEPŁE, EASTERN POMERANIA

ABSTRACT

Wadyl S. and Karczewski J. 2021. Touchstones from early medieval chamber graves in Ciepłe, Eastern Pomerania. *Sprawozdania Archeologiczne* 73/2, 313-326.

The precious metals of the early medieval period were the same as those of today. Knowing their purity was essential, which means that assaying and refining were of great importance. Touchstones have been used to assess the quality of precious metals since antiquity. Stone artefacts initially identified as whetstones were unearthed in two of the most prestigious chamber graves discovered at the cemetery in Ciepłe. Traces of precious and non-ferrous metals on the surface of the object from Grave 42 proved that this artefact was a touchstone. It is probable that the phyllite stone from the other grave served the same purpose. Tools of this type are often found in high-prestige burials in Europe, in some cases together with balance scales and weights, which suggests that the individuals in whose graves they were deposited had access to precious metals. Therefore interpreting touchstones as a reliable indicator of the high social standing of the deceased seems entirely reasonable.

Keywords: early medieval archaeology, funerary practices, chamber graves, eastern Pomerania, touchstones, SEM-EDS
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INTRODUCTION

It is a truism to say that goldsmiths and merchants need to be familiar with the properties of precious metals (gold and silver) and base metals (copper, tin, zinc, *etc.*). By the same token, they should also know how to assess the quality of a given metal or alloy and what tools are required for this purpose. Three basic methods to assay gold and other precious metals were already in use in antiquity: fire assay, touchstone testing and the Archimedes method. Interestingly, all three are still used to this day. The oldest means of assaying used by goldsmiths involved rubbing the tested article on a touchstone. This method provides a relatively easy way of determining the purity of precious metals, primarily gold and silver, and was already known in the late Bronze Age. The earliest confirmed archaeological evidence for touchstones comes from Late Bronze Age sites in Europe dating to the 8-7th centuries BC (Eluére 1986). The method was fairly widely used in antiquity and throughout the Middle Ages (Oddy 1983, 55-57; Moore and Oddy 1985; Ježek 2012; 2013).

Touchstones were used to estimate the content of precious metals in an alloy. In addition to the fairly obvious advantages of this method, providing easy, rapid, cost-free analysis, it also had the important benefit of being non-invasive and non-destructive.

Nowadays, touchstones are usually made of lydite (black siliceous slate of organic origin with a 90-98% silica content) (Zastawniak 1957, 60) or radiolarite (organogenic siliceous rock with a silica content of up to 98%) of a red hue (Wälchli 1981, 155). During the early medieval period, touchstones were made of hard raw materials, often metamorphic rocks like schist, slate, phyllite and quartzite (Ježek 2014, 714). They were often carefully worked into an oblong of quadrate cross-section with flat and smooth surfaces.

Touchstones should be kept clean so that subtle differences in the colour of the tested metal can be distinguished. They are cleaned using charcoal, water, wax and sand (Zastawniak 1957, 61; see also Ježek 2014, 714). In addition to the stone itself, a set of touch needles is required to assay a metal. The set should comprise needles of various composition and of as great a range of colours as possible (Zastawniak 1957, 62; see also Wälchli 1981, 156). Various types of acid solutions are also essential in the assaying process (Zastawniak 1957, 65, 66).

The gold, silver or other metal alloy to be tested is rubbed onto the surface of the touch stone in a series of adjacent lines covering an area of 1.5-2 cm in length and 0.5 cm in width. The lines should be uniform and compact producing an even streak on the touchstone (Zastawniak 1957, 68). The colour of the streak depends on the qualitative and quantitative composition of the alloy. Gold alloys will yield a range of colours from light green to red (Zastawniak 1957, 68). The colour of the streak is of greater significance when assaying silver alloys. Pure silver produces a white streak. The greater the amount of copper in the alloy the redder the streak will be. Conclusions can be drawn about the gold or silver content of the tested alloy from the colour alone; however, the accuracy of optical assessment is not fool-proof.

Both in antiquity and in the post-medieval period, the use of touch needles (standard alloys) is confirmed by written accounts. An accuracy of 2% was obtainable when testing precious metals using a set of needles (Oddy 1983, 55, 56). However, no touch needles or set of reference alloys has ever been found in any medieval contexts. Martin Ježek believes that individuals experienced in the use of this method were able to assess metal alloys from their colour alone (Ježek 2013, 713). As mentioned earlier, assays can be based solely on colour, and it is likely that during the early medieval period an error of 1-2% in the assessment of an alloy would not have been of any great significance.

PRESTIGIOUS GRAVES AT CIEPŁE CEMETERY

The cemetery at Ciepłe (northern Poland) is one of the most noteworthy burial sites dating from the 10th/11th centuries, the period that saw the emergence of the first Polish monarchy (Fig. 1). Until recently it was best known for a chance discovery made in the autumn of 1900, when six inhumation burials were found (*Amtlicher Bericht* 1901, 48,

Fig. 1. Location of Ciepłe in the context of the Piast state (according to Kara 2009, fig. 88). Illustration S. Wadyl

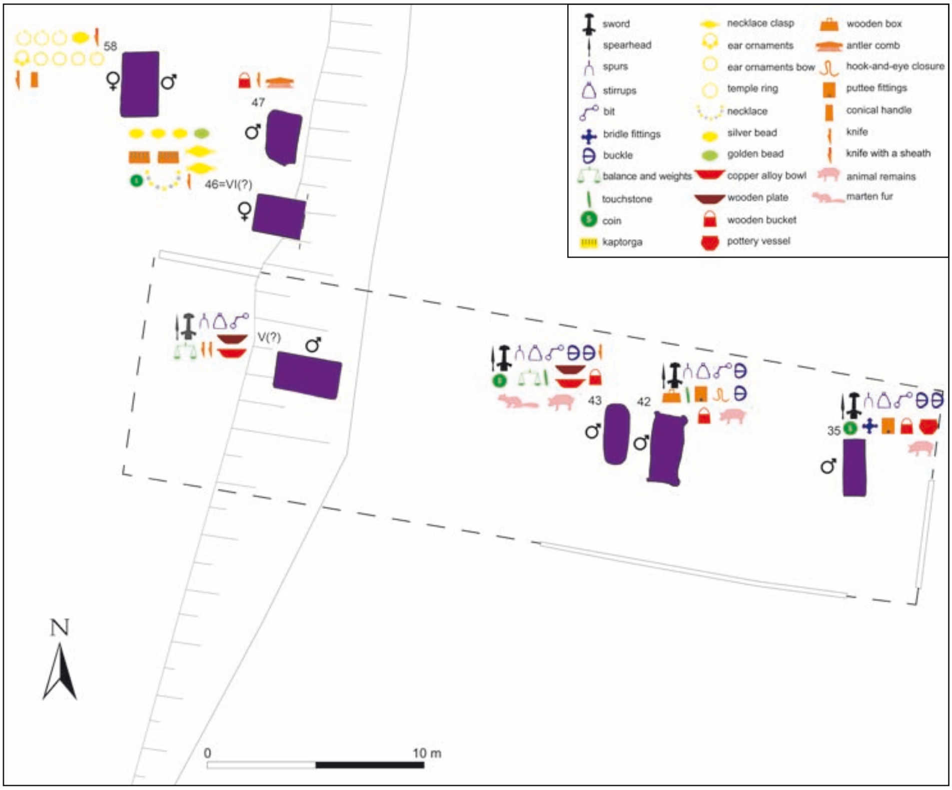

Fig. 2. Plan of the central part of the cemetery at Ciepłe showing the locations of grave goods. Illustration S. Wadyl

49). Two of the graves were distinguished by their extremely rich and unusual goods that were quite different to the burial assemblages found at other Pomeranian cemetery sites. The two graves were instantly identified as those of a Scandinavian male and accompanying female (La Baume 1926, 94, 95; Langenheim 1933, 263; 1939, 61, 62; Łęga 1930, 157, 205, 206; Kostrzewski 1948, 87; Kara 1999; 2001). Jan Żak disagreed with this interpretation, stating that "(the purported Viking burial) is the grave of a wealthy knight, or possibly even a Pomeranian magnate" (Żak 1957, 178). A similar opinion has been expressed recently by Leszek Gardeła (2019). More than a hundred years after its discovery, this necropolis came to light once again during work on a new sewage system in the commune of Gniew (the excavations were directed by Zdzisława Ratajczyk of the Gdańsk Archaeological Museum). This initiated a series of planned excavations at the site, which led to the discovery of 51 burial features. These recent excavations revealed five graves that differ from the others at the cemetery in terms of their form, size, orientation, and burial goods (graves no. 35, 42, 43, 47, and 58). They were classified as chamber graves, like the two other distinctive graves (V and VI) found in 1900 (Ratajczyk 2016; Wadyl and Ratajczyk 2019). The cemetery at Ciepłe is one of the few in the Vistula basin (alongside Bodzia, Dziekanowice, Kałdus, Pień and Sowinki) where chamber graves have been discovered (Janowski 2015).

Four chamber graves, located in the cemetery's central, demarcated section, are unique (Fig. 2). Graves 35, 42, 43, and V are without a doubt the most richly furnished burials of the early medieval period ever recorded in Poland. Similar sets of goods were deposited in each of these graves, consisting of swords, spears, and horse equipment in the form of spurs, stirrups, and bits. Graves 43 and V were each provided with a balance and a set of weights. Other items deposited in these graves included coins, a bronze bowl, and buckets.

Spatial analysis of the cemetery indicates that the earliest burials are those in the middle of the site, namely graves 35, 42, 43, and probably V. Marginally earlier graves (42 and 43) date from the early 11th century, as evidenced by a Bavarian pfennig struck in Cham during 1002-1009 (Wadyl 2019a).

PHYLLITE 'WHETSTONES' FROM GRAVES 42 AND 43

The grave goods in two of the lavishly furnished burials (42 and 43) at Ciepłe included items made of stone (Fig. 3). Initially, on account of their shape, they were deemed to be whetstones, in other words stones used for sharpening metal tools (Ratajczyk 2016, 92, 93). Both artefacts are made of fine-grained, dark grey phyllite. Because of its properties, phyllite was only used for making whetstones (Skoczylas 1990, 120). Central and western Norway are widely believed to be the source of origin of this rock (see, for example, Mitchell *et al.* 1984). Janusz Skoczylas (Majerowicz and Skoczylas 1983, 71; Skoczylas 1990, 51-53) was alone in suggesting that phyllite may have been sourced from the eastern Sudeten mountains. Recent research results show that phyllite whetstones were made from rocks of Scandinavian origin (Szydłowski 2011; Lisowska 2013, 216-220; see also Kara 2006).

The example discovered in Grave 42 takes the form of a rectangular prism with two holes at the top (Fig. 3: a). It survives intact and measures 130 mm in length, 5.8-9.2 mm in width, 3-6.8 mm in height, and weighs 16 g. It was found next to the left hip of the buried individual, suggesting that it may have been worn on a belt (Fig. 4).

The specimen recovered from Grave 43 takes the form of a flat, elongated, rectangular prism (Fig. 3: b). There are two holes at one end of it. Evidence of damage is visible at the opposite end: the stone cracked at the point where there had originally been a suspension hole, and an attempt was made to conceal the damage by grinding down and smoothing the edge (this attempt was not entirely successful as a small indentation was left). It was probably then that the two aforementioned holes were drilled. The fact that considerable trouble was taken to repair a 'simple whetstone' is rather surprising. The stone has an extant

Fig. 3. Touchstones from graves 42 (a) and 43 (b). Photo J. Szmit

length of 94 mm, and is 10-13 mm wide, 3.6-5 mm high, and weighs 16 g. It was found in the vicinity of the right hip, which could indicate that it was worn on a belt (Fig. 4).

Whetstones are relatively common features of early medieval burial assemblages. However, in recent years it has been demonstrated that a significant proportion of stone artefacts thought to be whetstones are in fact touchstones that were used to assess the quality of precious metal alloys and other non-ferrous metals (see Ježek and Zavřel 2010; Ježek 2013).

METHODS

The suspicion that items previously identified as whetstones were in reality used as touchstones prompted a study aimed at detecting any potential traces of metal on the surface of these artefacts. Given that touchstones need to be thoroughly cleaned after each use, marks left by the tested alloy end up being removed from the surface of the stone. In consequence there are usually no visible traces of metal on the surfaces of these objects. There are, however, microscopic traces and scratches that can be detected using specialist analyses. The current method of choice for identifying microscopic traces and scratches left by non-ferrous metals is SEM-EDS (scanning electron microscopy with energy dispersive spectroscopy). The first people to use this method of chemical microanalysis to detect traces of non-ferrous metals on the surfaces of stone artefacts were Christiane Eluére (1986, 58, footnote 5) and Frank Wietrzichowski (1993, 38). However, it was Martin Ježek and Jan Zavřel who were the first to employ this method more widely in studies of this type (Ježek and Zavřel 2010; see also Ježek 2012; 2013).

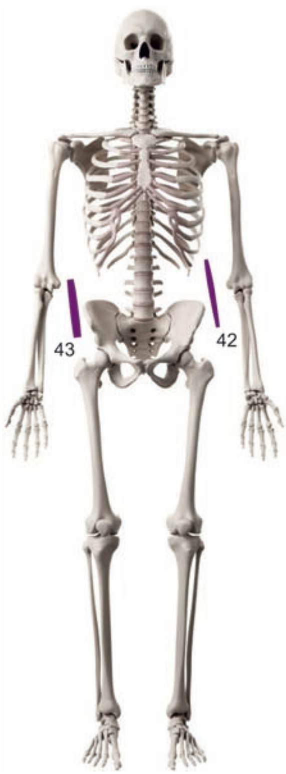

Fig. 4. Location of touchstones in graves 42 and 43. Illustration S. Wadyl

The exact methodology used in this analysis has not yet been described. Our first attempts to detect metal residues were unsuccessful. As a result, we carried out an experiment in order to devise a method for detecting microscopic traces of metal. Scratches were made with silver and gold on a non-historic stone object. After cleaning its surface, the item was placed in a scanning electron microscope and an attempt was made to detect micro-traces left by the precious metals. The success of this experiment allowed us to apply the same method to historic artefacts. The analyses were carried out with an FEI Quanta FEG 250 scanning electron microscope and the beam voltage was 30kV. Backscattered electrons (BSE) detector was used for imaging of the surface. Analysis of the elemental composition was carried out using an EDAX Genesis APEX 2i ApolloX SDD detector.

RESULTS

The undertaken analyses revealed the presence of precious metals and non-precious metal alloys on the surface of the artefact from Grave 42. The following metals and alloys were identified: silver (Fig. 5: a), tin, tin-lead alloy (Fig. 5: b), tin-lead-copper alloy (Fig. 6: a), and copper-zinc alloys (Fig. 6: b). No similar traces were detected on the surface of the object from Grave 43. There are a few traces of iron on it (Fig. 7), mostly in the form of linear scratches, which suggest that it may have been used occasionally for sharpening an iron tool, possibly a knife. However, it is not heavily worn as would be expected in the case of a whetstone. Due to the limitations of this method and its very time-consuming nature, an area of only 1 cm^2 was examined. Examining the entire artefact would probably yield different results. Thus it was confirmed that the item from Grave 42 was definitely a touchstone, and so probably was the one from Grave 43.

DISCUSSION

The weapons, equestrian equipment and numerous luxury goods found with the males buried in Graves 42 and 43 are evidence of their high social status, and possibly also their

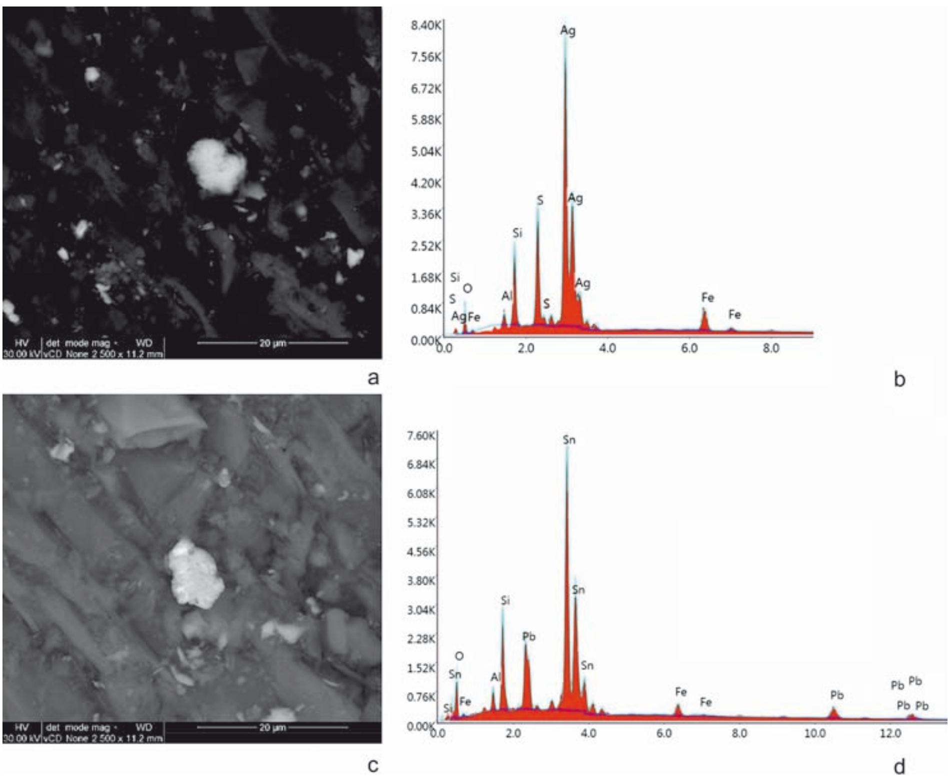

Fig. 5. Selected microphotographs (a, c) and spectra (b, d) of metal traces preserved on touchstone from grave 42. Photo J. Karczewski

profession. They were probably members of an elite military unit (Wadyl 2019b, 468, 469, 484, 485). Both graves were those of men. The individual buried in Grave 42 represents the *maturus* age group, whilst the one in Grave 43 belongs to the *adultus* category (Pudło 2019, 387). The goods found with the Grave 43 male also included a balance and a set of weights. A similar assemblage came from Grave V (La Baume 1926, 94, 95); however, there is no record of a 'whetstone' having been discovered with this burial.

Research carried out during the past decade, mostly by Ježek, shows that touchstones are quite often found in graves, and particularly in richly furnished ones, including chamber graves (Ježek 2013, 721-723; therein further references). In addition to the examples from Ciepłe, in Poland further touchstones have been recovered from chamber graves in Dziekanowice (Wrzesińska and Wrzesiński 2014; *cf*. Ježek 2018, 123-144) and Sowinki (Ježek *et al*. 2013). A carefully worked 'whetstone' was also found at a site in Pień (Błaszczyk 2020, 117-119), though in this instance no specialist analysis was carried out to determine whether it was used as a touchstone.

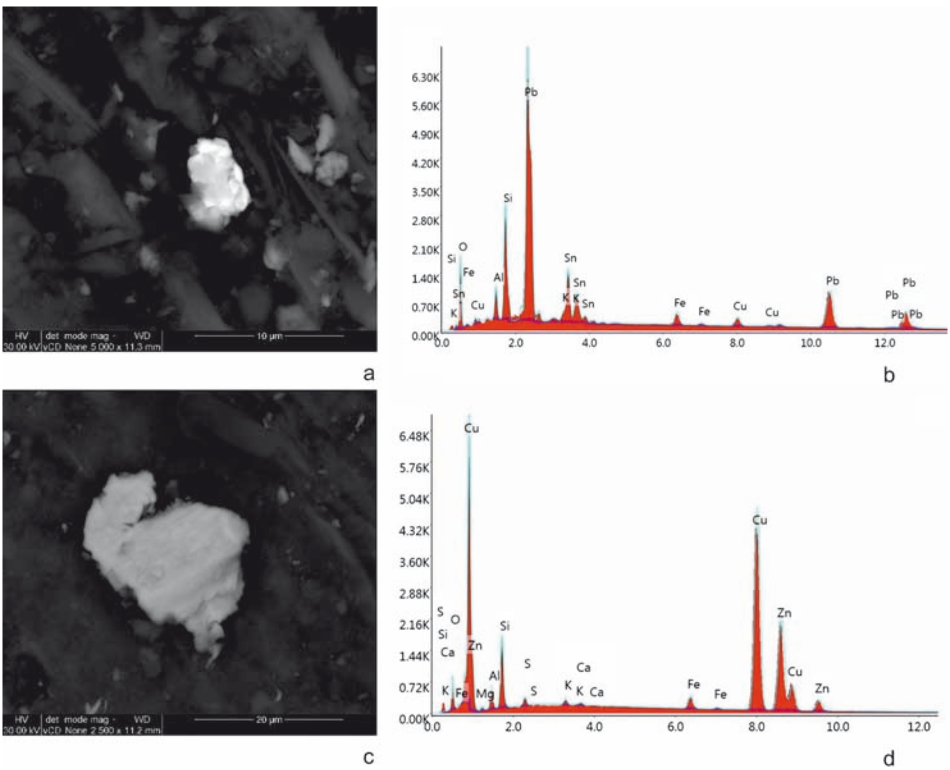

Fig. 6. Selected microphotographs (a, c) and spectra (b, d) of metal traces preserved on touchstone from grave 42. Photo J. Karczewski

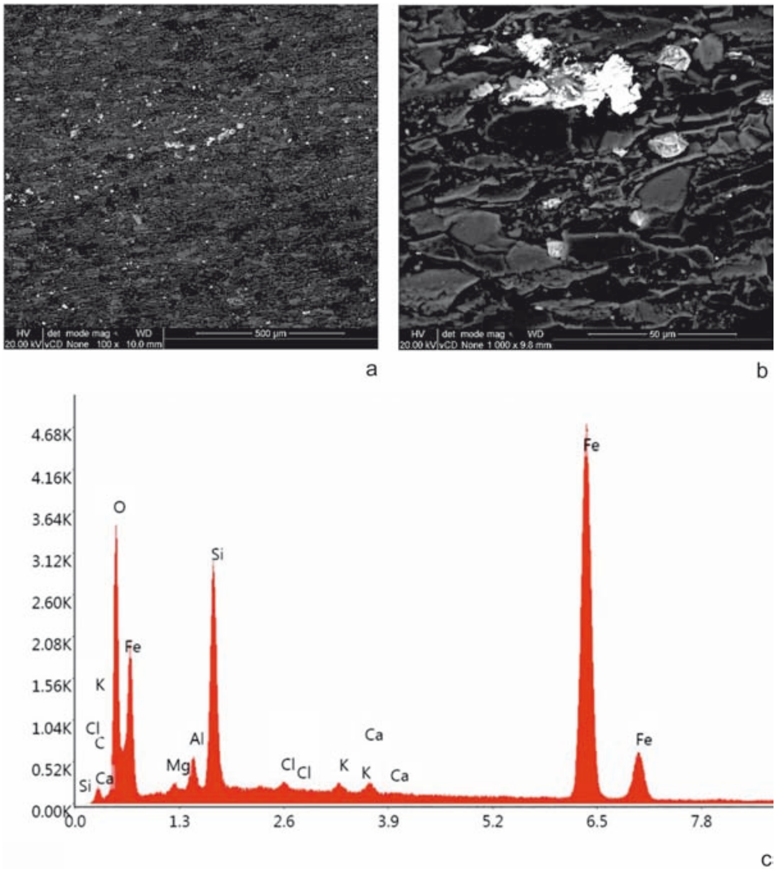

Fig. 7. Selected microphotographs (a, b) and spectra (c) of iron traces preserved on touchstone from grave 43. Photo J. Karczewski

There is no doubt that these artefacts should be interpreted as symbols of high social status. In many burials, particularly at sites in Scandinavia and the Baltic region, touchstones are often found together with balances and weights. The simplest interpretation of these assemblages is to see them as evidence of the deceased having been a merchant. The discovery of a burial containing merchant paraphernalia in conjunction with weapons usually results in the grave's occupant being identified as an armed merchant. This is exactly what happened at Ciepłe. A balance scale and 9 or 10 weights were found along with weaponry in Grave V (*Amtlicher Bericht* 1901, 48, 49), and in most articles on the subject the burial was classified as that of an armed merchant (Kara 1998; 2001). The individual buried in Grave 43 was also initially classified as an armed merchant (Ratajczyk 2013, 325). Many early medieval burials with weapons, balance scales and/or weights found in the Baltic region have been interpreted in this way (Winkelmann 1977, 97-104; Arrhenius 1979, 413-414; Berga 1988; Apals and Apala 1994; see also Bogucki 2010; *cf*. Ježek 2013, 718-720, wherein further references).

