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ZERO WASTE. SOME REMARKS ABOUT COPPER ALLOY BOWLS RECYCLING IN THE HIGH AND LATE MIDDLE AGES

Abstract: The article presents the results of interpretation of a parts of a copper alloy bowls from the 10th-13th centuries. The vessels might have been originally used for liturgical ceremonies. We know a lot of bowls fragments from Europe that have been reworked as linings, ferrules or rivets. In all these examples we are dealing with metal recycling.

Keywords: Middle Ages, metal recycling, copper alloy bowls, liturgical ceremonies

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Introduction

Recycling is the term associated mostly with waste segregation, care for the environment or fossil fuels. However, recycling primarily means reprocessing substances, materials and objects in order to obtain substances, materials or object which serve either the same or a different purpose. Such line of action is not new; the point is that in contemporary times it has been given a systematized form and written down in the form of acts and regulations. It is difficult to trace the phenomenon of recycling back in time nor is it possible to assess its scale. It could be presumed, however, that in times when human labour was cheap and raw materials expensive, such a line of action was even more popular than today. Reused were practically all objects and materials which were reusable, regardless of their size: from construction elements of houses (wood, bricks, stones) and fortifications, which were used to erect smaller structures or pave streets, to hulls of wooden boats which were used to reinforce, *inter alia*, piers.¹

Minor objects were also given a second life. Unfortunately, archaeology often faces problems with the very identification of minor and deformed objects, not to mention stating whether they were originally a part of some other, larger whole. It also needs to be remembered that parts of objects, if they are not made of a rare raw material or are not richly ornamented, are hardly ever a subject of scientific publications, which limits the chance of their identification by other scholars whose knowledge of a particular field is much broader.

Cases of repairs in order to extend the lifetime of a particular object are definitely more frequent:² they are visible on objects of various kind and, looking at them from a contemporary perspective, they are of various, not always a considerable value. It would mean that unless a particular object was subject to irreparable damage, loss or disuse for other reasons (deposit/hoard, grave goods) it was valuable to its owner. A few variants or stages of processing the original can be pointed out during which the object gradually lost its original properties.³

Raw material or damaged goods could be re-used out of desire to take over non-material values.

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¹ I.e. Woodward 1985; Reith 2003, 51-52; Andrzejewska 2009; Bailiff et al. 2010; Janowski 2013, 46; Biermann and Kersting 2017.

² Cf. i.e. Karpińska 1923; Mührenberg 2002; Baumeister 2004; Dąbrowska 2004.

³ Baumeister 2004, 24.

A fragment of an object of a considerable symbolic load raised the value of another one, because it was used in the process of its production. One such example could be ceremonial swords in the scabbards on which older elements were put in order to highlight the eternity of monarchy.⁴

Of course, not all materials were recyclable, but even clay and glass, which after the firing process change their characteristics offered such a possibility, albeit to a limited extent. Known are cases of manufacturing spindle whorls from fragments of broken pots or using them as gaming pieces, construction elements of furnaces or, upon grinding, as a leaning additive in the process of manufacturing further pots.⁵ Production waste and broken glass were reused because they facilitated re-melting by lowering its temperature. In the Middle Ages broken glass was even an imported commodity, sometimes from considerable distances.⁶

Antler and leather were much better suited for recycling. In the case of the first raw material known are cases of using waste from comb production or broken goods for the production of buttons, linings and pendants.⁷ In the latter case, recycled were not only goods ready-made and damaged because of use,⁸ but also, which is worth highlighting, in fact all waste from the initial process of production (fleshing, unhairing). Hair was used for the production of felt, flesh as fodder, fertilizer, glue or a component of dark blue dye; bark used in the tanning process was used as fodder and fuel.⁹

Difficult as it is to identify, recycling was nothing strange in medieval metallurgy. It was already Pliny the Elder who in his *Naturalis Historia* (1st century AD) recommended the use of copper scrap, which due to earlier removal of harmful impurities has a positive influence on “taming” the alloy.¹⁰ It was a common practice in Europe to recycle unfashionable Avar objects of the alloy of copper and precious metals by metallurgists of the Great Moravian culture.¹¹ If there was a shortage of natural resources in a particular territory, the whole production had to be based on imports or the recycling of objects which were produced from the raw material.¹² That was in the case, *inter alia*, silver

which until the 11th century was brought to Eastern and Central Europe from Arabic countries as coins or ornaments and it was only after they had been re-melted locally that necessary objects were cast.¹³ These are just common sense presumptions as in practice it is not possible to identify objects which were subject to total disintegration in the process of re-melting. Some scholars hypothesize that many deposits/hoards did not perform a hoarding function, but were just deposits of materials stored to be reused.¹⁴

The only comprehensive study of recycling metal goods in prehistory and in the Middle Ages is a study by Martin Baumeister.¹⁵ This problem has not been subject to many studies in Polish literature. In this article I am going to present some examples of the use of copper alloy plates of medieval bowls. The choice of the category of artefacts is due to characteristic engraved ornaments, which even in the case of small fragments enables their relatively easy identification on the basis of macroscopic examination. Numerous signs of cracks on bowls repaired by riveted patches,¹⁶ including items of exceptionally rich ornamentation, indicate how valuable those objects were and that their use other than originally intended was just the last resort.

Copper alloy bowls are a special category of medieval vessels in the shape of a fragment of a sphere measuring about 20-40 centimetres in diameter. They were used for washing hands during liturgical ceremonies and performed educational functions in novitiate monasteries for monks during contemplation. According to prevailing opinions this primary function concerned vessels decorated with representations of virtues and vices as well as with mythological and Christian cycles (Fig. 1). They date back mostly to the 10-13th centuries and their finds are relatively rare (so far more than 600 finds have been excavated)¹⁷, hence each new one enriches our knowledge of these artefacts. Unfortunately, an archaeologist is not always in luck and discovers a complete vessel. In many cases they are only bigger or smaller fragments (Fig. 2).¹⁸

¹³ Cf. Kóčka-Krenz 1993, 15-16; therein older literature.

