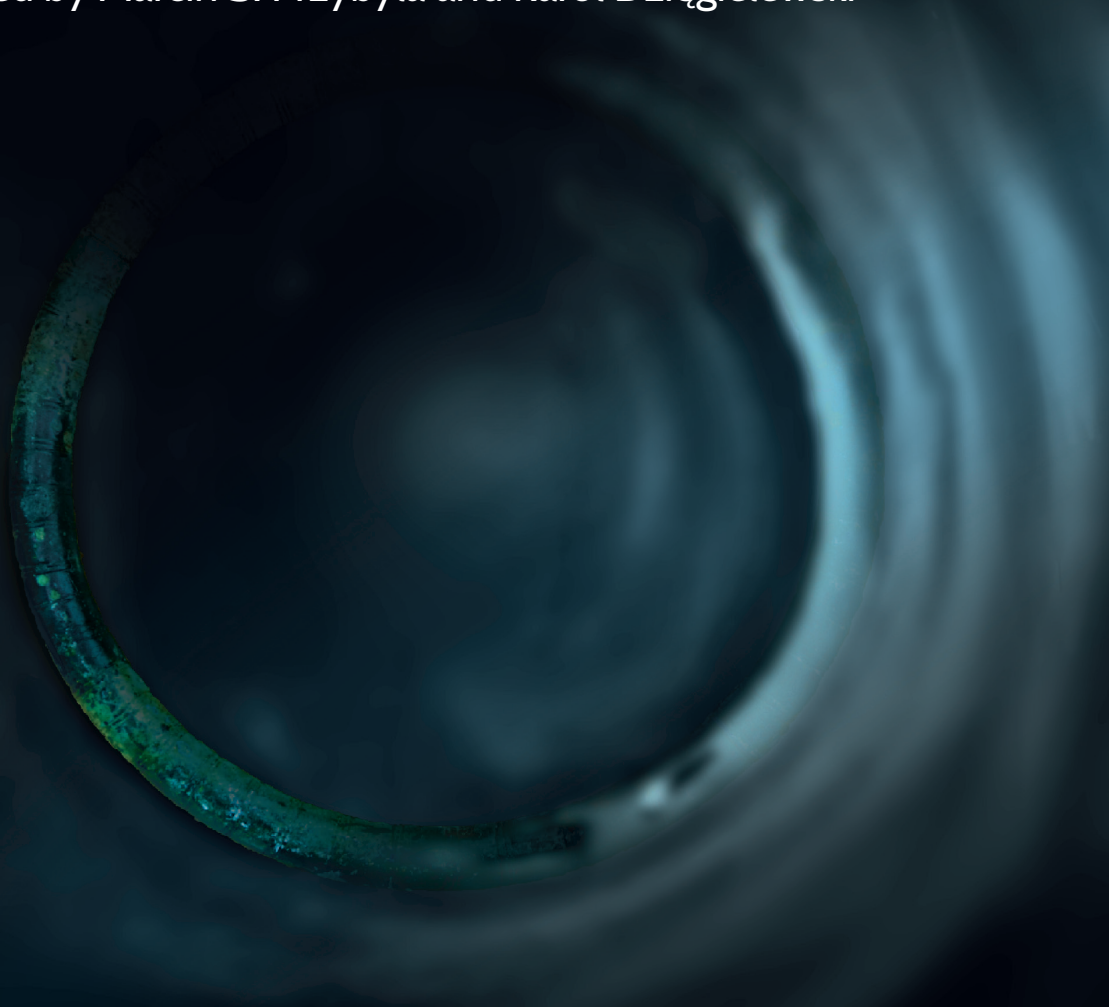


Chasing Bronze Age rainbows

Studies on hoards
and related phenomena
in prehistoric Europe
in honour of Wojciech Blajer

Edited by Marcin S. Przybyła and Karol Dziegielewski



**CHASING BRONZE AGE RAINBOWS
STUDIES ON HOARDS
AND RELATED PHENOMENA
IN PREHISTORIC EUROPE
IN HONOUR OF WOJCIECH BLAJER**

Edited by
Marcin S. Przybyła
Karol Dziegielewski

Jagiellonian University
Institute of Archaeology

Prace Archeologiczne

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**Prace Archeologiczne No. 69
Studies**

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Kraków 2019

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Professor Wojciech Blajer

WORD OF INTRODUCTION

It has long been observed that archaeology, perhaps more than other disciplines, is susceptible to changing fashions. Theoretical trends come and go, redefining our goals, and “big issues” fade in importance, giving way to newly popular questions. As a field of knowledge, archaeology since its very beginning has been developing in an unstable state of equilibrium, between ambitious projects of making it a truly and profoundly humanistic discipline or introducing a research regime typical of experimental sciences (attempts which often meet with criticism from scholars in both the humanities and natural sciences) on the one hand, and various shortcuts archaeologists have been and are still trying to exploit in order to define their place in society, feeding it with exoticism or strengthen a sense of group esteem, on the other. Despite this innate instability of goals and the fluidity of methodological principles, there has always been a group of scholars who have above all demonstrated their great respect for the sources – these stable foundations of our discipline – and their unceasing desire to strengthen and verify these foundations. Among these scholars one can certainly place the addressee of this volume – Professor Wojciech Blajer. In a biographical sketch devoted to him, tellingly entitled *Wojciech Blajer oder die Kraft der Ruhe*, Tudor Soroceanu (Tyragetia, serie nouă, vol. XIII/1, Arheologie, 2019) considers him as a representative of the “healthy core” of archaeology, somebody who guarantees consequent development of historical sciences, irrespective of the ideological disputes which often torment the discipline. Using a metaphor sometimes invoked by Professor Blajer himself – scientific research is like tediously constructing a tower from bricks, generation after generation. From this perspective, diligence is no doubt more important than the glitz which is so often promoted. However, for our generation of archaeology graduates from Kraków, Wojciech Blajer will always raise associations not only with diligence and precision (which we painfully felt when entrusting him our first texts for critical reading), but also – and maybe above all – with an enormous erudition going far beyond prehistory, even if often disclosed casually and accidentally.

Bronze Age hoards of metal artefacts have been the focus of Wojciech Blajer’s interest since the early days of his scientific career. His first encounter with the issue came as early as preparation for his master’s thesis, later published within the *Prähistorische Bronzefunde* series. He followed this by addressing the issue in a number of papers published before obtaining his PhD degree, as well as in the doctoral dissertation itself. The dissertation presented the corpus of hoards from phases BrA1-BrA2 found within the borders of present-day Poland. A continuation of this line of research was a book presenting hoards from phase HaB1, published relatively recently, in 2013. Professor Blajer’s

studies on particular categories of metal artefacts, on the inflow of bronzes to Poland, and on the chronology of hoards have become a benchmark for other researchers throughout Central Europe. Yet, the area of Blajer's interest extends far beyond purely typological-chronological discussions, and it covers the interpretation of Bronze Age hoards as well. Among other studies, these issues were addressed in his habilitation dissertation from 2001, and in a much briefer but highly inspiring paper from 1996 entitled *Prinzessinnen und Schmiede*.

Analysing Blajer's publications devoted to the phenomenon of hoarding in the Bronze and Early Iron Ages, one can precisely track the path that the archaeology of Central Europe has covered over the last 40 years with respect to the interpretation of such phenomena. The addressee of this volume contributed significantly to this development. His earliest statements (*O możliwościach wydzielenia horyzontów skarbów brązowych na obszarze Polski / Zur Aussonderungsmöglichkeit der Horizonte von Bronzedepotfunden im Raum von Polen*, 1982, with A. Szpunar) were strongly influenced (apart from very cautious suggestions concerning multiple causes of deposition of hoards, especially a votive motivation behind hoards from aquatic environments) by a Central European, dogmatic narrative associating the "horizons" of hoards with events of a political nature. This perspective was outlined in a very appealing manner by R. Bradley ten years later (*The passage of arms...*). Further works by Professor Blajer brought about a significant broadening of the interpretational spectrum, in particular with respect to hoards from the Early Iron Age (*Ze studiów nad skarbami okresu halsztackiego w Polsce / Aus den Studien zu den Depotfunden der Hallstattzeit in Polen*, 1992), the Middle Bronze Age, and the beginnings of the Late Bronze Age ("Older and Middle Bronze Ages" in the nomenclature used in the Montelius-Kostrzewski system – *Skarby ze starszej i środkowej epoki brązu na ziemiach polskich / Hortfunde der älteren und mittleren Bronzezeit auf den polnischen Gebieten*, 1999). What Wojciech Blajer emphasised in these studies was that the Polish school of interpretation of reasons behind the deposition of bronzes was not fully in line with "political-military" interpretations. Quite correctly, he pointed to a number of studies by scholars like W. Szafrński, D. Durczewski, or M. Gedl, in which the main focus was the economic reasons behind the gathering and burying of bronzes. The fundamental contribution of Professor Blajer's works lies in the fact that, while drawing inspirations from a range of traditions and ideas represented in European studies on hoards, he developed an original, multi-aspectual model of their interpretation, adjusted to the specificity of archaeological sources from the territory of Poland, where hoards of scrap metal were few, bronze artefacts were rarely deliberately damaged and fragmented, and hoards comprised of many artefacts of standard size and weight were absent (except perhaps from the Early Bronze Age). This model was later developed further in his monumental synthesis published in 2001 (*Skarby przedmiotów metalowych z epoki brązu i wczesnej epoki żelaza na ziemiach polskich / Horte der Metallgegenstände aus der Bronze- und der frühen Eisenzeit auf den polnischen Gebieten*). This approach takes into account cult motivations, as well as those of a ritual-social (prestige competition) and socio-political nature, each of them backed with proper argumentation and extensive source bases. Noticing how frequently changes in the popularity of bronze hoarding correlated with other important

cultural transformations, Professor Blajer resisted the tendency, evident from the 1990s especially in English- and German-language archaeology, towards rejecting all non-ritual interpretations. He also remained committed to analysis of hoards in their local cultural and settlement dimensions, rather than only as a broad, pan-European phenomenon. Among others, he pointed to the fact that local sets of bronze objects often overlap with traditional, cultural-historical taxonomic divisions. Such an approach placed him at the vanguard of a current arising more than decade later, that of detailed geographic-settlement studies on spatial distribution of hoards.

Furthermore, Wojciech Blajer is the author of frequently cited studies on the Middle and Late Bronze Ages in Poland, on the prehistoric settlement, and even – which at first may surprise – of several important publications concerning genealogy and the post-medieval history of Polish countryside. Despite his very wide scope of interests, metal artefacts from the Bronze and Early Iron Ages and the phenomenon of their mass deposition still remain the focus of Professor's research. These issues are addressed in nearly half (67) of his publications. Given the above, and taking into account both our qualifications as the editors of this volume and the Professor's well-known reluctance towards excessive celebration of academic achievements, we came to the conclusion that the best way to honour him would be with a specialist volume devoted precisely to hoards of metal artefacts from the Bronze and Early Iron Ages, rather than with a typical jubilee volume of texts addressing a wide range of issues. Apart from his 65th birthday in 2019, we were looking for a kind of caesura in Professor Wojciech Blajer's research path that could provide a scientific pretext for the publication of this volume. Important moments in academic careers are often later difficult to pinpoint precisely in time: the conclusion of work on an important paper rather than the time of its publication, or the beginning of fascination with a new field of research rather than the moment when a dissertation crowning this fascination sees the light of day. What remains clear is that Wojciech Blajer's philosophy of approaching archaeological sources and his research interests crystallized forty years ago, in the initial years of his research career, between his graduation in 1978 and nomination as an assistant at the Jagiellonian University in 1980. It was during these two years that he gained important experience as field researcher and came in direct contact with the theme of Urnfield-period hoards from south-eastern Poland, which he later developed throughout his career.

This collection is presented to the reader as 22 papers, in which hoards and the interpretation of the phenomenon of hoarding are analysed at different levels and from different perspectives. The volume opens with Part One: *Hoards as a multifaceted phenomenon...*, a group of studies which, referring to phenomena repetitively recorded in Bronze and Iron Age hoards or to changes in cultural picture related with hoarding, address anew the long discussed issue of the reasons behind burying deposits of metal objects. Part Two: *Hoards from regional perspectives* considers analyses of individual hoards, or their groups, performed from the perspective of archaeology of selected regions of Europe, from the Carpathian Basin to northern Poland. Part Three: *Inside a hoard...* comprises analyses of selected deposits, including those which focus on the reconstruction of the deposition process. This brings the reader back to the issue of interpretation of hoards,

addressed in the first part of the book, although this time the issue is approached from a much more holistic and particular perspective. While in parts two and three hoards are discussed in the context of the place of their discovery, in the last part (Part Four: *Beyond hoards...*) the emphasis is placed on their formal rather than regional contexts. This part is a compilation of texts on selected categories of metal objects, with a focus on their occurrence in hoards.

