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OSSEOUS ARTEFACTS FROM THE CHURCH OF ST JAMES IN TORUŃ AS A SOURCE OF INFORMATION ON THE PRODUCTION AND USE OF EVERYDAY BONE OBJECTS IN POLAND FROM THE 14TH TO THE 18TH CENTURIES

ABSTRACT

Sulkowska-Tuszyńska K. and Orłowska J. 2024. Osseous artefacts from the Church of St James in Toruń as a source of information on the production and use of everyday bone objects in Poland from the 14th to the 18th centuries. *Sprawozdania Archologiczne* 76/1, 629-656.

The article presents the results of typological and traceological analyses that involved seven objects made of osseous raw materials found around the church of Saint James in Toruń. Owing to technological analysis, it was possible to reconstruct the methods applied for working osseous materials by craftsmen of past times, whereas the analysis of use-wear traces allowed us to formulate conclusions regarding the function of the examined specimens. The objects were compared to other analogous finds in an attempt to recreate the techniques used for making them, the context in which they were used, and the role they could have played in the past.

Keywords: Osseous artefacts; traceological analysis; late medieval times; modern era; Poland; St. James's Church in Toruń

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1. INTRODUCTION

Archaeological-architectural studies carried out in cities-living organisms of the past – provide information on the beginnings of settlements, the buildings, the architecture, and the culture. These data are unique and not included in any chronicles. Discoveries made in the vicinity of churches, once surrounded by cemeteries, yield vast knowledge about the spiritual culture and burial rites, about the past of cities, towns, and their inhabitants in the Middle Ages and in the modern era. Among the abundance of ceramics, bits of bricks, tiles or vessels, other items of everyday use are unearthed immediately adjacent to churches; of these, well-preserved objects made of osseous raw materials are usually a rare find.

Toruń – a Hanseatic city in Pomerania, was founded in 1233. This swiftly growing organism prompted the Teutonic Knights to establish another one, the New City of Toruń, right beside it as early as in 1264. This New City had more to do with craftsmanship than the wealthier, trade-oriented Old Toruń did.

In the years 2008-2020, the area near the church of St James served as the site of archaeological-architectural studies conducted by the Institute of Archaeology, Nicolaus Copernicus University (UMK), during which the beginnings of the architecture and the stage of construction were identified; unearthed graves provided perspective for learning about the funerary culture, while various artefacts offered insight about the material culture. As a result of discoveries and expert analyses, it has been proven that right after the founding of the New City (after the year 1264), a brick parish church was erected. After a relatively short time, its chancel had been destroyed due to unknown reasons, and consequently, in 1309, a cornerstone was laid for a new chancel supported by the stone foundations of the previous church. Although the elegant structure with diagonal buttresses and slender staircases was finished in the mid-14th century, eight more chapels and an antechapel were added over time until the beginning of the 16th century (Sulkowska-Tuszyńska 2022).

Currently, this church has been regarded as a pearl of the Gothic architecture of the whole of Pomerania due to its slender shape, the charming beauty of the detailed brickwork, inscriptions and the polychrome decoration in the interior (Fig. 1). From about the turn of the 14thcentury to the mid-19th century, and in some cases to the early 20thcentury, the surroundings of the church served to bury the dead inhabitants of Toruń. In the past, this necropolis was not only a resting place and a haven of peace for passers-by but also a busy area on the road; through the quarter of the city where the church was located, one could reach the market square from the northern suburban area, as well as go towards the Old City of Toruń, and further to the harbour on the Vistula River.

In the course of the archaeological-architectural studies around the church of St James, the parish church of the former New City of Toruń, a unique collection of items made of osseous materials was unearthed. They were once objects of everyday use, employed by the inhabitants of Toruń between the 14th and the 18th centuries. These objects come from

cemetery layers disturbed by subsequent burials. Burials were distributed around the entire structure in 7-15 layers (!). The cemetery area served as a meeting place, a trading site, a refuge, and even a dumping ground for waste. The objects subjected to analysis were not grave offerings; they were not intentionally placed in burial pits. These were everyday accessories, likely lost or abandoned for various reasons.

The article shows the results of the typological and traceological studies of these items. The fundamental objective of the presented analysis was to seek to interpret technological

Fig. 1. A – View of Toruń in 1641 according to a work by Matthaus Merian with the location of the church of St James marked (white arrow); B – Toruń, St James church (Source: Wikipedia; B: church of St. James in 2011. Photo by Kapitel, CC BY-SA 4.0); C-E – St James church. Views from different sides (Photo by W. Ochotny)

procedures performed in the course of the manufacturing of the described artefacts, as well as to try to determine the ways in which they were used, that is, their purpose and the contexts in which they could have been used in the past. In the conclusions, the results of the conducted analyses were confronted with the most recent knowledge on the occurrence, chronology, manufacturing methods, and ways of using analogous products in Poland and in Europe, in the late medieval times and in the modern era.

2. MATERIALS

The total number of archaeozoological objects amounts to nearly 300 fragments, primarily consisting of small broken pieces of post-consuption waste. Bone objects with traces of processing constituted only about 5%. In addition to those presented in the article, there were, for example, several bone plates – probably production waste from buttons (diameter 6-10 mm). For the purpose of the presented study, seven objects were subjected to a detailed analysis. Below are brief summaries for each of the analysed artefacts:

Sleeve (inv. no. IZW- 59/13)

An object in the form of a narrow and quite long sleeve (11 mm in diameter, 7.3 cm long), empty inside, with remains of a corroded pin (?) at one end. The analysed specimen is covered on its entire surface with unevenly situated omnidirectional grooves (Fig. 2: 1). It is preserved entirely, with the edges at both ends slightly chipped. At two points along the axis, up to three-quarters up, two cracks are visible. The sleeve was found on the south side of the church close to its west corner, near the gate at St. Jakob Street (see the planigraphy of the place where the bone and antler items were found, Fig. 2). It was made of a long metatarsal bone of a small ruminant, such as sheep/goat. The item can be dated back to a broad time bracket between the second half of the 16thcentury and the first half of the 17thcentury.

Osseous knife handle (inv. no. IZW-21/10)

An osseous knife handle with a perforation right by the slightly broadened and rounded end (7.5 cm long, 1-2 cm wide). The object is preserved in its entirety, with a fragment of a broken iron tang of the blade. The visible iron heads of rivets are corroded. Found by the north corner of the monastery building, close to the corridor that links it to the church (Fig. 2: 2). Made of antler of an animal from the family *Cervidae* (Cnotliwy 1973), using two flat parts on the inside, and slightly curved on the outer surface. The handle has been dated to the 15th-16th centuries, approximately.

Gaming piece (inv. no. IZW-63/13)

An osseous gaming piece in the shape of a truncated pyramid (28 by 28 by 11 mm), of a milky-cream colour, meticulously crafted and strongly polished on the side walls and on the bottom. Each of the four side walls bears four circular depressions (1 by 2 mm), and one on the upper one, which is horizontal. The edges of the square base were emphasised with lines. About 80% of the object is preserved; its two corners are damaged. Unearthed