In most cases it is difficult to attribute specific hierarchical positions to members of a population of burials. We do not know who these people were and the validity of the inferences we make about their professions and roles in society based on the goods deposited in their graves, be they weapons or, for example, merchant paraphernalia. This issue has been addressed in the literature on numerous occasions (Härke 1997; 2014; Williams and Sayer 2009). Irrespective of whether we treat the presence of touchstones in graves as evidence of their occupants having been merchants or merely as evidence of the fact that they had access to precious metals, the artefacts themselves should be regarded as attributes of high social standing.

Assaying tools are quite frequently encountered at early medieval sites, mostly in burial contexts in Central, Northern and Eastern Europe. Crucially, their geographical distribution coincides with that of Arab dirham and hacksilver hoards, as well as with discoveries of balances and weights. Ježek contends that touchstones should be recognised as an important feature of the *Gewichtsgeldwirtschaft* zone, where hacksilver was the principal currency (Ježek 2013, 726; see also Steuer 1987; 1997).

CONCLUSION

Traces of precious and other non-ferrous metals on the surfaces of stone artefacts commonly identified as whetstones show that, in reality, these objects are touchstones. This reinterpretation of their function casts a different light on the graves in which they were found.

The touchstones from Ciepłe are not the only items of this type to feature in assemblages recovered from richly furnished graves in Central, Northern and Eastern Europe. Without going into whether or not their presence indicates any connection with the profession of merchant, or whether it simply attests to access to precious metals, these objects must be regarded as significant attributes denoting the prestigious position of their owners (*i.e.* the individuals with whom they were buried). The fact that some of the touchstones found in prominent graves are larger than average and very finely worked suggests that they may have been ceremonial attributes that demonstrated high social status (see Ježek 2013, 715).

Traces of precious metals have survived on numerous touchstones, and marks left by other non-ferrous metals (copper, lead, tin or zinc) and their alloys are even more commonplace. As well as providing a means of verifying whether artefacts commonly referred to as whetstones really are whetstones, or whether they served as touchstones, the analysis carried out as part of this study also highlights the wider value of archaeo-metallurgical research. Using SEM-EDS analysis it is possible to determine what metals were made and assayed in past times. Undertaking analysis of this type on a larger scale would significantly contribute to the quality of our knowledge of early medieval goldsmithing.

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HIGH MEDIEVAL FISH-SHAPED NEEDLE CASE FROM WOLIN. FROM THE STUDIES ON THE CULTURE OF THE ELITE

ABSTRACT

Janowski A. 2021. High medieval fish-shaped needle case from Wolin. From the Studies on the Culture of the Elite. *Sprawozdania Archeologiczne* 73/2, 327-337.

The article presents the case study of a needle case discovered in 2013 during excavations on the medieval harbour in Wolin, Pomerania, Poland. This rare artefact is made from antler and has a fish shape. A literature search revealed only a six analogical objects in Central and Eastern Europe – three in Poland and another three in Russia and Ukraine. All were discovered on important sites and strongholds of this specific territory, and all are elite products of 12th century craftsmanship.

Keywords: Pomerania, Wolin, High Midde Ages, bone and antler, needle case
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Needle cases are a group of objects that are used for keeping sewing needles and pins and protecting them against damage or loss. Such objects have been known from various regions in Europe and Asia since prehistory. They were made from a variety of materials: wood, metal, sometimes precious, bone or antler, quite rarely from leather. Most of them are straight, tubular in diameter, a few centimetres long and closed with a removable lid at

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the end. Some of them, especially in modern times, were in fancy shapes and richly ornamented (for example, Golubeva 1978; Firszt 1983; Wachowski 2002; Beaudry 2007, 70-79; Krylasova 2007, 236-247; Meacham 2007; Sergeyeva 2012; Sytaya 2019; Kuznetsova 2020; Dementeva and Lebedeva 2021). Needle cases are rare objects among archaeological finds excavated in regions populated by Slavs. In Poland, only a dozen or so have been uncovered, hence it should come as no surprise that there are only a few independent publications on the subject (Zielonka 1951; Firszt 1983; Wachowski 2002; Kuczkowski 2010a; 2010b). A group of objects of this function made from antler or bone and in the shape of a fish clearly stands out from the general pattern of straight tubular needle cases. One of these is the fish-shaped artefact from Wolin discussed here that was uncovered during archaeological excavations during the building of a marina on the western bank of the River Dziwna in 2013 (Janowski 2014, photo 37; inv. No. WS/2012/O/25). The artefact is in the collection of the Institute of Archaeology and Ethnology of the Polish Academy of Sciences in Szczecin). The site from which it came was located directly to the south of the Old Town, in an area marked as site 3 (AZP 21-06/34).

The needle case from Wolin was made from antler. It has survived down to our times in a very good condition, only the lid is missing (Figs 1 and 2). Its shape clearly displays paired pelvic fins, and dorsal, adipose and tail ones. The whole surface of the needle case is covered with irregular, deep incised ring-and-dot ornamentation (measuring about 4 mm in diameter), which imitates scales. On each side, by the gills there were diagonal slits imitating rays, which made it possible to feed a string through and close the needle case with a lid. The edge of the lid opening was decorated with incisions and there were three circular grooves. The object is 74.2 mm long and weighs 11.14 g. The cross section of the needle case is oval-shaped but variable: it is widest at the centre: (13.6 × 14.8 mm) while the size at the opening and the tail part are respectively 13 × 11.7 mm and 8.2 × 11.8 mm. The depth of the needle socket is 50.6 mm.

The needle case from Wolin is not the only example of such a shape and preliminary research has revealed that there are at least six more (Figs 3-5). The first one is an unpublished earlier find uncovered in Opole-Ostrówek in 1949 (Fig. 4: 1: Inv. Number. 11/49. The artefact is in the collection of the Institute of Archaeology and Ethnology of the Polish Academy of Sciences in Wrocław). The artefact was found during excavations in the north-western part of the site, in square 341, layer 3, whose timeline goes back to the castle which was built on the remains of an earlier stronghold in 1228. The needle case was probably made from antler, it is about 90 mm in length and its diameter is about 16 mm. Not only paired pectoral fins and dorsal, adipose and caudal fins are marked, but also the anal fin. Its shape is more ovoid than the one discussed above and the decoration imitating scales is much denser and more regular. There are three rays on the caudal fins. There are two circular incisions around the lid opening. The opening through which a string would have been fed for fastening the lid is in the shape of a vertical cut. It is not known whether it was originally made like this or whether this is the result of some damage to the find.

Fig. 1. High medieval needle case from Wolin (photo A. Janowski)

Fig. 2. High medieval needle case from Wolin (photo A. Janowski)

A damaged fragment found in 1951 during archaeological excavations at the site of a stronghold in OstrówTumski in Poznań is most probably the remains of a similar needle case (Fig. 4: 2). It was found in layer IVa in trench at Wieżowa Street 2-4 dated between the 12th and the first half of the 13th century (Dymaczewski 1961, 162, pl. 14: 29). The artefact is 80 mm long, its oval diameter measures 18 × 13 mm and it is decorated with an irregular pattern

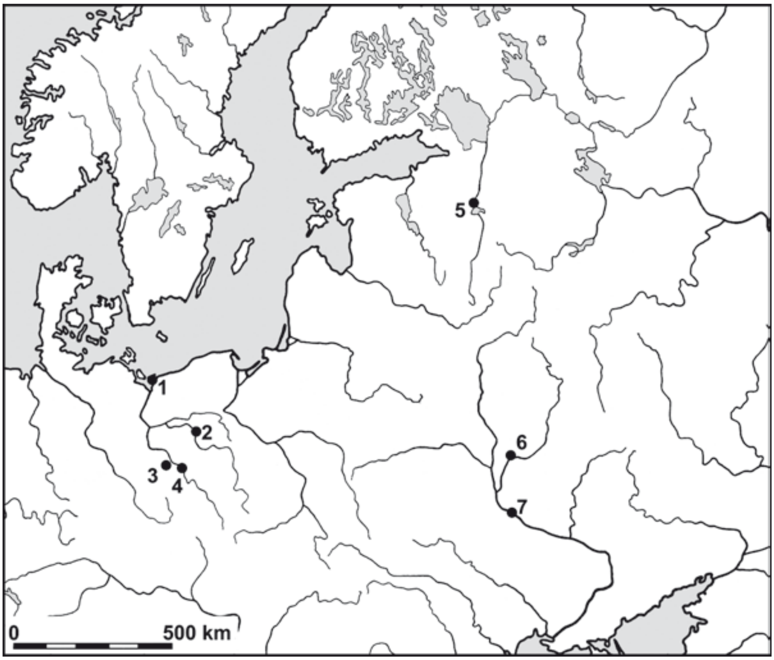

Fig. 3. Location of finds: 1 – Wolin, 2 – Poznań, 3 – Legnica, 4 – Opole, 5 – Novgorod, 6 – Chernigiv, 7 – Ivan Gora (elaboration by A. Janowski)

of incised circles similar to the ones which decorate the two finds discussed above. Except for the unclear caudal fin (?) the other fins are missing. A lid was uncovered one year later in the same layer might be part of the same object. In both cases the raw material used was bone (Dymaczewski 1961, 162, pl. 14: 32).

The last fish-shaped needle case (Fig. 4: 3) found in Poland was uncovered in 1962 during excavations on Castle Hill in Legnica (Kaźmierczyk 1975, fig. 43; Lasota 1980, 228-229; Firszt 1983; Stolarczyk 2014; the artefact is in the collection of the Museum of Copper in Legnica (Museum Number ML/A 1458. I wish to express my sincere thanks to Tomasz Stolarczyk PhD, the Head of the Department of Archaeology in this Museum, and Magdalena Kołacińska from the Museum Library for information about the artefact and assistance in gaining access to the 1983 article by Stanisław Firszt). The artefact was found in strata of the stronghold that preceded the construction of the stone stronghold, and which date to between the end of the 11th and the first half of the 12th centuries (Trench I, layer C1, square 1). The needle case is a unique find: it is the smallest and the thinnest of all. The fish body is compressed (laterally thin), the fin plan is also different. There is a single, long dorsal fin located on the back. On the ventral surface there is a single pelvic fin (?) and an anal fin; between them there is a herringbone decoration – a sequence of three angular

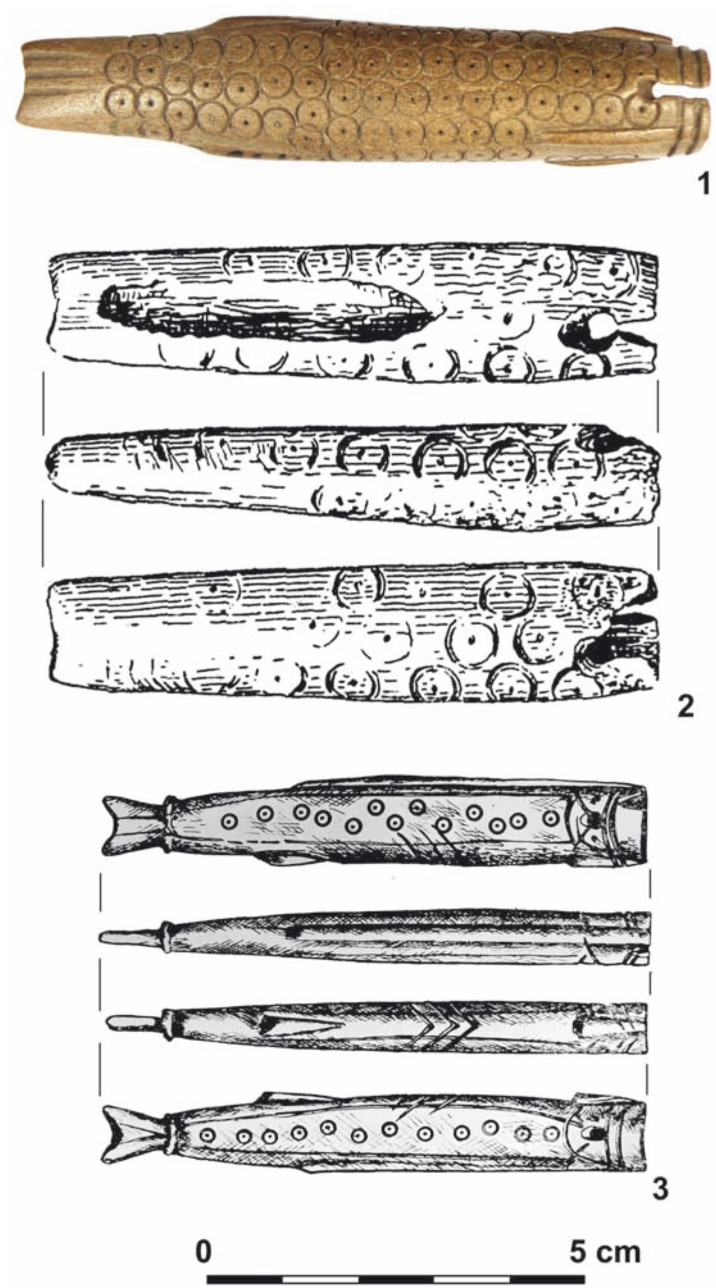

Fig. 4. High medieval fish-shaped needle cases from Poland. 1 – Opole (after Archive of IAE PAS in Wrocław), 2 – Poznań (after Dymaczewski 1961, tabl. 16: 29), 3 – Legnica (after Firszt 1983, Fig. 3) (elaboration by A. Janowski)

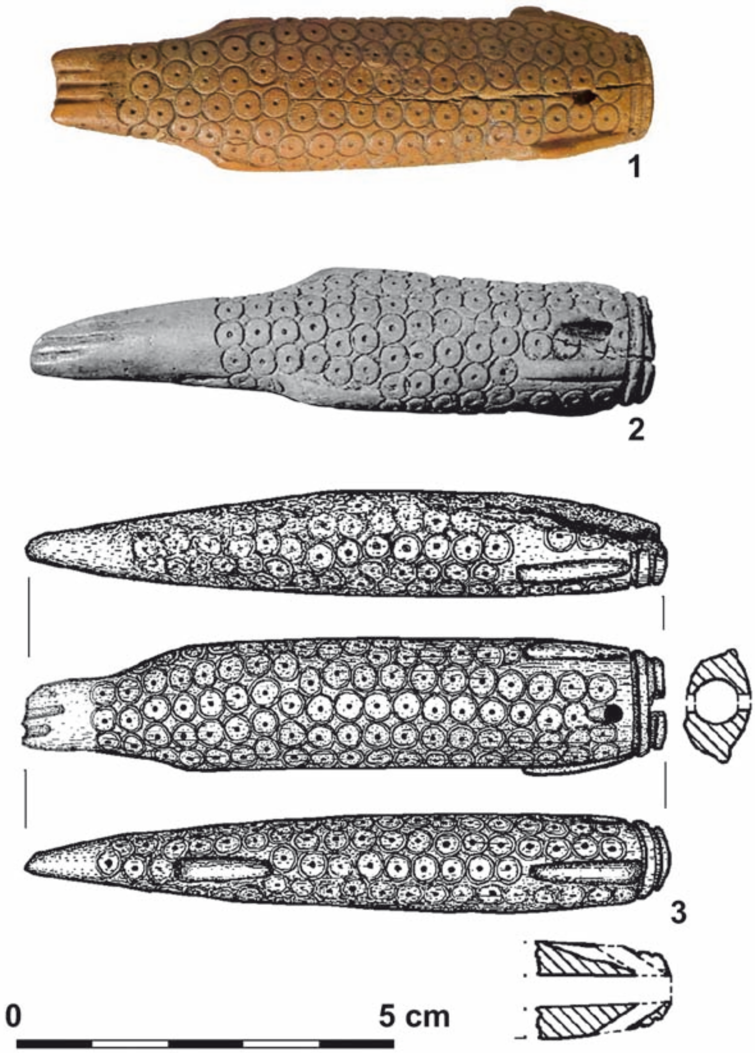

Fig. 5. High medieval fish-shaped needle cases from Russia and Ukraine: 1 – Novgorod (after Kolchin, Yanin and Yamshikov 1985, 94, no. 178), 2 – Chernigiv (after Chernenko, Kazakov and Rizhiy2010, Fig. 1), 3 – Ivan Gora (after Sergeyeva 2017, fig. 2: 1) (elaboration by A. Janowski)

lines, which might have been an attempt to mark pelvic fins. The caudal fin is symmetrical, clearly triangular and separated from the rest of the body with a protruding ring. The body is decorated with an incised ornament in the shape of a single series of circles with a point in the middle which form a line running parallel to the edge of the object. Semi-circular gills are clearly visible. Openings used to fix the lid simultaneously imitate the eyes. The total length of the find is 72 mm. The needle socket is 55 mm long and at the moment the artefact was excavated, a fragment of one of them was inside.

The needle cases described above exhaust the list of finds from the territory of Poland; three other ones come from the territory of Russia and Ukraine (Fig. 5). In 1961, such an artefact was excavated on the Nerevsky site (Russian: Неревский раскоп), in the northern part of Novgorod, in layer 18 which dates from 1130-1140 (Fig. 5: 1). Interestingly, the artefact was initially considered a knife handle (Kolchin 1956, fig. 17: 6; Bocharov 1969, 99; Bocharov 1983, 114; Kolchin *et al.* 1985, 94, no. 178). The find was almost identical to the one from Opole, but it was a bit wider and shorter, measuring 80 mm in length. On the body of the fish there is an identical set of fins: pelvic, dorsal, adipose, anal and caudal. Around the lid opening there are two circular incisions and the ornament imitating scales is very dense.

In the same year, a find was uncovered in the Ivan-Gora (Russian: Іван Гора) hillfort in Rzhyshchiv, Ukraine, about 80 km to the south of Kiev (Fig. 5: 3). The needle case is similar to the ones from Opole and Novgorod with regard to its shape, the layout of the fins and the decoration on the surface. Its length 85 mm, and the needle socket is 55 mm deep. The find dates from the middle of the 12th century (Sergeyeva 2012; 2015, 250-251; 2017, 121-124, figs 1: 1 and 2:1).

The last of the fish-shaped needle cases was uncovered in 2009 during excavations in the Peredhoroddya district in the western part of Chernihiv in northern Ukraine (Chernenko *et al.* 2010, 461, ris. 1; Sergeyeva 2015, fig. 6: 1v). It was found in strata dating to between the end of the 12th and the beginning of the 13th centuries and the published picture shows that its length is about 80 mm and the diameter about 17-18 mm. The picture shows pelvic, adipose, anal and caudal fins. The dorsal fin is not visible, but it is possible that it was marked too. The imitation of scales is very dense and covers the body down to the caudal fin (Fig. 5: 2).

While creating the classification of needle cases, Krzysztof Wachowski (2002, 235, fig. 1) distinguished a separate type of fish-shaped ones (type IV, variety c). He also wrote that they come from the 12th century, they were most probably invented in Scandinavia and went on to state that they were known from Western and Eastern Europe. Unfortunately, he did not make any reference to relevant sources and I have no information of which finds he had knowledge. While one could agree with the first part of the statement and date the finds to the 12th or, more precisely, to the period between the second half of the 11th and the middle of the 13th centuries (the find from Wolin was erroneously dated to the 10th century – Janowski 2014, 28), there are no premises to prove their Scandinavian origin. I do not know of any fish-shaped needle cases from that region. During the Viking period, *i.e.* until the middle of the 11th century the majority of needle cases was in the shape of horizontally suspended tubes made mostly of bronze (for example, Petersen 1951, 325-328; Mälarstedt 1984; Thunmark-Nylén 278-279). Examples of a shape like those of interest here cannot be found in the later period either (see, for example, Øye 1988, 109-111). Michał Kara

(2019, 145, 146) has recently suggested that the needle case from Wolin could have been the work of Frisian craftsmen. However, looking at the distribution of finds that have been excavated until today (Fig. 3) it seems that it needs to be assumed that they were of Slavic origin. Ukrainian scholars had no doubts the finds were of local origin; they also pointed to similarities between the artefacts from Novgorod and Ivan-Gora hillfort suggesting they were made in one workshop (Sergeyeva 2015, 250). It is possible that the needle case from Opole, almost identical to the other two, was also made in the same workshop. Of interest is also the fact that all these finds were excavated in major strongholds of that period and this is relevant not only for Wolin, Poznań, Opole or Legnica, but also centres in the territory of the Rus'. The Nerevsky site might be the oldest part of Novgorod, and it was definitely mentioned in the letopises as its first part as early as in 1067 and again in 1172 (Arcikhovskiy 1956, 13). Ivan-Gora hillfort was mentioned in the Ipatiev Letopis before 1151 as a stronghold and the place of assembly of dukes, who took part in fights against Yuri Dolgoruky under the command of Iziaslav II Mstislavich (Goncharov 1964, 129). The story continues under Chernihiv because Peredhoroddya district is mentioned for the first time in 1152 during the siege by the army of said Yuri Dolgoruky (Chernenko *et al.* 2010, 461; Motsia and Kazakov 2011, 118-139). Hence, fish-shaped needle cases were excavated on sites of historical significance. Beyond doubt their appearance also made them stand out from simple shapes and caused them to be esteemed as cultural objects of aesthetic value. The representations are quite realistic, the fins and scales are clearly visible. Russian scholars (Kolchin 1956, fig. 17: 6; Bocharov 1969, 99; Bocharov 1983, 114; Kolchin *et al.* 1985, 94, no. 178) have suggested that the fish represented is the lavaret (*Coregonus lavaretus*; Russian *сига*). Considering some flaws in the representation, I am of the opinion that it is not possible to establish which species of fish is represented. In the case of the find from Wolin, the anal fin is missing; the find from Legnica has no adipose fin and there is only one pelvic fin and actually there are no pelvic fins on any of the needle cases. It could be assumed that it was not a specific species of fish that was represented, but a general image. More expression and naturalism in the representation of fins would change little with regard to the symbolism of the object; on the contrary, they could make everyday use of the object considerably more difficult. The shape itself and the rough representation of a few fins sufficed to identify the object as a fish and modern fish-shaped needle cases are even less viable images (*cf.* Meacham 2007, fig. 19). Then the question arises as to why such an object of everyday use would be given such a shape if a straight tubular one would serve its purpose perfectly. Was it for some extra utilitarian purposes? According to Genrich Nikolaevich Bocharov (1969, 99, fig. 70), the shape of needle cases refers to the illuminated initial "O" in old Russian psalters which date back to the 12th century, while Leonillia Anatolevna Golubeva (1997, 156) is of the opinion that some needle cases could have been used as amulets. The image of the fish, especially in European culture, is very strongly connected to religious symbolism. The fish was the symbol of birth and immortality, but also wisdom and resurrection as well as baptism and the Eucharist (Forstner 1977, 255-258;

Matáková 2006; Sztych 2011). Therefore it is possible that apart from aesthetic considerations, it was the need for religious manifestation which was behind the making of such needle cases.

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CHRISTIAN TEXTUAL AMULET ON A LEAD SHEET FROM RĘKAWCZYN IN GREATER POLAND PROVINCE

ABSTRACT

Urbanová D., Mutlová P., Havel D., Knauber K., Schellner K. and Gorczyca K. 2021. Christian textual amulet on a lead sheet from Rękawczyn in Greater Poland Province. *Sprawozdania Archeologiczne* 73/2, 339-364.

The subject of this article is the discovery of a lead amulet with an engraved Latin inscription. It was found in Rękawczyn (the eastern part of Greater Poland) in 2018 during research conducted by the District Museum in Konin. This artefact is the first and so far only find of its kind in a Polish context. It was identified by comparing it to similar finds from Germany and Bohemia from the 11th-13th centuries that bear apotropaic Latin inscriptions. The text on the amulet consists of 24 lines, which are barely legible and which contain a long quotation from the Gospel of John followed by an apotropaic formula with magical words. The reconstruction of the text is accompanied by a tentative interpretation and commentary. The palaeographical analysis of the script (Gothic minuscule) dates the amulet to the second half of the 14th century. The study presents the amulet in the wider context of similar inscriptions of European origin.