Our intention behind preparing this collection of texts on Bronze and Early Iron hoards along with a group of renowned specialists and dedicated friends was neither to sum up Professor Wojciech Blajer's research achievements nor to put them on a pedestal. Witnessing his current activity, we are fully confident it is much too early for that. It would make us happy if the studies and materials gathered here were to become an inspiration for him to undertake further research. Given how difficult it is to interpret the topics he has been exploring for several decades, what we wish for both him and ourselves is that he does not lose faith that – against all difficulties – it is worth chasing rainbows. Especially Bronze Age ones.

Marcin S. Przybyła, Karol Dzięgielewski

DEPOSIT OF BRONZE ORNAMENTS FROM THE EARLY IRON AGE AT SITE 7 IN LUDWINOWO, KUJAVIA (CENTRAL POLAND) AND ITS AMBIGUOUS CERAMIC CONTEXT

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hoards from settlements
bronze ornaments
necklaces
bracelets
pottery
Early Iron Age
Polish Lowland

Deposit of bronze ornaments from the Early Iron Age at site 7 in Ludwinowo, Kujavia (central Poland) and its ambiguous ceramic context. During excavations of site 7 in Ludwinowo, a hoard consisting of six bronze objects and a glass bead was found, intentionally deposited in an atypical, elongated pit (feature No. Z55). The assemblage can be counted among hoards of complete (not fragmented) items, composed solely of ornaments belonging to two or three categories (necklaces, small rings, perhaps earrings as well). The bronzes were made using two techniques: by forming from forged sheet metal (necklace No. 1) and by casting (other ornaments). The chronology of the ornaments, which belong to types quite widespread in the Polish Lowlands, decorated with groups of transverse lines (*kerbgruppenverzierte Ringe*), can be narrowed down to the Ha C2 and Ha D1 periods of the Early Iron Age. What makes the deposit from Ludwinowo of unique value is its discovery in the context of a fairly numerous series of ceramics from the same archaeological feature. The pottery corresponds to materials known from the Ha D period, although with references to both older and younger local and supra-local ceramic styles. Of particular importance are similarities to vessels typical of the so-called Lusatian-Pomeranian cultural transformation in Kuyavia and Greater Poland. Assuming these are not coincidental, the presence of well-dated metals in the same assemblage makes it a very early (Ha D1) indication of this cultural phenomenon.

skarby z osad
ozdoby brązowe
naszyjniki
bransolety
ceramika
wczesna epoka żelaza
Niż Polski

Skarb ozdób brązowych z wczesnej epoki żelaza ze stanowiska 7 w Ludwinowie na Kujawach i jego niejednoznaczny ceramiczny kontekst. Podczas badań wykopaliskowych na stanowisku 7 w Ludwinowie natrafiono na depozyt składający się z sześciu przedmiotów brązowych oraz paciorka szklanego, złożony intencjonalnie w przydennej warstwie nieotypowej, podłużnej jamy (obiekt nr Z55). Depozyt można zaliczyć do skarbów przedmiotów całych (niepofragmentowanych), złożonych wyłącznie z ozdób należących do dwóch-trzech kategorii (naszyjniki, obręcze małego formatu, ewentualnie kolczyki). Brązy zostały wykonane dwiema techni-

kami: formowania z kutej blachy (naszyjnik nr 1) oraz odlewania (pozostałe ozdoby). Datowanie ozdób, należących do dość szeroko rozprzestrzenionych na Niżu Polskim typów zdobionych grupami poprzecznych kresek (*kerbgruppenverzierte Ringe*), można ograniczyć do podokresów Ha C2 i Ha D1 wczesnej epoki żelaza. Unikatową wartością depozytu z Ludwinowa jest znalezienie go w kontekście dość licznej serii ceramiki naczyniowej pochodzącej z tego samego obiektu. Ceramika odpowiada materiałom znanym z okresu Ha D, chociaż widoczne są w niej nawiązania zarówno do starszych, jak i młodszych lokalnych oraz ponadlokalnych stylów ceramicznych. Szczególnie istotne są nawiązania do ceramiki typowej dla tzw. etapu łużycko-pomorskiej transformacji kulturowej na Kujawach i w Wielkopolsce. Jeśli uznać je za udowodnione, to dzięki obecności dobrze datowanych metali w skarbie byłby to bardzo wczesny (HaD1) wyznacznik chronologiczny tego zjawiska kulturowego zachodzącego na Niżu Polskim w trakcie omawianej epoki.

Discoveries of bronze hoards in completely controlled circumstances are still rare. It is a paradox that the number of known hoards – probably the most enigmatic category of archaeological finds, described by H.-J. Eggers (1986: 267) as *deposited as a result of positive selection, for reasons unknown* – increases mainly as a result of amateur discoveries, which, by neglecting the context, contribute little to our understanding of the “reasons”. Only a small proportion of such discoveries (and the subsequent loss of information) currently being made in Poland are accidental discoveries. The vast majority, as in other European countries, come as a result of more or less planned searches using metal detectors (see Maciejewski 2018). On the other side of the spectrum are discoveries made under “controlled conditions”. These include – unfortunately still rare – instances of co-operation, when heritage protection officers or archaeologists are notified by treasure hunters prior to the extraction of a hoard (e.g. Stój 2019). However, we reserve the term primarily for the cases when hoards are found during regular archaeological excavations. In this context, the most common situation is the discovery of metal deposits within or in the peripheries of prehistoric settlements, much less often within cemeteries or other sites. Professor Wojciech Blajer recently estimated the number of deposits of metal objects obtained in such circumstances to be fewer than 30, against more than 1,100 of all Bronze and Early Iron Age hoards known from Poland (Blajer 2001: 314–371; Blajer *et al.* 2018: 334). Among the latter he listed an unpublished find from the Ludwinowo settlement in Kujavia (Kujawy), to which this article is devoted. The high research value of this deposit – after all a standard one in terms of composition, even if quite precisely dated – arises from the presence in its immediate context (within the same archaeological feature) of a fairly numerous series of ceramic vessels originating from a period for which we have very limited opportunities to date pottery.

THE CONTEXT OF THE DEPOSIT

Site 7 in Ludwinowo, Inowrocław District, was discovered in 2000 during surveys conducted on the route of the planned A1 motorway (Fig. 1). In 2000–2001, 2008–2009, and in

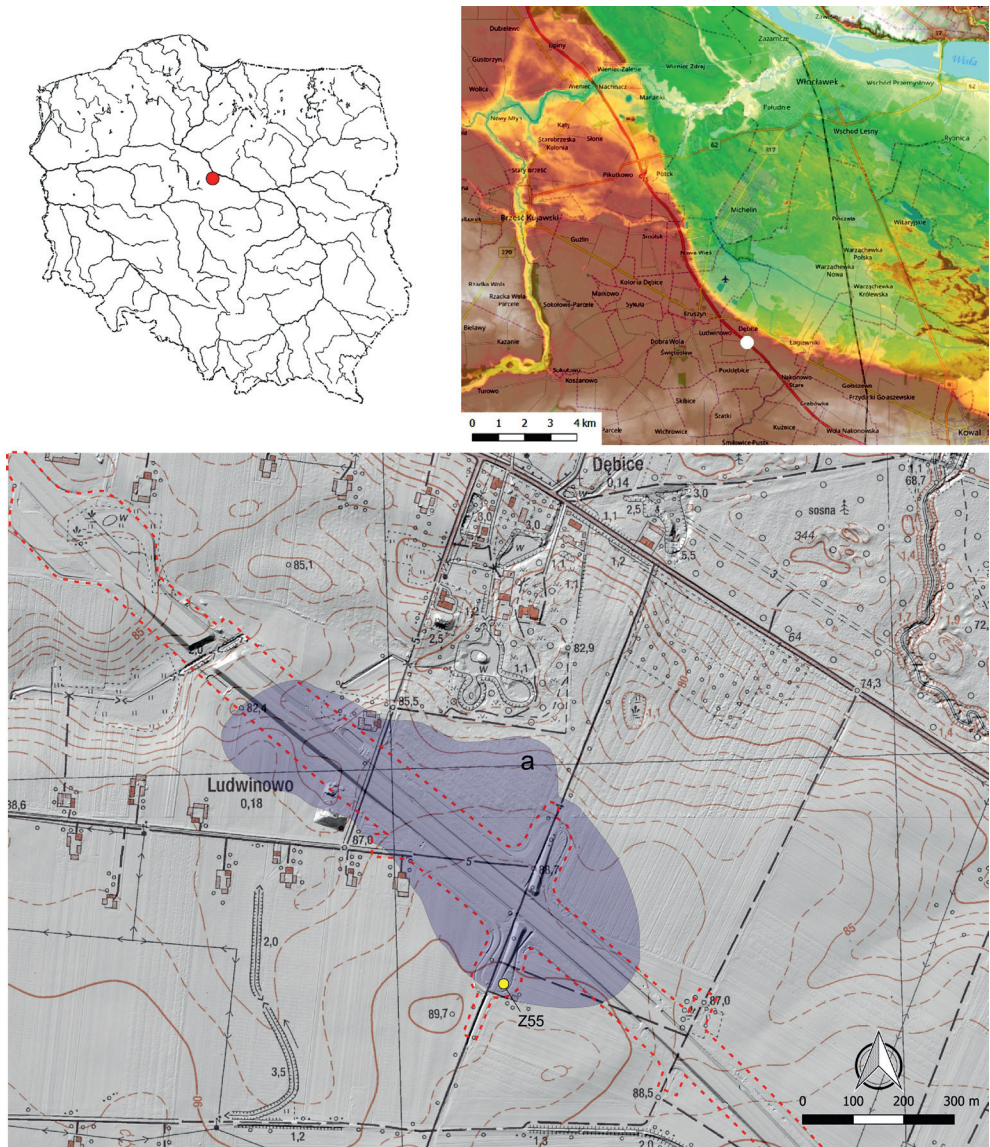


Fig. 1. Ludwinowo 7. Location of the site and its boundaries (a) recognised during rescue excavations; route of A1 motorway marked with red colour, location of hoard containing pit Z55 marked with yellow dot

2010, further research was carried out there, covering more than 1,119 ares. The research was performed by Joanna Pyzel, then from the Institute of Prehistory of the University of Adam Mickiewicz in Poznań, and later by the Archaeological Rescue Team in Poznań and a consortium created by the archaeological companies “Archeo-Explorers Wiesław Koszkuł” and “Pracownia Archeologiczna Dariusz Majewski” (for the history of research see: Pyzel ed. 2019). The hoard analysed here was discovered in 2010 in a feature explored by a team supervised by Wiesław Koszkuł and Małgorzata Koszkuł.

The site occupies a promontory within a glacial plateau sloping gently towards the Vistula valley (Fig. 1) (Koszkul, Pilarski, Cyganiewicz 2011: 1). In physiographic terms, it is located in the mesoregion of the Kujavia Lake District, which is part of the Greater Poland Lake District within the Polish Lowland (Kondracki 2001). Administratively, Ludwinowo lies within the commune and district of Włocławek in the southern part of the Kuyavian-Pomeranian Voivodeship.

Most of the finds from the site in question should be linked with an extensive settlement of the Linear Band Pottery culture (Linearbandkeramik, LBK) (Pyzel ed. 2019). Less numerous traces of Post-Linear occupation were also recorded, as well as finds from the Early Iron Age and the modern period. Relics from the Early Iron Age are mainly grouped in the southern part of the explored area, although individual features from this period were found in the northern part of the site as well.