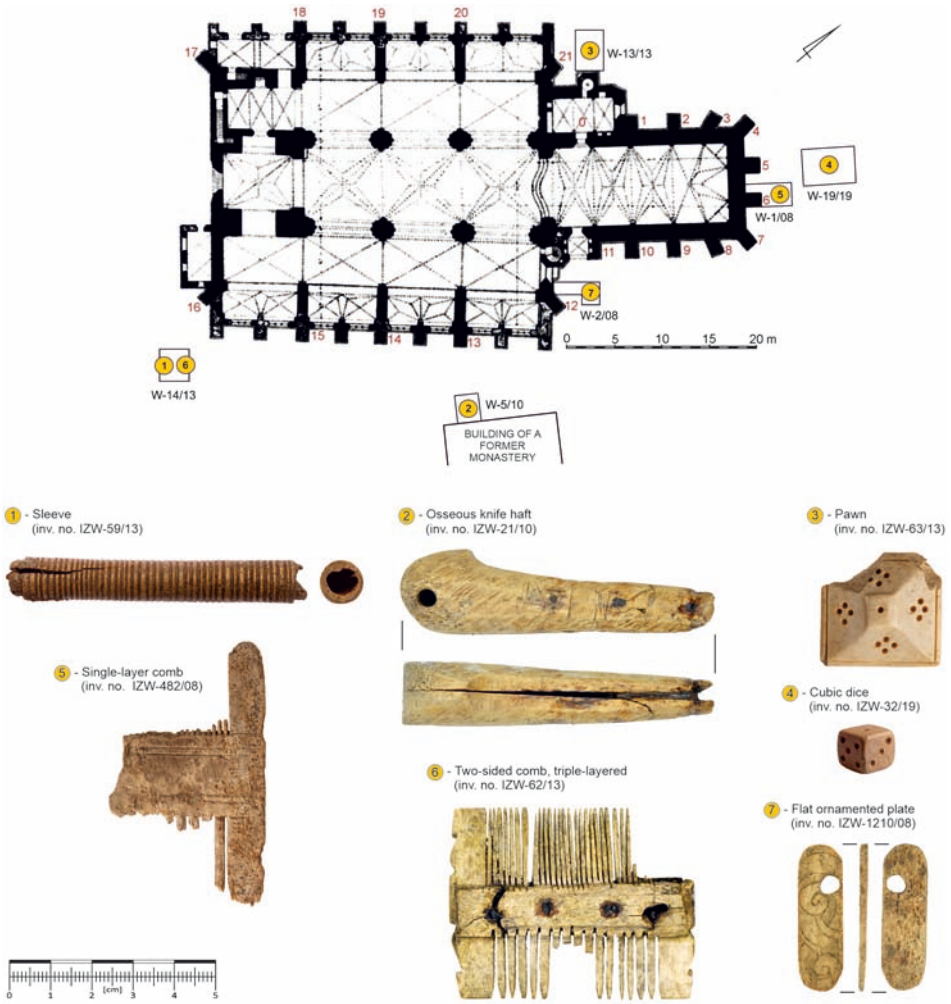

Fig. 2. Top: Toruń, church of St James. Plan after O. Freymuth with an additional marking of the buttresses (Freymuth 1981, 49) and find spots of the analysed artefacts. Bottom: artefacts analysed in the presented study (Photo by W. Ochotny)

by the sacristy, in a layer from about the 17th century (Fig. 2: 3). Made of a long bone, most likely that of a large mammal. The piece can be dated back to the 16th-17th century.

Cubic dice (inv. no. IZW-32/19)

A cubic gaming dice comprising six flat square walls of equal size (8 mm large). The surface of the specimen is polished and meticulously crafted. Preserved in its entirety, found close to the east wall of the cemetery near the gable end of the presbytery, in a layer of burials from about the 18th century (Fig. 2: 4). Since the bone material has been highly processed, it was not possible to identify it.

Single-layer comb (inv. no. IZW-482/08)

A two-sided comb (originally rectangular?), with a row of wider teeth on one side and a row of narrower ones, situated more densely, on the other side. On both surfaces in the central part, there is an ornament made of double straight lines. A feature that makes it stand out is the milky-grey colour of the raw material. Only a small fragment has been preserved (about one-eighth of the entire object) with only several broken teeth. Found right next to the east wall of the chancel, in the layer of burials from about the 18th century (Fig. 2: 5). The material the presented comb is made of is consistent with the structure of the dentine of the incisor tooth of an animal from the family *Elephantidae*. This structure is characterised by the presence of cracks in the form of a characteristic relief called the feather pattern (Locke 2014; fig. 5: F). The structure of the comb and the context of its unearthing allow one to date it to about the 17th-18th centuries.

Two-sided composite comb, triple-layered (inv. no. IZW-62/13)

The comb is made of three plates. The large plate is rectangular (5.8 by 5 cm), clad on both sides with two narrow bone strips (5.8 by 1.2 cm) This is a Hilczerówna (1961) type I, group III BG comb. The object was found by the southwestern corner of the church, in the layer of burials from before the year 1557 (Fig. 2: 6). It has been preserved almost in its entirety, with minor parts chipped; it has iron rivets, rusted. The archaeological-zoological analyses suggest that it was crafted using the antler of an animal from the family *Cervidae* (Locke 2014); most likely, it was the antler of the red deer (Cnotliwy 1973). The structure of the comb and the raw material it was made of suggest that it could be dated rather to the 15th century.

Flat ornamented plate (inv. no. IZW-1210/08)

A small cream-coloured plate (3.5 cm long, 1 mm thick) with rounded corners. One of the surfaces of the plate is adorned with a floral ornament with a slanted chequered motif.

The plate bears a large perforation (4 mm) asymmetrically located by one of the sides. Preserved in its entirety, with a shiny outer surface. The item was unearthed on the line of the corridor linking the monastery and the church, below the level of the floor laid after 1667 (Fig. 2: 7). The oldest building of the Cistercian-Benedictine monastery (from the 13th/14th century) was located approximately 20 metres south of the lateral portal of the chancel. When Catholics regained their church from Protestants after 110 years in 1667, the nuns immediately erected a corridor connecting the church with the monastic complex upon their return. Until the 18th century, additional monastic buildings were constructed to the southeast of the chancel (Sulkowska-Tuszyńska 2022). The ornamented plate was situated in a layer interrupted by several burials (G-6/08, G-8/08, G- 9/08), dated to the second or third quarter of the 17th century. It was made of an unknown, thin bone. Due to the high degree of 'working', it is difficult to determine whether it was a flat bone or a long bone. The object could have been used closer to the turn of the 16th and 17th centuries or in the first quarter of the 17th century.

3. METHODS

The results of the studies presented below are based on objectives developed in the traceological and archaeological literature concerning techniques for working bone and antler (for example, Żurowski 1963; Olsen 1984; MacGregor 1985; Jaworski 2012).

The taphonomical observations were made according to relevant literature (*e.g.*, Olsen and Shipman 1988; Fisher 1995; Madgwick 2014; Fernandez-Jalvo and Andrews 2016; Senyane *et al.* 2023) concerning artefacts made of bone and antler.

The traceological analysis of the artefacts was conducted using a Nikon SMZ-745T microscope-computer set fitted with a Delta PixInvenio 6EIII camera. This equipment provides magnification of the lens up to 12.6× (the actual magnification of up to about 120x) and computer digitalisation and processing of optical images. This set was employed to make most of the microphotographs used in the figures. The analysis of the polish was conducted using a Zeiss Axioscope 5 Variomicroscope fitted with an Axiocam 208 camera. The microphotographs made using this set are shown in Figures 4: N, 5: G-I, 6: K, L, 8: C, M-O, and 9: E.

The observed traces were analysed concerning their location, morphology and distribution on the artefacts' surface. The observed use-wear traces were verified by comparative analyses of micro-wear traces observed on experimental bone and antler products from former experiments that can be found in the Institute of Archaeology NCU in Toruń.

The applied traceological terminology was based on a terminology system that exists in the subject literature (*e.g.*, Korobkova 1999; Legrand 2007; Christidou 2008; Buc 2011; Orłowska 2016), which has been adapted for the purposes and requirements of the conducted analysis.

4. RESULTS OF THE TRACEOLOGICAL ANALYSIS

The state of preservation of the products subjected to the analysis varied. Some objects were preserved fragmentarily, and their surfaces were additionally eroded (among others, the fragmentarily preserved comb of ivory). Nevertheless, the state of preservation of the artefacts did not influence the analysis conducted or the identification of the observed technological and functional traces.

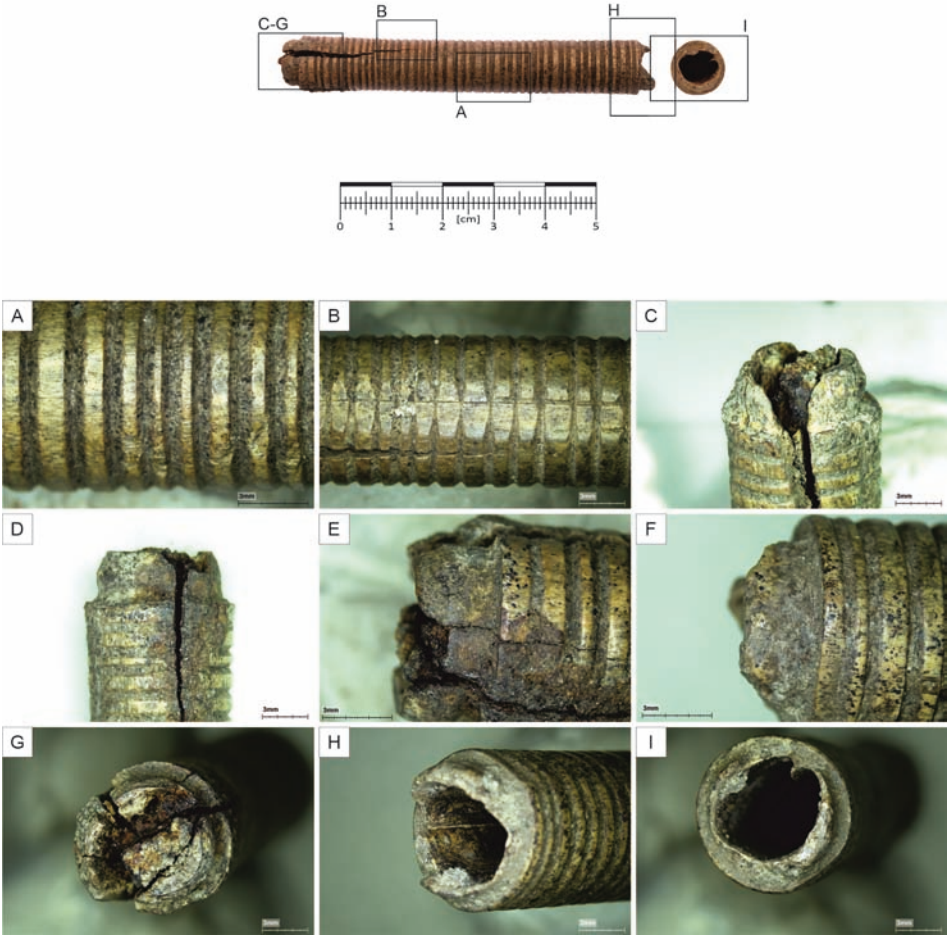

Fig. 3. Top: analysed sleeve with marked sites of microphotographs taken. Bottom: examples of the technological traces discovered on the artefact