Keywords: Christian amulet, lead amulet, protective magic, Gospel of John, Gothic minuscule, medieval archaeology
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LOCATION AND CONTEXT OF THE FIND

The amulet was found in the village of Rękawczyn (administratively, the village of Słowikowo) within the Orchowo Municipality, Słupca County, Greater Poland Province (52°32'05.31" N; 17°57'39.94" E). According to the physiographic regionalization by Jerzy Kondracki, the location is within the Gniezno Lake District, which constitutes the eastern part of the Greater Poland Lake District (Kondracki 2000, 222). The site is located on a sandy hill overlooking the surrounding area and border on the north-east by Kamienieckie Lake (Fig. 1). The site has been registered as Słowikowo Site 17, area AZP 50-37/17. It covers an area of approximately 4 ha.

Stationary excavations were carried out in 2016, 2017, 2018, and 2019 as part of subsequent International Archaeological Camps (X-XIII) organized by the District Museum in Konin and the Poland-East Association for Cooperation. The excavation was conducted under the supervision of Krzysztof Gorczyca, MA, and Katarzyna Schellner, MA, with the participation of archaeologists and students of archaeology and history from universities in Poznań, Bryansk, Kiev, Chernihiv, Minsk and membres of Exploratory-Historical Forum of Great Poland. Anthropological analyses were performed on site by a team from the Jagiellonian University. Preliminary reports have been published (Gorczyca *et al.* 2018; Schellner and Gorczyca 2018; Schellner and Gorczyca 2019; Sikora 2019), but a full presentation of the research results will be the subject of a separate study. Rescue excavations were carried out due to significant destruction of the site caused by a bulldozer. The site contains traces of settlement in the form of features and artefacts of various periods. The remains of prehistoric settlements can be associated with such archaeological cultures as Stroke-ornamented Pottery culture, Funnelbeaker culture, Lusatian culture, and Przeworsk culture. The majority of the finds should, however, be associated with medieval and modern times. Most probably, the site was inhabited as early as the 11th century.

At the turn of the 13th and 14th centuries, a wooden house was built on a hill in a plan close to a square measuring 5.6 × 5.6 m. Most probably it was a keep (donjon). It had a basement and maybe two floors. It was burnt down in the 14th century. The scattered material on the surface suggests that another newer house was built a few dozen metres further to the south-east.

Approximately 70 m to the south-west of the manor house, the remains of the Church of St. Laurentius, known from historical sources, were uncovered. It's foundation was destroyed, but a brick crypt with wooden coffins and skeletons are preserved (Fig. 3). The

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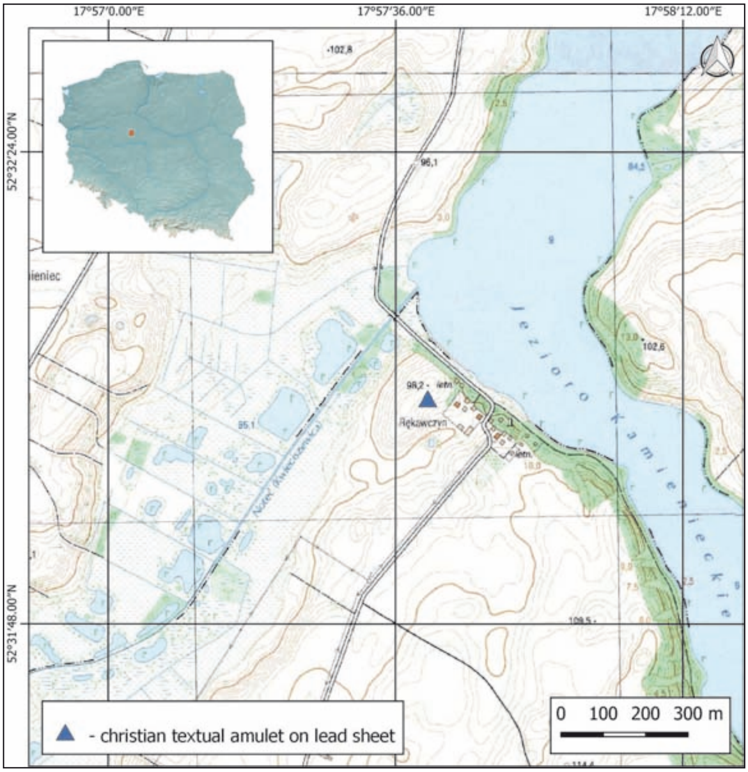

Fig. 1. Rękawczyn, Orchowo Municipality, Greater Poland Province. Location of the amulet discovery on a topographic map (compiled by Paweł Wiktorowicz)

church was surrounded by a graveyard, which functioned from the beginning of the 14th century (?) to the beginning of the 18th century (Fig. 4).

Written sources indicate that part of the now non-existent village of Rękawczyn Kościelny was situated on the hill. It belonged to a large, widely branched family, nicknamed Ligaszcz, that used the Szeliga coat of arms. In the 14th and 15th centuries, this family also owned nearby villages: Rękawczyn Stary, Rękawczyn Nowy (Rękawczynek), Rękawczyn Ligaszczowy, and the still-existing Gałczyn and Gałczynek. They were also closely related to the owners of the Kuyavian villages of Markowice, Kobielice, Smólsk, and the lost Suchorzewo (Karczewska 2010, 88-91). In the 14th century, the family founded the Church of St. Laurentius, which belonged to the Gniezno deanery of St. Michael (it means Zbar deanery). The oldest mention of the church dates back to 1398 (Lekszycki 1889, No. 688), but the furnishings of some of the examined graves indicate that the graveyard (and the church) existed already at the beginning of the 14th century. The church was made of wood with a brick tomb in which its founders were buried. During the Reformation, around

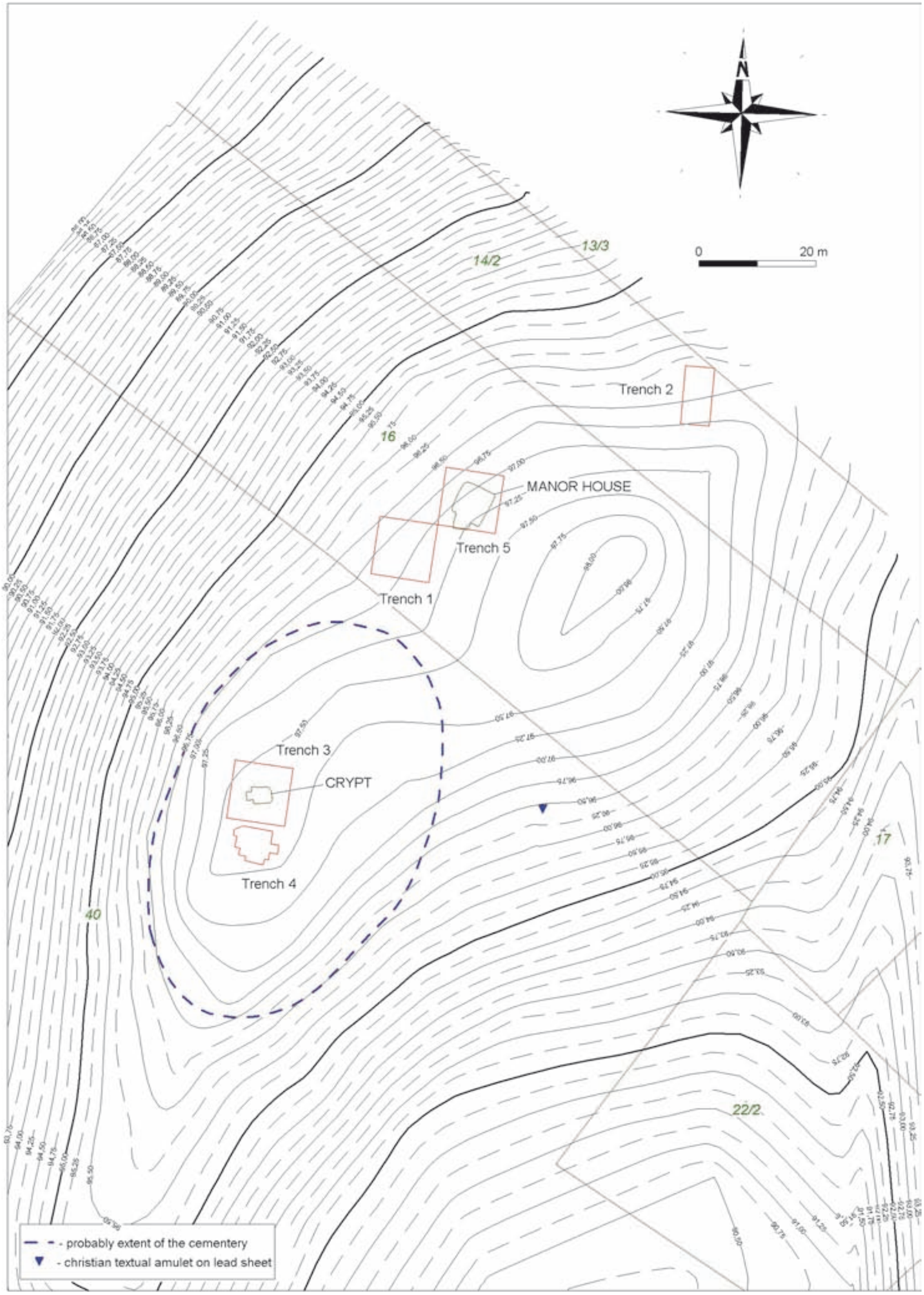

Fig. 2. Rękawczyn, Orchowo Municipality, Greater Poland Province. Location of the amulet discovery on a contour map (compiled by P. Wiktorowicz)

Fig. 3. Rękawczyn, Orchowo Municipality, Greater Poland Province. Trench 3. Crypt. Horizontal view of the graves (photo by K. Schellner)

Fig. 4. Rękawczyn, Orchowo Municipality, Greater Poland Province. Trench 4. Cementery. Horizontal view of the graves (photo by K. Schellner)

1578, new heirs from the Kunowski family converted to Evangelicalism and the parson's land was taken over by a certain Czarliński. Since then, the Church of St. Laurentius stopped fulfilling its functions, stood deserted, and slowly deteriorated. At the end of the 18th century, it had to be demolished and thus physically ceased to exist. The villages belonging to the parish of Rękawczyn were joined to the Kamieniec parish, formally only after 1807 (Łaski 1881, 197; Kozierowski 1914, 255; Librowski 1978, 140, 141).

The lead tablet was found in a humus layer using a metal detector on the eastern slope of the hill, approximately 50 metres east of the church and the surrounding graveyard (Figs. 1, 2). Amulets made of various materials containing inscriptions, including fragments of the Gospel of John, were often sewn into clothing in the Middle Ages (Brückner 1902, 63, 64). It should therefore be assumed that the tablet was ploughed from a grave when the hill was levelled. Similar grave finds are known from Germany (Muhl and Gutjahr 2013, No. 1, No. 3). It is uncertain where the tablet was made. Manufacture of similar amulets has been attributed mainly to monks (Bracha 1991, 21, 29). There were monasteries in the vicinity of Rękawczyn in the following towns: Trzemeszno (15 km), Mogilno (16 km), Strzelno (20 km), and Gniezno (29 km).

DESCRIPTION OF THE AMULET

At the time of finding, the amulet was in the form of a cube made of a folded lead plate measuring approximately 2 × 2 cm. On the outside, it was covered with a thin layer of iron oxide that had become deposited on it. Initially, the discovery went unnoticed. Only when it had been unfolded did it turn out that both sides of the amulet had small, difficult-to-read inscriptions engraved with a sharp tool (Figs 5, 6). Unfortunately, during the unfolding one part of the tablet ruptured. The tablet has a shape similar to a rectangle with the following dimensions: maximum length: 69 mm, width: 38 mm, thickness: 0.5 mm, and weight: 8.5 g. It was folded in half along the longer axis and then into four. The outer parts were folded inwards. The Dřevíč amulet was folded similarly (Blažková *et al.* 2017, fig. 9). On both sides of the tablet, along its longer axis, there is text divided into 12 rows (24 in total), each row underscored with a horizontal line. To ensure clarity, the outer side of the tablet (with traces of corrosion) was designated as A (Fig. 5), and the inner side as B (Fig. 6).

INTRODUCTION TO AMULETS AS A GENRE

This lead amulet from Rękawczyn is the first find of its kind from Poland and thus unique regional evidence of medieval Christian practices fairly common throughout Central Europe that functioned as curative or protective magic, preserving some elements of older pagan traditions.

Fig. 5. Rękawczyn, Orchowo Municipality, Greater Poland Province.
Christian textual amulet on a lead sheet, side A, outer side (photo by A. Żaczek)

Fig. 6. Rękawczyn, Orchowo Municipality, Greater Poland Province.
Christian textual amulet on lead sheet, side B, inner side (photo by A. Żaczek)

Since time immemorial, people have endeavoured to face diseases, risks, and various dangers in life and to protect themselves by magical means. Diseases, childbirth, poisonous animals, wars, and natural disasters could jeopardize or even quickly end a human life (Willer and Knauber 2016, 47). In the ancient Graeco-Roman context, an amulet can be defined as "a small protective device usually worn on the body to guard against unwanted supernatural influences, such as daemonic attacks and ghostly visitations, or to provide protection and healing from specific diseases and illnesses thought to have a non-medical cause" (*cf.* Kotansky 2019, 507). In antiquity, amulets could be made of various parts of plants and worn around the neck in a sack. They could also be personalized textual amulets worn in special cases, known as *capsulae,* or protective gems. These uses fall under the category "apotropaic", meaning "warding away" (of evil forces). In antiquity, however, more general functions of amulets were also known, such as for procuring good luck, a successful business outcome, legal victories, love, or triumph in games (Kotansky 2019, 507). The use of magic for protection and deliverance from diseases has therefore been widespread from the earliest times. People in the ancient Graeco-Roman world, as well as those in later medieval times, felt exposed to innumerable dangers. Therefore, they invoked diverse higher powers to obtain protection (Vavřík *et al.* 2020, 1). From antiquity, we know of several personalized text amulets in the form of small *lamellae* (tablets made of silver or gold) with prayers or incantations, sometimes written also on small pieces of papyrus or parchment sheets. From late antiquity, there are also amulets on lead tablets, for example the uterine amulet from Roman Britain – West Deeping in Lincolnshire (*cf.* Tomlin 1997, 291-294). From late antiquity and the early Middle Ages, we also have lead amulets protecting houses and fields or preventing hailstorms and floods (*cf.* Fernández Nieto 2010, 551); some of these were used against snakes and scorpions (*cf.,* for example Urbanová 2019, 1038; Muhl and Gutjahr 2013, 78-91). These old magical practices well preserved all over the Mediterranean did not cease to exist even when Christianity took over the reins. On the contrary, they adapted to the new faith, lived on, and were used abundantly throughout the Middle Ages, and, in addition to the divine apparatus, they often included magical formulae identical to those used in antiquity; all this despite the Church's efforts to eradicate such practices (*cf.* Skemer 2006, 21-73; Sanzo, 2019, 198-239). In the Middle Ages, textual amulets were also a popular and widespread "safety device" – usually small objects to be worn close to the body – which were believed to have magical or miraculous powers to protect their owners or to treat various illnesses and were in demand for any imaginable dangerous situation in life (Vavřík *et al.* 2020, 1-12). Skemer defined Christian medieval textual amulets as "portable devices filled with apotropaic text and images ... which were believed to give the bearer magical protection against the daemonic forces that were blamed for everything from plague and sudden death to toothache and bad luck" (Skemer 2015, 127). Textual amulets were obviously made prevalently by well-educated clerics according to the believers' wishes. Skemer stated that the Church believed in sacred miracles and mysteria; therefore, it is not surprising that clerics were willing to make amulets since they believed that in this way they provided good Christians with divine protection against the Devil and daemons (Skemer 2006, 22). While some amulets suggest a well-versed manufacturer (*cf.* Muhl and Gutjahr 2013, 41-46), a considerable number of others feature various spelling and syntax errors or unrelated passages, showing that they were copied from manuscript examples rather carelessly and/or without proper understanding of the source text. Various items, the use of which was accompanied by the utterance of magical words or prayers, could play the role of amulet, as well. Medieval Christian textual amulets were based on the faith in protective powers of certain incantations, prayers, divine names, passages of the Scripture, historiolae, and magical signs and symbols that were engraved or inscribed on a small pieces of suitable support material. Then, the amulet was rolled up or folded and could be worn around the neck or put into a piece of cloth and worn close to the body; the procedures for folding lead amulets in the Middle Ages are described by A. Muhl and M. Gutjahr and D. Vavřík *et al.* (*cf.* Muhl and Gutjahr 2013, 59-62; Vavřík *et al.* 2020, 4-6). There are dozens of mostly lead amulets that date to late antiquity and the Christian Middle Ages found in Central and Northern Europe as well as many charms and blessings extant in countless medieval manuscripts (*cf.*, for example, Kieckhefer 1997, 2014; Láng 2005; Heim 1892; Schulz 2003, 10, 11). The amulets in such manuscripts are often only recipes or formularies, *i.e.* inert or non-activated exemplary texts. Such texts can be categorized as "applied magic" only after they have been used to make a particular amulet, *i.e.* activated for personal use (*cf.* Skemer 2015, 129-132; Gordon 2002, 70). Amulets written on parchment – mostly preserved in manuscripts – and most other organic materials frequently have not survived (Skemer 2006, 2015). Schulz also mentioned the use of apples, bread, altar bread, *etc.* in various magical healing rituals (*cf.* Schulz 2003, 109-111). Medieval amulets on lead were preserved more often (*cf.* Muhl and Gutjahr 2013; Blänsdorf 2019; Simek 2011; Düwel 2001; Gastgeber and Harrauer 2001; Vavřík *et al.* 2020). Due to the fact that these protective texts were engraved on lead, they were less susceptible to damage than those amulets written on parchment and thus could survive until today. The recent rise in lead amulet findings enabled by the use of metal detectors has confirmed this fact. Several dozen lead crosses with Christian magical inscriptions have been preserved in north-western Europe. These were made specifically for funerary rites and were deposited in graves to protect the deceased person's body and thus represent a different category of objects (Muhl and Gutjahr 2013, 6 and 86-90).

TEXTUAL AMULETS FROM THE MIDDLE AGES

Passages from Scripture were commonly included in textual amulets right from the beginning; even the oldest Greek and Latin Christian amulets preserved on magical papyri contain quotations from Psalms and passages of the Gospel of John (*cf.*, for example, Skemer 2006, 85; Daniel and Maltomini 1990, 105-112., Nos. 35, 36). In the Latin West, it was believed that the Gospel of John had apotropaic and exorcistic powers, both as a whole and partially in the form of short quotations and therefore passages from this Gospel have been included in many amulets. Most frequently, the passages concerned were from John 1-14. In particular *In principio erat verbum* (John 1,1) and *Et verbum caro factum est* (1,14), were very popular and people believed that they could provide one with divine protection against daemons, the originators of various diseases. As Skemer claimed, "these fourteen verses [of the Gospel] strongly emphasized the creative power and immutable truth of the word of God as embodied in Christ" (Skemer 2006, 87). Moreover, these verses exemplified the underlying principle by which this Christian textual magic was thought to work: all things were believed to have been created through the word of God, so they could be saved from corrupting influence and restored to divine order by the proper use of the Holy Scripture (Muhl and Gutjahr 2013, 13; Willer and Knauber 2016, 51). Apart from this, medieval textual amulets often contained other features related to the deeds of Jesus Christ described in the Gospels, liturgical (*e.g.* † *Christus vincit* † *Christus regnat* † *Christus imperat*) and ordinary prayers (*Pater Noster, Ave Maria*, *etc*.). Magical elements such as the so-called *nomina sacra* – the particular 72 names of God, in Exodus, which was supposed to protect the bearer from all ills and perils (*cf.* Lecouteux 2015, 233) – and Christian divine names – which can refer to God the Father, Christ, the Holy Spirit, the Trinity (such as *In nomine patris et filii et spiritus sancti, Amen*) and the Virgin Mary, or INRI – were included in amulets. Amulets sometimes contain the *tetragrammaton* (*i.e.* the Greek word for the Hebrew ineffable name of God); further Hebrew names of God *Iao, Sabaoth* (*i.e.* Lord of Hosts, sometimes as a holy angel together with *Michael*); and names of powerful angels (Lecouteux 2015, 343). Some texts also contain the acronym AGLA (held as an efficient multi-purpose protective formula against bleeding, fever, daemons, and many other situations, it is most likely an acronym for the initials of four Hebrew words, *atah gibor leolam adonai*, which form a phrase meaning "You are mighty in eternity Lord"). In addition, they sometimes also use crosses or *characteres* (*cf.* Lecouteux 2015, 26-32; Düwel 2001, 231). The holy names in amulet texts are often interspersed with crosses. Furthermore, amulets could contain various stylized depictions of the cross, elaborate crucifixion scenes, or magical symbols and complex sigils. Christian powerful words, symbols, and a vast collection of protective charms meant as a formula can be found, for example, in the well-known Canterbury Amulet dated to the 13th century (*cf.* Skemer 2006, 199-214, 285-304; Bozóky 2003, 72-78; Heim 1892; Kieckhefer 2014). A continuous trend can be perceived in the employed techniques of magic: while earlier amulets (Late Antiquity to c. 11th-12th centuries) tend to feature an explicit incantation or exorcism of evil entities as the central part, often with the same adjuration formula, present on the amulets from Dřevíč and Halberstadt and cited below – which is analogous to older pagan traditions – late medieval amulets mostly showed a preference for a more "humble" prayer form and/ or employed cryptic magical words and "exotic", *i.e.* ancient, languages such as (often bastardized) Greek and Hebrew. In all probability, this is connected with the increasing prosecution of heresy, daemonic magic, and later witchcraft as well as the parallel rise in scholarship with accompanying occultism and the greater availability of translated ancient works on magic (Vavřík *et al*. 2020, 11).

PUBLISHED MEDIEVAL LEAD AMULETS FOUND IN CENTRAL EUROPE

The amulet from Rękawczyn is similar to other medieval artefacts of the kind found in Central Europe, although it also displays some unique features, namely a specific adaptation of the usual formulae. The amulet is inscribed on both sides of the lead plate with 12 lines on each side (the space for each is outlined on both sides, but the writing often crosses the grid). The number of 2 times 12 lines, 24 in total, is most probably intentional and might serve an additional magical purpose according to Judaeo-Christian numerology. Among other meanings, 12 refers to the number of the Tribes of Israel and the Apostles, thus combining the Old and the New Testament and possibly likening the Rękawczyn amulet to a "bible *en miniature*". A direct parallel for magical employment of the numbers 12 and 24 can be found in an amulet from Halberstadt: "*…p(er) xii apostolos (et) p(er) xii p(ro)phetas (et) p(er) xxiiii seniores…*" (*cf*. Muhl and Gutjahr 2013, 33), see below. Our text features the entire first chapter of the Gospel of John (1-14) written horizontally. Lead amulets usually do not contain such long quotations from the Gospel of John as we find in our amulet. We mostly find only the first three to five lines, presuming that users knew the rest of the text by heart. Longer texts appear in several manuscripts, however, such as an Italian amulet dating to the late 15th century supposed to protect a certain Illioneus, the Amulet for Francesco (*cf*. Skemer 2006, 214-222, 309, 310). Moreover, in F. M. Guazzo's book *Compendium maleficarum* (Guazzo 1992, 3, 14, 11) there is a reference to such amulets from the Moravian Episcopate of Olomouc with quotations from Psalms and the Gospel of John that were used to treat people possessed by the devil. The passage from the Gospel of John on our amulet comprises over three quarters of the text written on both sides of the tablet, while the hardly readable last six lines (19-24) contain an accumulation of various protective formulae and sacred names, including perhaps a personalized or "customizable" passage, as we can guess from line 22: *ut sit salus animae et corporis…*

Among published medieval lead amulets from Central Europe, and partially also from Scandinavia, we find numerous corresponding formulae. The highest number of such artefacts come from this area, especially Germany (Sachsen-Anhalt). So far, 14 such amulets have been published (*cf*. Muhl and Gutjahr 2013, 78, 79) and one amulet from Mörstadt dated to the 7^{th} century (*cf*. Blänsdorf 2019). Even though altogether 23 lead amulets have been found in Germany, several have not yet been unfolded or published (ongoing research by K. Knauber). There is also a recent finding (2014) from the Dřevíč hillfort within the Czech lands – Central Bohemia, (*cf.* Blažková *et al.* 2017; Vavřík *et al.* 2020) dating to the early 12th century. These surviving amulets display many common features regarding their content, dating, lead materiality (the proportions of the lead tablets are 14-10 cm × 8-4 cm), folding method (into small booklets), and location (where the context is known, these findings come from graves or graveyards). Based on the conformities in the formulae used, we can observe many parallels between particular amulets from this area. For the sake of comparison in this study, we will work with nine amulets, eight of which come from Germany (*cf.* Muhl and Gutjahr 2013, Nos. 1-5, 7, 13; Blänsdorf 2019) and the ninth of which comes from Dřevíč (*cf.* Vavřík *et al.* 2020). Some amulets, just like the one from Rękawczyn, begin with several verses from the Gospel of John, mostly citing only the first three to five verses. This pertains, for instance, to the amulet from Elbeu – Ohrekreis in Sachsen-Anhalt (Muhl and Gutjahr 2013, No.1), which cites the first three verses of the Gospel of John followed by other Christian formulae such as *in nomine patris et filii et spiritus sancti* and *signaculo sanctae crucis*... The text is damaged, and so the name of the person protected by the amulet is missing; apart from this, the text also includes a magical seal. The text of an amulet from the Salhausen hillfort – near Wolmirstedt, district Bröde in Sachsen-Anhalt (Muhl and Gutjahr 2013, No. 3) is structured similarly, containing only a short sequence from the Gospel of John, *In principio erat verbum,* followed by the names of other Christian entities: *Jesus Christus, Maria mater*, and the names of the Four Evangelists. The amulet was supposed to protect a certain Herwihin.