The finds constituting the subject of this study were retrieved from the fill of feature Z55, on are Z5 in the southern part of the site (Fig. 1; for the detailed location of the feature on the site plan, see Pyzel ed. 2019, Appendix CD 1, also available as an on-line document – DOI: 10.33547/ODA-SAH.08.Lud.map). This archaeological feature has been dated on the basis of portable finds to the Early Iron Age. Nearby, more or less similarly dated features were registered: Z56, Z57, Z58 and Z59 in the south-west direction, and Z5 to the north. At the discovery level, pit Z55 had the shape of an elongated oval measuring 3.8×1 m, with the longer axis slightly inclined eastwards from the north-south line (Figs. 2:1; 3:1). In cross section, the feature had the shape of a basin with a clearly deeper central part. Below the feature was a reddish-brownish illuvial horizon. The maximum depth of the pit was 80 cm from the level of its discovery. Within the feature's fill were found the following: six bronze ring ornaments (including one divided into two fragments), one glass bead, 163 potsherds, 186 lumps of daub (burnt clay), and 26 fragments of animal bones.

In the central and upper parts of the feature's fill there was a layer of burnt earth with numerous lumps of daub (especially numerous in the eastern part). Below that layer, in the northern part of the pit, a hoard of bronze objects was found, consisting of four necklaces (including one hollow, made of sheet metal), two smaller ring ornaments (probably bracelets), as well as a single blue glass (or glassy faience) bead with a bronze wire inside. Two pairs of necklaces were stacked on top of each other, with the bracelets laid between them in a space of not more than 50×30 cm (Figs. 2:2-3; 3:II, III; 4). There were no traces of a secondary cut to suggest the metal objects were deposited after the pit had been filled. On the contrary, the destruction layers (with daub and charcoal), certainly associated with the termination of functioning of the feature as a pit and the filling of the upper part of the feature, covered the place where the hoard was deposited.

The function of this feature is difficult to determine. This is not a typical pit like many others found in Ludwinowo or other contemporary settlements. The absence of any imprints of construction elements on the daub suggests that it was not a remnant of a burnt and collapsed wall. The small number of stones and the shape of the feature argue against its interpretation as a charcoal pile. Large amounts of daub (especially in the central part, within the W.C layer) may stem from the pit being used as an oven or clay-lined hearth. However, the oblong shape, unusual for such features, does not support this interpre-



Fig. 2. Ludwinowo, site 7, Inowrocław District. 1-4 – subsequent stages of exploration of pit Z55 with the hoard of bronze ornaments. Photo W. Koszkuł

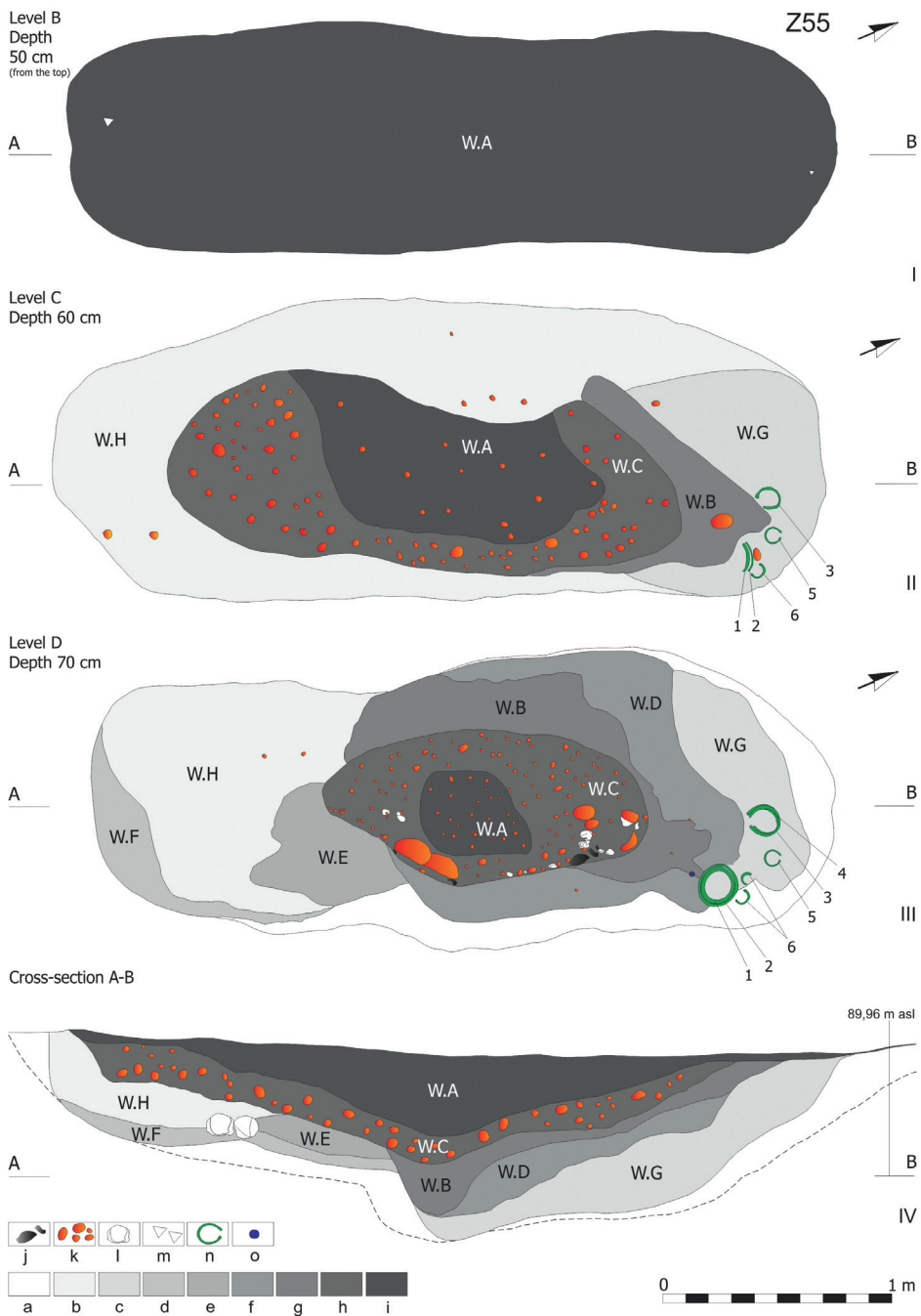


Fig. 3. Ludwinowo, site 7, Inowrocław District. I-III – plans of the pit Z55, IV – cross-section of the pit Z55. Key to colours and symbols: a – yellow silt; b (W.H) – brown/yellow sandy silt; c (W.G) – yellow sandy silt with chalk; d (W.F) – dark-brown sandy silt; e (W.E) – yellow/pale-brown sandy silt; f (W.D) – dark-yellow/yellow-grey sandy silt; g (W.B) – grey/dark-yellow/yellow sandy silt; h (W.C) – brown sandy silt with daub; i (W.A) – pale-grey/brown sandy silt; j – charcoals, k – daub; l – stones; m – pottery shards; n – bronzes; o – glass bead. Drawing by A. Zyzman



Fig. 4. Ludwinowo, site 7, Inowrocław District. The "eastern set" of the hoard *in situ*. Photo W. Koszkuł

tation. In addition, it should be noted that daub was absent from the bottom part of the feature, which means it originated from an aboveground part (dome?) rather than from a lining of a kind. It might even originate from some other structure located nearby, unrelated to the pit (e.g. a furnace), whose remains might have been simply poured into the pit to level the area. There is also a possibility that feature Z55 first served as a pit, and then, when it got partly filled back, a sunken hearth or furnace was located within it. In any case, the deposition of the hoard should be linked with the stage of functioning rather than filling of the feature.

PORTABLE FINDS FROM FEATURE Z55

Pottery

In addition to the hoard of bronze ornaments (see below), 163 pottery shards were found within feature Z55 (especially in its ceiling part), originating from a maximum of 107 vessels. Most of them came from thick-walled kitchen pottery: vases or pots, and bowls, accompanied by a single fragment of a so-called clay plate (Fig. 6:12). The surfaces of the vessels were usually smooth in the upper part, and sometimes slightly coarsened in the lower part. A fragment with traces of sweeping with a brush was also recorded (Fig. 5:10).

S-shaped pots, sometimes also called vase-like or biconical pots, had rims slightly bent outward, vertical, or slightly bent inwards. The transition from the neck to the belly was often marked by a slight indentation. Two specimens were decorated in this place with short, diagonal lines, in one case additionally with pairs of prominent, flat knobs (Figs. 5:4; 6:1). Some of the S-shaped pots were more squatty, without a separate neck part, often with thickened rims (Figs. 5:6; 6:3, 9). The feature probably also contained plain barrel-shaped pots, sometimes with the neck and rim part slightly separated (Figs. 5:3, 5; 6:3, 6, 8, 10, 11). One of the stumpy pots had a plastic ornament in the form of a ho-

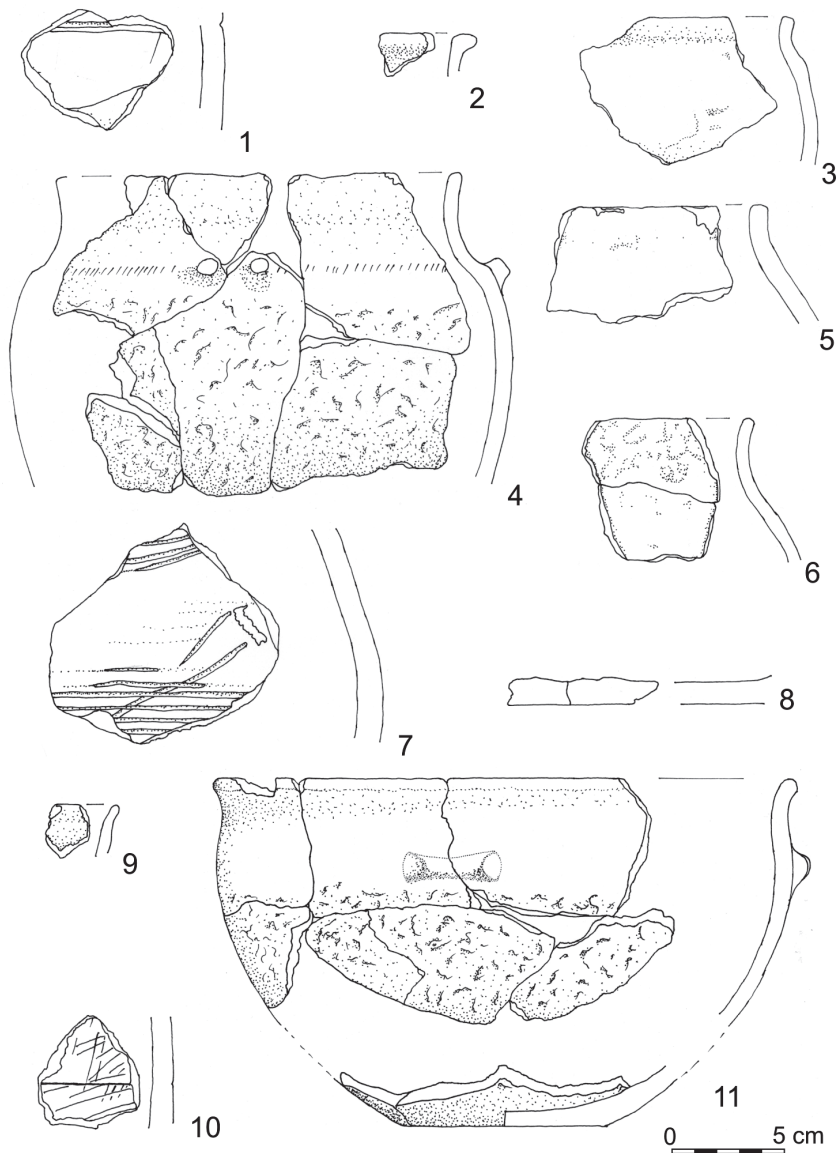


Fig. 5. Ludwinowo, site 7, Inowrocław district. Feature Z55 – selection of pottery forms. Drawing by A. Zyzman

horizontal rib (pseudo-handle) with saddle-like bent central part (Fig. 6:3). A similar ornamentation was recorded on another vessel: a large, deep profiled bowl (Fig. 5:11) found in the ceiling part of the feature.

Fragments of undetermined thick-walled vessels decorated with horizontal or vertical engraved lines (Figs. 5:1, 7; 6:2) were also recorded. Thin-walled vessels were definitely less well-represented, with forms difficult to specify (Figs. 5:2, 9; 6:4, 13).