Sleeve

The object was made using a small, long bone with a preserved empty medullary cavity. The entire outer surface of the artefact is covered with omnidirectional V-shaped depressions about 1 mm wide and less than 0.3mm deep at intervals of about 1-1.5 mm (Fig. 3: A, B). The observed traces are well preserved and have a readable inner linearity that runs along the side walls of the discussed depressions. These traces were made with a lathe-like tool. The entire surface in question has been smoothed, with the edges of spinning slightly rounded and polished. The visible polished, smooth surface could be caused by both the intentional working process and the use of the object (handling, transport). Inside one of the ends of the item, there are preserved remains of corroded iron (Fig. 3: C, D, E, G). This part of the artefact is also cracked. The opposite end of the object is empty inside, while its interior is the natural structure of a bone marrow cavity (Fig. 3: H, I).

Antler knife handle

The handle comprises two pre-worked fragments of antler, interlocked (Fig. 4: A) and fixed together with three metal rivets about 2mm wide (Fig. 4: B). Originally, between the antler pieces, there likely was the tang of the knife whose corroded remains are well-readable at about two-thirds of the length of the artefact (from the blade side). The entire object was meticulously crafted. Importantly, traces visible on the surfaces of the artefact prove that it was given its final form after the discussed components had been combined in one – here, traces of whittling are preserved, which was done to distinguish an edge protruding subtly at the base of the specimen (Fig. 4: C), and also right by the blade (Fig. 4: A). This treatment resulted in, among other things, subtle undulating nature of the surface in that area and poorly-preserved remains of incisions. Next, the specimen was scraped over. The remains of this treatment are preserved in several areas (Fig. 4: G, H), though they are best-readable on the bottom of the handle. Aside from the traces of whittling and scraping, the surface of the artefact bears clearly-legible, subtle V- and U-shaped cuts (Fig. 4: I). These traces are best visible on the lateral surfaces of the handle, closer to the base. These are most likely traces left by the use of a metal file. Likewise, the hole visible by the base of the specimen was made when the handle scales had already been attached with rivets (Fig. 4: D, E). Importantly, inside this hole, there is a well-visible mistake made by the craftsman during the drilling, namely, the lack of overlapping of the drilled perforations, which is evident at one of their ends (Fig. 4: F). Between the rivets, there are visible cuts, made intentionally albeit quite carelessly, oriented perpendicularly to the long axis of the artefact (Fig. 4: J, K L). The tip of the protruding edge seen at the base is clearly rounded (Fig. 4: M) and polished, which suggests that this part of the object was in contact with a soft material. The polish is accompanied by delicate multidirectional and also more parallel striations that run along the axis of the product (Fig. 4: N).

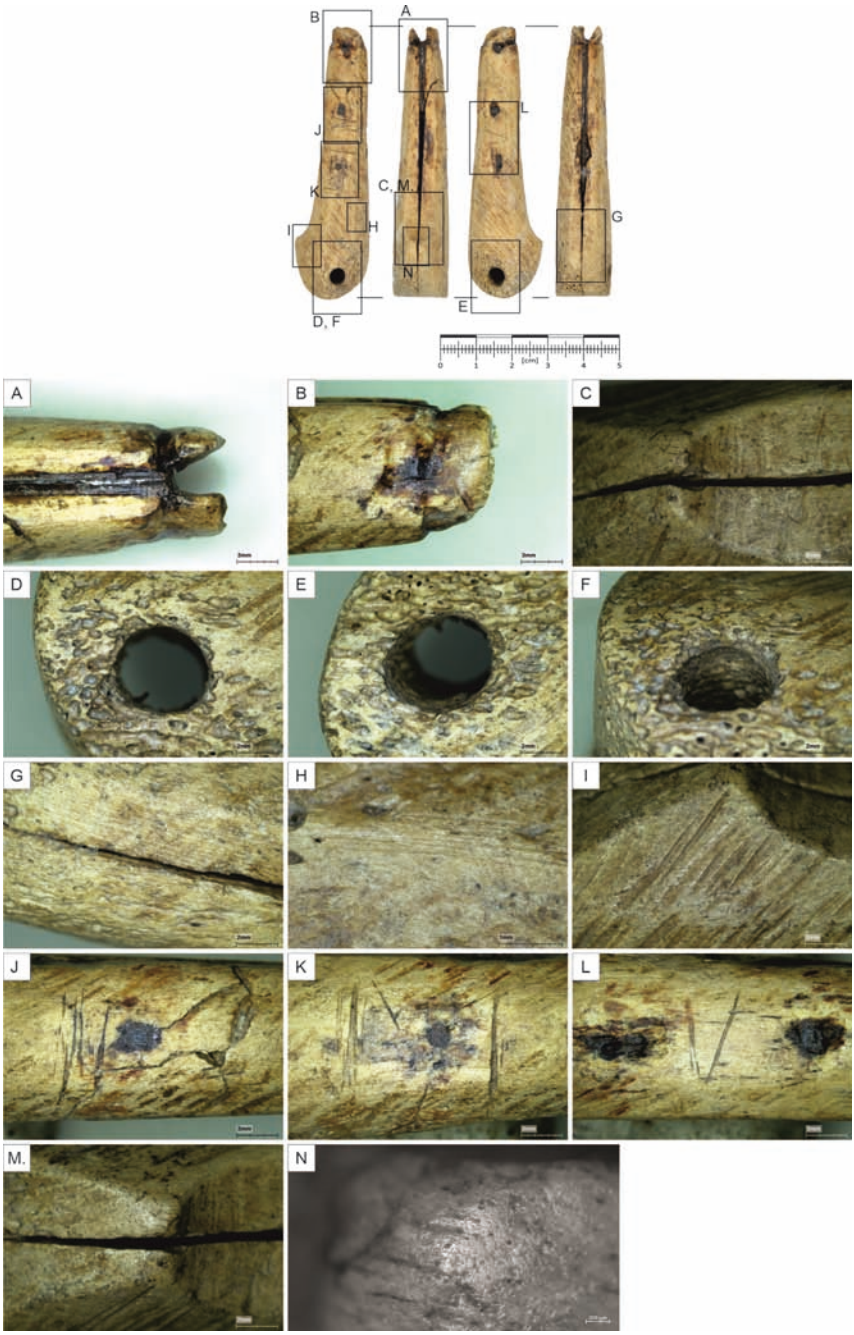

Fig. 4. Top: Osseous knife haft with sites of microphotographs taken marked. Bottom: examples of the technological (A-M) and use-wear (N) traces discovered on the artefact

Gaming piece

The artefact subjected to analysis was made with much care to detail. Right by the lateral edges of the item, in some areas, there are well-readable traces of cutting the gaming piece out of a bone (Fig. 5: A). The edges of the object on the upper side were emphasised all around with a carved straight line 0.5mm wide (Fig. 5: B, C). These lines have a square cross-section and are about 0.5mm deep. Inside the cuts, there are linear traces visible (Fig.5B). By the corners of the gaming piece, in areas where the carved lines cross one another, one can notice which line is secondary to another (Fig. 5: C). On this item one can distinguish four distinctive, trapezoidal walls. On each of them, four circular marks were drilled, about 1mm in diameter (Fig. 5: D). The visible 'pips' have straight inner walls and seem to comprise two levels. The drill used for making them must have been flat and come with a type of a pre-blade, resulting in this cross-section of the pips. On one of the walls, next to a group of four pips, there is a visible trace after a subtly initiated drilling that was then stopped (Fig. 5: E). The surfaces that constitute the upper planes of the specimen are heavily smoothed. In some areas, one can see remains of the preliminary shaping of the object, most likely by means of sawing or whittling the bone surface off. Nonetheless, these traces are poorly legible, as they have been almost entirely destroyed by polishing (Fig. 5: E, G). Despite the polish, some areas show readable traces related to the forming of the square tip of the gaming piece with one central pip (Fig. 5: F). The bottom side of the gaming piece is flat. It is worth noting that the polish seen on the upper part of the specimen varies significantly from the polish observed on the bottom side. The former is flat and bright. It is accompanied by a series of multidirectional, subtle linear traces. There are also well-readable micro-pits (Fig. 5: H). As for the bottom side, the situation is different – the entire surface seems ragged, cut with deep, multidirectional striations. The polish is more matt and covers only the upper surfaces of the bone (Fig. 5: I).