Other amulets do not cite the Gospels but use an apotropaic adjuration formula by which they banish evil spirits and diseases. Such is the case of an amulet from Halberstadt in district Harz Sachsen -Anhalt (Muhl and Gutjahr 2013, No. 5; Fuhrmann 2014, 1,142-1,144), the text of which was engraved on the sides of a central depiction of crucified Christ and which was dated to 1142 and was supposed to protect God's servant Tado. The text of this amulet starts with the sequence † *In nomine patris (et) [f]ilii (et) sp(iritu)s s(an)c(t)i (et) in nomine d(omi)ni n(ost)ri ih(es)u xp(ist)i* and continues with an exorcistic adjuration formula to banish dark powers. First, it addresses a daemon or elf named *Albis* (a mysterious but originally not necessarily evil being from Germanic mythology, known from lead amulets and manuscript charms, sometimes gendered and pluralized as *eluos aut eluas*; Simek 2011), an embodiment of a dark power that could harm the amulet's owner (in most preserved amulets the 'elves', are thought to cause illnesses, and are characterized as daemonic beings (Vavřík *et al.* 2020, 10). In accordance with the usual practice of magical texts, it preemptively enumerates all ordinary life situations in which the dark powers would not be able to harm the servant of God.

Adiuro te alb(er) qui[u]ocaberis diabolus v(e)l sat[anas] p(er) p(atrem) (et) filiu(m) [et] sp(iritu)m s(an)c(tu)m (et) p(er) om(ne)s ang(e)los (et) arca(n) g(e)los p(er) xii apostolos (et) p(er) xii p(ro)phetas (et) p(er) xxiiii senio(re)s (et) p(er) cclxiiii mil(ia) Innocent(i)[um] non habeas potestat[em] in [- - - i]sta [- - -]lica [- - -]dere aut [- - -] *famulu(m) de[i] TADO. N[e] nocere p[o]ssis non [in] die neq(ue) in [n]octe non in [..] sic neq(ue) non bibendo [ne]q(ue) manducand[o - - -] in stanti[- - -] [ne]q(ue) sedendo [- - -] neq(ue) [- - -] loco [- - -]lere nec anima(m) condem(n)[- - -] Coniuro te [- - -] s(an)c(t)e marie fac ad illum [- - -] non possis [- - -] mcxlii [- - -]mini.*

"In the name of the Father, and Son, and Holy Spirit and the name of our Lord Jesus Christ. I conjure (*i.e.* banish) you, Alber, who shall be called devil or Satan by the Father and Son and Holy Spirit and by all Angels and Archangels, by the Twelve Apostles and the Twelve Prophets and the 24 Elders and the 264 thousand innocents, so that you do not have power … over God's servant Tado. So that you cannot harm [him], neither day nor night … not while drinking, nor eating, nor standing, nor sitting [The following text is extensively damaged and so cannot be coherently translated] … nor at the place(?), … nor condemn the soul… I conjure you … Saint Mary … do … toward him … [may] you be unable, [in the year] 1142 of [our] Lord".

A similar adjuration formula is also found in an amulet from Dřevíč – Central Bohemia dating to the beginning of the 12th century that was supposed to protect God's servant Rozmysl against daemons and diseases:

Pax et patrocinium Sacr[o]sancte crucis super famulum [t]uum Roszmycil dei contra fraude[m] callidi diaboli † [- - -] Vas † Rubies † Riskme [..] Valentine R[isk]as Riskas Tr[isk]as Rubeam Mariam … Adiuro albis qu[i] vocaris diabolus vel satanas per patrem et fil [i]um et spiritum sanct[u]m…

Peace and protection […] of the most venerable Cross over your servant Rozmysl, (servant) of God, against the maliciousness of the scheming devil […] vessel † reddening […] (Saint) Valentine † dry out […], inflammation! Mary(?) […] I implore you, Elf, who are called devil or Satan, through the Father and the Son and the Holy Spirit…" (for the entire text and commentary, see Vavřík *et al.* 2020, 9-11).

The amulet from Mörstadt – in district Alzey-Worms in Rheinland-Pfalz, dated by archaeological context and palaeography to the middle of the 7th century and thus representing rare evidence from the early Middle Ages, contains the following formulae: …*Per passionem Iesu Christi, per sangui[nem domi]ni nostri Iesu Christi, per resur(r)ec<t>ionem domini nostri Iesu Christi, ut non noceatis famulo dei Ch[…]iuht…* (for the entire text, translation, and commentary, see Blänsdorf 2019, 279-282). Another amulet from the extinct village of Zehlingen – near Ballenstedt in district Harz in Sachsen-Anhalt (Muhl and Gutjahr 2013, No. 4) contains the Gospel of Matthew.

The most documented type of amulet in Central Europe includes a combination of the incipit of the Gospel of John and an adjuration formula, as is the case for amulets from Klein-Dreileben – in district Bröde, Sachsen-Anhalt, Salhausen, Seelschen – near Ummendorf in Sachsen-Anhalt (Muhl and Gutjahr, 2013, Nos. 2, 3, 7), and Schleswig. In addition, the amulet from Schleswig – in Schleswig-Holstein (Gastgeber and Harrauer 2001, 207-226) is a very illustrative example of contemporary notions of protection through these artefacts, including explicit exorcistic formulae after the beginning of the Gospel of John – *I(n) no(m)i(n)e d(omi)ni n(ost)ri Ie(s)u Chr(ist)i c(on)iuro vos demones sive albes et om(ne)s pestes om(n)iu(m) infirmitatu(m)...* – and another formula after the usual preemptive list of ordinary life situations – *Ecce cruce(m) † d(omi)ni fugite, partes adv(er)s(ae)*. "In the name of our Lord Jesus Christ, I conjure you, daemons and elves, and all the infections of all illnesses... See the cross †of Christ! Flee, you hostile forces!" (English transl. Simek 2011, 26-28).

PALAEOGRAPHY, DATING, COMMENTS ON THE SCRIPT OF THE AMULET FROM RĘKAWCZYN

Palaeographic analysis and determination of the age of the script found on the lead amulet must reflect two facts: the characteristics of the material used (soft lead) and the writing technique (engraved by a sharp stylus). Both of these naturally result in certain graphic characteristics that distinguish this type of evidence from other contemporary texts, including inscriptions or, generally, more quickly written texts of an epigraphic nature that can be considered typologically closest to amulets. In contrast, texts written on so-called palaeographic materials, especially in this case parchment, can hardly be compared (when it comes to external features) with lead amulet texts. Despite this reservation, the graphic treatment of the script in amulets respects the basic framework of the development of Latin script and the authors naturally used elementary components typical of the contemporary style of writing in the respective periods. Consequently, both of these aspects are taken into account while dating the amulet discussed here. On the one hand, we must consider the rough writing material and technique (engraving) used to create relevant text that may seem conservative; on the other hand, we must interpret those features of the used ductus that are decisive for classifying a text into a particular period. An appropriate combination of both perspectives thus secures reliable chronological classification of the analysed artefact. The preciseness of the dating is, however, directly proportional to the number of similar preserved and already published findings for which the dating can be supported by warranted archaeological context. Comparisons performed in the wide territorial horizon typical of amulet dating can provide us only with approximate dating. From the most general point of view, the script found in the Polish lead amulet represents a very casual and uncultivated writing style that displays substantial graphic lability in particular letters. These are generally isolated, with rare use of ligatures, which is a distinctive divergence from the script found in literary codices of the time. So-called Meyer ligatures, *i.e.* Gothic nexuses, are completely absent, which certainly indicates the inexperience of the amulet's author with contemporary literary script. Conversely, the engraver was familiar with a ligature regularly used for the conjunction *et* (&; *cf.* Fig. 7, No. 16). The text is written mostly in minuscule, but with a very unstable minuscule outline, which is due to the small letter size and also the engraving technique on a lead tablet with previous line spacing for only part of the text. Remarkably, the optional presence of the upper-case letter *Q* in the first line of side B of the amulet (in the abbreviation *Quoquod*) and lines 15 (*Qui*) and 19 (*Qureah*) of the same side is of chronological significance. All of the letters used in the amulet tend to break round strokes; it is therefore beyond any doubt that the basic style of the text is Gothic. The amulet is engraved with a casual Gothic minuscule with upper-case features made mostly in an isolated ductus. Even when rounding occurs, it is easily explained by the lead-engraving technique: see, for instance, the letter *o*, which is predominantly represented by a shape composed of two separate strokes of half-arches broken once (*cf.* Fig. 7, No. 9). The same morphology is found in the letter *c*, the shape of which is closely related to the letter *o* (*cf.* Fig. 7, No. 3). The letter *m* also has a fully Gothic ductus: it is composed of three isolated stems provided with serifs above and below (*cf.* Fig. 7, No. 7). The stems in the letters *n* and *u* are also equipped with serifs (within the frame of advanced Gothic assimilation): the letter *n* has a serif on its second stem (*cf.* Fig. 7, No. 8), and the letter *u* on its first stem (*cf.* Fig. 7, No. 15).

The letter *a* (*cf.* Fig. 7, No. 1) is composed of two strokes: the basic stem and the belly are broken; as a result of a faster engraving pace, the two strokes sometimes do not touch and therefore the lower part of the letter is open. The letter *e* has the most complicated ductus (*cf.* Fig. 7, No. 4), which is composed of three strokes: the basic arch is made of two markedly broken strokes, and a cross-bar runs from the location where the two strokes connect. The cross-bar is significantly emphasized by a diagonal extension, which can be regarded as a peculiar individual attribute of the engraver. The same phenomenon is found in the letters *g* (*cf.* Fig. 7, No. 5) and *t* (*cf.* Fig. 7, No. 14), while the letter *g* often lacks the loop running to the lower line. The letters *b* (*cf.* Fig. 7, No. 2), *h* (*cf.* Fig. 7, No. 6), and *r* (*cf.* Fig. 7, No. 12) are usually not stylized in a distinctive Gothic way; only sporadically do we find a serif on the basic line of the stem of the letter b. The presence of the long *s* and its exclusivity for the graphic realization of the consonant [s] (*cf.* Fig. 7, No. 13) is very important for dating. The preference for this grapheme can be explained by the specifics of the writing material, which suits direct lines rather than arches. This principle influenced the ductus of the letter *p* (*cf.* Fig. 7, No. 10), as well. The letter is composed of two strokes: a basic stem ended by a serif below and a fragment of an arch that is, however, represented by a direct line, which results in the upper part of the letter being open. Decomposition and the resulting disconnection of individual engraved lines, which was mentioned above with the letter *a*, was caused by a faster pace of engraving when making the amulet. The presence of the upper-case letter *Q* in a minuscule context is of significance, as well. The use of upper-case letters for writing whole texts, *i.e.* apart from initials and other distinguishing forms of script, disappears from epigraphic material (where the Gothic upper case remained

Number	*Letter*	*Realization of the letter in source*
1	a	
2	b	
3	c	
4	e	
5	g	
6	h	
7	m	
8	n	
9	o	
10	p	
11	abbreviation "Qd.qd."	
12	r	
13	s	
14	t	
15	u	
16	ligature &	

Fig. 7. Table of signs (compiled by D. Havel)

for the longest time) during the 14th century (Semkowicz 2011, 532). The occurrence of this (probably relic) upper case is found in the abbreviation *Quodquod* (*cf.* Fig. 7, No. 11; amulet, side B, first line) together with the upright minuscule *d*. The aforementioned abbreviation used for the conjunction *et* in a ligatured form (*cf.* Fig. 7, No. 16) can be considered a peculiar individual form. It occurs in two forms: more frequently it resembles the Greek upper-case Φ, and in other forms it is reduced. In conclusion, the author of the text engraved on this Polish lead amulet used Gothic minuscule with fully established Gothic features (angular lines) for all strokes, with optional roundedness determined by the used material and engraving technique. Conversely, the occurrence of the long *s* as well as the extraordinary use of the upper-case letter *Q* are conservative features of the analysed text. Engraved texts did not aspire for an aesthetic function; the authors of such texts did not strive for any ornaments or artistic stylization of the script. All of the morphological features of the used script correspond to the second half of the 14th century, the period that therefore represents the chronological range of the amulet's production.

INSCRIPTION – EDITION

The edition generally follows the epigraphic conventions of the Leiden System (Epigraphic Conventions 2015) with certain modifications with respect to the medieval origin of the amulet. For this reason, we have also considered the common editorial principles of the *Die Deutschen Inschriften* series, namely the principles formulated for the Viennese part of the project, as these guidelines are generally accepted for critical editions of medieval epigraphic material (Koch 1991).

Therefore, in the transliteration we have used square brackets to restore letters that are now illegible due to damage to the amulet (the precise number is indicated by the number of full stops, where possible), dotted letters indicate cases where only a small part of a letter is visible due to erasure but which could be restored from the context, and abbreviations are signalled by the mark of general abbreviation (superscribed or subscribed strokes are used). In the transcription, the abbreviations are expanded without further notice, curly brackets are used in cases that needed to be suppressed (*e.g.* dittography), and omissions that disturb the meaning of the text and therefore had to be supplied are placed in angle brackets. The inscription is written in *scriptura continua* and almost exclusively in minuscule letters. The transliteration keeps the minuscule letters, while the transcription reconstructs the text based on its sense, and therefore word division, punctuation, and capital letters are used accordingly.

PAGE A (outer side, see Fig. 5)

TRANSLITERATION

1. † iniciū sc̣ị euāgeḷị scđṃ ịohanē † in p̣ṛīcipio
2. erat ūbū êt ūbū er[.]t [..]u[.] đm êt đs er[.]t ūbū
3. ħ erat ī p̣ṛịn[.....] [...]ṭ đm omīa p̲ ipsụ̄ facta sūt êt
4. sine ipso factū ẹ̄ nichi qđ factū e[.]t i[.] ipso vịta erat
5. ṿịta erat lụ[.] ḥominū êt lu[.] ịṇ tenebris lụcet êt tene
6. bre eā n̄ c̣p̣ṛ[..........] [........] [..]ṣṣụs a đo cụị nom̄ erat ioha
7. nes ħ̣ uenịṭ testimoniụ̄ ut ṭesṭimonị̄ p̲iberet
8. đ lumine ū [..]s cređṛēṭ p̲ illū n̥̄ era[.] [.........] test

9. timoniū p̱ḥ[.....]ṭ đ lụmine erat lux ụ[...] [...] ịṇluminat
10. ọmē hom[.]ṇē u[.]n[...]tē i[.] [......] ịṇ ṃū̦do erạt
11. êt ṃū̦ḍụ[.] [...] [..]ṣū̦ factu[.] [.....] [...]dus eū ṇ ç̣ognouit
12. in [...] [.]ẹnit [........] noṇ

TRANSCRIPTION

1. †*Inicium sancti euangeli<i> secundum Iohannem*† *In principio*
2. *erat verbum et verbum erat aput Deum et Deus erat verbum.*
3. *Hoc erat in principio aput Deum. Omnia per ipsum facta sunt et*
4. *sine ipso factum est nichi<l>, quod factum est. In ipso vita erat*
5. *<et> vita erat lux hominum et lux in tenebris lucet et tene-*
6. *bre eam non conprehenderunt. Fuit homo missus a Deo, cui nomen erat Ioha-*
7. *nes. Hic venit <in> testimonium, ut testimonium per<h>iberet*
8. *de lumine, ut omnes crederent per illum. Non erat ille lux, sed ut test-*
9. *{t}imonium perhiberet de lumine. Erat lux vera, que inluminat*
10. *omnem hominem venietem in mundum. In mundo erat*
11. *et mundus per ipsum factus est et mundus eum non cognovit.*
12. *In propria venit et sui eum non*

PAGE B (inner side, see Fig. 6)

TRANSLITERATION

13. ṛecepe[.]ūt Qđqđ autē receperūt eū dẹdit eis
14. potestaṭē filiọs đi fieri q̄ credū̦t ī noīe
15. eius q̄ n̄ eẋ ṣaguinibuṣ neq̄ex uolūṭate carniṣ
16. nẹq[.] uiri [.]et đo nati sūt êt ūbū carọ factū ē êt
17. habitauit ī nobis êt uidiṃ̄ głṃ eiuṣ głam quasi u
18. nigenit a patre plenū grē êt ueritatis Ioh † [..]ịụṛ
19. Qureaḥ † ṣirah † idrā † remiasis † mẹdio ill êt dis
20. [.]p̱ṣṣat † [.......]asṣ eṭ sit salus hụịc portātị
21. steppoḥṇẹ †† marcus †matteus † lucas † iohanes
22. † scā mā[.] sit salus anime êt corporis † f̣ạṃulo đ[.]
23. elọ̄ eloṃ ọe sabaọṭ ṣạḅaoht elia ẹli ado a
24. tan agla ttragrạma

TRANSCRIPTION

13. *receperunt. Quodquod autem receperunt eum, dedit eis*
14. *potestatem filios Dei fieri <his>, qui credunt in nomine*
15. *eius, qui non ex saguinibus neque ex voluntate carnis*
16. *neque <ex voluntate> viri, set <ex> Deo nati sunt. Et verbum caro factum est et*
17. *habitavit in nobis et vidimus gloriam eius, gloriam quasi u-*
18. *nigenit<i> a patre, plenum gracie et veritatis. Iohannes † iur*
19. *Qureah † Sirah † Idra † Remiasis † medio illorum et dis-*
20. *perssat* † [.......]*ass, et sit salus huic portanti*
21. *Stepphone †† Marcus † Matteus † Lucas † Iohanes*
22.† *sancta Maria † sit salus anime et corporis † famulo Dei.*
23. *Eloy, Elohim, Eloe, Sabaot, Sabaoht, Elia, Eli, Adonay, A-*
24. *<re>tan, Agla, Tetragrammaton.*

COMMENTARY AND TENTATIVE INTERPRETATION

The reading of the amulet is presented here as a work in progress. Initially, Konrad Knauber transcribed the text with the help of a set of macroscopic photos and scans with different lighting, contrast, and angles provided by Krzysztof Gorczyca, but without being able to consult the original. In a first handwritten transliteration, he identified the passages from the Gospel of John and parts of the subsequent text on the lower half of the inner side (B) of the amulet. His reading was then revised by Daniela Urbanová, while a facsimile of the amulet was produced by Lucie Urbanová. The initial transcription was subsequently reworked and edited by Petra Mutlová and Dalibor Havel. All participating authors have extensively conversed on the inscription and its interpretation. Nevertheless, some passages are irreversibly corrupted and remain unreadable. Further clarifications, if possible, will be published in a follow-up article.

The text from the Gospel of John (verses 1-14) takes up the entire outer side of the tablet (lines 1-12) and half of its inner side (lines 13-18). The last undoubtedly identifiable word in line 18 is the end of the relevant part of the Gospel of John (*veritatis*); the remainder (8 to 10 characters) of the line is hardly legible, but it seems possible that it is followed by an abbreviated form of the evangelist's name (*Iohannes*), followed by a cross and perhaps the word *iur[o]* (as in *adiuro* or *coniuro*), but, since the reading is uncertain at this part, it is unclear whether this explicit conjuration formula (which appears regularly in earlier Christian and pagan amulets) was used in this amulet text at all or whether it was rather a magical word, sacred name, or formulaic abbreviation since they appear in the following passages. Still, it is possible to assume that the formulaic part of the text starts already at the end of line 18 as signalled by the cross (crosses represent the act of blessing as occurs in Catholic Church missals, as noted by C. Wulf). However, since this location has not only been damaged by the unfolding procedure but also irreversibly deformed by its location at the flexion point made by folding of the lead plate, our proposed reading remains a matter of conjecture.

Lines 19 to 24 begin under the horizontal dividing line created by the first (vertical) folding of the tablet. These represent a unique part of the amulet: they consist of a sequence of magical words and the names of the Evangelists and protecting formulae, which were in all probability personalized according to the needs of the owner of the amulet. The use of a shortened version of magical precepts for the production of amulets was common in the Middle Ages as well as in antiquity, see Section 3.1. Sadly, it is exactly this part that is hardly readable and partially damaged by lead corrosion. Moreover, the fact that the letters are not engraved into prearranged lining spaces – and the individual lines intersect especially on the inner side of the lead sheet (page B) – further complicates the reading. With respect to the aforementioned, the last six lines of the text cannot be coherently translated; however, some of the parts offer sufficient grounds for at least a tentative interpretation. Basically, these lines contain a compilation of magical words, sacred names, and formulae from different contexts and purposes (possibly also originating from various text sources), as suggested also by the crosses that partially separate them. The sequence *mediomardis* or *medio ill(orum)* at the end of line 19 is very uncertain. As *mediomardis* (or *dio iuardis* and other possible combinations), it might belong to the sequence of unclear, unidentifiable, or corrupted magical words or sacred names divided by crosses that are listed in the same line (*Qureah* † *sirah* † *idra* † *remiasis* †). Reading this sequence as *medio ill(orum)* opens the possibility for a *pars pro toto* use of the popular formula *Iesus autem transiens*, often employed for safe passage and to prevent capture; in its most common form, it appears as *Iesus autem transiens per medio illorum ibat*, referring to the Gospel of Luke (4, 30), and is often used in similar abbreviated forms elsewhere (Lecouteux 2015, 184-186). Christine Wulf (*per litteras*) proposed adding *(ce)ssate* † *(satan)ass* in the subsequent line (there is an unreadable gap corresponding to about seven characters), *i.e.* ‘retreat, satanic forces’ in order that salvation may be brought to the owner of the amulet, as the following passage suggests (being read as *et sit salus huic portanti*; we have also considered the variant reading *ut sit salus hinc portatus,* but it does not rest on safe palaeographical grounds). Another possibility is to read the passage as *medio ill(orum) et dis-p(er)ssat demonass* (or *satanass*), implying that by means of these (*i.e.* the sacred names) may the dark forces be dispersed.