Daub and bones

186 lumps of daub were found in the fill of feature Z55. Brick-red in colour, they contained gravel and traces of organic admixture in the form of chaff. In addition to creating some kind of internal skeleton, this type of organic admixture allows for obtaining so-called closed porosity (during the firing, and therefore only in the case of some production facilities), increasing the thermal insulation properties of the material (Mogielnicka-Urban 1984: 140). Due to the difficulty in identifying specific tools that could have been used to prepare the straw chop (or hay – the admixture was usually quite fine and did not allow for such a distinction), it can be assumed that dung or turf from which the soil had previously been removed was used as the admixture (Kunicka-Zyzman, Zyzman 2012: 243–244). In this case, the preparation of ingredients was not laborious.

Animal bone fragments (26) were also found within the feature. Of these, the species was identified in 23 cases: 19 bones belonged to cattle (minimum number of individuals: one), three were pig bones (minimum number of individuals: one) and one was that of a horse (Ablamowicz 2011).

Hoard's contents

Unlike ceramic finds scattered throughout the entire fill of feature Z55 (although mainly in the upper parts), the arrangement of the metal objects and glass (or glassy faience) bead leaves no doubt as to them being a separate set meeting the definition of a hoard (cf. Blajer 2001: 16). The deposit consisted of six ring ornaments preserved in whole or in fragments (with a total weight of 629 g) and the single bead with a fragment of bronze wire in the canal – probably part of an earring or necklace:

1. Necklace No. 1 is a hollow ring, open but with a fastening, made of bronze sheet 0.65 mm thick rolled into a tube 1.15–1.25 cm in diameter and bent into a circular hoop having an internal diameter of 14.1–14.3 cm and an external diameter of 16.4–16.7 cm (Figs. 8; 15; 16). The longitudinal edges of the sheet adhere closely to each other from the inside of the ring (Fig. 15:4). The fastening has the form of a narrowed end, marked by a fault (Fig. 16:1, 5). The diameter of the narrowed end is 1.05 cm, and its preserved length is about 0.8 cm. Originally it had to be at least 1.4 cm long, as evidenced by the presence of rivet holes at the other end. Circular rivet heads (diameter 0.3 cm) are still embedded in the holes, from the bottom and top sides (Figs. 8; 15:2–4, 16:1–2). The rivets (it is not known if they survived completely, or the heads are their only relics) passed through the holes made in the narrowed end. At the time of discovery, the ends of the necklace were not inserted one into another, but they slightly diverged (Fig. 15:2–3).¹ The object is decorated on its 'upper' side with transverse engraved lines appearing in groups of three (exceptionally two), separated by empty areas about 0.5 to 1.0 cm wide. Individual lines within the groups were executed separately,

¹ This situation has been "mended" (!) during conservation or museum activities and now the ends of the ring are inserted one into another again (Fig. 15:1).

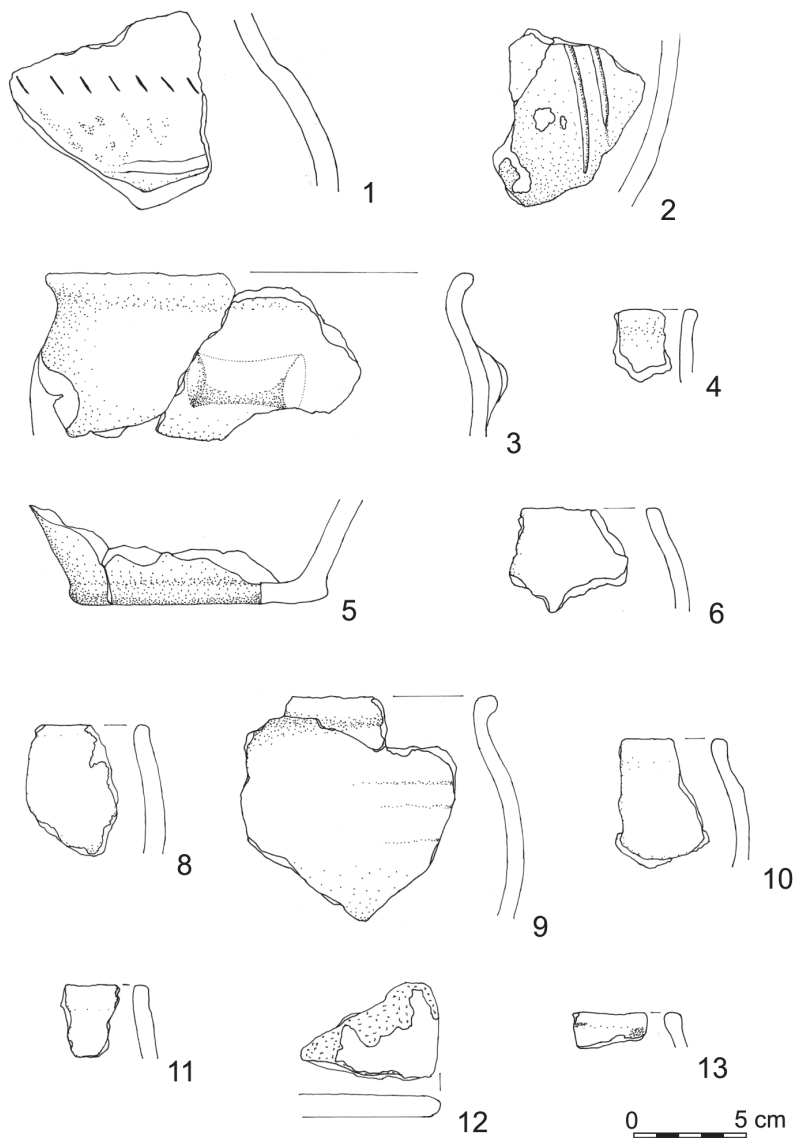


Fig. 6. Ludwinowo, site 7, Inowrocław District. Feature Z55 – selection of pottery forms. Drawing by A. Zyzman

after the sheet was rolled (Fig. 16:4, 6). The condition of the decorated surface is quite good (local corrosion sockets, places of wear). Weight: 159 g. Inventory number: LU7/380/10 (7) (Regional Museum in Syców).

2. Necklace No. 2 is made of a bronze bar 0.6–0.75 cm in diameter bent into a circular, open ring of 19.0×19.2 cm (Figs. 9; 17). The ends of the ornament taper slightly, and one of them is cut flat (Figs. 9; 17:1). The distance between the ends is currently 2.5 cm. The object is decorated on its 'upper' side with groups of three transverse

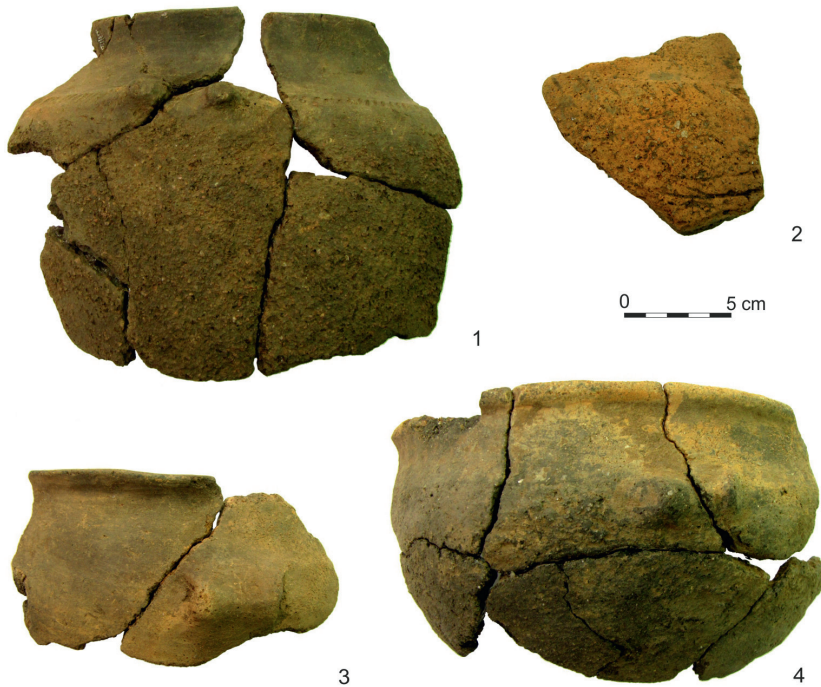


Fig. 7. Ludwinowo, site 7, Inowrocław District. Feature Z55: selected pottery forms. Photo A. Zyzman

- engraved lines separated by empty areas about 0.5 cm wide, probably executed already at the wax model (Fig. 17:2). The condition of the surface is poor, corrosion and surface defects making observation difficult. Weight: 175 g. Inv. No.: LU7/380/10 (8).
3. Necklace No. 3 is made of a bronze bar 0.6–0.7 cm in diameter bent into an elliptical open ring of 15.5×16.2 cm (Figs. 10; 18). The ends are ‘stamp-like’, one of them slightly narrowing (Fig. 18:1, 3). The distance between the ends is currently 2.6 cm. The object is decorated on its ‘upper’ side with transverse, quite deep grooves, appearing in groups of two, with empty spaces between the groups divided in two (each about 0.2–0.3 cm wide) by a fairly prominent rib; the decoration was executed at the stage of the wax model (Fig. 18:2, 4). As the sequences of grooves and ribs are each about 0.3 cm wide, they create the impression of a rhythmic, quite dense, plastic ornamentation. The condition of the decorated surface is good. Weight: 107 g. Inv. No.: LU7/117/10 (2).
 4. Necklace No. 4 is made of a bronze bar 0.45–0.55 cm in diameter bent into an elliptical open ring of 16.1–16.5×17.5 cm (Figs. 11; 19). The ends of the ornament narrow slightly; one of them is straight and the other has a ‘step-like’ cut (Fig. 19:1). The distance between the ends is currently 1.9 cm. The necklace’s ‘upper’ side is decorated with transverse, densely spaced grooves, executed at the wax model (Fig. 19:3–5). The condition of the surface is quite good (local corrosion and surface defects). Weight: 85 g. Inv. No.: LU7/117/10 (1).
 5. Ring ornament (bracelet or arm-ring) No. 5 is made of a bronze bar 0.5–0.6 cm in diameter bent into an elliptical open ring measuring 9.5×10.3 cm (Figs. 12:1; 20:1–3). One

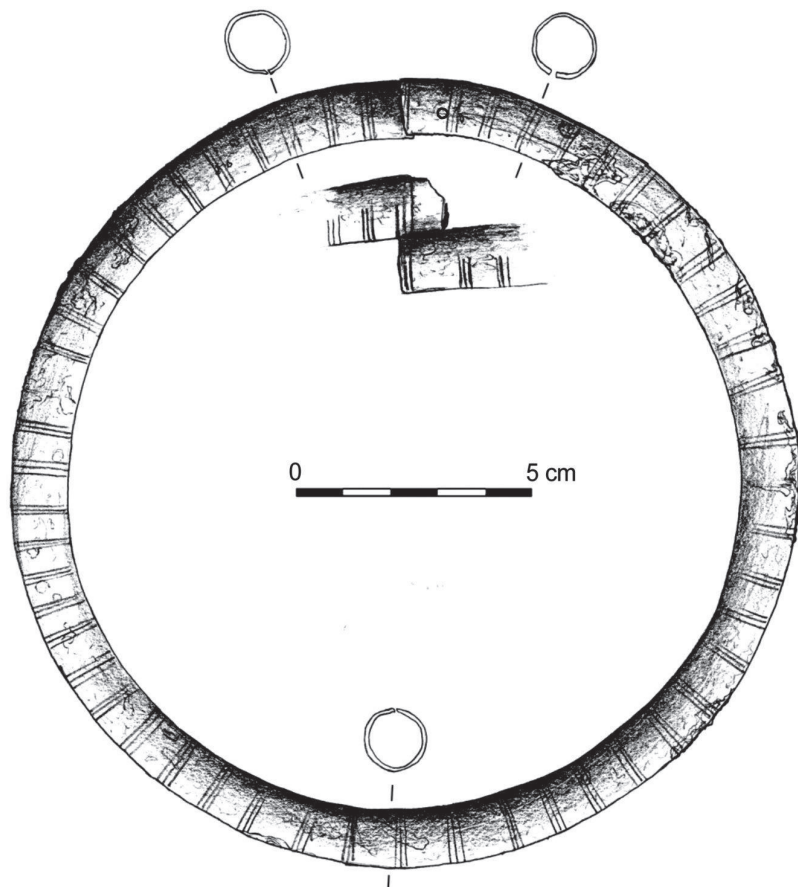


Fig. 8. Ludwinowo, site 7, Inowrocław district. Feature Z55: Necklace No. 1. Drawing by I. Jurkiewicz

end of the ornament narrows slightly and the other is cut flat. The distance between the ends is currently 1.4 cm, and the bending of the ring means that they are on different planes (1.5 cm apart). The object is decorated on its 'upper' side with transverse engraved lines, appearing in groups of three, separated by empty fields about 0.5–0.6 cm wide, made at the wax model (Fig. 20:2–3). The condition of the decorated surface is quite poor (wear, corrosion, surface defects). Weight: 49 g. Inv. No.: LU7/380/10 (6).