Cubic dice

The analysed dice have six flat rectangular faces with carved-out marks in the system of 7. The edges and the corners of the cube are rounded. The entire surface of this object is smooth and polished (Fig. 6: A-F). The mentioned 'pips' are about 1 mm in diameter each. They are slightly conical in cross-section (Fig. 6: H). In some cases, the pips show a well-readable inner structure (Fig. 6: G), which allows one to distinguish a deeper central point, a slight bump, and, again, a circumferential depression immediately next to the wall of the pip. The morphology of the drilled marks is consistent with the 'pip motif'. The pips are made scrupulously, though if they appear on a face of the dice in a higher number, some lack of manufacturing precision can be noticed, which shows as an asymmetrical arrangement of the pips to one another, as in the case of the central pip on the face bearing five drilled marks (Fig. 6: E), or differences in their depth, which in some cases compromises

the readability of the applied type of drill (Fig.6: I). The polish visible on the surface of the dice is flat, bright, with multi-directional linear traces (Fig. 6: K). In the case of the polish observed on the corners of the dice (Fig. 6: J, L), it seems more matt.

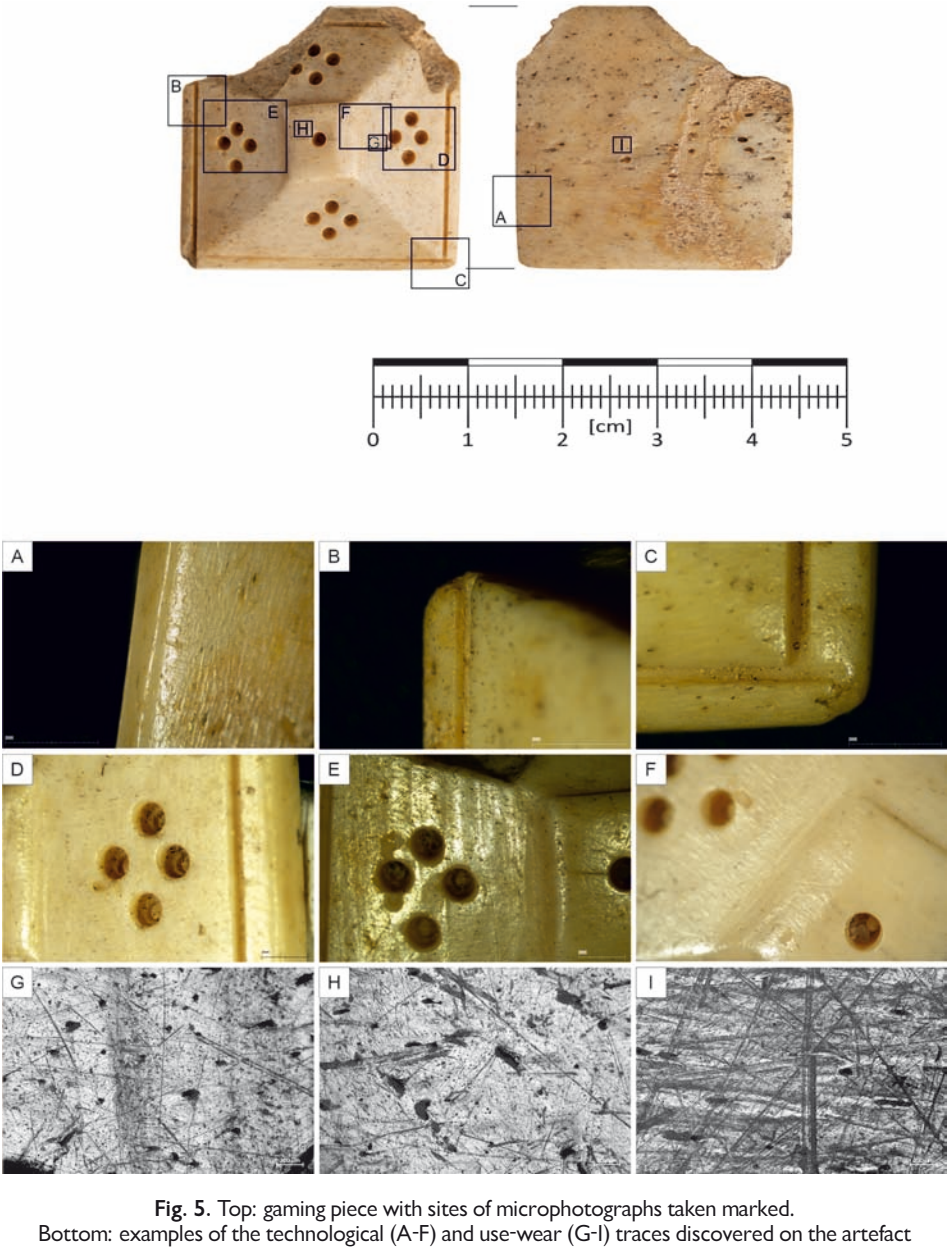

Fig. 5. Top: gaming piece with sites of microphotographs taken marked.
Bottom: examples of the technological (A-F) and use-wear (G-I) traces discovered on the artefact

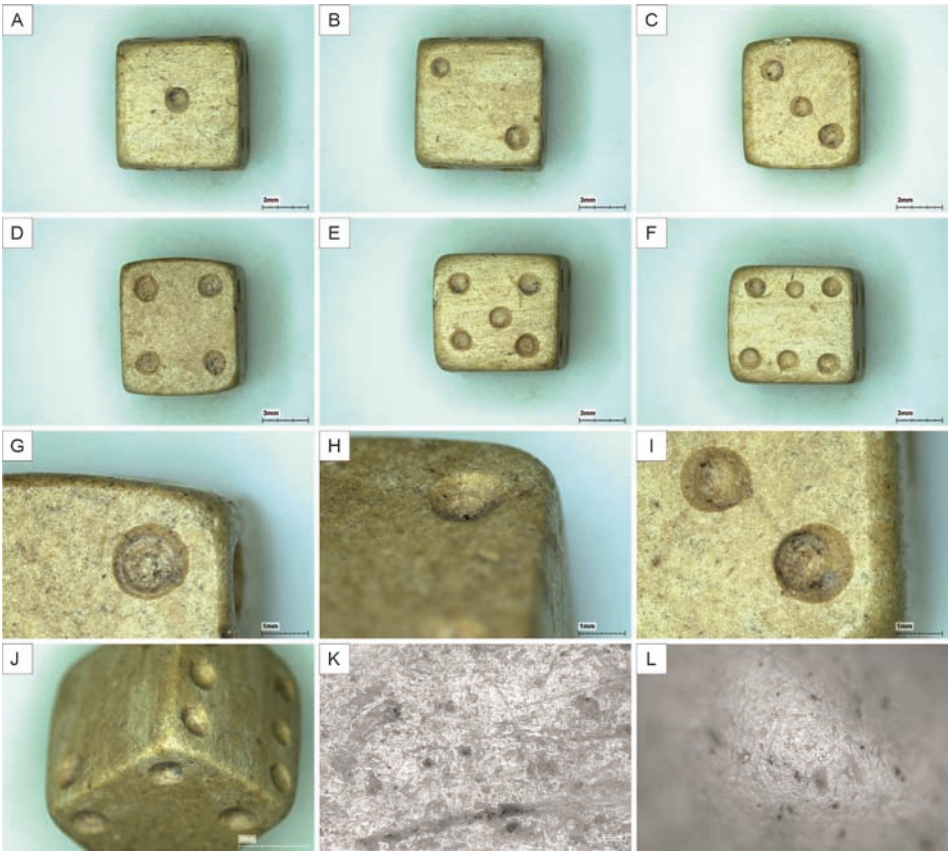

Fig. 6. Cubic dice.
Examples of the technological (A-J) and use-wear (K, L) traces discovered on the artefact