¹⁴ Cf. Morris 1983; Bradley 1988.

¹⁵ Baumeister 2004.

¹⁶ I.e. Weitzmann-Fiedler 1981, Figs. 22:11, 41:18b, 70:29e, 99:58d, 124:136c, 138:157, 145:179, 145:180; Wallerström 1985, 15-21; Janowski 2003, 221, Fig. 2; Müller 2006, 132-135; Janowski and Słowiński 2008.

¹⁷ Cf. Janowski and Słowiński 2006, 227, therein older literature.

¹⁸ A majority of copper alloy bowls survived in fragments only – cf. i.e.: Grimm 1990, 97, Figs. 51:c, 52:b; Gross 1990; Gläser 1992, 234, Fig. 17:8; Nowak 1997, 553; Müller 1998; Schoknecht 1998, 68, 73, Fig. 15:d, 17:g; Trotzig 1998, 96, Fig. Aa 17:183, S 22:7; Krabath 2001, 36-40, 469-470, Table 3:7-9; Befundkatalog 2003, Fig. 10:1; Lungerhausen 2004, 79-81, Fig. 13:21; Janowski

⁴ Cf. Janowski and Kurasiński 2009. Possibly for similar “unmaterialistic” reasons some objects were deliberately not used secondarily.

⁵ Cf. Buko 1990, 176-180.

⁶ Cf. Olczak 1968, 185-186, Fig. 44; Dembińska and Cnotliwy 1978, 177; François and Spieser 2003, 598. Today broken glass is also used in the process of glass melting – Cf. Nowotny 1975, 165.

⁷ Cnotliwy 1973, 62; Luik 2008, 152-162.

⁸ Wywrot-Wyszkowska 2008, 87.

⁹ Kurbatov 2004, 8-9.

¹⁰ Piaskowski 1957, 111.

¹¹ Galuška 2013.

¹² Fleming 2012.

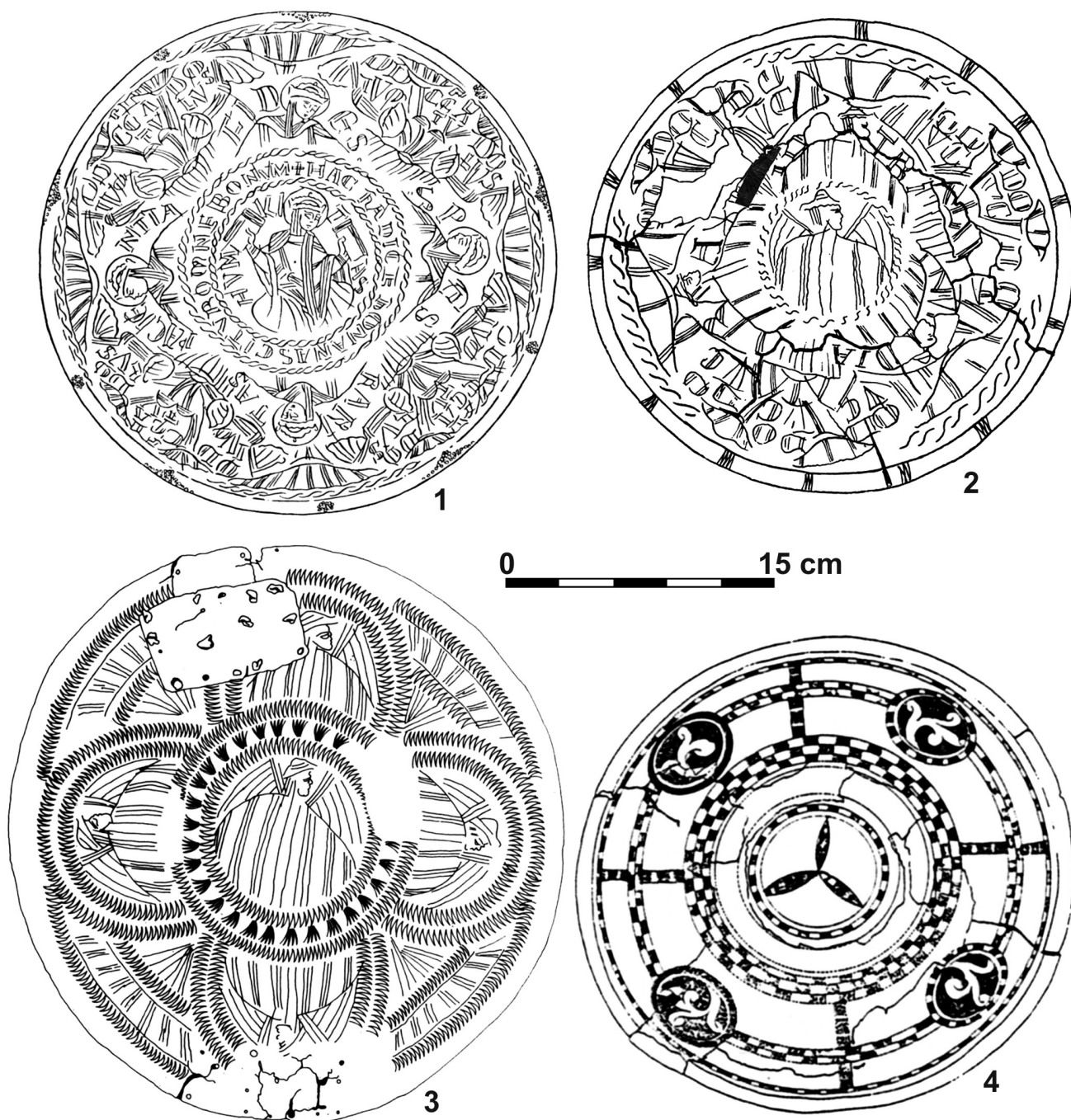


Fig. 1. Examples of copper alloy bowls of type II (1), III (2-3) and V (4) according to T. Poklewski: 1 – Togur (RU). After Jakovlev 1998, Fig. 1; 2 – Wierzchlas (PL). After Poklewski 1961, Table XXIV:a; 3 – Laukuluspa (SE). After Wallerström 1985, 17; 4 – Rone (SE). After Trotz 1991, Fig. 34. Elaborated by A. Janowski.