6. Ring ornament (bracelet or arm-ring) No. 6 is made of a bronze bar 0.6–0.65 cm in diameter bent into an elliptical open ring of 8.5×9.5 cm (Figs. 12:2; 20:4–6). The ornament survived in two fragments (it had been broken before its deposition; perhaps the bracelet was originally bent just like specimen No. 5 but the bar broke at some point. It is less likely that the two fragments come from two different specimens). Both ends narrow slightly and the reconstructed distance between them is about 3 cm. The object is decorated on its 'upper' side with transverse engraved lines, appearing in groups of three, separated by empty fields about 0.7–0.9 cm wide, made at the stage of the wax model (Fig. 20:5–6). The condition of the decorated surface

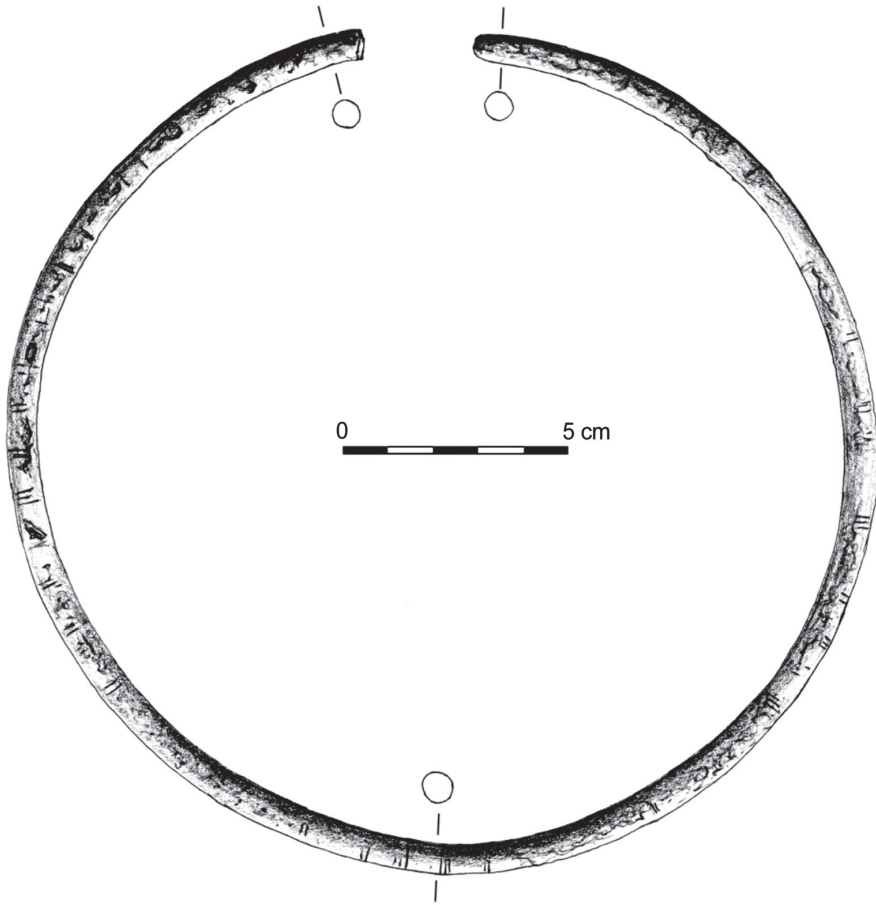


Fig. 9. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 2. Drawing by I. Jurkiewicz

is quite poor (wear, corrosion, surface defects). Weight: 54 g (33 g + 21 g). Inv. No.: LU7/380/10 (3 – larger fragment; 4 – smaller fragment).

7. A dark blue glass or glassy faience bead with a fragment of bronze wire stuck obliquely in the canal (Fig. 13). The specimen belongs to the type of unadorned beads with a single body in the shape of a truncated sphere (almost spherical), of medium size (approx. 1 cm in diameter and approx. 0.9 cm high). Typologically, it represents the I.I.V or I.II. II subgroups according to T. Purowski (2012: 58, 66, fig. 13). The artefact has been lost.

ARRANGEMENT AND TREATMENT OF THE ORNAMENTS

The Ludwinowo deposit counts among hoards of complete (non-fragmented) items, comprised only of ornaments belonging to two or three categories (necklaces, small rings, perhaps also earrings). These items were certainly not buried in a ceramic conta-

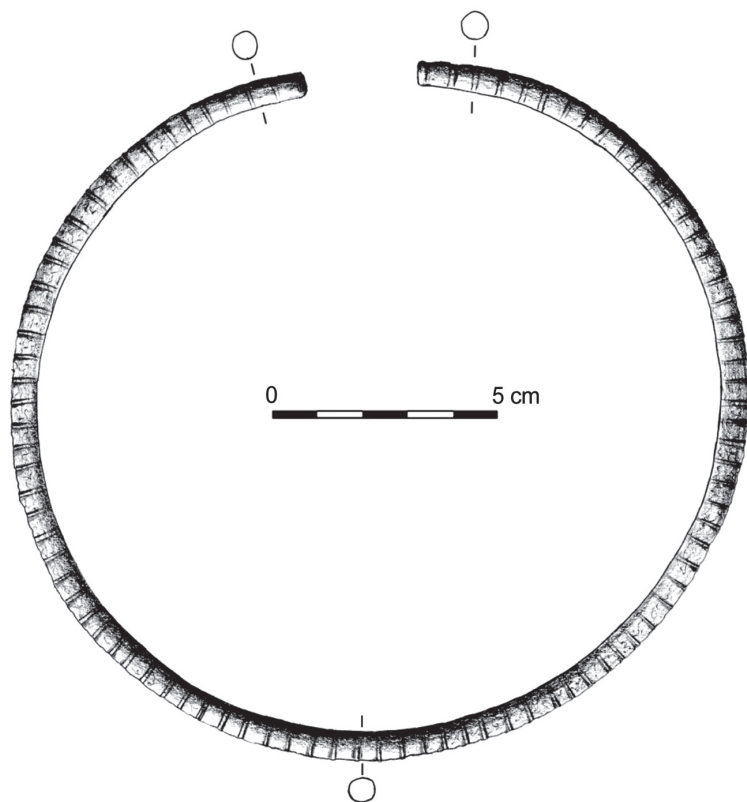


Fig. 10. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 3. Drawing by I. Jurkiewicz

iner (despite the fact that many fragments of vessels were found in the feature's fill; see above). One cannot rule out another kind of container, e.g. an organic one, although this seems little likely given the arrangement of the items in the pit.

All the rings were found lying roughly horizontally in pit Z55, at a slight angle, consistent with the inclination of the W.G layer. The necklaces lay in two pairs. The first pair, closer to the eastern edge of the pit, consisted of necklace No. 1 (hollow, made of sheet metal) arranged inside necklace No. 2 (the largest in the set) (Figs. 3:II, III; 4). Right next to them, to the N and E, were two fragments of small ring No. 6 (the smaller part, as the only one in the set, did not lie flat, but was placed vertically) (Fig. 4). About 10 cm further to the south bead No. 7 was found (Figs. 3:III; 4). About 20 cm to the NW from the first pair of necklaces, closer to the northern wall and the longitudinal axis of the pit, necklaces Nos. 3 and 4 (of similar size) were found lying on top of each other (Fig. 3:II–III). Between the two pairs of necklaces and slightly to the NE of them was bracelet No. 5 (Fig. 3:III). The open parts (or fastenings) of the necklaces did not point in the same direction, and therefore their arrangement was probably not intended to imitate their position on the human body. The same is suggested by the 'non-anatomical' arrangement of the bracelets.

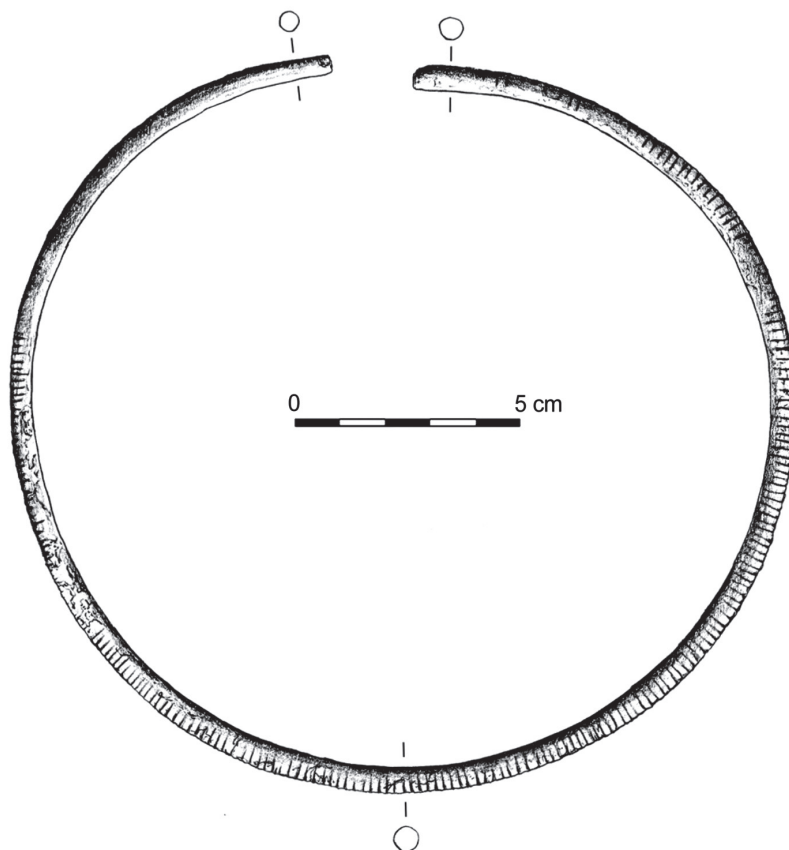


Fig. 11. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 4. Drawing by I. Jurkiewicz

All the bronzes were found within a space of 50×30 cm. It seems that the original arrangement of the ornaments was not significantly changed during the post-deposition history of pit Z55. This is indicated by the fact that the deposit was located directly below the ceiling part (Figs. 2; 3) which – as it seems – filled back at a fairly fast pace. It is worth noting that even though the upper layers of the fill contained a lot of charcoal and daub indicative of a fire directly above or near the pit, the bronzes and the bead do not show traces of secondary exposure to high temperature, suggesting they had been partially covered with sediment by the time the upper fill formed.

The lack of clear traces of fragmentation does not mean that the bronzes were buried in the ground intact: one small ring (No. 5) had the ends bent away from the common plane by almost 2 cm (Fig. 12:1), and the other small ring – perhaps subjected to a similar treatment – was broken in two (No. 6; Fig. 12:2). Analogical deformation was recorded at the time of the discovery of necklace No. 1 (see footnote 1). In other necklaces the ends deviate only slightly from the common plane (up to 0.5 cm), which may stem from their normal use.