Single-layered comb

The presented object is the most poorly-preserved one of all the analysed items. On its highly eroded surface, traces related to the preliminary working of the bone plate that serves as the basis for the comb were identified. In this case, the preserved damage occurred in the form of parallel linear streaks of various widths, running at a small angle across the entire length of the preserved object (Fig. 7: A, B). These traces are most likely related to cutting a plate of a desired thickness out of a bigger fragment of osseous material with a metal saw. The surface of the object is adorned on two sides with longitudinal carved lines (Fig. 7: A). Additionally, though most of the teeth were destroyed, the comb still bears traces of preliminary sawing of the plate using a saw about 0.3 mm wide, in order to form individual teeth (Fig. 7: C). As mentioned in the part that presents the artefact,

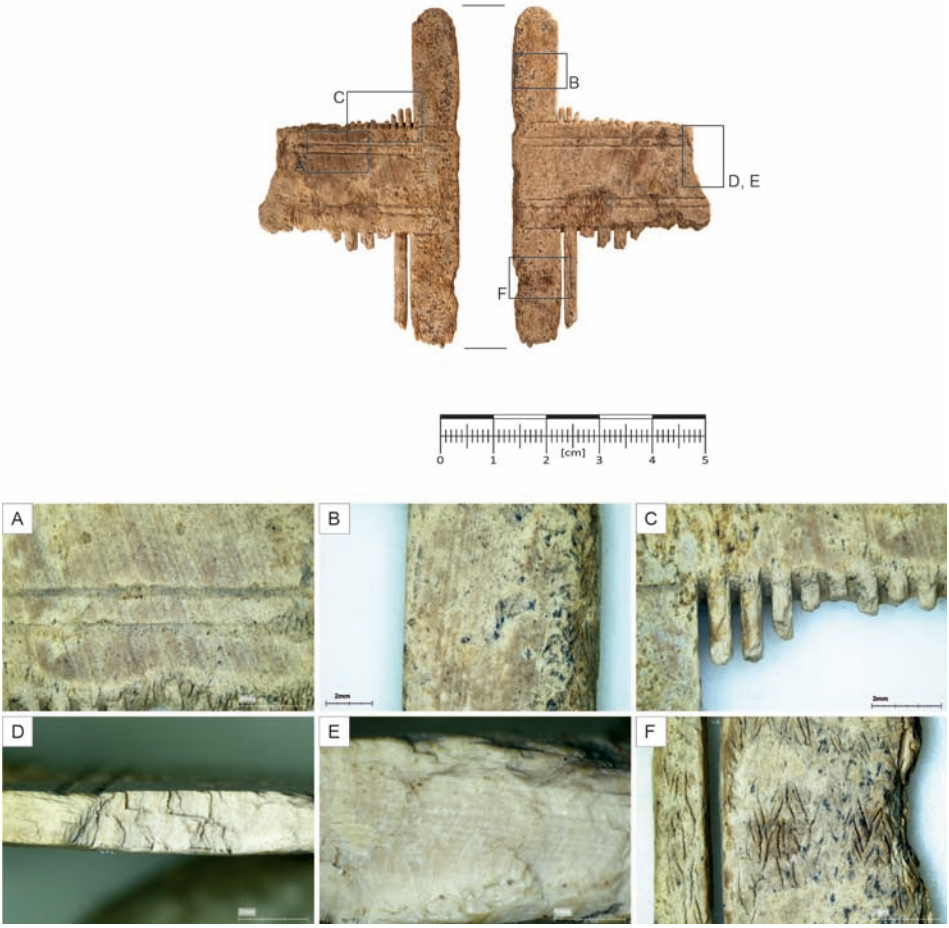

Fig. 7. Top: single-layer comb with sites of microphotographs taken marked.
Bottom: examples of the technological (A-C) traces discovered on the artefact and close-ups of the details of the tusk structure (D-F)

it was most likely made of elephant ivory. Figs. 7: D and E show delamination typical of this raw material, whereas Fig. 7: F presents characteristic cracking and relief referred to as the feather pattern.

Double-sided comb, triple-layered

The profile of the analysed comb clearly shows that it is composed of three bone plates (Fig. 8: A). The entire surface of the central plate was meticulously ground (Fig. 8: B). Traces of this procedure are readable in the form of a series of striations that cross one

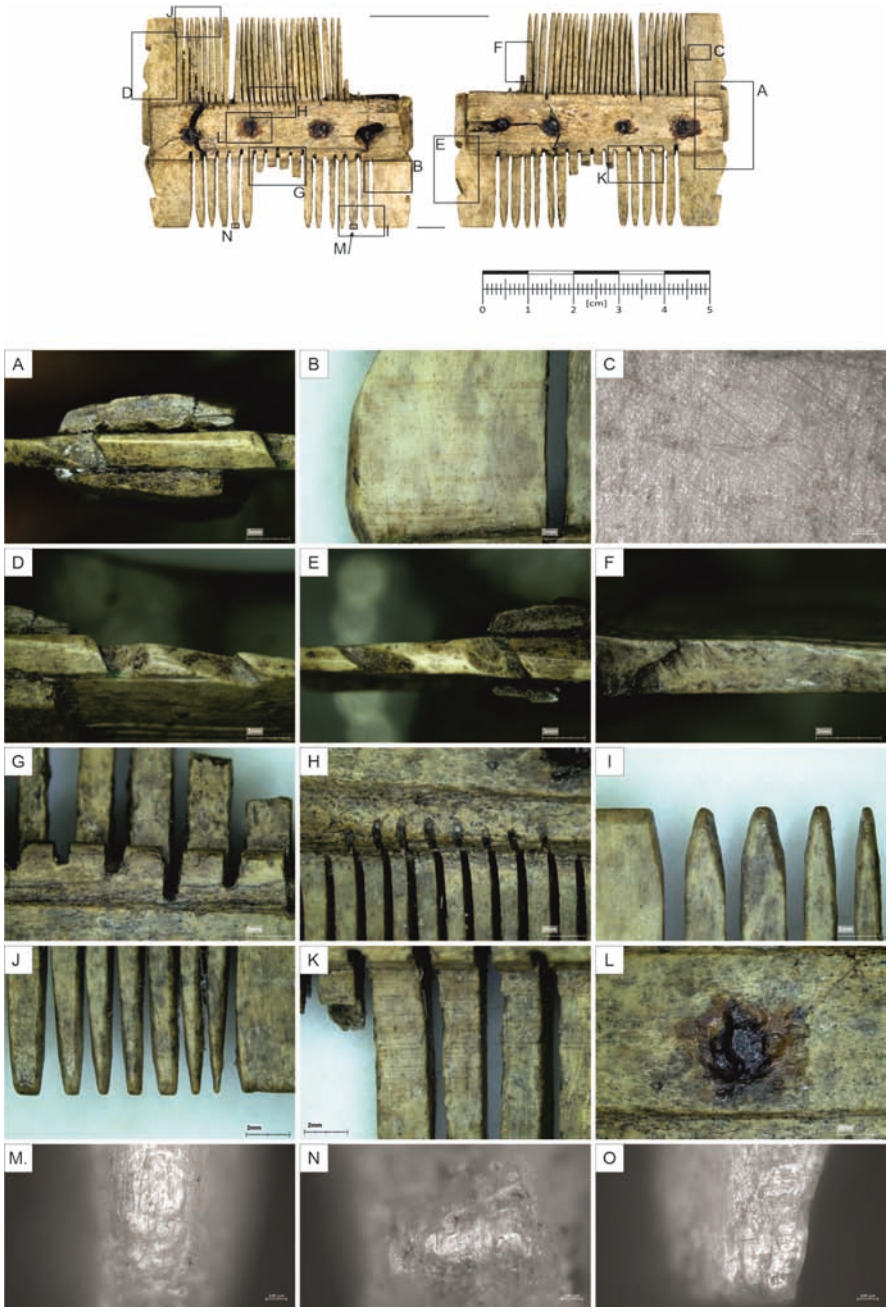

Fig. 8. Top: double-sided comb, triple-layered with sites of microphotographs taken marked. Bottom: examples of the technological (A-L) and use-wear (M, N) traces discovered on the artefact and the use-wear traces formed on an experimental antler comb used for combing hair (O)

another almost perpendicularly (Fig. 8: C). On both lateral edges, the large plate was adorned with three cuts (Fig. 8: D, E) made by pre-sawing of the mentioned edges at a small angle. Traces of this procedure are well-readable as a series of linear streaks that run parallel to one another. On one side of the large central plate, 15 thick teeth were cut with a significant spacing, whereas on the opposite side, 30 thin ones were made, situated close to one another. They were formed by means of pre-sawing of the osseous plate that constitutes the central element of the comb at a small angle (Fig. 8: F). Importantly, the mentioned sawing was done at the moment when all the three elements of the comb had already been fixed to one another. This is evidenced by the pre-sawing of the cladding seen on each side of the object (Fig. 8: G, H). The ends of individual teeth (on both sides of the comb) were additionally filed, making their ends sharper (Fig. 8: I, J). The surfaces of the teeth were additionally ground and scraped near the cladding (Fig. 8: K). The entire three-piece structure was fixed together using four iron rivets 3-4 mm in diameter (Fig. 8: L). The ends of the teeth in the analysed comb are highly rounded and polished. The analysis of the use-wear traces of this item has shown that the observed polish is best developed on the tips of the teeth and that the degree of the polish is marginal (about 4 – 6 mm). The observed use-wear traces are greasy and cover the surface, while their topography is relatively flat. The polish is accompanied by a series of striations parallel to one another, oriented along the long axis of the teeth (Fig. 8: M, N). These traces were compared to the use-wear traces formed on an experimental antler comb used for combing hair and proved identical (Fig. 8: O).