Lines 21 and 22 contain five Christian protective entities separated by crosses, which are quite usual in amulets: the names of the Four Evangelists separated by crosses in line 21 and *sancta Maria* in line 22. The first word in line 21 – *steppohne* – is understandable only with great difficulty. It is separated from the names of the Evangelists by two crosses. Providing that it draws on the previous protecting formula, it could express the name of the amulet’s owner, perhaps a dative or vocative form of *Stephanus* or its misspelled or vernacular variant. However, it does not seem very plausible that the word *steppoḥṇe* could refer to the first name of a mortal person as it appears before the "sacred" names in the line (it could also be an acronym made of divine words that is not known to us). Therefore, we cannot reject the possibility that it refers to the protomartyr Saint Stephen, who was stoned to death and, corresponding to the principles of sympathetic magic, is often called upon against headaches and specific diseases, such as kidney stones. The relics of Saint Stephen were translated in the 6th century and today are housed in the Basilica of San Lorenzo fuori le mura in Rome next to those of Saint Lawrence. Therefore, there might be a connection to the local church of Saint Laurentius at Rękawczyn near the location the amulet was found if lesser relics of Saint Stephen were brought from Rome together with those of Saint Lawrence that were needed for consecration of the main altar at Rękawczyn and thus local veneration of Saint Stephen may have also followed. If the word *steppoḥṇe* was really meant to refer to the intended user of the amulet, then its position could be explained by copying – in a now incomprehensible order – from multiple exemplars of different lists of sacred names, magical words, and blessings; such a practice is attested to in various extensive multi-purpose amulets, the Canterbury amulet, mentioned above, being the most renowned example. Moreover, in the lead amulets found in Central Europe, the name of the bearer usually appears only after the names of the Evangelists or other divine forces and is preceded by the sequence *famulus/a Dei*; see, *e.g.*, the Dřevíč amulet: *Pax et patrocinium Sacr[o]sancte crucis super famulum [t]uum Roszmycil dei contra fraude[m] callidi diaboli*; the amulet from Halberstadt: *famulum dei Tado*; and the amulet from the Seelschen hillfort (Muhl and Gutjahr 2013, no. 6): *famule dei Hazga*. Considering that our text also contains the phrase *famulo Dei* at the end of line 22, it could be expected that the bearer's name should follow it. Yet this is not the case. Therefore, we cannot rule out the possibility that the owner of this amulet was a certain Stephanus and the writer of the amulet used a prescription hitherto unknown to us. Additionally, in the longer textual amulets from the later Middle Ages, the formula with *famulus/a Dei* sometimes appears to have been faithfully copied without individualization, *i.e.* without providing the names of the actual patients, or alternatively the patients' names might have been put in the wrong place. Misplacing and mixing up personal names with sacred names can be seen in the 13th century amulet for Adam and Osanna from the Ingleby Arnliffe Crucifix mentioned by Skemer (2006, 185, 186). Line 22 of our amulet starts with a cross and continues with the abbreviated *scâ mâ*, *i.e. sancta Maria,* followed by the formula *sit salus anime et corporis* † *famulo Dei*, meaning 'may the soul and body of the servant be healthy/redeemed', or potentially 'may Holy Mary be the salvation of soul and body for the servant of God' (with the formula maybe also addressing the aforementioned Evangelists and – possibly – Saint Stephen, if these names do not instead represent separate semantic units).

The following two lines (23-24) contain Hebrew names for God. Line 23 – in all probability – includes *Eloy, Eloim, Eloe* (variants of *'Elohim*') and *sabaọt ṣaḥaoht*, *i.e. 'Sabaot(h)*', and the misspelled *Sabaoht*, *Elia, Eli, Adonay*. Similar sequences of magical words are well attested in medieval magical manuscripts, such as, for example., † *ely* † *eloy* † *tetragramaton* and † *ely* † *eloy* † *alfa et o* † in the Italian amulet of a certain Ilioneo (*cf.* Skemer 2006, 214 and 308-310) and *ely, eloe, emanuel* in the Canterbury amulet (Skemer 2006, 290) or *on* † *ely* † *eloy* † *agla* † (Lecouteux, 2015, 69); for the sequence *Eloy, Eloim, Ely*, see the list of 72 names of God (*cf.* Lecouteux 2015, 191) or (Lecouteux 2015, 236) *Eloy* † *Eloim* † *Ely* documented in the *Enchyridion Leonis Papae* (or the Lesser Key of Solomon), perhaps the most similar sequence of magical words appears in the Canterbury amulet: col. 3, in the sequence *Haec sunt nomina domini. on enofaton. el. eloe, sabaoth. eleon. eloe. adonay. saday* (Skemer 2006, 290).

The last line of our amulet, 24, starts with *tan*, and it is unclear whether the last letter in line 23 (*i.e. a*) can provide the beginning for the name *Arethon* (Lecouteux 2015, 204), meaning 'virility' or 'strength', or even more likely *Areton* (gk. 'the inconceivable' as a name of God); this is followed by *Agla* (*cf.* Section 3.1.) and an abbreviated form of the *Tetragrammaton* (a common code for the four letters of the unspeakable personal name of God, see also the sequence *Sabahot, Tara* † *Tetragrammaton* in Lecouteux 2015, 236).

SUMMARY

The last six lines of the amulet – which represent the most valuable, original, and personalized section – start with possibly five or more unidentified sacred names. Most probably, these begin after the cross at the end of line 18 where the quotation from the Gospel ends, (18) † *iur* / (19) *Qureah* † *Sirah* † *idra* † *remiasis* †, and seem to be followed by a protective formula. The last word in line 19 might pertain either as the sixth magical word (*mediomardis*) in the previous sequence of sacred names interspersed with crosses, or it could be read as *medio ill(orum)* and belong to the following protective formula. The lacuna at the beginning of line 20 may be interpreted as *et dis/sp(er)ssat demonass* or *satanass*; the second part of this line reads *et sit salus huic portanti*. The overall meaning is that through these holy names (*i.e. Querah*, *etc.*) the evil forces (*i.e.* the daemons) are to be driven away and salvation is to be brought upon the bearer of the amulet. The beginning of line 21 starts with the unusual word *steppohne*, which may be understood as a peculiar form of a personal name: **Stephanus* can be either the person to be protected by the amulet or a reference to Saint Stephen. Separated by two crosses, another sequence of well-known Christian sacred names follows: Mark, Matthew, Luke, John, and Holy Mary (it is worth noting that the sequence of the Four Evangelists does not correspond to the Vulgate but seemingly testifies to Marcan priority), together with another protective formula: *sit salus anime et corporis famulo Dei*, which can be understood as 'may the soul and body of the servant of God be healthy or redeemed'. The last two lines conclude the protective effort by invoking mighty names – they contain various names and epithets of God from Hebrew tradition and other powerful magical devices, such as the acronym *Agla* and the

Tetragrammaton. All in all, it remains to be decided whether the amulet belonged to a certain Stephen and had a general apotropaic function by combining various more specific magical remedies, or it was intended to secure divine protection for, *e.g.*, a specific safe passage. As it was folded down into a small portable size, however, it seems that it was intended to be worn on the body for a longer period of time. The invoked entities and the magical names still need to be deciphered with more precision, while it is safe to assume that the total number of 2 times 12 or 24 lines was specifically chosen to enhance the amulet's power according to Judaeo-Christian numerology. In any case, the fact that a lengthy portion from the Gospel of John is cited here marks the amulet as an outstanding example of an older tradition, especially in the Central European context. Additionally, it shows typical characteristics of amulets from the later Middle Ages: the tendency towards longer but also less individualized texts from a long tradition of compiled sources, maybe even specific medicinal manuscripts or other collections, as well as the obvious avoidance (if we exclude the very unclear reading in line 20) of direct addressing/naming of evil entities such as daemons or personified illnesses. Instead, the power of this amulet and its contemporaries was derived from clerically sanctioned liturgical prayers and blessings as well as a diverse number of divine names and magical words with a tendency to favour (bastardized) Greek and Hebrew, which were thought of as much closer to the miraculous accounts from the Bible and, thus, much like the older *historiolae*, invoked "sacred time" and heavenly power, restoring the divine order of God's creation by manifesting them through the act of writing. The Rękawczyn amulet is unique evidence for the manufacture and use of medieval textual amulets as it represents the easternmost discovered surviving physical example from the sphere of medieval Latin Christianity to date in the wider European context (the closest, though older, local evidence in Central Eastern Europe is from Dřevíč, dating to the 12th century from the Czech Republic, and a 14th-century parchment example discovered in St. George at Prague [Nováček 1901, 353 and Mach and Šittler 1910, 403]).

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DISCUSSIONS AND POLEMICS

Elżbieta Sieradzka[1]

UNIQUE VERSUS UNUSUAL – SOME COMMENTS ON THE GLOBULAR AMPHORA CULTURE CEMETERY AT THE ZŁOTA-GAJOWIZNA SITE

ABSTRACT

Sieradzka E. 2021. Unique versus unusual – some comments on the Globular Amphora culture cemetery at the Złota-Gajowizna site. *Sprawozdania Archeologiczne* 73/2, 365-374.

The article is inspired by the new paper (Witkowska *et al.* 2020) "The cemetery of the Globular Amphora culture community at the Złota-Gajowizna site in the light of radiocarbon analysis and dendrochronology". It delivers some remarks on the famous GAC necropolis, focusing mostly on the issues concerning the layout of the cemetery and interpretation of various funerary features.

Keywords: late Neolithic, cattle burials, funerary rites
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Over 100 years since its discovery in the early 1900s, the Złota-Gajowizna site remains one the most famous cemeteries of the central (Polish) group of the Globular Amphora culture (GAC). Yet, perhaps due to its originality or quite complicated history of research, archaeologist still struggle with explaining many complex issues concerning of the necropolis (*e.g.* Krzak 1977; Szczodrowski 2015).The recently published paper, co-written by Barbara Witkowska, Janusz Czebreszuk, Barbara Gmińska-Nowak, Tomasz Goslar, Marzena Szmyt, and Tomasz Ważny, delivers a much-needed new evaluation of the Złota-Gajowizna

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site, together with the results of radiocarbon dating and dendrochronological analysis (Witkowska *et al.* 2020). At the same time, as I will try to argue below, the presented interpretation of the features from famous cemetery overlooks a few important details, thus creating some problems on its own.

To start with, in official records the Złota-Gajowizna necropolis is listed as site no. 14 in Polanów, Sandomierz district (Witkowska *et al.* 2020, 261). The site was dubbed 'Złota-Gajowizna' to reflect its connection with three other large Late Neolithic cemeteries located less than 1 km to the south-west, in the north-western outskirts of the village of Złota. These are the sites: Nad Wawrem, Grodzisko I, and Grodzisko II (Krzak 1958; 1961; 1970; 1977). Złota-Gajowizna is not only the smallest funerary site belonging to this cluster, but also the only one containing almost exclusively GAC features – the other three necropolises were used mainly by communities of the Złota (ZC) and the Corded Ware (CWC) cultures, with some graves that were dated to the Middle Neolithic and Early Bronze Age. At the same time, with more than 32 graves and ritual pits, Złota-Gajowizna clearly diverges from other cemeteries of the central group of the GAC, consisting typically of less than three features in total (*e.g.* Szmyt 2002, 212, 213).

Another very recognizable characteristic of the Złota-Gajowizna necropolis is its layout. Most of the ritual features were organized in parallel rows, oriented NW-SE, with two complexes situated perpendicularly along the W-E axis (Fig. 1: b). While linear arrangements of human graves and animal deposits are not uncommon in the GAC milieu (*e.g.* Szczodrowski 2015; Balfanz 2017), for a very long time the Złota-Gajowizna site used to be the only known large GAC cemetery with multiple cases of such clusters. According to Radosław Szczodrowski (2015, 53), the unusual layout of the Złota-Gajowizna site may have been mirrored by the GAC necropolis at the site 78 in Sandomierz, located just about 7 km north-east from Polanów. We must keep in mind, however, that the latter site has been only partly excavated, making the reconstructions of both plan and range of the GAC cemetery mostly hypothetical (see Ścibior and Ścibior 1990). Another 'Gajowizna-like' GAC necropolis was discovered as recently as in 2015 at site 23 in Sadowie, Opatów district, about 30 km to the north-west of Polanów (Mackiewicz *et al.* 2016; Pasterkiewicz 2017; 2020). Archaeological work at the cemetery is still ongoing. As of late 2020, 29 Late Neolithic funerary features have been uncovered – 26 GAC graves and ritual pits and 3 graves of the ZC, arranged in parallel rows matching the layout of the Złota-Gajowizna site (personal communication by Dr Wojciech Pasterkiewicz; *cf.* Fig. 1: a).

While a proper comparison of these two necropolises can be only written after a full publication of the Sadowie cemetery, it seems a bit disappointing that the paper by Witkowska *et al.* (2020) fails to even acknowledge the preliminary results of the latest archaeological research in the central part of the Sandomierz Upland. Instead of that, the new interpretation of the Złota-Gajowizna necropolis proposed in the above-mentioned article is based mostly on the available data on the features unearthed at the cemetery, with only a brief review of possible analogies (Witkowska *et al.* 2020, 265-272). In my

Fig. 1. Plans of large GAC cemeteries from the Sandomierz Upland:
a – Sadowie, Opatów district, site 2; excavation campaigns 2015-2019 (after Pasterkiewicz 2020, 56, fig. 2, with modifications); b – Polanów, Sandomierz district, site 1 – Złota-Gajowizna (after Witkowska *et al.* 2020, 273, fig. 9, with modifications)

opinion, the main weakness of this approach is the relatively poor state of preservation of finds from the famous site. In the late 1920s, when the professional excavation at the Złota-Gajowizna cemetery took place, the site had already been damaged by multiple amateur investigations (Witkowska *et al.* 2020, 261). In addition, the results of the main 1926 field campaign remained unpublished for the next 50 years (Kowalczyk ed. 1977). During the long period of storage, including the tumultuous time of World War II, a large part of the excavated material and documentation had been lost. As a result, the descriptions of features given in the long-awaited 1977 monograph (Kowalczyk ed. 1977) often lack important details, especially concerning the human and animal remains from graves and ritual pits (see Krysiak and Lasota-Moskalewska 1977; Lasota-Moskalewska 1977; Miszkiewicz 1977). For that reason, I believe that we should not underestimate the importance of aiding the fuller interpretation of the Złota-Gajowizna with observations of similar ritual complexes.

According to Zygmunt Krzak, the author of the first full analysis of the Złota-Gajowizna necropolis, ritual pits from the cemetery should be put into two main categories – human graves and so-called ‘sacrificial pits’ containing animal deposits (Krzak 1977). Apart from that classification, there are also a few features whose original function remained undetermined, usually as a result of prior devastation or loss of contained material (see Krzak 1977, 78, 79). However, as correctly noted by Witkowska *et al.* (2020, 261), a closer look at Krzak’s paper reveals some inconsistencies. A good example of that situation would be the case of Feature 19. Based on a comment in the 1920s field journal, Krzak classified the pit as a human grave (Krzak 1977, 37). At the same time, only cattle remains were identified among the bones collected from the feature (Krysiak and Lasota-Moskalewska 1977, 86), suggesting that the pit was most likely another animal deposit (Witkowska *et al.* 2020, 271).

Hence, it seems completely reasonable that the authors of the paper opted for their own interpretation of the ritual features from the Złota-Gajowizna cemetery (Witkowska *et al.* 2020, 265-272). The main goal of the new classification was to provide a better tool for recognizing human graves. According to the researchers, such features could generally be characterized by: a rectangular outline of the pit, lack of complete animal skeletons, presence of human remains as well as grave goods such as ceramic vessels, flint axes, and amber ornaments (Witkowska *et al.* 2020, 265). Applying these criteria, as many as 18 human graves were identified, with 12 features classified as animal deposits (Fig. 1: b). The results of the new analysis differ significantly from the reading of the Złota-Gajowizna site by Krzak, who strongly believed that ‘sacrificial pits’ outnumbered human graves (Krzak 1977, 78, 79). Interestingly, Krzak’s concept certainly is true for the Sadowie necropolis (Pasterkiewicz 2020, 55) – all four fully excavated rows of ritual features consisted of a sole human grave and 2-4 animal deposits (Fig. 1: a).

To find a reason for such striking discrepancies, we need to closely examine the criteria for distinguishing human graves accepted by Witkowska *et al.* (see above). To start with, linking the presence of grave inventory solely to human burials, in my opinion, seems a bit disputable. While both ceramic vessels and flint axes are considered 'standard' offerings for GAC human graves, they are not uncommon in animal graves or deposits (see Kołodziej 2011, 94-97; *cf*. Witkowska *et al*. 2020, 267). For example, 'sacrificial pits' found in the Sadowie necropolis were typically equipped with at least 1-3 vessels, sometimes accompanied by flint tools or even tusks of a wild boar (Pasterkiewicz 2017, 285; 2020). At the same time, the two remaining GAC cemeteries with animal deposits from the Sandomierz Upland – Malice, Sandomierz district, site 1 (Kamieńska 1964) and the above-mentioned site 78 in Sandomierz (Ścibior and Ścibior 1990) – yielded only 'sacrificial pits' with no pottery goods. At the Złota-Gajowizna site, the latter group of features is represented by many well-preserved animal deposits (nos 3, 4, 8, 16, 22, 25, 27, 29, 31). Yet, the occurrence of pottery sherds, or even whole ceramic vessels, was confirmed for few pits containing only or almost exclusively animal remains – nos 5, 6, 7, 11, 15 and 24. For that reason, their interpretation according to the above-discussed rules proposed by Witkowska *et al*. could be a little problematic.

To start with, the features no. 5, 7 and 11 from the Złota-Gajowizna cemetery had oval or rather irregular outlines, and, as a result, in the analysed paper they were classified as settlement pits rather than ritual deposits (Witkowska *et al*. 2020, 265). Another factor in favour of this explanation could be the location of the pits – all three of them were discovered on the outskirts of the excavated area of the Złota-Gajowizna site, at some distance from the nearest agglomerations of GAC funerary features (see Krzak 1977, 10, fig. 2). On the other hand, the published profile of the pit no. 5 reveals that it had a relatively level bottom (Krzak 1977, fig. 22), no different from well-documented ritual or funerary features found at the cemetery (*cf*. Krzak 1977, fig. 3, 24, 36, 61 and 66). Thus, we cannot completely reject the possibility of at least some of the discussed pits originally being badly damaged animal deposits. I should add that the presence of single funerary features, situated apart from regular rows of graves and 'sacrificial pits', was confirmed at the Sadowie necropolis (no. 14, 15 – Fig. 1: a).

Moving on, according to Witkowska *et al*. (2020, 262, 263, table 1), Features no. 6 and 15 from the Złota-Gajowizna site should be classified as human graves, despite the fact that there is no information whether any human remains were recovered from their fills (Krzak 1977, 21, 23, 35). Both of the pits had been looted prior to the professional excavation. In Feature no. 6 remains of a bull and at least four pigs were discovered (Krysiak and Lasota-Moskalewska 1977, 85), while Pit 15 yielded just a few fragments of cattle bones (Krzak 1977, 35). Hence, I would not abandon the original interpretation of Feature 6 as an animal deposit (Krzak 1977, 62), while the original function of Pit no. 15 should perhaps remain undetermined.

Another feature considered by Witkowska *et al*. (2020, table 1) as a possible human grave is Pit no. 24, containing the complete skeletons of at least 10 cattle individuals, as well as partial burials of three sheep or goats and two pigs (Krysiak and Lasota-Moskalewska 1977, 86, 87). Additionally, near the central part of the pit, on top of the layer of animal bones, the remains of a child of the age of *Infans II* were uncovered (Miszkiewicz 1977, 149), alongside fragments of at least four vessels (Krzak 1977, 42; Witkowska *et al.* 2020, fig. 3). Following the criteria for identifying human graves from the Złota-Gajowizna site presented above, the authors of the paper decided that the artefacts and animal deposits could be treated as possible grave goods intended for the child (Witkowska *et al.* 2020, 267). Witkowska and her co-authors are aware of the rather controversial nature of this interpretation, as this type of human-animal grave is very atypical for the central group of the GAC (Witkowska *et al.* 2020, 267). In this province of the GAC, animals intended to be buried as an offering for a deceased human were usually placed in a separate pit dug in close proximity of a human grave, as exemplified by the above-mentioned GAC cemeteries in Sadowie, Sandomierz, or the Złota-Gajowizna itself (*see* Fig. 1: a, b). Alternatively, such deposits or burials may have been laid in a special part of a human grave – next to human remains (*e.g.* Malice, grave 33; Kamieńska 1964, 32, fig. 2) or in a second grave chamber (*e.g.* a GAC grave from Las Stocki, Puławy district, cemetery 'H'; Bronicki 2016, 144, fig. 96).

Hence, as noted by Witkowska *et al.* (2020, 267), the closest analogy for Feature 24 from the Złota-Gajowizna necropolis could be the animal grave no. 1 from the site 4 in Brześć Kujawski, Włocławek district, in northern Poland. In the eastern part of a large, rectangular pit, the excavators discovered remains of a cow and a child of the age of *Infans I*, as well as a large vessel (Gabałówna 1958, 72-75). In that case, however, the human burial is commonly regarded either as a blood sacrifice matching the ritual killing of the cow (Gabałówna 1958, 94) or even as a part of the grave inventory of the said animal (Wiślański 1969, 297).

In my opinion, more useful in interpreting Pit no. 24 from the Złota-Gajowizna site may be an analysis of Late Neolithic human-cattle burials known from eastern Germany. As a rule, children buried in such graves were accompanied by at least one adult (see the catalogue prepared by Valeska Becker: 2017, 118-126). An example of this type of feature is the GAC grave from Zweimen-Dölkau, Saalekreis district, cited by Witkowska *et al.* (2020, 267). In addition to the burial of two cattle individuals and a child of the age of *Infans II* that were mentioned in the discussed paper, the grave yielded remains of three people, including at least two adults, one cattle individual, as well as bones of two pigs, a horse, and a sheep or goat (Beier 1988, 132; Becker 2017, 120). On the other hand, single child burials were sometimes identified in features interpreted as animal deposits, such as Pit 62 from the Salzmünde culture barrow in Dörstewitz, Saalekreis district (Balfanz 2017). The feature contained a complete burial of a bull or an ox, together with skulls and some loose bones belonging to a cow and a calf (Balfanz 2017, 249-251). In addition, the remains of a child of the age of *Infans I* (2-3 years old) were placed on the abdomen of the bull/ox (Balfanz 2017, 251, fig. 19). Anthropological analysis of the human skeleton revealed many bone pathologies, indicating that the cause of death of the child may have been a serious illness. Subsequently, it has been suggested that the child may have been interred alongside the bovine as a way to ensure his or her success in reaching the afterlife (Balfanz 2017, 251). A very similar interpretation was given to the Late Neolithic human-cattle grave from Gimritz, Saalekreis district (Jarecki 2007). Inside the feature, researchers discovered a miniature stone cist laying on the abdomen of a cow (Jarecki 2007, fig. 3). Although no bone remains were unearthed in the interior of the cist, based on the size of the structure, it was deduced that it may have originally contained a burial of an infant (Jarecki 2007).

All things considered, I believe that Feature 24 from the Złota-Gajowizna necropolis fits well into the Late Neolithic horizon of animal deposits with child burials. In the context of other similar finds, neither the presence of the remains of the child nor the ceramic vessels can be regarded as definite arguments for classifying the pit as a human grave (*cf.* Witkowska *et al.* 2020, 267). Without doubt, the main difference between Feature 24 from the Złota-Gajowizna site and the above-discussed deposits from Brześć Kujawski, Dörstewitz and Gimritz is the outstanding number of animals interred in the analyzed pit – at least 15 (Krysiak and Lasota-Moskalewska 1977, 86, 87). While Feature 24 appears to be the biggest of all 'sacrificial pits' from the Złota-Gajowizna cemetery, we need to keep in mind that at least four complete cattle skeletons were discovered within as many as three other animal deposits from the site (nos 27, 29 and 31 – *see* Krzak 1977).

To conclude, it seems to me that the criteria for identifying human graves at the Złota-Gajowizna necropolis proposed by Witkowska *et al.* (2020) may have resulted in a slight overestimation of number of such features at the famous cemetery. Instead of the 18 human graves reported in the discussed paper (Witkowska *et al.* 2020, 269), I would count no more than 10-12 (nos 1, 2, 9, 10, 14, 18, 30, 32 as well as, possibly, 13 and 28; *see* Fig. 1: b). Based on the position of the possible human graves in the layout of the Złota-Gajowizna site, I suspect that most of the remaining pits from the cemetery may have been animal deposits (nos 3, 4, 6-8, 11, 16, 19, 22, 24, 25, 27, 29 and 31, *cf.* Witkowska *et al.* 2020, 271). At the same time, I do not think that the available information concerning many damaged or poorly preserved features makes an adequate basis for assigning them a specific interpretation (Krzak 1977, 64; *cf.* Witkowska *et al.* 2020, 265, 274). Furthermore, we need to keep in mind that, according to some researchers, among the finds from the Złota-Gajowizna site may have occurred other types of funerary or ritual features, such as hearths used for charring human remains (Wilk *et al.* 2011, 51, 52).