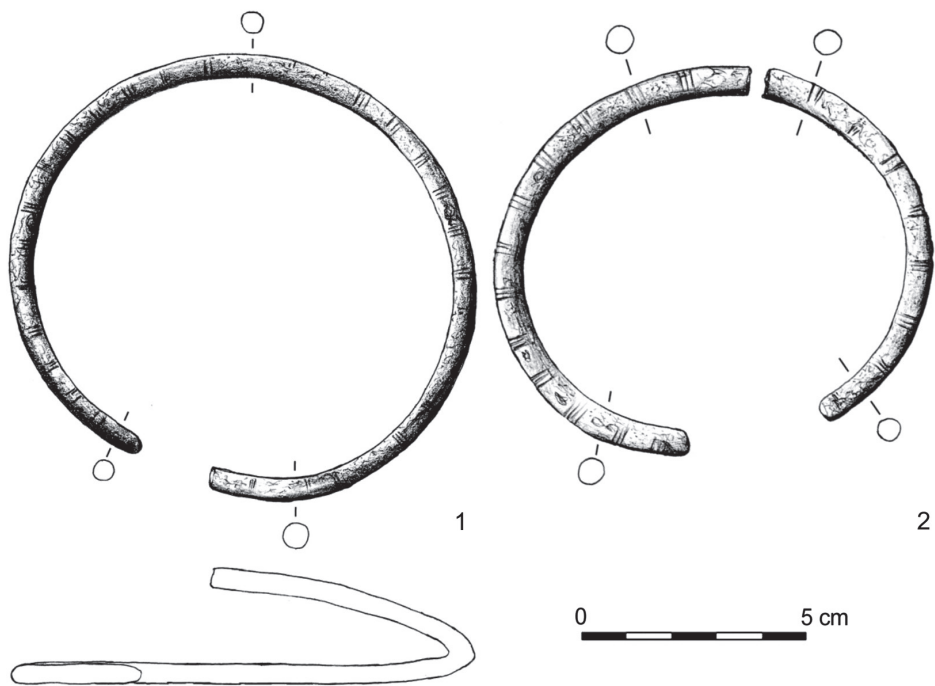


Fig. 12. Ludwinowo, site 7, Inowrocław District. Feature Z55: Bracelets/armrings Nos. 5 and 6. Drawing by I. Jurkiewicz

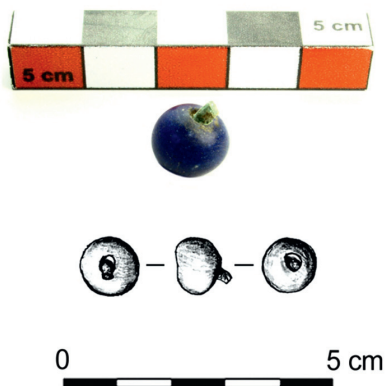


Fig. 13. Ludwinowo, site 7, Inowrocław District. Feature Z55: Glass (or glassy faience) bead No. 7. Drawing I. Jurkiewicz and photo by B. Pilarski

TYPOLOGICAL AND CHRONOLOGICAL ANALYSIS OF THE HOARD

Necklace No. 1 (Figs. 8; 15) belongs to hollow, open necklaces with fastenings in the form of inserted ends, described as type Woskowice Małe.² At the time of its discovery the

² Unless indicated otherwise, this and subsequent typological terms come from a yet unpublished system of typology and chronology of Late Bronze Age and Early Iron Age ornaments from the northern part of the Polish Lowland developed by Karol Dzięgielewski (forthcoming).

necklace was bent back, with the ends slightly overlapping and touching each other (Figs. 8; 15:2, 3). Ornaments of this type were made from rectangular sheets of forged metal which were wound on an elongated round-sectioned core, and after the removal of the core were bent into a ring and closed in such a way that one end was inserted into the other. Most of them were decorated (in our case with groups of transverse lines) either prior to or after the bending (as in the case of Ludwinowo). Three such necklaces were found in the eponymous, rich deposit I from Woskowice Małe in the Namysłów District, Silesia (Gedl 2001, pl. 57:1-2), and the hoard from Odolanów, Ostrów District, Greater Poland, consisted solely of two such necklaces (Durczewski 1961: 43-44, fig. 35). In the first of these deposits, two richer decorated specimens were accompanied by a formally identical necklace decorated only with grooving, as was the specimen from Ludwinowo. A similar situation was noted in Złotów, Złotów District, Pomerania (Conwentz 1901: 33-34), where a necklace decorated with identical grooves was accompanied in a hoard by two other ornaments of the same class – a hollow necklace made of sheet metal, of the Malbork-Wielbark type, and a cast hollow ring of the Kluczbork type. Of particular importance for determining the chronology of necklaces of the Woskowice Małe type is hoard I from Woskowice, as it consists almost exclusively of imported items being inter-regional chronological indicators. The latter include a horse harness set of the Sesto Calende type, which allows hoard I to be placed in a narrow section within subphase Ha C2 or in the beginnings of Ha D (cf. Torbrügge 1995: 518; Trachsel 2004: 426).

The most numerous group of ornaments in the hoard from Ludwinowo is made up of three open necklaces of the Bronczyn-Pomarzanki type, made of solid bars 0.55 to 0.7 cm thick and decorated with transverse grooves on the outside of the perimeter (Figs. 9-11). They differ slightly among themselves in diameter and decoration. The hoard contained a specimen covered with dense grooving (No. 4, Fig. 11), as well as rings with grooves in groups of two to three lines, separated by undecorated spaces (Nos. 2-3, Figs. 9-10). The ends of the necklaces were slightly thinned and rounded or cut flat. Necklaces of the Bronczyn-Pomarzanki type can be included into a wide group of ornaments known as *kerbgruppenverzierte Ringe* (Derrix 2001: 105-111; for the chronology of this group of ornaments, in particular of smaller items referred to as *kleinformartige kerbgruppenverzierte Ringe*, see below). In contrast to small items, rings of the size of necklaces were rarely found in the well-dated contexts (one example of such a chronologically poorly defined set is the hoard from Jaroszewo, Żnin District, Greater Poland – Durczewski 1961: 26-27, fig. 19). Nevertheless, single specimens have occurred in hoards (e.g. in Waławów, Konin District, Greater Poland; Durczewski 1961: 64-65, fig. 62) whose inventories allow for a typological “connection” with chronologically better embedded contexts. The results of seriation recently carried out for the majority of Late Bronze and Early Iron Age hoards from the northern part of the Polish Lowlands (Dzięgielewski, forthcoming) point to Ha C2 as the most likely time of production and circulation of Bronczyn-Pomarzanki necklaces.

Two smaller ornaments from feature Z55, decorated in a similar way to the necklaces described above, can be included in the *kleinformartige kerbgruppenverzierte Ringe* group (Derrix 2001: 105-111, 218-219, fig. 58). With diameters of 8.5-10 cm, their likely role was to

adorn forearms. They are open rings with flat or slightly rounded ends (Figs. 12; 20). Both in Poland (where first iron specimens also appeared – see Dzięgielewski, forthcoming) and in the wider European context (e.g. at the cemetery in Hallstatt), rings decorated with groups of lines occurred with particular intensity in graves and hoards in the stages of Ha C2 – Ha D1 (see Derriks 2001: 107–110).

It is quite difficult to determine the original function of the blue glass (or glassy faience) bead, preserved with a fragment of a bronze wire stuck inside the canal (Fig. 13). At first glance, it resembles a fragment of an earring. Earrings made of bronze wire, including those with glass beads, are known primarily from grave materials associated with the ‘classic’ phase of the Pomeranian culture (the Karczemki phase), both as accessories for the deceased and/or as earrings in the ears of face urns (cf. Andrzejowska 1981; Dzięgielewski 2017, fig. 2; Purowski 2019: 209–211, pl. XXIII–XXIV). In the light of the chronology of metal objects from the Ludwinowo hoard (HaC2 or HaD1), the bead’s connection with the Pomeranian culture can be regarded as probable to some extent (if we accept a relatively early chronology of the burial complexes of this culture south of the Noteć River). The problem is that earrings have thus far never been recorded in hoard inventories (neither in those attributed to the Pomeranian nor to the Lusatian culture): such interpretation would make the discussed specimen an absolute exception. Although this would speak in favour of a quasi-sepulchral association of the hoard (see the discussion further in this text), it seems worthy considering yet another functional interpretation of this artefact: as a fragment of a necklace composed of beads strung on a bronze wire, another type of ornaments known from graves and settlements of the Lusatian culture (cf. Griesa 1999, pl. 60; Purowski 2012: 418, fig. 97, pl. 5:14, 37A, 57:301).

TECHNOLOGICAL ANALYSIS OF THE BRONZES

The set of metal objects was examined in 2019 using an optical microscope, and the chemical composition of the alloys was analysed with X-ray fluorescence spectroscopy with energy dispersion. The analyses were carried out in the Laboratory of the Faculty of Foundry Engineering of AGH University of Science and Technology in Kraków. The tested surfaces, which had been covered with a stabilizing substance (wax) in the course of previous maintenance, were only cleaned with acetone. In the areas of planned examination, the layers of wax and patina were removed. The wax layer, which lay over the green patina, and in some places also over the corrosion, to some extent obstructed the observation (especially by blurring possible wear traces) and documentation (this is evident in the presented photographs – Figs. 16–20).

The bronzes were made by two techniques – forming from forged sheet metal (necklace No. 1) and casting of rods (other ornaments). The hollow necklace 1 was probably made in the following steps (Fig. 14): 1) preparing a strip of forged, flexible, unadorned sheet metal with dimensions of about 3.75×53.5 cm (one cannot exclude that the sheet was wider and was cut only on the form – see step 4); 2) forming a step/fault at one end of the sheet by bending its last 1.5 cm (to make the narrower part of the fastening); 3)

piercing holes for a rivet at both ends of the sheet (remark: this could also be done after step 9); 4) winding the sheet up on a cylindrical matrix (from wood or other raw material); 5) removing the matrix to obtain a tube with a diameter of about 1.2 cm, 6) filling the tube with loose material (e.g. sand) to stiffen it in order to avoid fracturing when bending; 7) bending the tube into a ring (remark: this could also be done using a matrix, e.g. a tree trunk with a diameter of approx. 14 cm); 8) spilling the stiffening material out through the inner slit and the ends; 9) inserting the ends one into another and pressing the internal slit to close it; 10) fitting the closing rivet. The application of engraved ornamentation consisting of groups of transverse lines took place probably after step 4, as evidenced by the fact that the engraved lines sometimes extended to the opposite edge of the sheet (Figs. 15:4; 16:4, 6), but it cannot be ruled out that this was done only after stage 7.

Bars used for making necklaces Nos. 2-4 were probably cast in disposable clay moulds using the lost-wax technique. They were next cut to proper length and formed into rings. No traces of gating systems (sprues) survived on the bronzes themselves, but this technique can be inferred from the characteristics of the plastic decorations: the edges of the ribs are gently rounded and do not show traces of engraving tools (Figs. 17:2; 18:2, 4-5; 19:3-5), so they must have been designed in a wax model and cast. In this respect, only bracelets Nos. 5 and 6 stand out, on which the edges of the transverse grooves are clearly sharper (Fig. 20:2-6). However, it cannot be excluded that they were cast as well, and that the sharper edges stem from rougher ornamentation on the wax model.

Due to the lack of invasive testing of the structures of the alloys, it is difficult to say whether the casts were subjected to further blacksmith processing, either hot or cold. In some specimens, however, the bars from which they were made bear slight traces of

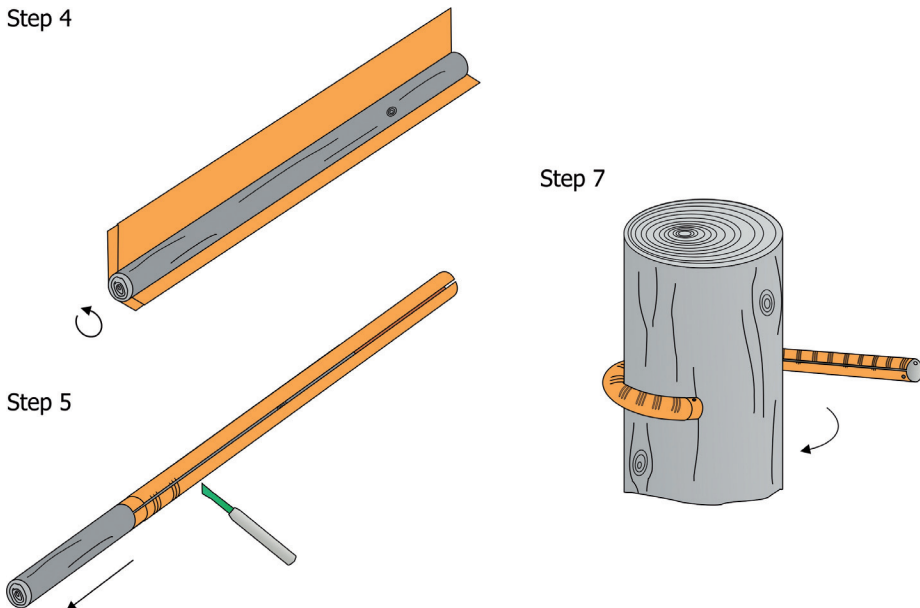


Fig. 14. Selected steps in manufacturing hollow necklaces from forged sheet metal. Drawing by K. Dziegielewski