Flat decorated osseous plate

The plate subjected to the analysis is of a small size, made of a thin bone. It is rectangular in shape with rounded corners and is richly ornamented on one side. The other side, which was originally the inner surface of the bone, was only ground. The item has an intentionally made perforation (Fig. 9). On the lateral edges of the object, there are preserved traces of sanding (Fig. 9: A). The perforation made in the plate is irregular (about 4mm in diameter). Its outline obliterates the decoration seen on the plate surface; it was made after the ornament was formed. A visible series of chips in the bone, fine and flat, on both sides of the perforation suggest that it was widened on both sides (Fig. 9: B, C). Within the perforation area, traces were observed in the form of a surface smoothing and rounding of its edges focused closer to the plate edge; it occurs on both sides of the object (Fig. 9: D). The analysis of the visible smoothing made using a metallographic microscope confirmed the presence of a well-developed polish of a smooth topography (Fig. 9: E) accompanied by a series of fine, multidirectional linear traces. The morphology of the observed polish suggests that a string made of a soft material was threaded through the perforation; this could have been a leather thong. The upper surface of the pendant (covered with the ornament) is flat and slightly polished, with numerous legible, omnidirectional

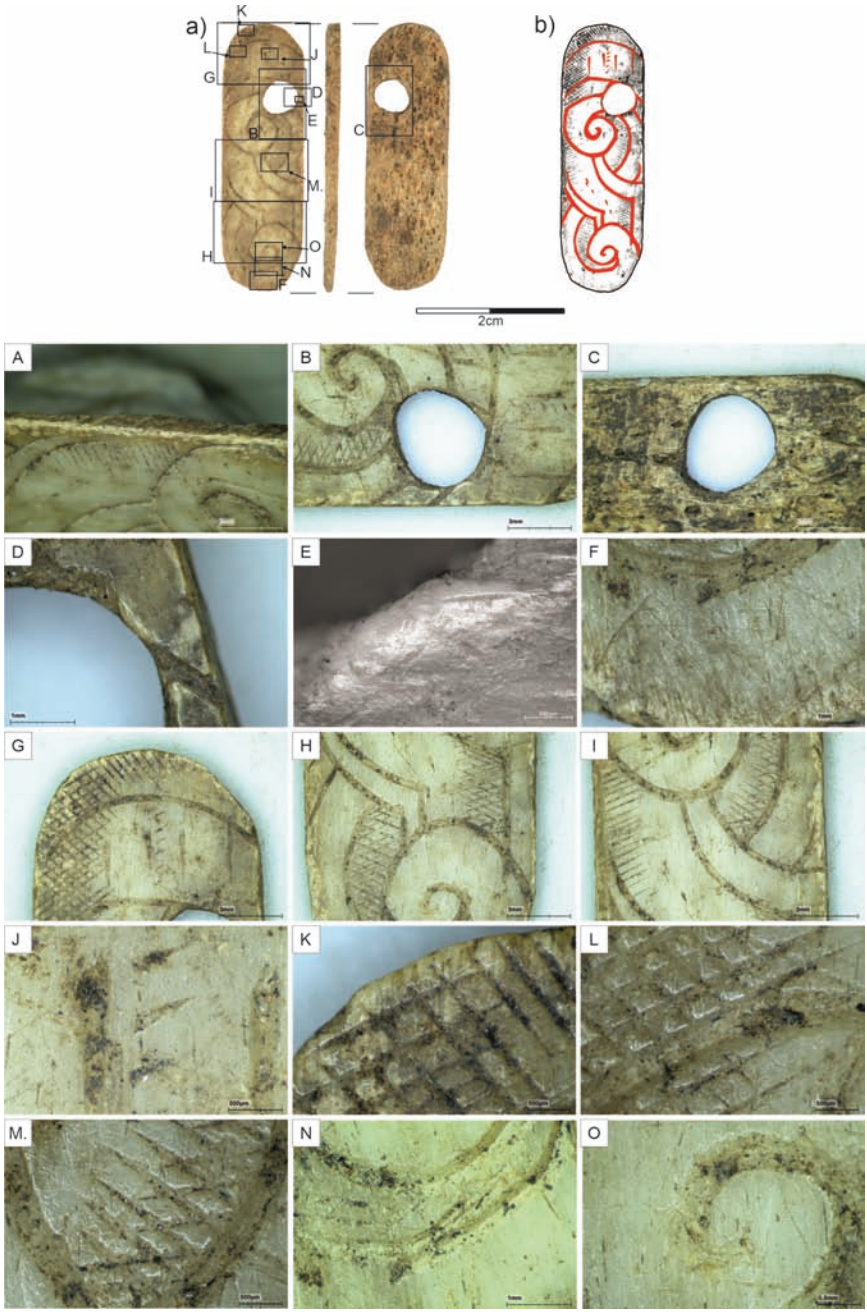

Fig. 9. Top: flat ornamented plate with sites of microphotographs taken marked (a), and schematic representation of the floral ornament visible on the artefacts (b). Bottom: examples of the technological (A-D, F-O) and use-wear (E) traces discovered on the artefact

striations (Fig. 9: F). These traces can be partly related to the sanding and polishing of this part of the object.

As mentioned, the artefact is covered with a rich ornament. Here, one can distinguish two basic motifs (Fig. 9: G-I), namely, a series of fine cuts that are a type of hatching (Fig. 9: b) – the motif marked in black) and distinctive, unquestionably wider and deeper lines (Fig. 9: b) – the motif marked in red), along with accompanying short incisions in the shape of an elongated, acute-angled triangle (Fig. 9: J). In many areas, the incisions that are part of the hatching start at a close distance to the edge of the plate (Fig. 9: K), whereas others seem to be continued further. It is difficult to unequivocally state what the sequence in which specific elements of the decoration were made was. However, it seems that the ornament made of the wider lines was formed once the hatching had been made. This is supported by the fact that the lines that form it cross the mentioned hatching, obliterating its elements (Fig. 9: L, M). Despite the high precision with which the entire object was crafted, in some areas, one can notice traces suggesting that it was necessary to correct specific lines of the ornament (Fig. 9: N, O). As for the lines that form the hatching, they are V-shaped in cross-section, whereas the lines that form the motif made up of wider incisions are more U-shaped.

5. DISCUSSION

The results of the conducted traceological analyses allow the reconstruction, at least to some extent, of the technological procedures carried out in the course of the manufacturing of the items made of osseous materials found during the archaeological-architectural studies conducted around the church of St James in Toruń. Due to the high degree to which the bone raw material was processed, it has been impossible to recreate in a fully reliable manner the initial manufacturing stages, that is, the stage in which blanks were obtained and later formed into the end products. The very process of making the analysed items seems standardised and consistent with the bone-working techniques known from other late medieval or modern contexts in Poland (*e.g.,* Jaworski 2012).

The technological traces observed on the first of the analysed artefacts (the sleeve) confirm the use of foot-powered (treadle) lathes for working bone. The cuts made on the sleeve were intended, most likely, to prevent it from sliding out of one's hand. Its intense use as a handle is evidenced by the highly developed polish and the rounding of the entire surface. The metal fragment preserved inside of the sleeve suggests that it was a shaft for fixing the metal shaft of a small tool or utensil such as a knife, a burin, a two-pronged fork, a spoon for cleaning the ears, or various implements employed by a barber or a surgeon.

Sleeve-shaped lathe-turned handles are rarely found and published. In Wrocław, in the 11th-13thcentury, they were made of antler and used as burin handles (Jaworski 1999). In the 13thcentury, smooth sleeves of unidentified purpose (8.5 cm long) were used in Elbląg

within a tenement house area. In the years 1346 – 1516, narrow, sleeve-shaped handles with grooves were known in the area of the butcher's shambles in Gdańsk as handles of small knives (1.5 – 1.8 cm in diameter, handle length of 8.5-10.5 cm; Marcinkowski 2003, 332, fig. 1-5; Kasprzak 2018, 458, fig. 5 – 3462, 3499; Trawicka 2018, fig.11-3257).