Despite my scepticism regarding some of the methods of classification of features from the Złota-Gajowizna necropolis developed by Witkowska *et al.* (2020), I believe that the discussed paper deserves a great deal of credit for including the first comprehensive retelling of Krzak's (1977) interpretation of the famous cemetery. The authors of the article correctly pointed out many of Krzak's shortcomings (see above) and managed to develop a consistent alternative theory (see Fig. 1: b). In addition, the work by Witkowska *et al.* (2020) introduces crucial new data about the Złota-Gajowizna site, including the first set of radiocarbon dates from graves and ritual deposits, as well as dendrochronological analysis of burned wooden beams from one of the features. It was revealed that the cemetery was in use in the first half of the 3rd millennium BC, most likely between 2 900 and 2 600 BC

(Witkowska *et al.* 2020, 281). Without doubt, establishing a chronological framework for the famous cemetery makes a vital contribution to the ongoing discussion concerning the time-frame of the GAC in the Sandomierz Upland (*e.g.* Włodarczak 2017, 284, 285; Pasterkiewicz 2020). The absolute chronology of the Złota-Gajowizna site matches the radiocarbon dates obtained for the ZC graves from the nearby necropolises at Złota-Nad Wawrem and Złota-Grodzisko I (see above), revisiting a century-old question about the nature of the relationships between GAC and ZC communities. All things considered, I strongly believe that the discussed paper Witkowska *et al.* (2020) could open a new chapter in research of the Late Neolithic funerary rituals in southern Poland.

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ON THE SYNCHRONIZATION OF THE CHRONOLOGY OF PHENOMENA AND ARTEFACTS

ABSTRACT

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The article presents a slightly different point of view on the issues related to the chronology and significance of the Chotyniec agglomeration (SE Poland) from the one presented in the discussion by Denys Grechko published in the 72nd volume of *Sprawozdania Archeologiczne*. The author highlights the importance of Grechko's contribution in clarifying the chronology and provenance of biconical glass beads, which should be considered eastern imports. The polemical remarks concern the dating of the hillfort in Chotyniec and the entire Chotyniec agglomeration. The current state of research does not authorize drawing categorical conclusions that would limit its use to the end of the 7th and early 6th centuries BC. This is contradicted by the entire series of radiocarbon dates and other premises. With regard to the Pomeranian culture, it was shown that it is not justified to distinguish the Lusatian-Pomeranian stage in south-eastern Poland. At the same time, new sources of the Jastorf culture were indicated.

Keywords: chronology, the Chotyniec agglomeration, Scythian culture, Hallstatt culture, Pomeranian culture, Tarnobrzeg Lusatian culture
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INTRODUCTION

This text would probably not have been written if it were not for the Editorial Board of "Sprawozdania Archeologiczne", which published a very important article by Denys Grechko (2020b) in the "Discussions and polemics" section of the last volume of 2020 (72/2). We can see it as a provocative invitation to a debate, definitely worth accepting. The aim of this article, however, is not engaging in a direct polemic with the author (although such references will also be included), but drawing attention to slightly different aspects regarding evidence and interpretation. Moreover, the author of the article encourages such a step himself in the last sentence of his paper: "The presented work only outlined several possibilities for highlighting individual periods in the phase III/1 of the TLC (SC: Tarnobrzeg Lusatian Culture), which is a task for future fundamental research of Polish and Ukrainian specialists" (Grechko 2020b, 601). It should also be noted that the author published a second paper in 2020 (Grechko 2020a), which should be considered an extension and a more detailed account of chronological issues in a wider European context. In this case, it is a proposal to change the chronology of the "Scythian" invasions in Central Europe, which also applies to Polish territories.

Before we proceed to the main body of the article, it should be noted that in the Polish archaeological literature (*e.g*. Czopek 1989; Kłosińska 2007), attention has for a long time been drawn to the issues related to the chronology and interpretation of phenomena observed in the Early Iron Age in the Polish lands east of the Vistula. In terms of the material evidence, this area differs from the general "Lusatian" scheme in the presence of numerous artefacts of eastern or south-eastern provenance, the best example of which are items related to the Scythian cultural circle (Bukowski 1977). More recent studies advance this thesis even further, providing numerous arguments extending older interpretations (Andrzejowska 2016; Trybała-Zawiślak 2020). The distinctiveness of the area of eastern Poland (associated rather with "the east" in its broader sense) in relation to western Poland has been clearly demonstrated by recent discoveries of sites attributed to the Hallstatt ("Western European") cultural circle in Lower Silesia (Gediga 2010; Gediga *et al*. 2020). Thus, it can be stated that in the Early Iron Age, the border between the cultures of Eastern and Western Europe runs through the present-day Polish lands. The contemporary national frontier between Poland and Ukraine does not correspond to any cultural border (Czopek and Machnik 2013) nor an environmental one (Makohonienko 2009), which leads to the conclusion that there is a need for cooperation in the context of homogeneous, international and interdisciplinary research programs. It is for these reasons that the very interesting article by Denys Grechko (2020b) should be warmly received and its findings should be adopted as a starting point for a discussion. The author's most important proposals involve correction of the dating of selected artefacts – the archaeology of artefacts (military items of Scythian provenance and small, biconical glass beads), which have been used as the source basis for the separation of two chronological phases ordering cultural temporal relations (chronology of phenomena) in some parts of Central Europe, particularly in the east of Poland.

TARNOBRZEG LUSATIAN CULTURE (TLC)

The cultural situation in the Early Iron Age in south-eastern Poland has long been treated as a kind of phenomenon, the sources of which were sought in relations with eastern and south-eastern cultural groups. At the same time, researchers adopted the thesis about cultural homogeneity resulting from the continuation of the TLC (Moskwa 1976). However, the latest study by Katarzyna Trybała-Zawiślak (2019) clearly showed that cultural relations and their exact chronology are more complex than previously thought, and TLC can no longer be treated as a monolith in time and space, especially in terms of its youngest materials. Studies on the chronology and periodisation of this unit in relation to the Early Iron Age have been repeatedly undertaken by archaeologists associated with the Rzeszów (Czopek 1989; Czopek and Trybała-Zawiślak 2015; Trybała-Zawiślak 2019, 137-182) and Cracow academic centres (*e.g.* Przybyła 2003; Gawlik and Przybyła 2005). The new perspective of Denys Grechko, although incomplete or even fragmentary, is very valuable because it meets the criteria of an objective and "external" point of view. His most important and well-motivated finding is the narrowing of the chronology of the small, biconical glass beads that appear in funerary complexes (well-dated thanks to Greek imports) of the Scythian cultural circle in the first three/four (?) decades of the 6th century BC, not going beyond the middle of that century (Grechko 2020b, 587-597). The researcher also identifies a production centre at the Black Sea settlement of Yahorlyk in Kherson Oblast operating, in his opinion, within the lifetime of one generation of Greek colonists who produced the aforementioned beads. In such a context, these inconspicuous artefacts take on the significance of Greek imports, reaching the Vistula and Oder basins via "Scythian" mediation. There are no obstacles to assigning a significant role to the Chotyniec agglomeration in this respect, which is also pointed out by Grechko (2020b, 598). The author proposes synchronizing the horizon of biconical beads with the HaD1 phase and the second phase of the Kelermes period. It seems, however, that there is a fundamental contradiction here between the "narrow" chronology of the production workshop (*ca.* the first three decades of the 6th century) and the entire HaD1 phase, the beginning of which covers also the last decades of the 7th century (Trachsel 2004, 151, 152). Therefore, if we assume a very narrow dating of the beads, then we should only talk about the synchronisation with the younger part of HaD1. At this point it is worth mentioning a rich grave inventory with this kind of beads (referenced in Grechko's article), coming from Zabłotce (left bank of the San river, Jarosław district), dated no earlier than the middle of the 6th century BC to the beginning of the 5th century BC (Bajda-Wesołowska *et al.* 2014), thus later than HaD1. It should be noted, however, that this complex is associated more with the "Thracian" environment, hence, although similar to the “Black Sea” ones, the biconical beads may have a different provenance and therefore a slightly different, later dating. These inaccuracies show that the chronology of the aforementioned biconical beads cannot be considered settled. However, it would be very promising to adopt a narrow horizon (early 6th century BC) for the occurrence of such beads in south-eastern Poland. This interpretation seems to be confirmed by the grave inventories from large TLC cemeteries (Trzęsówka, Kosin), where the beads appear in single graves (in about 3,000 known graves from phase III of the TLC, biconical beads were registered only in eight), suggesting the existence of a short period of their functioning in south-eastern Poland (Czopek 2011). In such an interpretation, we could obtain an artefact with the most precise dating, but it would rather not have a “phase-forming” significance for the entire III1 phase of the TLC, but its part. Therefore, “horizon” is a suitable term here.

Recognizing the provenance of the described artefacts as proposed by Denys Grechko, one can refer to them as Greek (“provincial Greek”) imports. This quite fundamentally changes their interpretation as a determinant of the rank of people buried with such ornaments and creates new possibilities for determining the dynamic functioning of the necropolises in historical time. A good example here could be the cemetery in Grzęska (Czopek *et al.* 2016). It is characterized, like many other TLC necropolises from phase III (Trybała-Zawiślak 2015), by an ordered, linear arrangement of graves, which is derivative of the time when they were founded. In Grzęska this period was defined for five generations, *i.e.* 125-150 years. Two graves with beads can be assigned exactly to the middle of this interval, as long as we make some adjustments to the order of graves in zone B of the cemetery, which was proposed in the monograph (Czopek *et al.* 2016, 116-125). Taking into account the limited dating of the horizon of biconical beads (600-570 BC), the onset of the functioning of the cemetery can be attributed to the range 660-650 BC, and its decline to 520-510 BC. From the point of view of cultural relations, it is important to observe that this narrow horizon of the evident “Scythian” provenance, which is also confirmed by the grave ceramics, falls in the middle stage of the use of the necropolis. It cannot be linked to either the beginning or the end of its functioning. This example shows a slightly different manner of inference, specifying the chronology of the site on the basis of findings about its functioning in a situation when we have an accurate dating of at least one component of the grave inventory. Such a possibility is given by the precise dating of the horizon of biconical beads (or other artefacts occurring over a period of several decades). Considering the remarks above, it is difficult to overestimate the contribution of Denys Grechko, who establishes a precise dating for the seemingly inconspicuous biconical glass beads. However, not only the beads can determine the absolute dating of phase III1 TCl, which should last at least until the end of HaD, or even the beginning of LtA, *i.e.* the end of the 6th century BC. In many complexes we have confirmed the presence of other artefacts, well dated to the second half and the end of the 6th century.

DATING AND IMPORTANCE OF THE CHOTYNIEC HILLFORT

A very important issue, and at the same time one of the essential elements of Denys Grechko's reasoning, is the chronology of the Chotyniec agglomeration, particularly the Chotyniec hillfort itself. It is not yet possible to set the dates of its beginning and end, as the excavation work has not been completed. The only thing we can date with precision is the *zolnik* (ash mound), excavated in its entirety. Transferring the observations and chronological discoveries made for this feature in order to determine the time of functioning of the entire settlement is unjustified (which is the bottom line of Denys Grechko's proposal), at least until the field research has been completed. So far, only 2% of the area of the settlement itself have been explored. The sum of the facts (for the *zolnik*), *i.e.* the dating of ancient amphorae, arrowheads and pins, together with radiocarbon dates, places its origin in the 6th/7th centuries BC. The chronology of the entire collection of arrowheads, consisting of 38 items, ranges between the mid-7th and mid-6th centuries (Burghardt 2020). Some types of pins and a twisted necklace may be similarly dated (Czopek 2019, 133), although this group of artefacts may be placed in a slightly wider chronological range. Fragments of Greek amphoras used to transport wine, including the best-preserved items, indicate the turn of the 6th/7th centuries or the first decade of the 6th century BC (Czopek 2019, 126, 127; Trybała-Zawiślak 2019, 268-272). Needless to say, Greek imports in Eastern Europe are considered the best determinants of absolute chronology.

A few words should also be devoted to the hand made ceramics. At the sites of the Chotyniec agglomeration, we encounter forms present in other hillforts of the forest-steppe zone. Most of the pottery found in the Chotyniec *zolnik* (over 12,000 fragments) can be synchronized with phase III.1.3. of the fortified settlement in Nemirov, dated to the second half of the 7th and the first thirty years of the 6th century, BC related to stage 3 of the Early Scythian culture ("ESC"; Smirnova *et al.* 2018, 223, 224, 231). The presence of fragments of large, thick-walled vessels with black surface in Chotyniec (Fig. 1), which in the Nemirov hillfort were considered a manifestation of influences from the Hallstatt culture (!), clearly suggests the possibility of an earlier dating – at least until phase III 1.2. synchronized with "ESC" 2, *i.e.* dated to the first half of the 7th century (Smirnova *et al.* 2018, 227, 231). Thus, we obtain a premise to date the Chotyniec hillfort earlier than the 7th/6th centuries, perhaps even in the second half of the 7th century. We find confirmation of this thesis in the radiocarbon dating. One must agree with the caution that Denys Grechko (2020b, 587) exhibits in approaching radiocarbon dates for the Early Iron Age, but they cannot be ignored, especially as we now possess an increasing quantity. They relate to various Early Iron Age complexes and cultural groups in south-eastern Poland (Trybała-Zawiślak 2019, 143-158). For the hillfort in Chotyniec, we currently have 17 such dates from the *zolnik* area, which make up a sequence from the 8th/9th to the 4th/5th centuries (Czopek and Krąpiec 2020). The oldest of them correspond to the period before the founding of the *zolnik*, which took place in its first phase, *i.e.* 7th – 6th/7th centuries. The largest series of dates

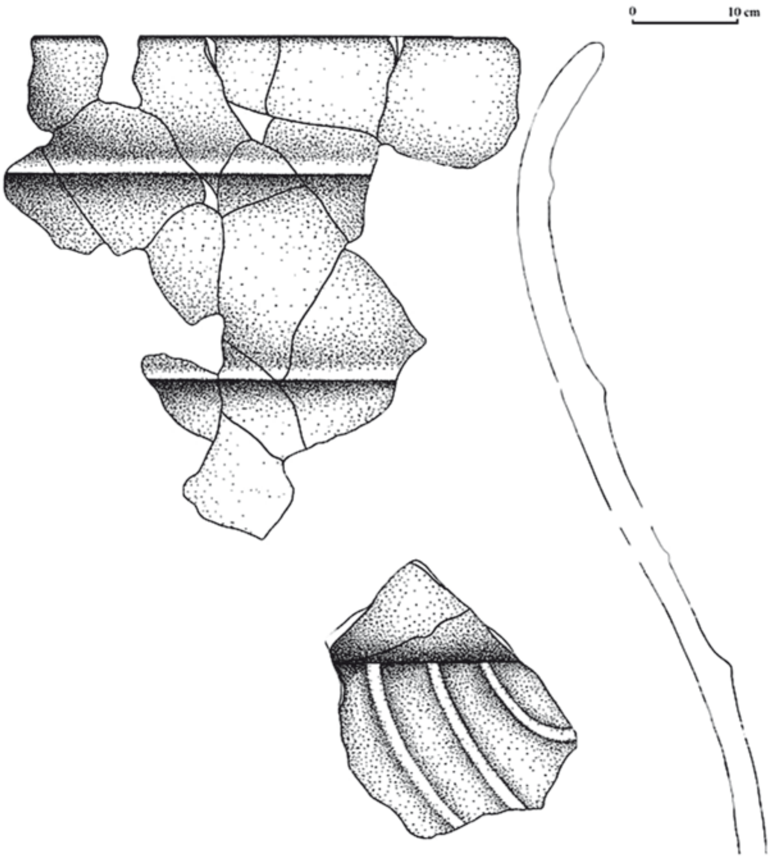

Fig. 1. Chotyniec, Jarosław district, Site 1. Zolnik (ash mound). Fragments of a large thick-walled vase with black outer surface

indicates intensive use in the second phase, falling in the 6th and 5th centuries. Only one date can refer to possibly the youngest horizon (6th-3rd centuries), which is quite problematic in all respects (concerning stratigraphy, dating of artefacts or knowledge of the processes and trends in the development of settlements in the Scythian circle). There is no doubt, however, that the Chotyniec *zolnik* functioned also in the second half of the 6th century and probably in the 5th century (possibly only in part of it). The main argument here is very clearly preserved relationship between the various layers. In the profiles that have already been published (Czopek 2019, fig. 5; Czopek and Krąpiec 2020, 1602, fig. 4) only the oldest layer, rich in artefacts, including precisely dated ones, is clearly visible. The younger layer is preserved only on the edges of the *zolnik* and is distorted by modern ploughing. Thus, it can be assumed that the youngest horizon of its use was almost completely destroyed, hence the lack of sources that could characterize it. The only traces are the charcoal from the edges of the "ash-*zolnik*" layer, and probably some bones and ceramics that cannot be accurately dated.

In the last research season (2020), it was possible to obtain material for radiocarbon dating at the base of the embankment, thus identifying the time of its construction. It is a charcoal sample dated to 2514±24 BP (MKL-A5046). Its calibration is not entirely unambiguous, but the highest probability ranges, both at 1 and 2 sigma levels, clearly indicate the second half of the 7th and first half of the 6th centuries BC (Fig. 2). It seems that such dating may correspond to the beginning of the use of the *zolnik*.

If we take radiocarbon dates as a determinant of the dating of the entire settlement, which does not have to constitute an obvious strategy, it probably functioned from the second half of the 7th to the 5th century. Its decline cannot be precisely determined at the moment. Therefore, Denys Grechko's view that the settlement was abandoned as early as the 6th century (and even at the end of the first thirty years of this century – Grechko 2020b, 600) seems to be at least premature. The hillforts to which we refer for analogies when analysing the site in Chotyniec, located in the zone of the Ukrainian forest-steppe (from the Dnieper to the Dniester), can be dated very differently. While the beginning of their usage is attributed quite consistently by many authors to at least the end of the 7th

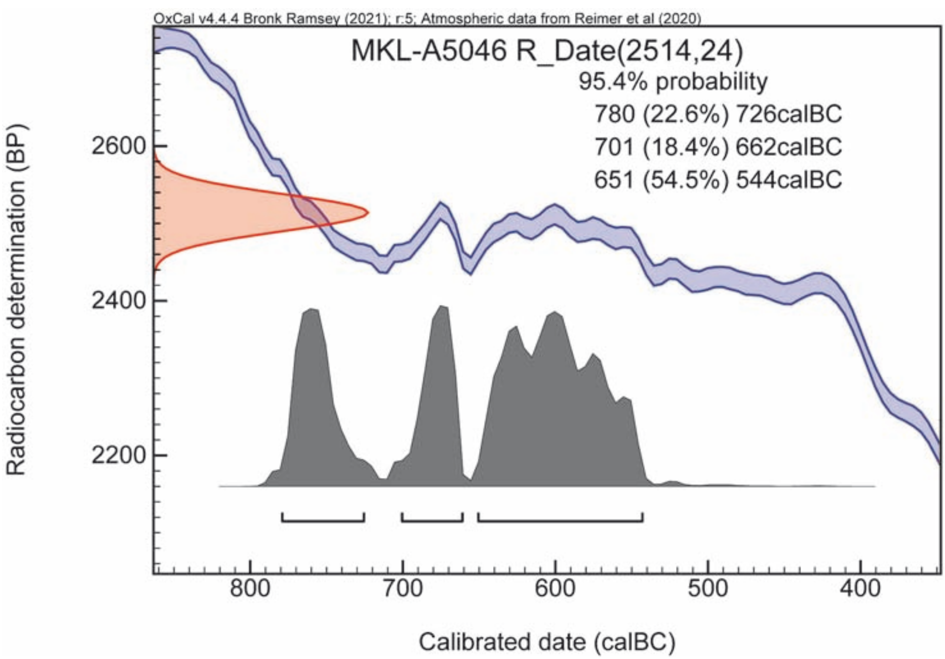

Fig. 2. Chotyniec, Jarosław district, Site 1.
Calibration chart of radiocarbon dating of a charcoal sample from the base of the embankment

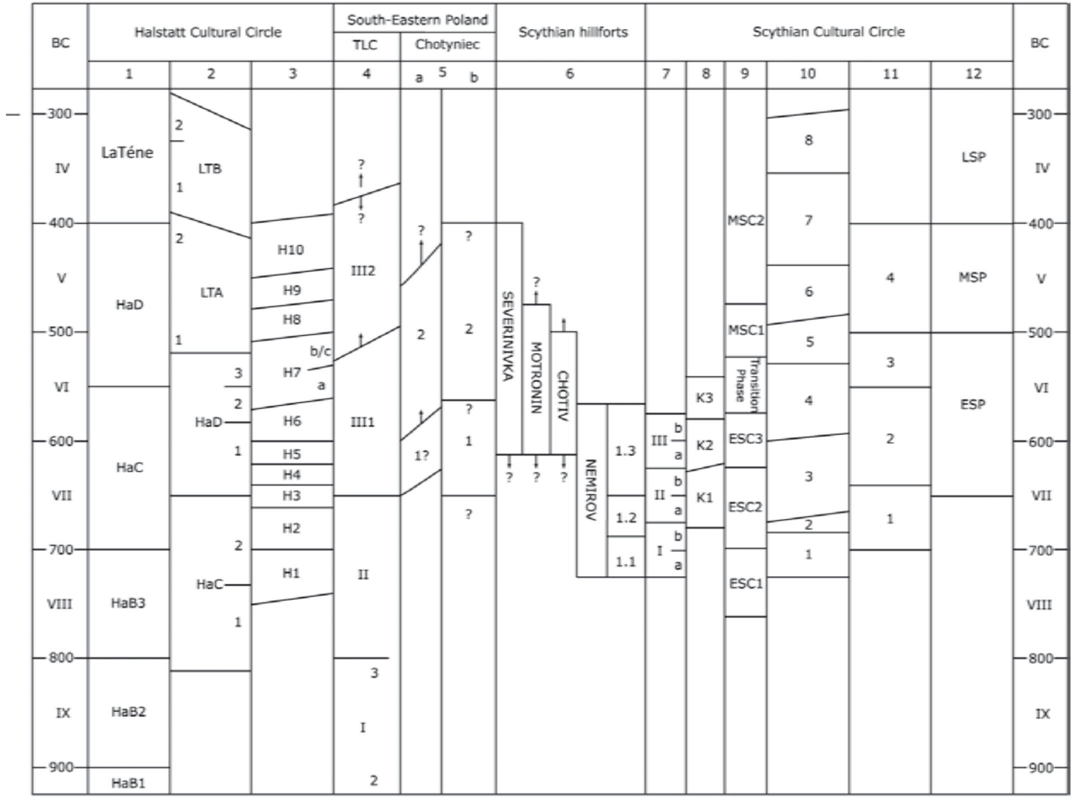

Fig. 3. Chronology of the Early Iron Age. Authors: 1 – Reinecke/Kostrzewski – Czopek 2010; 2 – Trachsel 2004; 3 – Parzinger 1998; 4 – Czopek 1989 (with later modifications); 5a: *zolnik* – Czopek and Krąpiec 2020; 5b – Hillfort (the author's own proposal); 6 – Ignaczak *et al*. 2016; Bessonova and Skoryi 2001; Kravchenko 2017; Smirnova *et al*. 2018; 7 – West Podolian Group: Bandrivskiy 2014; 8 – Kelermes Period: Grechko 2013; 9 – Early Scythian Culture – Medvedskaya 1992; Grechko 2012 (MSC – Middle Scythian Culture, ESC – Early Scythian Culture); 10 – Alekseev 2003; 11 – Murzin 1984; 12 – Melyukova 1989 (LSP – Late Scythian Period, MSP – Middle Scythian Period, ESP – Early Scythian Period)

century, the end of their functioning is not so clearly defined. More recent studies of hillforts point to the end of the 6th or the beginning of the 5th century. Examples are the hillforts in Motronin (Bessonova and Skoryi 2001, 125) and Chotiv (Kravchenko 2017, 131). It seems that in terms of chronology, the dating closest to Chotyniec was confirmed for Severynivka – from the end of the 7th century to the end of the 5th century (Ignaczak *et al.* 2016). Adopting the narrow dating proposed by Denys Grechko would be consistent with the chronology established for the aforementioned Niemirow (Smirnova *et al.* 2018). It would also have to mean an unequivocal link between the Chotyniec agglomeration and the West Podolian group (probably this is the basis of Denys Grechko's reasoning), which is possible, but not proven. This grouping ended its presence on the Dniester in the 6th century, but also in this respect we note discrepancies in the accuracy of dating. It is even attributed to the first quarter of the 6th century (Kowalski-Biłokryłyy 2012, 184; Bandrivskiy 2014, 306, 345, 355) or the first half of that century (Chochorowski 2014, 21-25). On the other hand, this would suggest earlier dating of the beginning of the hillfort in Chotyniec, at least from the middle of the 7th century. So we see that fundamental decisions on this issue are still ahead of us. We must wait for the completion of the first phase of research on this important site.