Their identification as remains of bowls is possible in terms of macroscopic identification in case those are remains of ornamented vessels or in case the cast is clearly visible on the preserved part. The analysis of the ornament

on their surface indicates that in most cases these are shards of copper alloy bowls of type II (bowls depicting virtues and vices) and type III (bowls ornamented with representations of winged male figures) while bowls of type V (bowls with floral and geometric ornaments) are relatively rare according to Tadeusz Poklewski.¹⁹

and Słowiński 2006; Müller 2006, Figs. 3:191, 4:264, 11:86, 11:89-1, 14:265-1, 15:17, 18:267, 21:178, 22:246-2, 24:135, 24:140, 31:131-2; Schanz 2007; Kennecke 2008, 129; Wollschläger 2011; Schanz 2012; Janowski and Zamelska-Monczak 2016; Marti 2017.

¹⁹ Poklewski 1961, 25, 35-38.

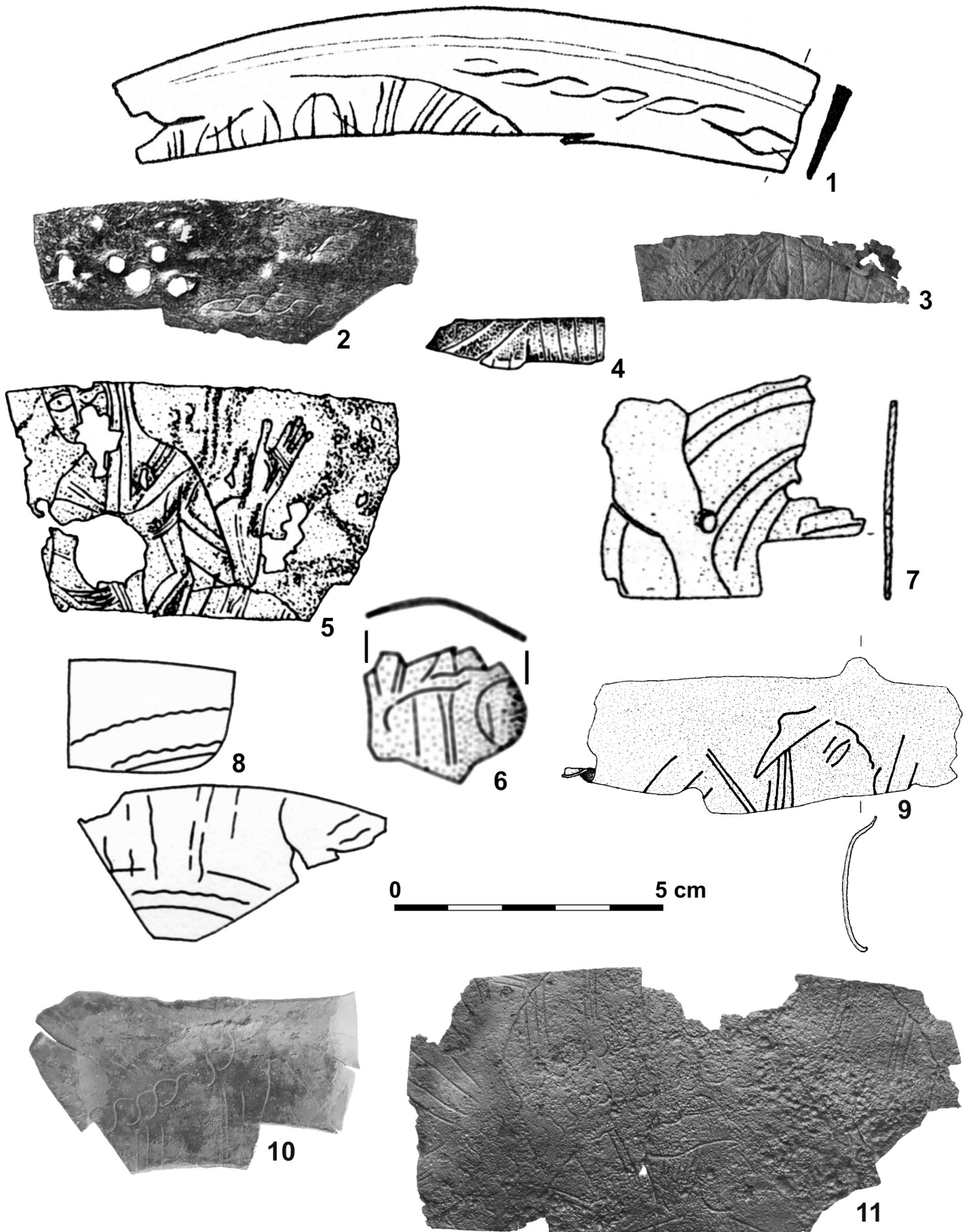


Fig. 2. Small parts of copper alloy bowls identified by characteristic ornament: 1 – Braunschweig (DE). After Lungerhausen 2004, Fig. 13:21; 2 – Heilbronn (DE). After Gross 1990, Fig. 1; 3 – Szczecin (PL). After Janowski and Słowiński 2006, Fig. 4:1; 4 – Tilleda (DE). After Grimm 1990, Fig. 51:c; 5 – Soest (DE). After *Befundkatalog* 2003, Fig. 10:1; 6 – Halbtorn (AT). After Nowak 1997, Fig. 818; 7 – Gramzow (DE). After Schanz 2007, Fig. 55:5; 8 – Eketorp (SE). After Trotzic 1998, 96; 9 – Kapelle (DE). After Schanz 2012, Fig. 134; 10 – Ilow (DE). After Wollschläger 2011, Fig. 126:2; 11 – Santok (PL). After Janowski and Zamelska-Monczak 2016, Fig. 3:2. Elaborated by A. Janowski.