The traces of treatments preserved on the scales of the antler knife handle performed in the course of forming the product in question are evidence of the complex nature of the entire process. This object was made using two longitudinal osseous plates cut with a metal saw out of a compact inner layer of antler. The two parts of the cladding were fixed together, with the flat surfaces facing each other. Once the perforations had been done, both parts of the cladding and the shaft were fixed together using three iron rivets by putting them in the front half of the handle and flattening them out, perhaps on an anvil. The technological traces observed on the surface of the artefact prove that it was given its final shape after the mentioned elements were fixed together. The handle of the object was profiled on the bottom side by cutting it off with a sharp knife, whereas on the end part of the shaft, a perforation was drilled, 5 mm in diameter (drilled on both sides, with the drilling that was shallower visibly offset in relation to the deeper one). Additionally, on the lateral surfaces of the haft, closer to the base, a series of parallel V- and U-shaped cuts were observed. It is difficult to determine unequivocally whether they are remains of previous technological procedures, such as the use of a metal file intending to form both elements of the haft, or whether it is a treatment intended to 'beautify' the object. Apart from the fact that the entire surface of the haft is smoothed, it was observed that the tip of the protruding edge visible at the base is noticeably rounded and polished. The damage observed on its surface is most likely a result of the object being held in the user's hand or being in contact with a leather sheath. Most likely, the handle was part of a kitchen/personal knife carried on a string or leather thong, which was suspended from something. The cut from the bottom side is characteristic of kitchen knives, as it prevents the object from sliding out of the user's hand. Such forms were universal, serving for cutting and chopping.

Similar knife handles, additionally adorned with an ornament consisting of pips, are known from Toruń from the period after the demolition of the castle of the Teutonic Knights in 1454 (Chudziakowa and Kola 1974, 110, table 32: 13, 66). It is likely that such knives were used in Toruń in the 14th century and in the first half of the 15th century before the demolition of the castle. In Gdańsk and Elbląg, knives of this kind (7-9, 12 cm long, blade from 10 to 15 mm wide), meticulously crafted, with ornamented handles, made of bone, antler, or wood, were associated with personal knives or table knives and used from the end of the 14th century to the mid-16th century (such forms of shafts have not been observed in early medieval layers, see Norska-Gulkowa 1985, 265-276). In the Netherlands, they were known in the first half of the 17th century. Similar, yet much longer knives (10-12 cm) were used in the Middle Ages in the castle in Puck, referred to as kitchen knives (Marcinkowski 2003, 333, fig. 1-6; Michalik 2007, 56-58, fig. 7: 5, 8: 3; Gomoliszek 2016, 391-393, 435-440; knives no. 44, 46, 49; Rembisz-Lubiejewska 2021, 358, cat. 93, 95).

The square gaming piece was cut out of a bone plate, probably using a metal saw. The next step was cutting the redundant material off at a small angle and obtaining the form of a truncated pyramid. On each trapezoidal side wall, four circular marks were made with a compass and on the top one, which is rectangular, only one was made. Along the base of the gaming piece, four lines were carved separately along each of the four edges. The entire object was smoothed and polished. In the course of the microscopic observation, a significant difference was noticed between the traces visible on the upper side of the gaming piece and those seen on this base. The damage on the lower side clearly shows that the gaming piece was in contact with a hard surface and was moved, which suggests it was used.

Analogous gaming pieces with rectangular bases served for playing board games in both medieval times and the modern era. Some of them were perforated, most likely so that they could be hung on a string or thong. In Gniewkowo near Toruń, in the second half of the 16th century, a gaming piece of this kind, with a perforation, probably made in a specialist workshop, was used in the premises of what was likely an inn – a wooden house heated with a ceramic stove. In Opole, Wrocław, the Czech Republic, in various castles, in tenement houses of Elbląg and Lidzbark Warmiński, such pyramidal gaming pieces were used in the mid-12th century, yet more often in the 13th-15th century (Norska-Gulkowa 1985, 256, fig. 13; Konczewska 2010, 249-252; Nawrolska 2014, 189, fig. 178; Koperkiewicz 2014, Fig. 3: 1i; Sulkowska-Tuszyńska 2018, 126, cat. 82, 84). These kinds of artefacts are sometimes interpreted as chess pieces moved on the board or pawns used for board games. The different numbers of cut marks and pips, as well as the lines made them diverse and were related to the rules of a given game (Borkowski 1995, 102).

Interesting observations were made owing to the analysis of the cubic dice. These small items were usually made of the metatarsal bones of cattle, less often of antler, amber, or glass. After cutting out square-shaped strips with a hand plane or a saw, most likely, only a higher number of pips were marked on their faces since it was easier to form the marks on a wall of a strip using a vice. It was only after a strip had been cut into smaller cubes that single pips were added onto the walls of the dice. The pips were marked in various ways depending on the applied tool which left different traces. On the dice from Toruń, they were likely made using a metal compass. This is evidenced by the presence of a deeper central point in each of the pips, followed by a subtle bulge and, further to the outside, an omnidirectional depression close to the wall of the perforation. The origin of the visible smoothing and polish on the surface of the dice is difficult to interpret clearly – it might be caused by overlapping traces of intentional polishing of the object, or due to the way in which it was stored, as well as polish caused when it was used.

Tiny cubic dice (sporadically 5-6 mm large, usually 7-15 mm large) were highly popular in the Middle Ages. They were marked using various systems. Aside from the system of 7 (the sum of pips on the opposite faces was 7), in Hanseatic cities, including Elbląg and Kołobrzeg, dice were made using the North European marking system where the sums of pipes were 11-7-3 (Rębkowski 1997, 238-239; Nawrolska 2014, 290, fig. 292). They served

solely for starting board games or, alternatively, the dice alone were used in a game. Cubic dice are known from many cities and suburban areas, from gathering places, and in the premises of private property; they were used in inns, hospitals, and lost at cemeteries. They were unearthed on passageways, squares, and city streets. In Toruń, such dice were found near the church of St James in hospital premises (unpublished) and the suburbia of Chełmno (the cemetery by the church of Saint Lawrence, a group burial of seven people dating from the second half of the 16thcentury to the 17thcentury), where a dice with a metal ring were considered grave goods. In Gniewkowo near Toruń, a tiny die (7 mm) was lost in an inn (second half of the 15thcentury – the 15th/16thcentury), while in Lidzbark Warmiński, a quite large (20 mm) ceramic dice was lost (?) by someone close to the town hall (Górzyńska *et al.* 2011, 27, fig. 12: c; Koperkiewicz 2014, 94, fig. 3: 1e; Sulkowska-Tuszyńska 2018, 126-127, cat. no. 83). Cubic dice were found in Pomerania, Masovia, from Greater Poland to Lesser Poland and Silesia; from Wolin, Kołobrzeg, Słupsk, Gdańsk, and Elbląg, through Toruń, Sandomierz, Racibórz, all the way to Nysa, Bardo, Opole, Krakow, and other cities. In Wrocław, over ten of these objects have been unearthed in various areas of the city, the majority of which were found in layers from the 13th- 14thcentury. In some cases, they were accompanied by production rejects that serve as evidence that they were made locally. They were manufactured for one's personal use and at workshops; older ones were made more often of antler, while later ones – of cattle bones. The oldest cubic dice in Silesia are dated to the turn of the 11thcentury. The most numerous dice identified in various regions come from the 12th-14thcentury. Cuboidal dice are interpreted as counterfeits. Since the 16thcentury, dice were losing popularity in favour of card games, yet in some cities, they were still in use in the 18thcentury and even after that (Borkowski 1999, 187; Adamczyk 2009, 85, fig. 5; Konczewska 2010, 247-249; Fonferek *et al.* 2012, photo no. 74; Romanowicz 2013, 216-217, fig. 1; Kołyszko 2014, 168, fig. 164; Nawrolska 2014, 290, fig. 292; Gomułka 2018, 1027-1030).