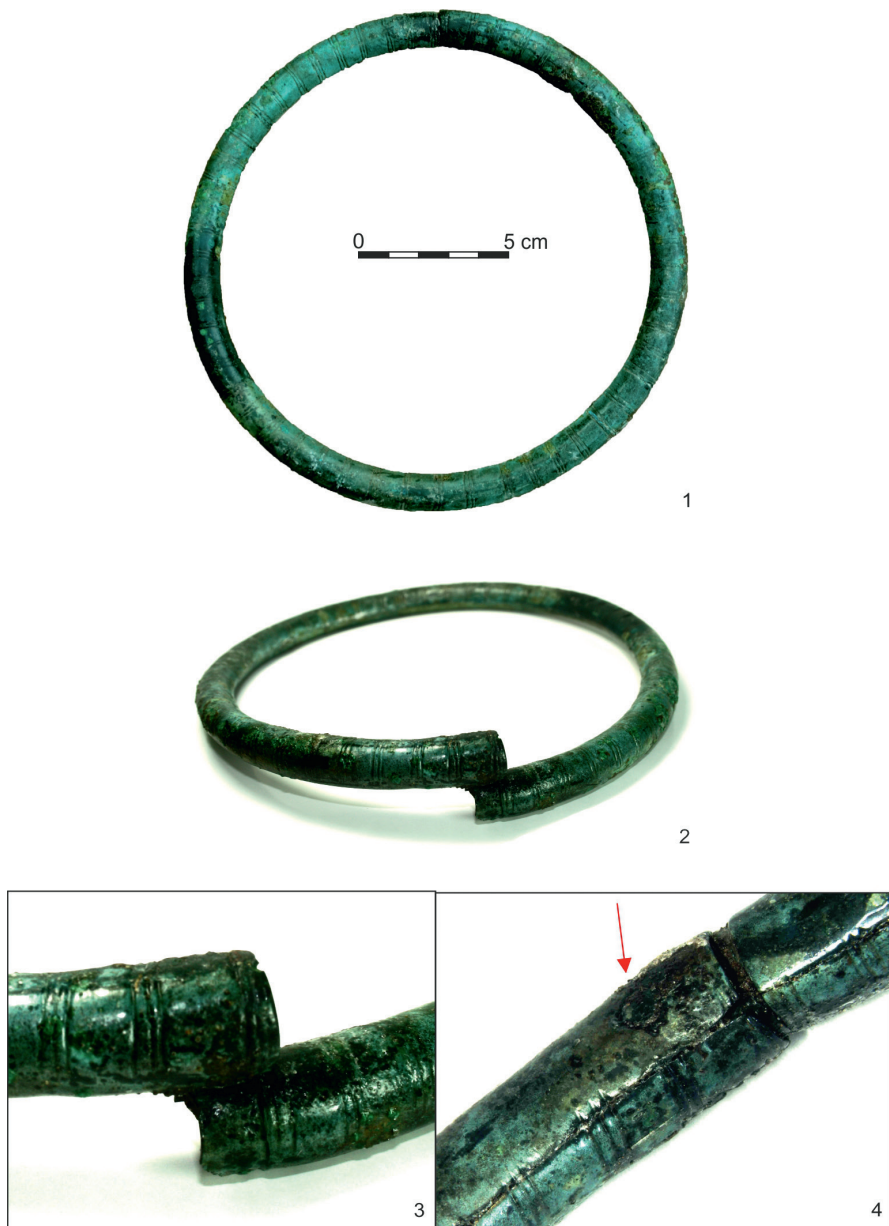


Fig. 15. Ludwinowo, site 7, Inowrocław district. Feature Z55: Necklace No. 1. Photo B. Pilarski, K. Dziegielewski

re-forging, probably on a profile (bracelet No. 5, inner side, at one end; necklace No. 4, bottom side, at one end – Fig. 19:2). The absence of similar traces within the ornamented zones may indicate that these specimens were not significantly elaborated (forged) after casting, of course if we assume that in the case of necklaces Nos. 2, 3 and 4 the ornamentations were created prior to the casting.

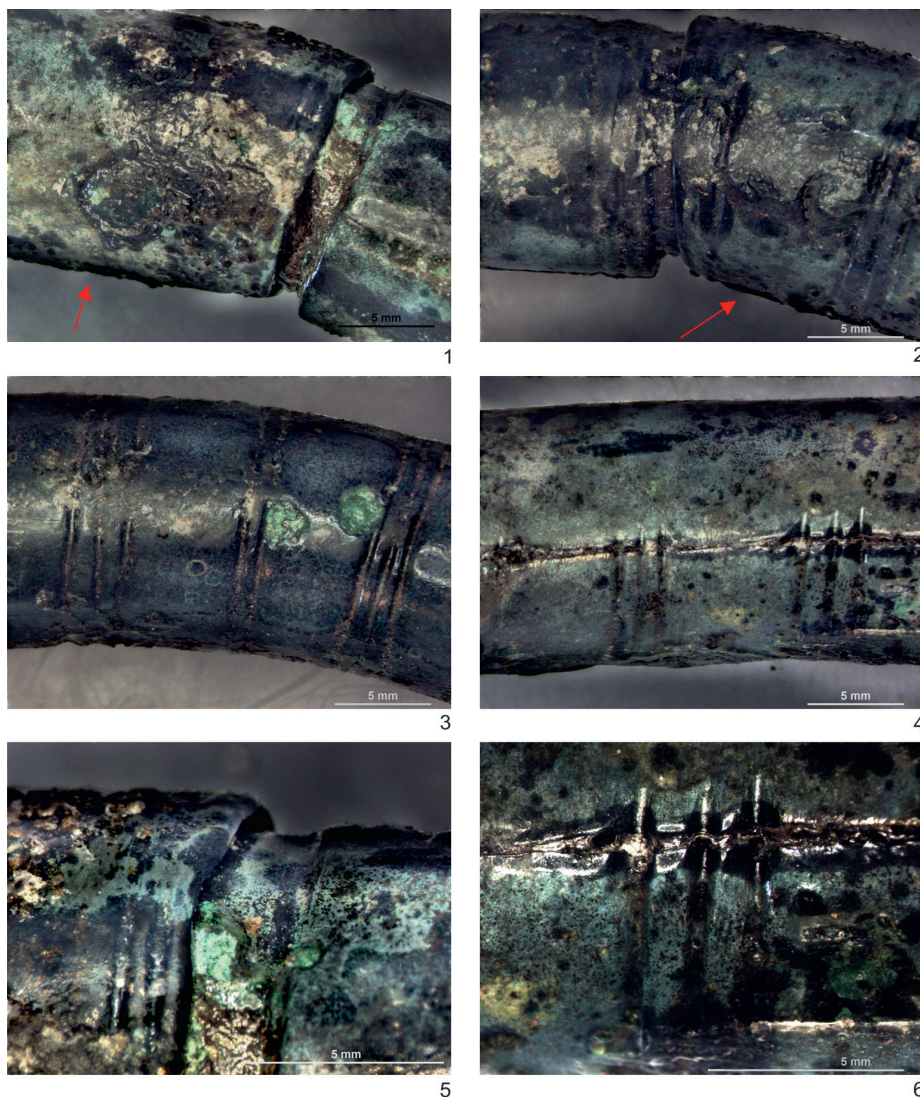


Fig. 16. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 1. Rivets' heads are marked by red arrows. Microphotographs A. Garbacz-Klempka, K. Dziegielewski

Regardless of the technique, tin-lead bronze was used as the material in each case (Table 1). It was used both for an ingot forged into the sheet metal from which necklace No. 1 was created, and as raw material for cast ornaments. However, the bronzes differed from each other in proportions of tin and lead, which were in the ranges of 6.5–12% (tin) and 1.6–9% (lead). In each case, there were also characteristic elements directly derived from ores, which were not removed by the metallurgical process to which copper ore was subjected but remained in the alloy. These include, among others: arsenic, antimony, zinc, nickel and silver. Only in necklace No. 1 was the antimony absent.



Fig. 17. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 2. Microphotographs A. Garbacz-Klempka, K. Dziegielewski

Tin-lead bronzes containing alloy additives in amounts close to those recorded in the analysed specimens are characterized by specific properties, which qualify these alloys as a material suitable for casting and plastic working. Apart from the aesthetic value, the possibilities of producing copper alloy castings are primarily determined by such properties as castability and ability to fill the mould cavity, which allows for accurate reproduction of the model's surface. The alloy in the mould undergoes a process of crystallization, resulting in the creation of a specific microstructure, which, along with the alloy's composition, significantly affects the mechanical properties of the product. Tin-lead bronzes show plastic properties at both low and higher temperatures. This means that a casting can be shaped by forging and other plastic working processes. Plastic shaping allows for a permanent change of the shape and dimensions of the workpiece, but also for the recon-

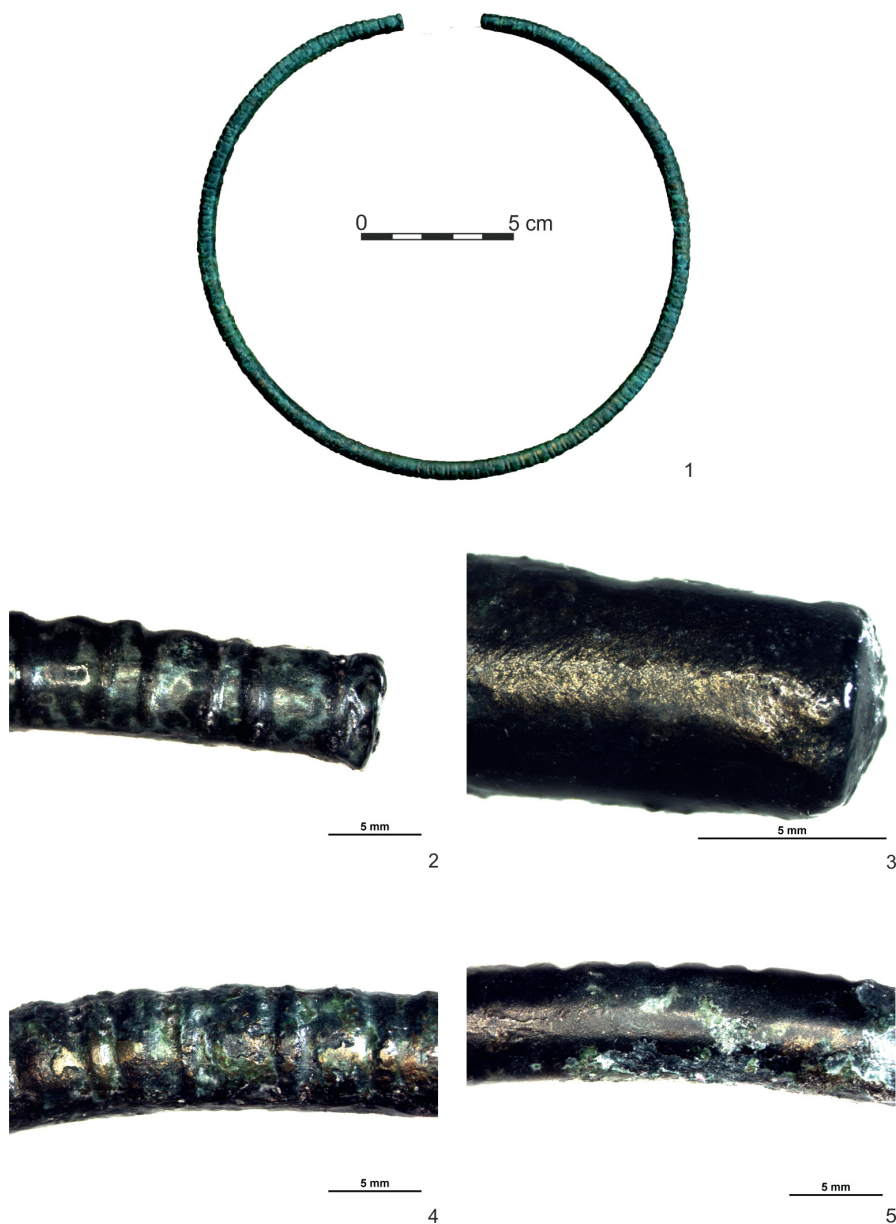


Fig. 18. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 3. Microphotographs A. Garbacz-Klempka, K. Dziegielewski

struction of its structure, which affects the usable properties. Therefore, these properties depend not only on the type of the processed material, but also on the technological conditions of the conducted process and on the thermo-plastic treatments applied during and immediately after the shaping process. In the case of the ornaments under