It should be remembered at this point that the available literature clearly shows a tendency to rather precisely determine the beginnings of hillforts in the forest-steppe zone, while, but when it comes to determining the end of their use we encounter a number of difficulties. This is related not only to the state of their excavation, but also to the possibilities of source studies. There is a visibly greater dynamics of changes of leading types of artefacts, mainly militaria in the Early Scythian period (ESC). It is enough to look at the chronological patterns (Fig. 3) where we can see narrow ranges of separated periods (*e.g.* in the Early Scythian phase or in the Kelermes complexes), which clearly contrasts with the Central Scythian period (Grechko 2012; 2013). The 6th century BC is sometimes called the "dark age" (Alekseev 2003, 27, 153-168), which results from the low accuracy of the dating of the sources. This remark must be taken into account when discussing the chronology of the Chotyniec agglomeration.

The chronology of the Chotyniec hillfort is important for the site itself, but also for several other reasons. It also allows us to study the cultural input of the phenomena of Eastern European origin on the areas to the west. Two recent works (Czopek 2020; Trybała-Zawiślak 2020) clearly show its role as a centre from which the impulses referred to as the "scythization" of local Early Iron Age groups might have spread. This is also admitted by Denys Grechko (2020b, 598), but he clearly suggests that this process (probably lasting at least from the end of the 7th century) preceded the military actions of the Scythians in Central Europe. The key in this narrative is the changed dating of the fall of the hillfort in Wicina to the last years before the middle of the 6th century and its synchronization with the period of destruction of other hillforts in Central Europe – the so-called "Horizon of the Scythian invasions" (570/560-520 BC: Grechko 2020a; 2020b). Unlike other researchers (*e.g.* Chochorowski 2014, 41), he proposes a narrow and clearly "rejuvenated" chronology.

In the context of Chotyniec, it is worth paying attention to a very significant typological and chronological similarity of the arrowheads from the Chotyniec *zolnik* (Burghardt 2020) and the ruins of the defensive settlement in Wicina. It may of course be a matter of good synchronization in time of their use, but also a cause-and-effect relationship can be considered. In this case, the hillfort in Chotyniec might not have been abandoned. It is also probable that a group of "Chotyniec warriors" participated in the Scythian invasion of other areas of Central Europe. In such a case, two scenarios are possible – feeding the main wave of aggressors towards the Carpathian Basin or an independent escapade aimed at the territory of the Lusatian cultural circle to the west (example of Wicina), but also to the north-west (see axes from the vicinity of Płock in Mazowsze – Kotowicz 2014, 42, table 21: 2; Andrzejowska 2016, 299, fig. 8: a).

Eastern references are also visible in the forms and ornamentation of local, "East Lusatian" ceramics (Andrzejowska 2016, 281-297; Ignaczak 2016; Trybała-Zawiślak 2020). In this case, we are also dealing with the observation already made of quite precise dating of the beginning of a given phenomenon, and less precise determination of its end. Limiting the significance of the stronghold in Chotyniec only to the narrow range of HaD1, as it is done by Denys Grechko, does not seem justified. Influences from the forest steppe zone in eastern Poland are visible after the hypothetical discontinuation of the use of this hillfort. An important argument here is the fact that they also occur in communities of the Pomeranian culture, *i.e.* younger than the first half of the 6th century BC (see below). Other TLC materials quoted by Denys Grechko, referred to periods later than HaD1 (*e.g.* an arrowhead from Nienowice – a site close to the compact range of the Chotyniec agglomeration, or the entire assemblage of material from Site 22 in Grodzisko Dolne) do not contradict, but rather support, the thesis about the functioning of the Chotyniec enclave of the Scythian cultural circle also in the second half of the 6th century, and possibly also in the 5th century BC. Also of interest is the remark by Denys Grechko about the quantitative difference of artefacts of "Scythian" origin in these two horizons – the 6th to 7th centuries and the end of the 6th to the middle of the 5th century BC. However, the thesis that in the latter period the mediation of the inhabitants of the Chotyniec agglomeration was no longer involved is debatable in the light of the above-mentioned comments. However, it is necessary to take into account not only nail-shaped earrings and arrowheads, but also other artefacts of exceptional importance – *e.g.* acinaces from Rozborz nad Sanem (Czopek 1995) or more and more numerous finds of greyware wheel-thrown ceramics. For most of them, it is difficult to pinpoint their origin. It is possible to link them with the East European zone – forest-steppe one, but also with the Vekerzug Culture, which has already been highlighted in the analysis of arrowheads (Czopek *et al.* 2015). These issues should undoubtedly be analysed more thoroughly in a wider territorial context, in the zone adjacent to the north-western zone of the forest-steppe variant of the Scythian cultural circle.

POMERANIAN CULTURE (PC)

Apart from his essential remarks, Denys Grechko (2020b, 600, 601) also touched upon the issues related to the Pomeranian culture (PC). In south-eastern Poland, two horizons are becoming increasingly clear, which is attributed to the appearance of new evidence (Trybała-Zawiślak 2019, 312-342). The first of them is represented by a few funerary complexes, and the second, clearly younger, by settlement material. The finds made concerning the settlement in Jarosław (Czopek 2014) are of key importance for their dating, which this author did not take into account. On this site we confirmed the chronological sequence of TLC and Pomeranian culture settlements. Radiocarbon and TL dating as well as historical material (including wheel-thrown ceramics – the so-called "grey Thracian"; glass beads, an iron axe) allow us to relate these materials quite reliably with two chronological intervals within the 8th to 6th (TLC) and 5th/4th-3rd centuries (PC). Separation is also confirmed by the manner and location of the spatial development of the settlement. The only problem is the 5th century, which may suggest the existence of a settlement hiatus or a transitional horizon, assuming the continuity of use of the settlement by two different communities – local (TLC) and coming from outside (PC). It is impossible to recognize the presence of the latter type of materials already in the HD phase, therefore it was assumed that in this phase we are dealing with homogeneous TLC settlements. On the other hand, the horizon of the 5th/4th-3rd centuries BC (and maybe also a bit later) is well dated by the presence of graphitic (Celtic) ceramics, as well as the ceramic references to the Jastorf circle. Identification of similar materials at Site 24 in Nienowice (Czopek *et al.* 2018, 274-280), among which more distinct and probably slightly younger "Jastorf" features were discovered (slanted vessel rim, globular vessels, presence of typical clay spoons and fragments of the so-called firedogs), allows for a formation of a completely new hypothesis. It refers to the presence of PC settlement materials in the Jastorf context, dated to the older pre-Roman period. So it seems that the population of the Jastorf culture arrived (probably with some Pomeranian component) not earlier than in the 4th and 3rd centuries (= LtB2 and LTC – Woźniak 2011, 31-33; Grygiel 2018, 352-375) and put an end to the TLC settlement. There is no reason to date materials of this type to HaD. Such a chronology can at best be justified for some, few burial complexes known only from the northern part of the Sandomierz Basin. The analysis of the chronology of brooches (Woźniak 2011, 27) shows that we can speak of the appearance of the Pomeranian culture in Lesser Poland only at the end of HaD3 and at the beginning of LTA, *i.e.* not earlier than at the turn of the 6th and 5th centuries BC. Similar conclusions apply also to other areas of eastern Poland (Andrzejowska 2016, 307).

In this context it is difficult to talk about the Pomeranian expansion and the emergence of a new cultural model ("Lusatian-Pomeranian"; Grechko 2020b, 600) in the San and Vistula interfluve. It is rather about the diffusion of small, individual groups that seem to have been assimilated fairly quickly by the local TLC population. The separate nature of burying the deceased in different cemeteries is very significant in this context. Among all TLC cemeteries dated to the Early Iron Age (with a total number of over 3,000 burial complexes), not a single case of a grave with PC features was found, nor that of mixed (TLC/PC) grave inventories. This can be compared to the relationship between the TLC and the Scythian cultural circle. In this case, the list of such complexes would be very long, including the materials referred by Grechko to the time both before and after the horizon of the Scythian destruction in Central Europe (Grechko 2020b, 600, 601). A good argument is also a clear discrepancy in the radiocarbon dating of the TLC and the dates for the settlement material of the Pomeranian or Pomeranian-Jastorf culture (Trybała-Zawiślak 2019, 342, fig. 8.13).

CONCLUSIONS

The comments presented in the article systematized some chronological issues concerning south-eastern Poland in the Early Iron Age. One of the most important observations here is that in this dynamic period of many changes, it is difficult to develop a homogeneous system of relative chronology for all the material evidence available today. Good chronological markers relate mostly to eastern analogies, the chronology of which takes into account, first of all, absolute historical dating. References to the Hallstatt circle are practically absent in this area (in contrast to the western part of Poland), hence it is difficult to responsibly use the patterns developed for it. They are based on the occurrence of specific forms of artefacts, and not on their absolute chronology, as this is a secondary issue. This is not surprising, because the basis of relative chronology is always stratigraphy and typological variability of artefacts. Therefore, comparing cultural phenomena from eastern and western Europe is very difficult (if at all possible) due to the low mutual repeatability of the types of material evidence. In this case, we use a similar scheme: **artefacts/layer → phase of relative chronology/periodisation → absolute chronology**. However, there is a very big difference between the East and the West, resulting from the research tradition. While the understanding of the chronology of the Hallstatt cultural circle has been developed on the basis of relative chronology since the times of Reinecke (*i.e.*, the 1920s), the Eastern European Scythian world has for many years been treated in a different way, disregarding the relative chronology. We can even talk about the opposite situation, *i.e.* assigning archaeological material to specific historical events with a specific chronology. The situation has changed only in recent decades, with the appearance of more precise internal divisions based on the variability of the archaeological sources themselves – *e.g.* the periodisation of the Early Scythian culture (Medvedskaya 1992; Grechko 2012). It should be noted that the relative chronology remains a stable element in the aforementioned three-stage system, while absolute dating undergoes numerous corrections as more evidence becomes known and more precise analytical methods – including the use of natural dating – are used.

Another important observation is the opposition of regionalism versus universalism. The history of European archaeology (especially in relation to the archaeology of the Bronze Age and Early Iron Age) shows the degree of the attachment to universal chronological systems into which local sources and cultural phenomena were adapted, not always on the basis of strong premises. This was more a case of "salving the conscience" of local researchers than a real chronological study. Recent decades have shown, as almost every year of new excavations provides new arguments, that these general findings can only be viewed as schemata. Much more important for the actual chronology of specific areas are regional studies, which can take on a more universal dimension. At this point, we can refer to studies for the Hallstatt period (*e.g.* Parzinger 1988: ten chronological horizons between 750/740 BC and 400/390 BC with numerous local modifications) and for comparison of the Scythian circle (Alekseev 2003: eight horizons between the end of the 8th and the turn of the 4th/3rd centuries). Their common feature is a different scale of the length of individual stages, resulting from the findings of source studies and not the arbitrary adoption of the same, several hundred year long intervals.

Referring these remarks to the Tarnobrzeg Lusatian Culture as a whole, it should be said that at the moment we can be more precise in designating certain chronological boundaries, most often dates (or wider ranges – *e.g.* a quarter of a century) in terminus *post quem* or *terminus ante quem* type for some phenomena rather than to construct more detailed periodisation diagrams for the evidence. This goes hand in hand with the proposals of Denys Grechko (2020, 597, 598), who also distinguishes two separate and opposing horizons: the presence of biconical beads as a determinant of acculturation processes and destabilization in Central Europe caused by the "Scythian" nomads. It should be noted, however, that their distinguishing is not comparable (archaeology of things versus archaeology of phenomena). In the case of the "horizon of beads" it would be more appropriate, for example, to name it a "scythization" of local cultures of the Vistula basin of the Early Iron Age. Such a term (or a similar one) would be comparable to destabilization and would adequately reflect wider processes that are being reconstructed at the moment. In addition, it should be slightly longer-in temporal extent than the narrowly understood horizon of the appearance of biconical glass beads. The emergence of the Chotyniec agglomeration in the second half of, or at the end of, the 7th century, a centre transmitting Scythian cultural elements further north and west, is essentially such a chronological indicator, and the starting point of the changes in many aspects of material culture, clearly visible in this part of Europe.

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REVIEWS AND SHORT REVIEW NOTES

Elżbieta Trela-Kieferling[1]

(Review) Martin Oliva, *Těžba a rituál, paměť a transformace. Uzavírky šachet a obětiny z doby bronzové v Krumlovském lese. Mining and Ritual, Memory and Transformation. Offerings in shafts and the obliteration of mining areas from the Early Bronze Age in "Krumlovský les"* (= *Anthropos Studies in Anthropology, Paleontology and Quaternary Geology* 40/N.S. 32). Brno 2019: Moravské zemské muzeum, 225 pp.

In 2010, the archaeological literature on flint artefacts was supplemented with the exhaustive final report on an important multifaceted investigation of Jurassic chert mining in the region of Krumlovský les (Krumlov Forest) in southern Moravia (Oliva 2010). Its author Martin Oliva is an experienced researcher, an expert on prehistoric flint mining in Moravia, the Czech Republic and elsewhere, an active member of the Anthropos Institute at the Moravian Museum and an editor of the *Acta Musei Moraviae*.

Last year, the Moravské Zemské Muzeum published Martin Oliva's monograph *Těžba a rituál, paměť a transformace: Uzavírky šachet a obětiny z doby bronzové v Krumlovském lese/Mining and Ritual, Memory and Transformation: Offerings in shafts and the obliteration of mining areas from the Early Bronze Age in "Krumlovský les"*, within the „Anthropos Studies in Anthropology, Paleontology and Quaternary Geology" series (vol. 40/N.S. 32/2019). The publication covers selected topics related to the long human habitation of the Krumlovský les region in the Early Bronze. The monograph, like the report in 2010, is not limited to the technology and economy of chert mining in that area; it also considers the Early Bronze Age exploitation of siliceous rocks in its ritualistic and symbolic aspects.

The publication concerns Fields I and II, the least investigated eastern part of the mining area. It consists of six chapters, an extensive summary in English and a comprehensive bibliography. A short geographic description and a recapitulation of the archaeological excavation carried out earlier at the site are given in Chapter II (pp. 13-16).

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Chapter III, the most substantial part of the monograph (pp. 17-156), centres on Fields I and II, excavated in 2005-2012 and 2012-2016 respectively. It presents the results of the fieldwork, illustrated with many photos and drawings. The author discusses the variants of the raw material, technology of core exploitation and typology of items recovered from individual excavation units. Fifteen tables contain metric, weight and percentage data, and the finds are presented in numerous figures.

Chapter IV (pp. 157-170) describes the geological structure of Fields I and II, which has been shown to differ from the structure of the mining fields explored before. Some differences have been noted in the fills of mineshafts and in earthworks (diagrams 1-4) as well. The author focuses on the methods of filling the mineshafts intentionally and on changes in the lie of the fields (pp. 161-168). He discusses in detail two recovered pots of the Únětice culture (p. 167): one deposited in the fill of a mineshaft in sector I-13-1, excavation unit 13-14/AB, the other found in sector II, excavation unit II-27, metre 6/F. In the latter case, the immediate vicinity of the vessel has yielded more than 22 kg of "initial cores" and cortical or semi-cortical flakes (p. 170). In Martin Oliva's opinion, that deposit had a ritualistic function.

Chapter V (pp. 171-196) interprets the results of the research in the Krumlovský les region in a broader context of raw material procurement in Europe in the Neolithic and the Bronze Ages. The author develops the idea of a ritualistic function of mining activities, which had already been mentioned in the report from 2010 (Chapter VIII). He discusses, for example, "the phenomenon of chipping for chipping's sake", noticeable not only in the items from the Krumlovský les region, but also in those from other mining sites (Lech *et al.* 2015, 225). He refers to numerous examples of ritualistic and magical activities identified in the explored Neolithic mines of copper ore in Bulgaria and Serbia (pp. 171-173). The chapter also provides data (as given in Topping 2011; 2017) to correlate findings of ethnographic research with the putative strategies of prehistoric communities (Table XIX).

Oliva also discusses actions that are supposed to have accompanied "closure rituals" and to have been linked to "veneration of the sacred landscape (including ancestors and the related consecrated work)". He perceives elements of the creation of a cultural landscape in burial mounds located in the western part of Field II in the Krumlovský les region (p. 106 f.). Restoring the area of the mining fields to its original state is interpreted as an expression of "respect of the living for the underground realm of the ancestors". In this section of Chapter V (pp. 186-188), the author quotes many ethnographic and historical examples of symbolic behaviour accompanying the extraction of raw materials.

According to Martin Oliva, prehistoric mining should be viewed in social and ritualistic terms. During the development of the Únětice and the Věteřov cultures, when the chert extraction in the Krumlovský les region, particularly in Fields I and II, increased, the symbolic dimension of the mining seems to have predominated over the practical dimension, contributing to social balance.

The “anthropological” perspective on the mining site in the Krumlovský les region, as Prof. Jacek Lech writes in his introduction to the monograph (p. 9), has been present in Martin Oliva’s studies for over twenty years (Oliva 1999; 2002; 2015). This insightful researcher is consistent in drawing attention to the non-utilitarian and non-economic sides of flint mining that were important to many prehistoric miners, craftsmen and members of the elite. His latest publication centres precisely on this aspect of the subject, but without neglecting comprehensive information about the excavation and the recovered artefacts. And it is this combination of archaeological expertise and multifaceted interpretation of phenomena accompanying prehistoric mining or raw material processing that makes the monograph by Martin Oliva so interesting and valuable.

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Bogumiła Wolska[1]

(Review) Joanna Zagórska-Telega, *Obrządek pogrzebowy ludności kultury przeworskiej nadliswarciańskiego regionu osadniczego w młodszym i późnym okresie rzymskim* (= *Opera Archaeologiae Iagellonicae* 4). Kraków 2019: Uniwersytet Jagielloński Instytut Archeologii, Towarzystwo Wydawnicze „Historia Iagellonica", 282 pp.

The discoveries made in the Liswarta basin have been of special importance for research on the archaeology of the Roman Period in Poland. The uniqueness of this region, which probably results from numerous years of fieldwork, is manifested by the diversity of sepulchral features of the Przeworsk culture communities, and also by several items uncovered in them. The analysis of such material from Opatów 1 – the largest and fully excavated cemetery of those people located in the area discussed – constituted the background for the relative chronology of the Roman and the Early Migration Period in the Polish lands (Godłowski 1970). The author of the presented book has also made a significant contribution to those studies (Zagórska-Telega 2000; 2015; Madyda-Legutko *et al.* 2002; 2006; 2015).

The monograph deserves attention for two reasons. Firstly, the regional funeral rites of the Przeworsk culture population had never been examined on such a scale before. It is the first publication to present such a wide array of burial activities and is based on a comparative analysis of a number of cemeteries (including the well-known necropolis in Opatów). Secondly, the study is interdisciplinary and unusual in terms of the methodology that involves archaeological, anthropological, archaeozoological and archaeobotanical interpretations. The need for such a comprehensive research had long existed in the scientific community, therefore the book was eagerly awaited and eventually very well received.

The publication consists of the author's short foreword, thirteen chapters, thirteen lists, an extensive bibliography and a summary in English. The layout was thoroughly

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planned, which makes the contents coherent and logical. The graphic part includes 121 figures. Most of it is digitalized archaeological documentation concerning sepulchral features and plans of the necropolises, the rest are graphs and maps. Unfortunately, their poor quality diminishes the book's aesthetic value. Luckily, this does not affect its substantive value.

The first chapter is divided into three subchapters. The first of these (1.1) presents the main goal and the scope of the research that includes an overview of five cemeteries of the Przeworsk culture communities: Opatów, site 1, Mokra, site 8, Rybno, site 1, Walenczów, site 10 and Żabieniec, site 1, Kłobuck district. The author also justifies her own investigation by defining a need for a complex study of the funeral rites of the population in question, which is represented by the varied grave materials from the Liswarta region. The reasoning behind this approach can be found in the next subchapter (1.2) that describes the history of the archaeological excavation in that area. The last subchapter (1.3) presents the database used for the analysis. It includes cremation burials of various forms, the so-called "proper graves", as well as sepulchral features that played an important role in the funerary rituals. At the end of the chapter, the cognitive value of the data is objectively assessed, illustrating difficulties encountered during the research, *e.g.* inconsistent field documentation.

An extensive review of the literature on the funeral customs of the Przeworsk culture population are presented in Chapter 2. From it, one can easily perceive a certain stagnation in this area of study in the last two decades. Most of the sources did not apply the comparative and multidisciplinary approaches, which were employed for the analysis of the materials from the Liswarta region. Moreover, the author points out certain terminological inconsistencies regarding the nomenclature of sepulchral features that have appeared in the archaeological publications. The issue is of special importance and requires standardization.

The significance of the natural sciences in the study of the population was emphasized in Chapter 3. The discussion revolves mainly around the anthropological, archaeozoological and palaeobotanical expertise that is usually implemented to study the material from cremation graves. The research possibilities of those methods, as well as their historical background are also briefly described (though limited to work done in Poland). It should be noticed that the current state of knowledge in general offers a more insightful analysis than the presented one. It can be achieved, among others, through anthropological examination of the bone taphonomy, which for example can allow one to infer about the temperature and duration of cremation (Ellingham *et al.* 2015).

The crucial part of the book begins in Chapter 4. The first subchapter (4.1.) presents the classification of sepulchral features that were involved in the investigation. The 'proper graves' contains pit, urn and urnless burials (the latter involving containers made of organic substances) – all of them are separated into two further groups, depending on the presence or the absence of pyre remains. Cenotaphs, *bustum* type graves and barrows also belong to this category. The other group consists of ditch- and layer features, cremation layers and pyre sites, also called *ustrina*. It is worth emphasizing that this synthetic division is the first one that meets the criteria of the modern archaeological documentation. It can certainly be considered as a proposal for the aforementioned standardization. The next two subchapters (4.2., 4.3.) confirm the usefulness of this classification by applying it to the analysis of the funeral features discovered in the Liswarta basin. All of them were also carefully examined in terms of the pit size (large, medium and small), location of urns or burned remains, placement of grave contents, as well as the position of stones or stelae. Although no general rules were established (with the exception of pits containing ceramic vessels, which were probably dug to match the urn size), the approach itself and the conclusions are definitely noteworthy.

So far, the subject of double and collective burials of the Przeworsk culture community has been raised in three papers (Czarnecka 1990, 91-96; Wiśniewska 1999, 55-146; Szczepanek 2013, 85-91). These observations have recently been enriched by the study of materials from the Liswarta region (Chapter 5). Particular attention is paid to the results of the examination of double graves in which an adult, usually a woman, and a child were buried together. Frequently, it was estimated that the child died at an age between 2 and 5 years old. This information allowed the author to challenge the common opinion about high maternal mortality rates. Instead, she puts forward other interpretations of this phenomenon, explaining it as an accidental and simultaneous death of two people as a consequence of 'weaning stress' – a negative side-effect of separating a child from the mother's milk. These remarks have led to a revision of the previous understanding of that occurrence that had persisted in the archaeological literature for many years.