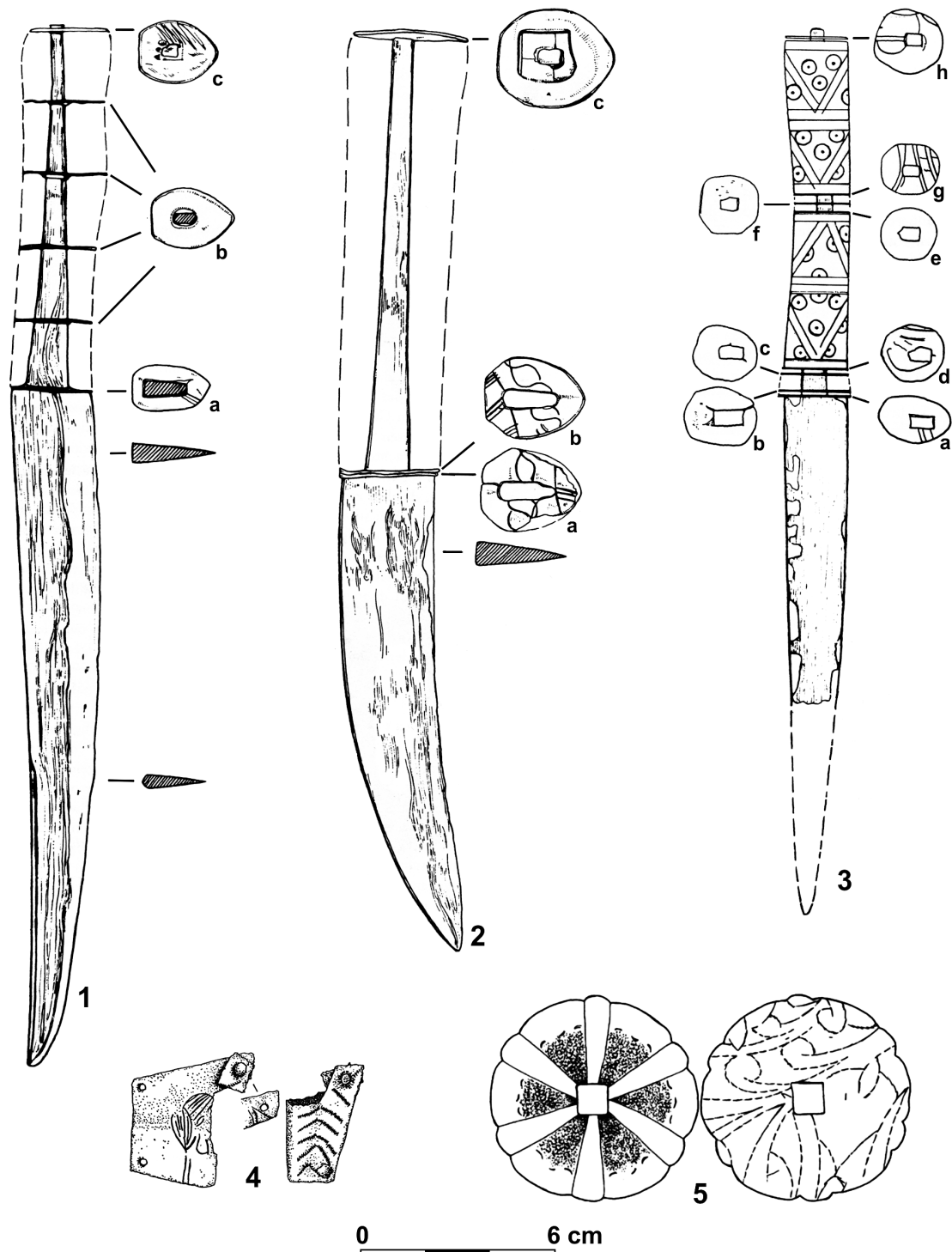


Fig. 3. Linings of handles and ferrules of knives from copper alloy bowl's fragments: 1 – Lübeck (DE). After Drescher 1975, Fig. 4:2; 2 – Winsen (DE). After Drescher 1975, Fig. 3:1; 3 – Bytom (PL). After Drescher 1975, Fig. 4:1; 4 – Berlin-Spandau (DE). After Gandert 1968, Fig. 1:1; 5 – Rugard (DE). After Müller 2001, Fig. 1. Elaborated by A. Janowski.

Some excavated fragments are shapeless, some, however have straight edges and show clear signs of cuts, strengthening or unbending which are the result of an intended activity aiming at recycling the objects. It

could be presumed that such activities were undertaken to recover valuable raw material and to process it further. The analysis of the context of deposits of copper alloy bowls in the area of Szczecin's *suburbium* showed