Of the two analysed combs, one specimen is single-piece but double-sided. Combs of this type were made of different raw materials – antler, domesticated cattle horn sheath, or the plantar wall of cattle metatarsal bones (Jaworski 2012), and also from ivory (Chmielowska 1971, 87). The analysed comb is preserved fragmentarily. The way in which it was manufactured is most likely consistent with the techniques applied in medieval craftsmen's workshops (*e.g.,* Chmielowska 1971, 28-32). Despite its compact form, the presented comb is a unique specimen due to the material of which it was made. It was made of ivory, that is, a raw material that was hard to access even in the modern era and, most likely, expensive. Combs made of ivory were used mainly in the 5th -12th century in the area of the elite European centres of that time, from Sweden to North Africa and the coast of the Black Sea. And again, from the 14-15th century onwards, when elephant ivory became accessible again with transmission from Flanders and French merchants. One comb of this type, made of ivory and richly ornamented, single-layered yet one-sided, was found in Poland, in Ostrów Lednicki, close to Poznań, in an old residence of the first Piast rulers,

next to a wooden church, where it was most likely used in the mid-11th century (Górecki 2000,13, 41). The area closest to Poland, where such combs were used was in Czechia in the 10th century and in Lund, Sweden. In the modern period, during the 17th and 18th centuries, the production of ivory combs was noted in many places in Europe. Amsterdam was a centre for the production of such combs, and it served as a training ground for their craftsmen. The production, which flourished from the 16th to the 18th century, began to decline after this period (Rijkelijkhuizen 2009, fig. 6, 8). These modern combs were typically not as elaborately decorated as those from the medieval period. Combs made of ivory, similar to the one found in Toruń, were used in the modern period, for example, in the castles in Latvia (Āboltiņš 2019, fig. II-2) and in elite circles in Lithuania (Luik *et al.* 2018). The artefact found in Toruń confirms the widespread use of ivory as a material in various European regions, especially in the 17th and 18th centuries. Richly ornamented ivory combs, referred to as liturgical combs, were used prior to the commencement of a liturgy, near the *sacrum,* when a priest was cleansing himself spiritually, which involved cleansing the mind and the hair by combing it (Chmielowska 1971, 87). The comb from Toruń was deposited by the chancel, about 30 m away from the sacristy, between graves. Aside from the specific material of ivory, this artefact is not similar to early medieval liturgical combs. It cannot be ruled out, however, that before the commencement of the Holy Mass, a priest was using such a comb.

The other of the analysed combs is a double-sided, triple-layered type. In such combs, the basic material was deer antler and the metatarsal and metacarpal bones of cattle. In Poland, antler working developed in the early medieval times, particularly in Pomerania (see Cnotliwy 1973). The process of making the analysed comb was more complex than in the case of the single-piece specimen. The starting point for the craftsman was obtaining proper semi-finished products in the form of antler plates. Such plates were usually obtained as a result of dividing (by means of sawing) the antler into sections of a proper size, removing the *spongiosa* (the spongy inner part of the antler) and dividing it further into pieces of a proper size. The technological traces observed on the comb prove that the surface of each plate was meticulously ground. Then, the plates were fitted and fixed to one another with iron rivets. The next step was to cut the teeth using a metal saw. The traces identified on the ends of the teeth prove that the comb was used for grooming hair.

Analogies for the comb unearthed in the church of St James in Toruń are provided by, among others, triple-layered combs known from Elbląg and Kołobrzeg, which, likewise, had profiled sides. Albeit not common, this feature was known at the end of the 13th century until the beginning of the 15th century. In Gdańsk, such combs with a pit ornament were used in the butcher's shambles in the 13th-14th centuries. Undecorated, triple-layered combs fixed with rivets were known in the monastery in Strzelin in the late medieval period. Wooden combs replaced combs of osseous materials in the modern era (Marcinkowski 2004, 500-505, fig. 1.1. and fig. 3-4; Wywrot-Wyszkowska 2016, table 57-22; fig. 31-6; Kasprzak 2018, 458, fig. 5; Sulkowska-Tuszyńska 2018, 127, catalogue – no. 85, p. 193; Marciniak-Kajzer 2020, 366-368).

The last analysed object, the small osseous plate with ornament is characterised by highly meticulous craftsmanship. The ornament visible on the surface was made with a sharp metal tool used for the gradual cutting of the plate surface. In many areas, traces were noticed that evidence a necessary correction of the lines of the ornament. Due to the high precision and the details, the visible ornament was most likely made using a magnifying glass. The perforation made in the plate seems inconsistent with the precision and the orderly nature that characterises this product. Microscopic analysis has shown that it was formed after the ornament had been made, as it partly obliterated the latter. However, what is more important, on the edges of the perforation, a use-wear polish was observed, the morphology of which suggests that a string made of a soft material, probably a leather thong, was threaded through it. It seems that the object itself could have originally served as a subtle cladding of some flat surface, which, after ending up as a single plate, was reused as a pendant of some sort (a talisman?) due to the excellent artistry. The beautiful decoration on this small plate could have evoked the desire to own it and keep it close.

A close relationship regarding the style of decoration visible on the plate is evident in art from the turn of the 17th century to about the year 1630, among other examples in the sacral art of Kraków, such as the fashionable ferrule ornament with a Moresque design (Czyżewski and Walczak 2022, 80-89, 177, 183, 196-200, fig. 47-51, 143, 146, 148-155).

Nevertheless, small plates made of materials such as bone or mother-of-pearl were also used to decorate hand firearms. Some military muskets were richly adorned with bone plates. In the collection of the District Museum in Toruń (inventory number MT/B/279), there is a long musket, likely crafted in a gunsmith's workshop in Toruń in the second half of the 16th century. It is inlaid with a floral motif and covered with plates depicting half-figures under arcades. On the side of the stock, there are rectangular bone plates (5-6 × 1.2 cm) with an engraved pattern of diagonal mesh. Circular holes, typically asymmetrical to the plates' axis, with a diameter of 3-6 mm, were used to insert hooks connecting the barrel to the stock. On the barrel, on one side of the stock, there could be two to three such hooks, for which openings must have been made in the bone overlays. On firearms used in Polish territories, similar to the plate found in Toruń, there were overlays on the so-called "cieszynki" – wheel-lock rifles used in the first half of the 17th century, manufactured in Cieszyn and Toruń. Oval plates with a length of 3-4 cm adorned the stock and butt of Cieszyn rifles. Some hunting rifles were also decorated with small oval plates featuring a sinuous ornament (Kobielski 1975, 133, 134; Żygulski 1982, 286-287, fig. 320, 322; Skóra and Strzyż 2012, 291, 292, fig. 6). The resemblance to the "Toruń plate" can also be seen on bone overlays of short German wheel-lock pistols, referred to as "puffer," produced in the 1570s-1590s in Saxony and Thuringia (Schulz *et al.* 2009, 20, 21, 28, 29). Bone overlays with holes for hooks, decorating rifles and short pistols (puffers), were crafted in specialised gunsmith's workshops, such as those in Stralsund, in the second half of the 16th century (Radohs and Ansorge 2014, 194, 195). Similar motifs are found on wheel-lock pistols, including puffer-type pistols, used during military conflicts in the second half of the 16th

century and the 17th century in Latvia and Estonia (Haak and Rannamäe 2012, 311, 313, fig.15-1-4; Āboltiņš 2022, 174, fig. 12; 189, fig. VI-10).

The described ornamented plate from Toruń was found in a layer between graves on the former cemetery before a narrow corridor connecting the church with the monastery, which was built in this place soon after 1667. The cemetery itself was located close to numerous roads leading from the northern suburbs to the Vistula riverside and from the west towards the east to the Old Town. Here, Toruń residents would lose various items, coins, decorations, game accessories, and even stone cannonballs driven into the ground next to the chancel. Therefore, it seems highly likely that the tiny plate adorned some musket or other firearm, perhaps used during the Swedish aggression on Toruń in 1629. It might have detached from a pistol during the fights with Swedish musketeers, who were storming the city gates from the north (Dybaś 1994, 146-151), near the church of St. James. Over time, it became a pendant. This is just one of many possible suggestions.

CONCLUSIONS

The conducted studies are the first traceological analysis carried out in such detail of osseous objects unearthed in the course of archaeological-architectural analyses carried out in the surrounding of the church of Saint James in Toruń. Owing to the conducted analyses, it was possible to identify many significant traces related to the ways in which the analysed items were produced, and, more importantly, in some cases, it was possible to confirm that they had been used. The dice, the gaming piece, the knife, the sleeve, the combs, and the ornamented pendant were used in the area of Toruń between the 14th and the 18thcenturies. Most likely, they were once lost, perhaps right after a game was finished or during a walk across the cemetery and, later, when the graves were being dug or filled, they ended up in the grave pits. It is unlikely that they were put inside the graves intentionally, though this possibility cannot be ruled out. These items show not only that such objects were in use in the area in question at the specified time, but they also evidence the level of craftsmanship and the use of osseous raw materials over the course of several hundred years. The game accessories show that there was a fondness for amusement and gambling, while everyday items speak to us through the marks left on them over time due to wear and tear. Following the conducted traceological studies, various activities and the tools used, as well as the context in which they were used, have been partly deciphered. It should be expected that further research in this respect will bring us even closer to various aspects of the life of late medieval and modern Toruń.

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