The overview at the beginning of Chapter 6 focuses on the various kinds of artefacts that can usually be found in the graves of the Przeworsk culture population. The author also discusses some 'models' of arranging the items that were probably determined by sex, age and even the social status of the deceased. In subchapter 6.1. these matters are thoroughly analysed based on the material from the Liswarta area, using an interesting examination scheme divided according to the aforementioned 'models'. It is possible to observe certain tendencies regarding the contents of the graves and how they changed over time, especially in the C1b phase of the Younger Roman Period. From the perspective of archaeological studies, such a method of interpreting objects from the burial context is relatively rare, even though it may provide some references about past rituals, which is well proven in this part of the book.

The analysis of the animal bones from the cemetery in Opatów, site 1, has already been published several times, including a text co-authored by J. Zagórska-Telega (Madyda-Legutko and Zagórska-Telega 2006). Chapter 7 presents the conclusions drawn from those papers, supplemented with new data and also extended by the archaeozoological report of material from the necropolis in Mokra, site 8. The research has shown that in most sepulchral features the majority of animal bones found belonged to domesticated rather than wild animals. Also, no regularities concerning their occurrence in graves were observed.

However, there is a subtle disproportion between the two analysed cemeteries. Based on that observation, the author puts forward a concept about the regional differentiation of the funeral customs of the Przeworsk culture communities, during which deliberately selected animals were gifted or consumed. This opinion is supported by the results of studies from other funeral sites, which also demonstrate a high diversity of the animal species. This is a significant observation that certainly requires further careful investigation.

Palaeobotanical remains discovered in cremation graves consist mainly of charcoal, which is probably the remnants of funeral pyres. Such material, obtained from the necropolises located in the Liswarta region, is discussed in Chapter 7. The research showed a significant dominance of the *Pinus sylvestris* (Scots pine), with a negligible presence of other species. These results stand in contrast to other studies carried out on pyre debris from the Roman Period cemeteries, which has demonstrated a much greater diversity. According to the author, the observed discrepancy is not related strictly to funeral customs, as commonly believed. She proposes a more plausible explanation that the people were merely practical and used those kinds of wood that were easily accessible. Even though the opinion sounds reasonable, there are no references to the environmental conditions of this region in the period in question that could support such a point of view.

Chapter 9 presents a paleodemographic study of burned human remains from the cemeteries in Opatów, site 1, and Mokra, site 8. Analyses of the former have already been published (see, among others, Szczepanek 2015). In most cases, the results match the demographic structure of the Przeworsk culture population, *e.g.* in terms of the age proportions or the average family size. However, the palaeodietary research presented at the end of this chapter raises numerous reservations. The investigation concerned the elemental composition of the burned human remains (odontological samples) from Opatów, site 1, on the basis of which the diet was estimated. Apart from dietary factors, the chemistry of bones depends on a number of factors, such as metabolism, possible illnesses, age at death as well as changes in the *post mortem* period. All these factors may significantly affect the final elemental composition of a human skeleton. This is why this method, similarly to the isotope studies of light elements (DeNiro *et al.* 1985), should not be applied to determine the diet of cremated people.

The location of the Przeworsk culture population cemeteries from the Liswarta basin (Chapter 10) corresponds to the commonly known scheme. They were usually placed on hills, near a watercourse and close to a settlement. The differences observed during the research are limited to the direction of the spatial development and the position of a pyre. However, no crucial irregularities were observed in the layout of such places (10.2). This Chapter is a suitable supplement to the earlier essential papers about this issue by K. Godłowski (1970) and T. Dąbrowska (2007).

Chapter 11 is a subjective attempt, albeit a reasonable one (and one supported by literature and historical sources) to reconstruct a cremation funeral rite. The author discusses each hypothetical stage of this event, from washing and dressing the deceased to burying their burned remains in the grave. Such a vivid visualization of the potential customs depicts their complexity, and also the multitude of details that are still not very well known in contemporary research. Currently, some of the funeral activities can be determined by applying bioarchaeological and physico-chemical analyses (see Nikita 2021). Such an approach is the future of these studies.

All the data gathered during the investigation was discussed based on the general knowledge about the funeral rites of the Przeworsk culture communities from the Younger and the Late Roman Period (Chapter 12). This very detailed study has revealed that, contrary to some convictions, the Liswarta basin does not differ significantly (with some exceptions) from other areas. It should be noted that this region is distinguished by varied sepulchral features, involving almost all known types that are characteristic for the discussed population. This is why it can be considered as an accurate reflection of the burial customs of the entire Przeworsk culture people. The main part of the monograph is closed with some concluding remarks (Chapter 13) that objectively summarize the most important points.

It is not an exaggeration to state that the book may serve as a methodological model for further regional research projects of this type, which are eagerly awaited. It should also be underlined that its value is definitely not limited to the single area discussed. It is actually quite universal, as some of the proposals included in the publication constitute a significant step forward in the Polish archaeological studies of funeral sites. Finally, one should also recognize the vast and comprehensive knowledge of the author, which is definitely confirmed by her presented work.

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ON THE ISSUE OF DATING CHRISTIAN BURIALS

(Review) Andrii Fylypchuk, *Arkheolohiia khrystyianskykh nekropoliv litopysnoho Plisneska* [Archaeology of Christian necropolises of the chronicle's Plisnesk]. Lviv 2020: Rastr-7, 136 pp.

In the study of the beginnings of Rus', the funeral rites of the princely era are inextricably linked with the process of Christianization of the region. It is the nature of burials to function as a kind of marker in space and time, reflecting the degree of penetration of the new creed into the society of the period. At the same time, in some regions, the introduction of Christianity as a state ideology had certain features due to a number of factors, among which socio-political changes (reforms in the system of territorial division, state administration and taxation) are basic ones. Reforms aimed at "conquest or conversion of souls" were implemented more slowly, on the way to which obstacles had to be overcome in the form of age-old traditions and social mentalities with their own forms of mythological perception.

At the dawn of the formation of proto-state Slavic groups, the Ukrainian Prykarpattia was the last region to lose its territorial and political independence. As a result of Prince Volodymyr's campaign against the Croats in 992/993, these territories became part of Rus', forming extensive lands of the grand-ducal domain. This event began an era of changes that lasted more than a century. In the context of the genesis of the new religious culture, processes that reflected the "restructuring" of spirituality and social consciousness are ex-

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tremely interesting. Due to the lack of written sources, archaeological material, especially the results of excavations of Christian necropolises, become the basis that allows highlighting the problems of the genesis of Christianity in the Prykarpattian region. Of particular importance are the sites, where the continuous development of the settlement for several centuries can be traced. Such sites include the Plisnesk hillfort*, where researchers have noted construction horizons dating back to the seventh to thirteenth centuries.

Territories of the Ukrainian Prykarpattia, which were newly incorporated into Rus' at the end of the 10th century, were undeveloped land far from Kyiv. There is no doubt that in the process of appropriation of these territories it was the military garrisons that took the first steps. However, at a certain stage of the process, clergymen would have joined them. Their missionary activity included the introduction, dissemination and rooting of the state religious doctrine.

Plisnesk, which was located on the border with Volhynia, and where the military garrison was deployed (which is confirmed archaeologically), was in the micro-regional epicentre of social and cultural transformations. Therefore, features (barrow cemeteries, dugout and surface residential, household and manufacturing buildings, flat cemeteries), which have survived to the present day, reflect the complex intertwining of these historical and cultural processes. Of course, we are unlikely to know how and when the missionary work of the first Christian preachers took place. However, the results of archaeological research allow us to record reliably the time when, and form in which, this activity brought in Plisnesk its tangible and stable consequences, which was decisive for the whole region. One such factor, which testified to the dominant role of Christianity in the spiritual culture of the local population, is the widespread introduction of the funeral rite, carried out in accordance with the canonical principles of the Orthodox Church.

Despite the importance of Christian burials in the highlighting of a number of sociocultural aspects in the past, this category of archaeological sites is still poorly reflected in the scientific literature of the region. The difficulty lies not only in identifying the graves (usually in flat cemeteries without any surface markers) but due to current trends in scientific research of the existing materials. At the same time, the vast majority of these cemeteries are identical in composition of the bodies, without burial equipment, which, at first glance, looks like they contain a minimum of historical information. Yet, it is precisely in the mass character, the unification of the ritual, and the total area of the necropolises that their information content lays, which is the task of an inquisitive researcher to see. Plisnesk is just such a site, where the archaeological excavation of burials has been carried out for many decades, but the time to draw general conclusions about them has now come.

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* Plisnesk [Пліснеськ], a large fortified Rus' settlement on the banks of the Buh River near modern Pidhirtsi, Brody raion, Lviv oblast, mentioned in medieval chronicles as an important center of the Principality of Galicia-Volhynia, abandoned in the 13th century and excavated in 1880-1883, and on a number of occasions since 1940 [Ed.].

In the context of the general vision of the problem, the latest monograph *Archaeology of Christian necropolises of the Chronicle's Plisnesk* by Andrii Fylypchuk attracts attention. In the light of the current dearth of analytical knowledge, the monograph's title raises hopes that we will finally get the long-awaited reconstruction of the religious life of the Plisnesk of the Annals. The epigraph of the work *In cultum domini dei nostri exodi x*[**] best characterizes the victory of the Christian funeral ritual, as a result of the activities of the local clergy to the glory of the Lord. Will this study fulfil the expectations of the scientific community?

The monograph is not large – 136 pp. Its content consists of an introductory foreword, three chapters, conclusions, an appendix, a list of sources and literature and an afterword. The text part of the main content (97 pp.) contains 17 photos and 44 figures.

In the introduction, the author presents a brief description of the Plisnesk Archaeological Complex, the periodisation of which is presented in accordance with the results of many years of research, carried out by Mykhailo Fylypchuk. The stages of development of Plisnesk during the seventh to thirteenth centuries is illustrated by a plan. While this is already known from a number of articles written by M. Fylypchuk, it is also relevant in this case, as it introduces the reader uninitiated in the problems of site to the essence of its complex spatial organization and the dating of its constituent areas. Noting the mentions of Plisnesk in the written sources and the events connected with them, the author singles out certain periods in the socio-political development and development of the structure of the site's plan, emphasizing the importance of places where presumably churches and cemeteries are located. Andrii Fylypchuk paid special attention to the circumstances of the discovery and study of these necropolises, emphasizing the accidental discovery of most burials, their perfunctory and partial, partly unprofessional, study. In this regard, it should be noted that from the point of view of the modern researcher this is true. But to assess the achievements, mostly of amateurs, and only rarely scholars of the nineteenth century should be through the prism of the development of the science of that time rather than our own. Both then and now, we are permanently losing valuable sites. The point is to note those positive efforts of enthusiasts, due to which the archaeological remains were recorded (at the level of the methodology of the time), and the material was stored in museum collections. In the introduction, A. Fylypchuk defines the issues that the present volume is intended to address, the introduction into scientific circulation and the implementation of a generalized analysis of all currently known ground inhumation burials.

Chapter 1 "Necropolis of the Chronicle's City" is generally devoted to the history and results of research of the burials within single urban areas, which are reflected in three sections: "1.1 Cemetery on the Dytynets (Zamchysko place)", "1.2 Burial in Tserkvyska place", "1.3 Cemeteries on the posad (Vysoke Horodysko)".

** The quote comes from the inscription on the portico to the rotunda of the nearby church of Exaltation of the Holy Cross and St. Joseph (1752-1766) by the Koniecpolski Palace in Pidhirtsi (Podhorce) [Ed.].

The archaeological excavations at the *Dytynets* (Citadel) were the largest, as they were carried out by almost all famous Lviv archaeologists who studied the Medieval Period: Yaroslav Pasternak (1940), Ivan Starchuk (1948), Volodymyr Honcharov and Mykhailo Kuchera (1953), Roman Bahriy (1970-1971, 1988), Mykola Peleshchyshyn and Roman Chaika (1980), Mykhailo Fylypchuk (1993, 2001, 2003). Already from this list, it is clear that these researchers belonged to different generations of scientists, and used different methods of excavation and documentation of objects. And here we should pay tribute to both Mykhailo and Andrii Fylypchuk, who, realizing the difficulties of drawing up consolidated plans, tried to analyse the location of the excavations as carefully as possible and plot them on the plan of the area as close as possible. Thus, the plan of excavations in the central part of the hillfort (fig. 3) is in fact the basis that serves as a source for conclusions about the social topography, periodisation of features and the time of their functioning. Describing the layout of burials within each of the excavations, A. Fylypchuk, if necessary, refers to excerpts from site diaries and reports, as in part these are the only clarifications of the circumstances of the discovery of burials, not reflected in the plans. However, the low quality of illustrations must be noted.

Describing the burials, A. Fylypchuk provides information on the total area of the site excavated by each researcher, the number of opened graves and their topography, shape and parameters of grave pits, the peculiarity of the position of the skeletons and the availability of accompanying grave goods. At the same time, the researcher focuses on the stratigraphy of features – the superposition of grave pits on the older structures, which is crucial for the periodisation and dating of both the burials themselves and the stages of functioning of the *dytynets*. At the same time, the opinions of researchers who conducted their excavations regarding the types of burials, sex and age of the dead, time of the funeral are noted. It is important to emphasize here that most of the burials on the *dytynets* represented flat, extended inhumations lying on their back, head to the west, with a Christian position of hands (on the chest or abdomen in various combinations). Five burials under stone slabs and one in a stone sarcophagus have been distinguished from the total number. All this information is presented as comprehensively as possible.

In our opinion, the excavations in the Tserkvyska place, located on the western side of the *dytynets* and outside its fortifications, were extremely important. R. Bahriy was attracted to this area by clusters of boulders, on which the researcher noted traces of working. This material gave him the hope of finding the remains of a monumental structure. However, all researchers (R. Bahriy, M. Fylypchuk and N. Shui) failed to capture any regular outline of any building structure. Instead, A. Fylypchuk rightly connects this accumulation of stones with natural quarries, raw materials from which were extracted for centuries and also in the eighteenth century for the nearby Pidhirtsi monastery. It should be noted that near the scatter of stones a cultural layer with traces of residential activities was recorded. In an area of 160 m2 there were two clay kilns, around which a considerable number of fragments of pottery were collected, which R. Bahriy dated to the tenth to eleventh centuries. Interestingly, in the southern part of the excavation, at a distance of 4 m from the kilns, there was a burial covered with stones and with a stone tile-pillow under the head of deceased. A bronze lyre-shaped buckle (at the feet) and a pot with small embers inside (near the head) represent grave goods. R. Bahriy dated the burial to the to the tenth to eleventh centuries. However, the proportions of the pot and the shape of its rim, presented by A. Fylypchuk in Fig. 39 indicate a later date, at least twelfth century. Besides the pottery, four ceramic glazed tiles were also found within the excavation area. These two categories of archaeological material (burials and ceramic tiles) indicate, as A. Fylypchuk finally points out, that there was a cemetery on this western terrace, apparently planned near a sacred building. It is important in this point to establish the time of burial, because it is possible that this will provide an answer to the question where people who lived in the *dytynets* in the twelfth to thirteenth centuries were buried.

Another large area on the hillfort is the '*posad*' in the Vysoke Horodysko place. Active excavations were also carried out here in 1940 (J. Pasternak), 1949 (I. Starchuk, V. Honcharov, O. Ratych and T. Plaksiy), and again in 2013 (M. Fylypchuk). Describing the results of these studies on the basis of reports, A. Fylypchuk, unfortunately, did not indicate on general plan the location of both these and the latest excavations from 2015-2016.

Chapter 1 concludes with brief research results, placed after each section. This chapter is important because both the history of research and the characteristics of the burials presented here serve as a source for investigating the questions of the chronology of the necropolises and the development of the funeral rites, presented in the next two sections "The problem of the cemeteries' chronology" and "Pre-Christian and Christian Plisnesk's burials: evolution or revolution of the funeral rite?".

In considering the chronology, it seems obvious that any consideration of these problems should start with a presentation of the features of the stratigraphy of the features (superposition of burials on the residential buildings) and a presentation of the evidence for the dating of both the cultural layer and the buildings themselves, and thus the burials presented in chapter 1. Yet, A. Fylypchuk refers only to the chronology of the features discussed as deduced by the original authors of the excavations. Most researchers attributed the burials considered here to the post-Mongol period. Instead, M. Fylypchuk identified three phases of the functioning of the necropolises within the period from the middle of the twelfth to the beginning of the thirteenth centuries. The author of the monograph considered here generally agrees with this opinion. We would like to make a few comments about this.

The situation concerning the burials in the Plisnesk hillfort is both difficult and typical for this category of sites. First of all, it is necessary to take into account the degree of destruction of the surface within the structural areas of the ancient defensive site. All researchers noted three levels of depth to which the burial pits were dug even within the area of single excavation: 0.30-0.40 m, 0.50-0.60 m, 0.7-0.8 m. In some places, they could lie even shallower – just below the turf, or a little deeper – up to 1.0-1.10 m. It was also briefly noted that the cause of the shallow grave pits was ploughing. It is therefore extremely necessary to present the characteristics of the surface in the area where the burials were studied, noting any modern earthmoving and the degree of destruction of the cultural layer. This, to certain extent, would allow reconstruction of the original level of the ancient surface. The comparative analysis of the depth of those burial pits that intersect each other is essential for the periodisation of burials (and especially its verification). Unfortunately, in most records, these data are missing and the reader is forced to rely solely on the already generalized account of the author of the monograph. As for the depth of inhumation, it would be worth taking into consideration the fact that the later burial pits were dug much deeper than the previous ones. Therefore, the difference in the depth of burial pits, as a separate feature, is not a sufficient basis for the periodisation of burials. A notable example of an unreasonable interpretation of a burial concerns Grave No. 8 a (a cluster of bones of an entire skeleton), the grave pit of which was covered by Grave No. 8 (examined at the level of the legs) (p. 54, fig. 31; 34) and which, incidentally, was dug deeper than the other one. Following M. Fylypchuk, the author defines Grave No.8a as “reburial or multiple burial […] that continued the burial pit of Grave No. 8”. But the figure clearly shows that the bottom of the burial pit of Grave No. 8a (0.50 m) is cut by Grave No. 8 (0.55 m). It is clear that as a result of digging a pit under the latter came across an ancient burial, the remains of which were carefully collected in one place (in this case at the feet of a new burial). This practice, recorded in other towns of the princely age, speaks in favour of the presence of canonical precepts in the funeral ritual, which eventually took place in the subsequent period. Although it is worth noting that the custom of multiple burial in the grave of the ancestor after exhumation and washing the bones of the last one with holy water is also known in the Balkans. In some places, it has survived even in the twentieth century and was considered one of the types of “reburial”. The existence of such a custom in Rus’ is not reflected in any sources, after all, as in ethnographic evidences.

The larger problem, in our opinion, lies in the circumstances of the overlapping of structures by graves. Most researchers thought that the burials lay on top of features that they dated quite widely to the tenth to eleventh centuries, and were dug into the cultural layer of the twelfth to thirteenth centuries. M. Fylypchuk attributed only one building (building 1/1993) to the end of the thirteenth century, and dated the three burials that cut it to the post-Mongol period. All this indicates the need for a thorough analysis of artefacts from these structures, primarily the ceramics. As the above example of dating a pot of charcoal shows, the situation with the dating of ceramic material from this site is ambiguous. A well-developed periodisation and chronology of pottery from the site would be an indispensible the basis for dating the necropolises.

Analysing the excavations from different years, A. Fylypchuk provides all possible information about these studies, which indicates a balanced approach to the chosen topic of an experienced researcher. He also carefully marks the excavation area by year. And hence there was only one step to present to the reader the total excavated area, and therefore the area occupied by the burials (a total of about 170 graves) and to calculate the percentage of the necropolis compared to the area of the *dytynets* or *posad*. This means that the fact that the necropolis in particular on the *dytynets* (as the most researched part of the city) occupied most of its area would be more clearly reflected. And this raises doubts about the simultaneous existence of the cemetery and household and manufacturing buildings there. The conclusion of A. Fylypchuk that "the cemetery functioned for a long chronological period, [...] grew strongly and constantly reduced the space for household and manufacturing building" (p. 60) obviously does not stand up to criticism. But we must pay tribute to the researcher, he reserves the right to make mistakes and future studies will allow him to clarify questionable points.

A few words are necessary about a special category of artefacts from these investigations, ceramic glazed tiles. They were recorded in all areas of the site where excavations were carried out. In combination with the burials, as A. Fylypchuk rightly points out, they are an indirect proof of the existence of a sacred building. Various researchers of Rus' antiquities once wrote about this, in particular M. Hrushevsky, L. Chachkovsky and J. Pasternak. It is only necessary to pay attention to the fact that in Plisnesk both single tiles (whole and in fragments) and their clusters appeared in the studied areas, but certainly in a redeposited state. This indicates the destruction of the sacral buildings. The presence of tiles in the filling of grave pits, or even near them, indicates rather the planning of burials on the place of destroyed churches.

In his account, A. Fylypchuk draws attention to the lack of grave goods in burials, as well as to the presence of certain items, in his opinion, typical for the Old Rus' (namely pre-Mongol) period – especially glass bracelets and gold-woven items of clothing. Here we must note that the existence of these and other artefacts that appear in the burials of Plisnesk is limited to the end of the thirteenth century. This *a priori* pushes the upper chronological boundary of the necropolis to the end of the thirteenth century. At the same time, A. Fylypchuk cites examples of burials under stone slabs and in the stone sarcophagus as an argument that they "could not have been carried out in post-Mongol times". Why not? Because the researcher thinks that from the second half of the thirteenth century on the hillfort was a hamlet, and if we consider that these burials had taken place at this time, the rural form of settlement "did not correspond to the social status of the dead". At the same time, the author does not give a generalized description of the burials under stone slabs interred on the site of the settlement (the total number of which is at least 10), simultaneously making assumptions about their elite nature. And here we could argue, make different assumptions, but the further we go, the more obvious is the problem of the need for a comprehensive analysis of ceramic material as a basis for dating features. As for the above-mentioned "elite" burials, their small number (only 10 burials under slabs and one in a sarcophagus) speaks in favour of the fact that they are not a natural manifestation of a functioning social elite, but rather an exception, its remains. Here it is worth drawing attention to the fragmentary nature of both the slabs and the sarcophagus which seem to support this. The fact that most burials are single ones (very few that overlapeach other), there is a clear layout, as well as a small number of grave goods allow us to speak of a fairly short time of functioning of the necropolis, which was probably limited to the thirteenth century. During the first half a century after the Mongol invasion, the remains of the surviving population whose houses were in a different place, and not in on the site of former fires and massacres laid their dead to rest on the ashes of sacral complexes. The buildings of subsequent centuries already reflected other historical realities.

In general, in our opinion, the work would be enriched by statistics presented in tables, for example, on the characteristics of the position of hands of the deceased, the presence of grave goods or so-called “stone pillow”. Diagrams would facilitate the perception of content with rich factual material. In addition, the lack of anthropological analysis is highly noticeable in the characterization of burials. The known difficulties in achieving this in expeditions of the twentieth century can still be understood. But the absence of an anthropologist in the 2015-2016 expeditions is unjustified. As a result, the book does not contain much significant information from anthropological studies.

The last section, “Plisnesk’s Pre-Christian and Christian burials: evolution or revolution of the funeral rite?” is devoted to the comparative analysis of the sepulchral tradition of the Slavic and Rus’ periods. A. Fylypchuk rightly notes the lack of an evolutionary link in the rituals that were observed during these very different historical stages. He interprets the appearance and dominance of flat inhumation burials in the context of the introduction of Christianity in the Ukrainian Prykarpattian region as a new (for these areas) state ideology. The term “revolution” in relation to the canonical church precepts in the observance of the new funeral ritual, proposed by the author, is quite applicable.

In conclusion, it should be emphasized that A. Fylypchuk’s monograph *Archaeology of Christian necropolises of the Chronicle’s Plisnesk* is one of the few studies devoted to the analysis of Christian necropolises in Galician Rus’. The value of the work (despite the critical remarks here) is primarily in the source base, which represents a consolidated analysis of the results of excavations carried out by several generations of archaeologists. The author took into account and emphasized the conclusions of all the researchers who studied the Plisnesk burial complexes and expressed their own views, opinions and assumptions. The appearance of this book, dedicated to only one site, once again proves the relevance of such research. It focuses on that huge layer of knowledge associated with Christian culture that is still a poorly studied sphere of the activity of the Church and spirituality of the princely ages of the history of the region.

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