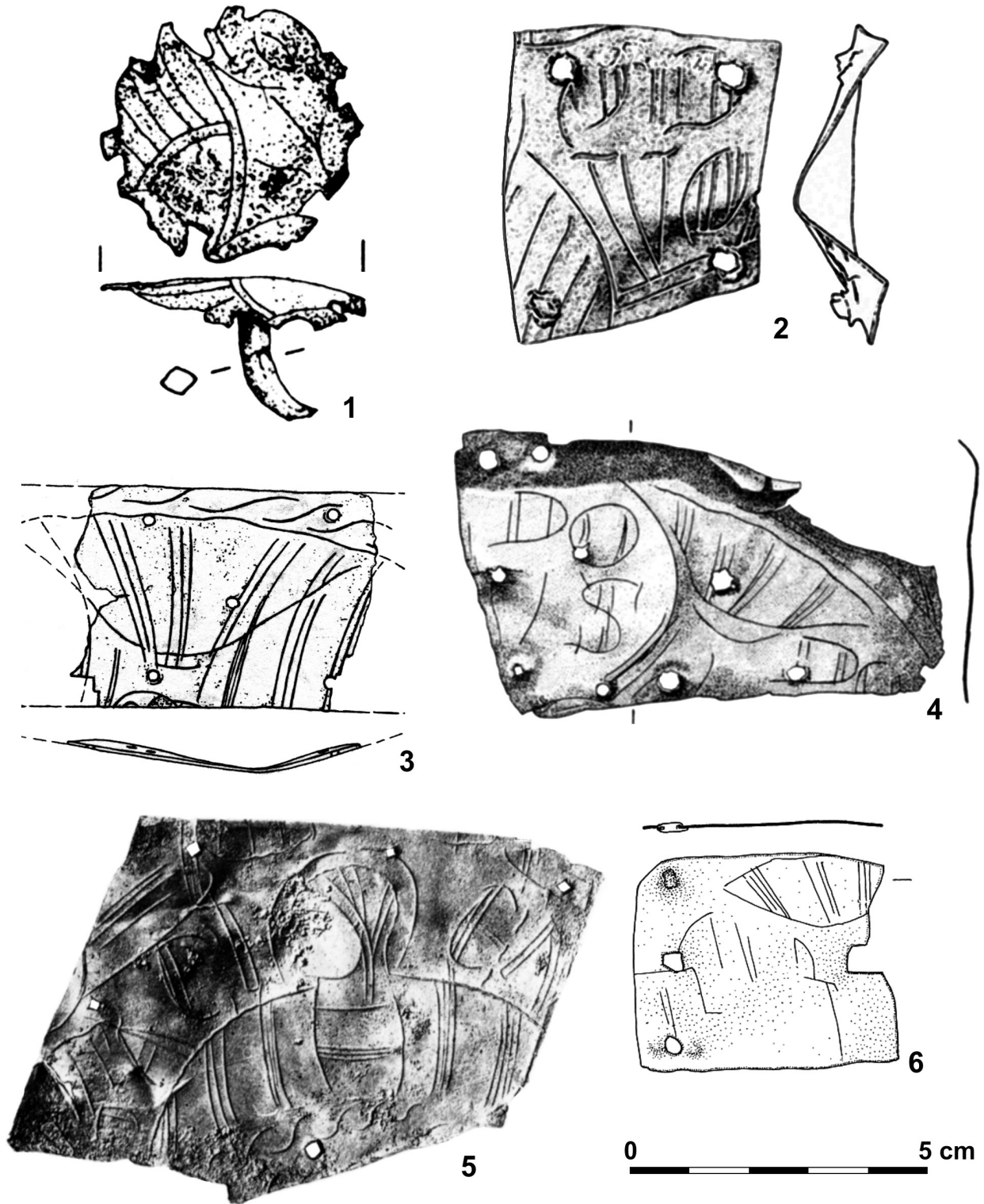


Fig. 4. Ferrule and rivets from copper alloy bowl's fragments: 1 – Soest (DE). After *Befundkatalog* 2003, Fig. 10:3; 2 – St. Olaf harbour, Insel Drakon (SE). After Huggert 1998, Fig. 2; 3 – Albersloh (DE). After Drescher 1975, Fig. 3:2; 4 – Eketorp (SE). After Trotzig 1998, 96; 5 – Lund (SE). After Weitzmann-Fiedler 1981, Fig. 86:47; 6 – Monte Iato (IT). After Quast 2017, Fig. 5. Elaborated by A. Janowski.

that they come from deposits of layers which formed shortly after the Danish raid which destroyed Szczecin in 1189 and the Brandenburg raid in 1214. Hence those were quite turbulent times, when there could have been shortage of all kinds of raw materials and efforts

were undertaken to retrieve each and every available piece.²⁰ A further example of such an activity is

²⁰ Cf. Janowski and Słowiński 2006.

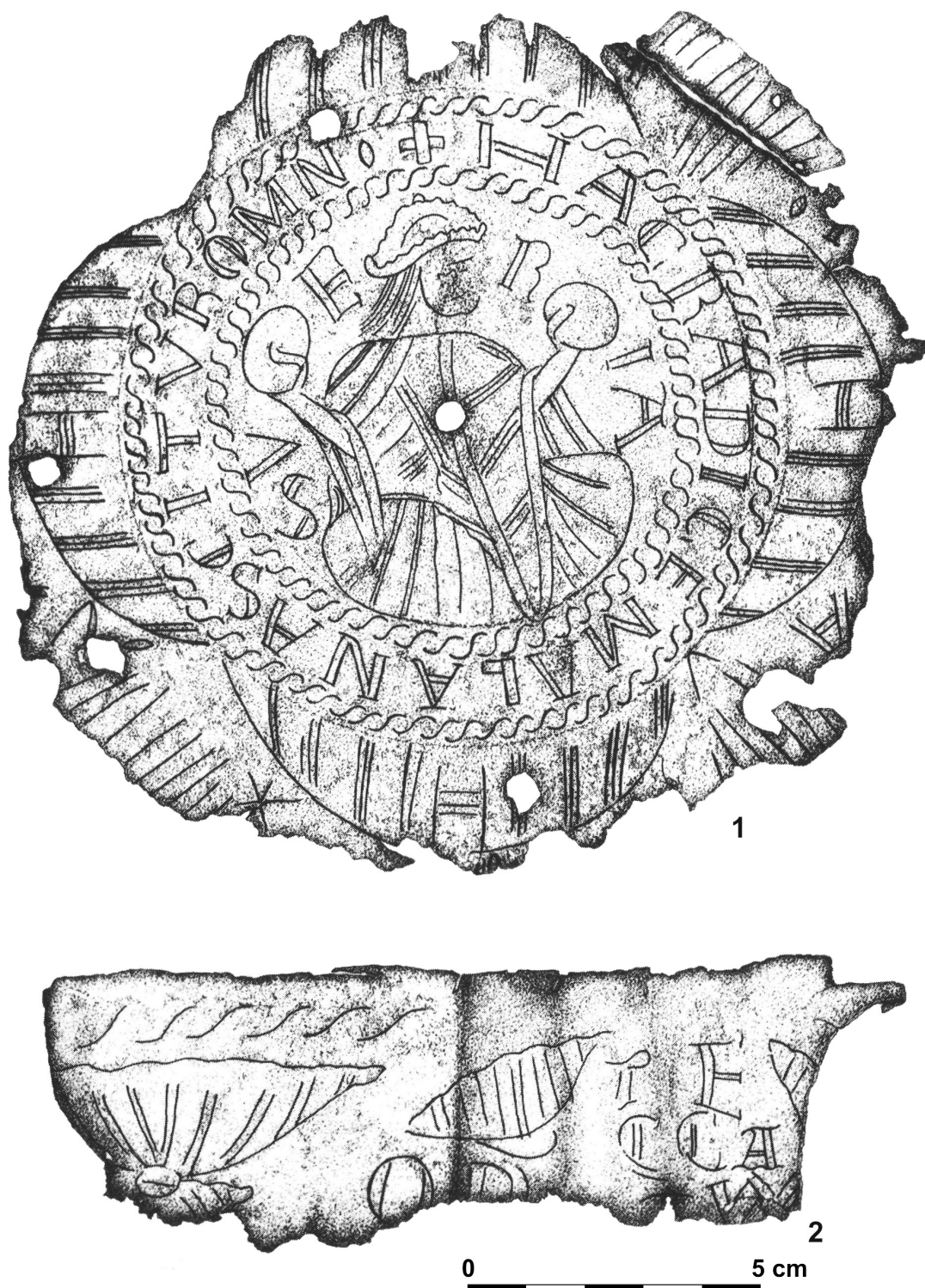


Fig. 5. Parts of a copper alloy bowl from Bátmonostor (HU). After Biczó 1992, Fig. 2. Elaborated by A. Janowski.

perfectly illustrated by the discovery of a settlement in Raciąż (Pomerania). The whole area of the archaeological site was subject to a thorough examination following which the remains of, *inter alia*, a smithy were unearthed with fragments of copper alloy bowls at various stages of destruction, ferrules made of copper alloy plates as well as melted semi-finished products for the production of

metal plates as well as mended vessels. Further fragments of bowls were discovered in adjoining buildings.²¹ In turn, a piece of a plate cut out of a vessel and

²¹ Cf. Kowalczyk 1976, 59-74; Kowalczyk 1986, 70-71, 73, Tables XLVII:c, e-f and XLIX. It is regrettable that the collection was not subject to a comprehensive research and a presentation in



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Fig. 6. Hanging bowl from Blackwater (GB): 1 and 3 – After Bruce-Mitford 2005, Figs. 631-632; 2 – After Bourke 1991, 22. Elaborated by A. Janowski.

found in a settlement in Santok was excavated in layers which contained a destruct of a smithy, which could date back to the 14th century.²²

a graphic form. The author only just mentions, without giving any numbers, elements of interest to us and but a few are illustrated in the quoted studies.

²² Janowski and Zamelska-Monczak 2016.

Linings of handles and ferrules of knives

There are at least five examples of reuse of recycling of copper alloy bowls for the purpose of making elements of handles and ferrules of sheaths of knives. The first case was identified in 1968 by Otto-Friedrich Gandert.²³

²³ Gandert 1968, 169-172.

The find which he described was excavated in a settlement in Berlin and the plate of a copper alloy bowl was used to make the ferrule of a sheath (Fig. 3:4). The artefact measures 38 mm in length and a maximum 12 mm in width. Its shape is typical for objects of this kind produced in the Slavic milieu.²⁴ The outer layer is decorated with a vibrating element in the form of “sliding angles”. On the inside there is a representation of a woman’s head. The place in which the ornament was discovered was invisible in the course of everyday use of the small sheath and there was no need to cover it with ornaments hence it can be concluded that the sheath must have been recovered from some other ornamented object which was recycled. Presumably, the object was a copper alloy bowl of type II according to T. Poklewski.

Hans Drescher made the same assumption when he published three examples of similar practices and the use of sheets of bowls for the production of elements of knife handles in 1975.²⁵ Two of them were new finds (Winsen, Lübeck) (Fig. 3:1-2), however, in one case he reinterpreted an artefact which had been published earlier (Bytom)²⁶ (Fig. 3:3). The knife from Winsen is 282 mm long, out of which 137 mm is the handle. At its end, at the junction of the bolster and the blade there are three, oval-shaped copper alloy plaques measuring 30 × 25 mm and being 0.5-1.0 mm thick (Fig. 3:2a-b). There are engraved ornaments of a fish on two of them hence it can be concluded that the raw material used for their production was a sheet cut out of the upper part of bowl of type II or III according to T. Poklewski (Fig. 1:1-3).

The artefact from Lübeck is a bit bigger: the total length is 315 mm, the handle length is 110 mm. Six plaques were used to produce the handle: four inside ones were made of tin (tin and lead?) (Fig. 3:1b) while the outside ones were made of copper alloy (Fig. 3:1a, c). Ornaments in the form of engraved lines and zigzags can be seen on both outside ones (measuring, respectively 18.5 × 23.5 mm and 14.5 × 22.5 mm); however, they display no features that would allow the identification of bowls that they were cut out from. Similar zigzags can be seen both bowls of type III and V according to T. Poklewski (Fig. 1:2-4).

Mixed raw material was also used to make eight plaques separating elements on the handle of the Bytom knife (preserved total length 212 mm, handle length 117 mm). All of them are round or oval shaped, their lengths range from 17 to 22 mm. Three of them were cut out of lead plates (Fig. 3:3b, c, e) while five of a copper

alloy one (Fig. 3:3a, d, f-h)²⁷ which presumably came from bowl of type II or III according to T. Poklewski.

All three knives represent a form which is relatively rare in Europe, used mostly in the territory of Germany. Most artefacts date back to the 13th and 14th centuries, although there are also few older finds.²⁸

The last example of the use of recycled plate of a copper alloy bowl for the production of handles comes from Rugard (Fig. 3:5).²⁹ The object excavated here is roughly spherical and measures about 64 mm in diameter. In the central part there is a quadrangular hole (10-11 mm). Both surfaces of the plaques are decorated: on one of them there are floral ornaments which go beyond the edges, so originally it must have covered some other, larger object. According to Ulrich Müller, who published the find, such a decoration refers to, albeit not wholly, the ornaments of copper alloy Gotland bowls with floral decorations (cf. Fig. 1:4) and the plaque itself is an element of a dagger’s handle.

Ferrules and rivets

Apart from cases of recycled of plates of copper alloy bowls for the production of lining of sheaths and handles of knives, known are a few examples of their use for the production of rivets and various ferrules the purpose of which is unknown (Fig. 4).³⁰

During archaeological excavations in Soest a rivet was discovered in a layer dating back to the turn of the 12th and the 13th centuries. Its head was 43 mm³¹ in diameter and had a clear engraved ornament characteristic of copper alloy bowls type II and III according to T. Poklewski (Fig. 4:1). Arguably, the sheet comes from the same bowls as the fragment unearthed in a different (younger) layer on this site.³²

A few ferrules made of plates of copper alloy bowls type II according to T. Poklewski were uncovered during archaeological excavations in Sweden. The first object is from St. Olaf Harbour on Drakön Island³³ (Fig. 4:2). In layers dating back to the 14th century a trapezoid ferrule measuring 55 × 50 mm with four holes for rivets in the corners was found. On the surface

²⁴ Knorr 1938, 491.

²⁵ Drescher 1975, 57-68.

²⁶ Cf. Szydłowski 1966, 85, Fig. 35; see also Knorr 1971, 127, Fig. 4:1.

²⁷ Cf. Knorr 1971, 127.

²⁸ Cf. Holtmann 1993, 417-426, Fig. 170.

²⁹ Müller 2001, 116-125; Müller 2002, 38-60.

³⁰ An interesting find, yet of uncertain classification comes from Grötlingbo on Gotland, wherein grave 11/61 a fragment of unidentified copper alloy vessel was found, used as ferrule of a wooden bucket (Trotzig 1991, Fig. 94). Ulrich Müller (2006, 343) believed that this fragment was a part of a bowl of type III or V according to T. Poklewski.

³¹ Cf. Befundkatalog 2003, 169, 210, Fig. 10:3.

³² Cf. Befundkatalog 2003, 161-162, 210, Fig. 10:1.

³³ Huggert 1998, 89-95, Fig. 2.

of the plaque there is a clear ornament of engraved lines and four Roman majuscule letters: two upper ones are O and D and below them there are U and O. As Anders Huggert, who published the discovery, aptly noted the letters are the remains of the inscription: ODIUO (from Latin *odium*, eng. hatred). In a similar form the word was written on bowls from Lund (Sweden) and Togur (Russia)³⁴ (cf. Fig. 1:1).

A lot of information is also provided by the analysis of ferrule discovered in Lund³⁵ (Fig. 4:5). Its shape is roughly pentagonal (size: 105 × 68 mm) with five quadrangular holes for rivets. On its surface there is the upper part of a female figure with a halo and letters: PACIEN, which are a part of the word PACIENTIA (eng. patience).

The origin of a fragment of a vessel found in Eketorp in layers from the 13th century can be stated with relative precision³⁶ (Fig. 4:4). On originally quadrangular plaque measuring 70 × 47 mm and holes for 8 to 9 rivets, there is a clear ornament separating letters DO US and again DO. It can be assumed with relative certainty that here we deal with repeated words DOLUS, “deceit”, while the whole is a relic of the upper, edge part of the bowl. Similar objects which survived down to our times as wholes are known from, *inter alia*, from Aseri (Kalvi, Estonia), Chersones (Ukraine), Groningen (Holland) or Togur (Russia)³⁷ (cf. Fig. 1:1).

Further examples come from Skänninge, where in the course of archaeological excavations of a medieval hospital a few plaques were discovered. They were provided with rivets and were interpreted as ferrules/joining elements. A clear pattern on their surface is, according to the author of the studies, conclusive evidence that they are recycled copper alloy vessels dating back to the 12th and 13th centuries with representations of virtues and vices similar to the ones found in Eketorp.³⁸

The artefact uncovered during archaeological excavations in a church in Albersloh (Germany)³⁹ (Fig. 4:3) also falls in the category of ferrule made of plates of copper alloy bowls with images of virtues and vices. (type II) or with representations of angels (?) (type III). On a rectangular plaque measuring 50 × 37 mm with five holes for rivets there are clear engraved lines: straight and wavy in a pattern characteristic of upper parts of the types of bowls mentioned earlier (Fig. 1:1-3).

A piece of metal sheet found in Monte Iato on Sicily (Fig. 4:5)⁴⁰ is considered to be a part of an element of a buckle ferrule. Characteristic ornamentation leaves no doubt as to the origin of the raw material. A few holes were made in a plaque measuring 45 × 35 mm: three on one side (a rivet made of metal plate survived down to our times) and a further one opposite them. On the surface in between the holes there is an ornament typical of copper alloy bowls of types II and III.

Undoubtedly the purpose of a metal plate, for its considerable size alone, was different. It was uncovered during archaeological excavations in the monastery in Bátmonostor (Hungary) founded in the 12th century and destroyed in 1241-1242 (Fig. 5).⁴¹ The figure SUPERBIA (Eng. haughtiness) is clearly visible in the centre of a large fragment of the bottom measuring 15–16.5 cm. The figure is surrounded by an inscription from of *Moralia in Job* by Saint Gregory the Great: *Hac radice mala nascitur omne malum* (“from this poisonous root all evil springs”). There are a few holes in the sheet (Fig. 5:1). The first is circular, measuring 5 mm in diameter, and positioned in the very centre. Other ones, no fewer than four, are quadrangular and were placed on the edges.

The object discussed above is not the only Hungarian example of recycled copper alloy plate of a bowl. Other ones from the same period come from Orosháza in the south-east of the country.⁴²

The use of the whole vessel

A unique example of a recycled copper alloy bowl comes from Northern Ireland. A vessel measuring about 40 cm in diameter was found in the River Blackwater, south of Charlemont, Co. Armagh. It was decorated with figural ornaments characteristic of bowls representing virtues and vices (Fig. 6:1-2). In this case the bowl was not fragmented, but re-used as a whole. An Irish craftsman fitted three handles (escutcheon): two of them survived down to our times, including one decorated with an animal head typical of Irish style in the 12th century (Fig. 6:3).⁴³ Thanks to this relatively minor modification a hanging-bowl, i.e. a vessel characteristic to Anglo-Saxon culture which performed liturgical and ritual functions was made. In this case a unique construction goes hand in hand with unusually late chronology. Hanging bowls were vessels used mainly in the 1st millennium AD.

³⁴ Cf. Weitzmann-Fiedler 1981, Fig. 85:46; Jakovlev 1998, Fig. 1.

³⁵ Cf. Weitzmann-Fiedler 1981, 92, Fig. 86:47.

³⁶ Trotzig 1998, 96, Fig. 24:1.

³⁷ Cf. Poklewski 1961, 73, 78, 80; Jakovlev 1998, Fig. 1.

³⁸ Jonsson 2012, 106.

³⁹ Drescher 1975, 67, Fig. 3:2.

⁴⁰ Quast 2017, 89, Fig. 5.

⁴¹ Biczó 1992.

⁴² Szatmári 2014, 180, Fig. 2:5-7.

⁴³ Bourke 1991; Bruce-Mitford 2005, 410-412.

Conclusion

The examples presented above definitely do not represent either the scale or the complexity of the issue of recycling of copper alloy bowls in the Middle Ages. A relatively large copper alloy plate offered a whole range of possibilities of its re-use. I am sure that a closer analysis of many so called “undefined objects” or “plaques” would reveal further fragmented vessels. Examples described above show that the phenomenon was not typical of some territory, but prevailed all over Europe.

Summing up, I would like to highlight opportunities offered by in-depth observation and analysis of discovered fragments of objects, not only bowls. Many of them: small, shapeless and apparently insignificant conceal a wealth of information, not only about the bowls themselves, but also about the behaviours of people who used them. The behaviours were different from the impressions we have about them although when it comes to recycling we should by no means be surprised as it is only advanced civilisations that show less respect for raw materials and produce really useless waste.

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Streszczenie

Zero odpadków. Kilka spostrzeżeń o ponownym wykorzystaniu mis brązowych w młodszych fazach średniowiecza

Recykling to pojęcie, które dziś kojarzy się głównie z segregacją odpadów i dbałością o środowisko naturalne. Recykling to jednak przede wszystkim powtórne przetwarzanie substancji, materiałów lub przedmiotów w celu uzyskania substancji, materiałów lub przedmiotów o tym samym lub innym przeznaczeniu. Przejawy takich zachowań można odnaleźć już w pradziejach, choć trudno je śledzić, a ich skala jest niemożliwa do ustalenia. W przeszłości, gdy praca ludzka była tania, a surowiec bardzo drogi, zachowania takie były zapewne nawet częstsze niż obecnie. Powtórnemu wykorzystaniu podlegały praktycznie wszystkie zdatne do tego przedmioty i materiały, niezależnie od rozmiarów. Przetwarzano ponownie drewno, skórę, szkło oraz glinę. Recykling nie był również obcy średniowiecznej metalurgii, a Gajusz Pliniusz Starszy w *Historii naturalnej* (I w. n.e.) zalecał nawet stosowanie przy wytopie złomu miedzianego, który ze względu na wcześniejsze oczyszczenie ze szkodliwych domieszek korzystnie wpływał na „oswojenie” stopu.

W tekście zaprezentowano przykłady ponownego wykorzystania mis brązowych – szczególnej kategorii naczyń używanych w od X do XIII wieku. Wiele z nich było zdobionych rozbudowanymi ornamentami figuralnymi,

geometrycznymi i roślinnymi. W powszechnej opinii naczynia te przeznaczone były do obmywania rąk np. w czasie obrzędów liturgicznych, a niektóre z nich pełniły dodatkowo funkcje edukacyjne w nowicjatach klasztornych – jako przedmiot kontemplacji mnichów. Liczne ślady napraw, w postaci łątek przynitowanych w miejscach pęknięć, wskazują jak cenne były to przedmioty; ich wykorzystanie w sposób niezgodny z pierwotnym przeznaczeniem było ostatecznością.

Wiele mis znajdujących jest jedynie we fragmentach. Niektóre z nich są bezkształtne, inne mają proste krawędzie i noszą wyraźne ślady cięcia, prostowania czy rozginania na skutek wtórnych intencjonalnych działań. Można przypuszczać, że czynności te wynikały z chęci odzyskania potrzebnego surowca w celu jego dalszego przetworzenia. Znajdiska takie pochodzą m.in. ze Szczecina, Raciąża czy Santoka. Oprócz tego znamy przykłady wtórnego zastosowania blachy mis brązowych do wykonania elementów okładzin rękojeści i okuć pochewek noży. Wytwarzano z nich także nity i różnego rodzaju okucia o trudnym dziś do ustalenia przeznaczeniu. Odosobnionym przypadkiem jest modyfikacja całego, nieuszkodzonego naczynia – poprzez dodanie uchwytów przekształcenie w tzw. misę wiszącą.

Zaprezentowane przykłady nie oddają na pewno skali i złożoności średniowiecznego recyklingu mis brązowych. Stosunkowo duży arkusz blachy stwarzał cały wachlarz możliwości jego ponownego wykorzystania. Zjawisko to ma charakter ponadregionalny; notowane jest w całej Europie.