Fig. 19. Ludwinowo, site 7, Inowrocław District. Feature Z55: Necklace No. 4. Microphotographs A. Garbacz-Klempka, K. Dziegielewski

discussion, in addition to changing the shape, the hardness of the processed metal increased as well. Due to the specific shape and dimensions of the artefacts, and the limited options regarding surface preparation, the microhardness tests were carried out using a microhardness tester. This method makes it possible to determine the microhardness of objects with minimal interference in the analysed artefact, in the form of an imprint

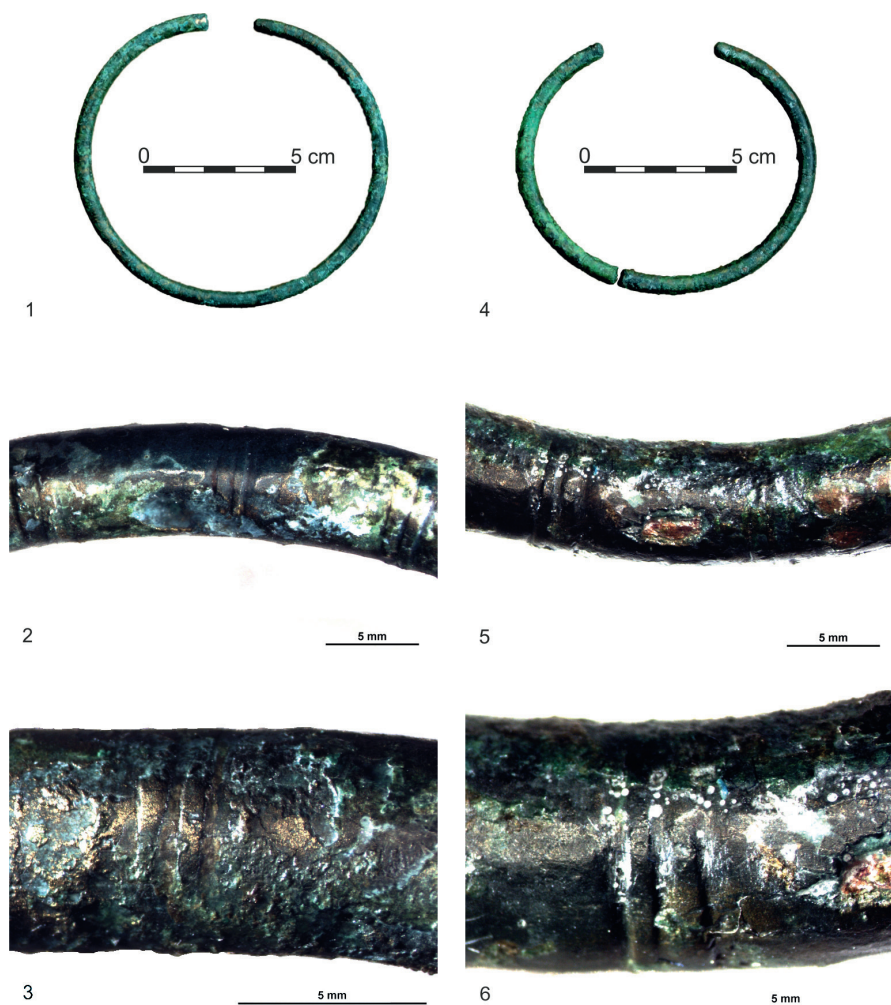


Fig. 20. Ludwinowo, site 7, Inowrocław District. Feature Z55: Bracelets/armrings Nos. 5 (1-3) and 6 (4-6). Microphotographs A. Garbacz-Klempka, K. Dziegielewski

with dimensions of about 0.02 mm, invisible to the naked eye. Microhardness tests were carried out in places previously prepared for chemical composition analysis (Fig. 21). The measurement was carried out by the Vickers (HV) method (indenting tool in the form of a rectangular, quadrangular diamond pyramid with a diagonal angle $\alpha = 136^\circ$) under a load of 0.2452 N (25 g) for 15 seconds. The obtained chemical composition results and the microhardness results obtained for two objects, necklace No. 1 (284 μ HV) and necklace No. 2 (222 μ HV) (Fig. 21), confirm that these objects were made by plastic forming and casting, respectively. The chemical composition of the analysed objects (Table 1) seems to have a limited impact on the results of microhardness examination. With an increase in tin content in the alloy, the hardness should increase slightly, while in the analysed cases

Table 1. Results of the ED XRF analyses of the alloy of the Ludwinowo hoard. Data present mean values of five measurements (wt %)

	Fe	Co	Ni	Cu	Zn	As	Ag	Sn	Sb	Pb	Bi
Necklace no. 1 Lu_7-380-10 (7)	<0,025	0,07	0,11	85,36	0,13	0,16	0,02	10,65	<0,051	3,17	0,04
Necklace no. 2 Lu_7-380-10 (8)	0,31	0,08	0,16	89,21	0,21	0,32	0,11	6,49	0,16	2,60	0,15
Necklace no. 3 Lu_7-117-10 (2)	0,30	0,10	0,17	87,31	0,26	0,34	0,08	7,89	0,08	3,26	0,21
Necklace no. 4 Lu_7-117-10 (1)	<0,025	0,09	0,35	86,72	0,14	0,71	0,26	9,66	0,40	1,57	0,10
Bracelet no. 5 Lu_7-380-10 (6)	0,12	0,09	0,10	75,22	1,06	0,27	0,59	12,85	0,04	8,95	0,51
Bracelet no. 6 Lu_7-117-10 (3)	0,33	0,11	0,13	82,63	0,33	0,77	0,11	9,52	0,13	5,55	0,38
Bracelet no. 6 Lu_7-117-10 (4)	0,35	0,11	0,14	81,11	0,26	0,66	0,11	9,48	0,09	7,31	0,39

the microhardness is almost 30% higher for the bronze with a higher tin content (tin content in necklace No. 1: 10.65% Sn, 284 μHV ; in necklace No. 2: 6.49% Sn, 222 μHV). This confirms that the material of the necklace No. 1 was strengthened, not only with regards to the effect of increased tin content, but also through mechanical deformation (forging).

CERAMIC CONTEXT

The unique value of the Ludwinowo deposit lies in the possibility of placing it in the context of a numerous series of ceramic vessels recovered from the same archaeological context (feature Z55). Establishing a direct relationship between metal objects and local stylistic series of pottery is usually possible to only a very limited extent in hoards: it concerns either individual vessels in which metals were deposited (Vachta 2016: 77–80; Baron *et al.* 2019), or larger series whose direct relationship with metals is, however, only implied (e.g. they come from neighbouring features; see Dzięgielewski *et al.* 2019). In Ludwinowo, the stratigraphic relation of the ceramics from the pit and the metals is at least promising: the bronzes were found in the ceiling part of the W.G layer, which itself formed the bottom fill of the pit (Figs. 2; 3). This means that the bronzes were probably deposited towards the end of the period when the pit functioned as a sunken structure, rather than after the final filling of the structure. Most of the characteristic ceramic forms were found within layers W.B, W.C, W.D, and W.E, which were also formed prior the formation of the youngest (ceiling) part of the fill, i.e. the W.A layer (Fig. 3). The W.C layer, containing remains of clay plaster (daub) and almost certainly associated with the termination of primary function of the pit, directly covered the layers with ceramics (W.B, W.D, W.E). It seems unlikely that the metals were deposited at an-

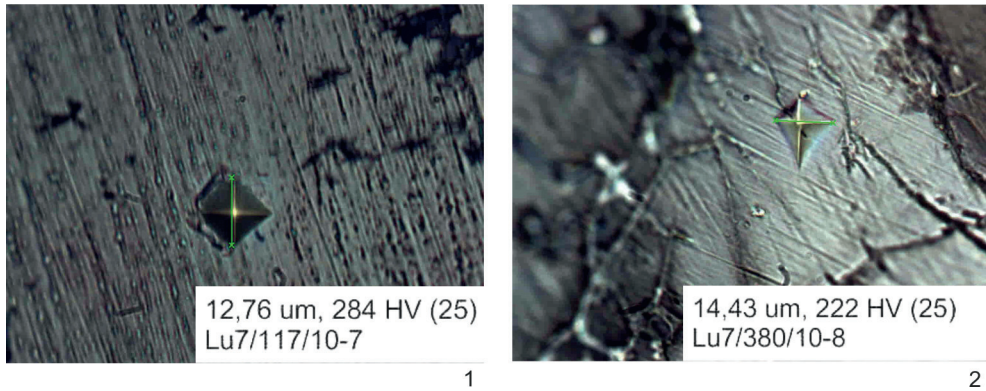


Fig. 21. Microstructure of the alloy of necklaces Nos 1 (1) and 2 (2) in places of microhardness tests. Microphotograph J. Kozana

other stage within the systemic, depositional, or post-depositional history of this feature, e.g. at the beginning, the pit was dug out after (then they would be on its bottom), or at the end after the formation of the fill (then traces of a secondary cut intersecting the upper layers should be visible). This makes it highly likely that the hoard was deposited more or less contemporarily with the deposition (whether deliberately or not) of the ceramics; therefore both categories of finds have to be considered contemporary in the sense of a deposition moment.

Such an optimistic conclusion, however, does not facilitate the interpretation of the discussed situation for a different reason, namely the state of recognition and dating of local ceramic series from the Early Iron Age. In the broadly understood region of Kujawy, Pałuki, eastern Greater Poland and the western part of the Chełmno land, two series of settlement pottery from the time spectrum of our interest are particularly well documented and recognizable: the older one (attributed to the Lusatian culture) originating from fortified settlements of the Biskupin type (e.g. Malinowski 1958; Durczewski 1985; Szamałek 1987; Mikłaszewska-Balcer 1991; Harding *et al.* 2004), which can be broadly linked with the close of Ha B but above all with the Ha C period, and the younger series, associated with the Pomeranian culture (e.g. Kola 1969; Głogowski *et al.* 2004: 331-332; Szamałek 2006: 47, 58-59, figs. 14-15; Marchelak 2017) and referring to the younger parts of the Ha D period and the older pre-Roman period. This younger series is also sometimes associated with the so-called “post-Lusatian-Pomeranian stage” in the development of the Early Iron Age communities in the Polish Lowlands (Dzięgielewski 2015, fig. 17; 2016: 27-28). Scattered traces of occupation from this period were recorded at Ludwinowo site 7 as well (Kirschke, Narożna-Szamałek 2011: 313; Koszkuł *et al.* 2011: 110-166). However, in the discussed part of the Polish Lowlands the pottery from the period between these two better recognized horizons (“styles”) has not as yet been thoroughly analysed. This applies to the fairly wide period of time between the end of Ha C and the beginning of the early La Tène period, i.e. from the mid-7th to the beginning of the 5th century BC. Pottery from that time was probably more heterogeneous (regionally diversified and/or continuing some older traditions).

The lack of a synthetic study does not mean that there are no data available on the style of vessels from Ha D in the broadly understood region of Kujawy. K. Szamałek (2006: 58) places this pottery within his stage I of the “Lusatian-Pomeranian cultural transformation” and defines it as “still fitting in the canon of the late Lusatian style” but already containing some new “Pomeranian” features.³ Examples of such syncretic style are provided, among others, by Kuyavian settlements in Bożejewice, sites 15/20 and 28, Sławsko Wielkie, site 12, Rożniaty, site 2, Łąkocin, site 1, or the cemetery in Karczyn, site 32 (Głogowski *et al.* 2004: 319–320; Szamałek 2006: 47). However, some of the forms associated with this phase in these sites have analogies in fortified settlements of the Biskupin type, and may therefore be slightly older (although one has to be aware that some of these settlements may continue in Ha D – see Dzięgielewski 2017). Other forms reveal traits considered typical for the younger stage (the “late Lusatian-Pomeranian”). Dating of the discussed group of ceramic materials (apart from a few radiocarbon age determinations, which, however, due to the problem of the Hallstatt plateau remain of little use when testing such a narrow time spectrum – see Głogowski *et al.* 2004, fig. 47, table 34) is therefore largely based on an intuitive assessment of the proportions of ‘older’ and ‘younger’ stylistic elements. Paradoxically, this approach seems to have produced correct results, which is suggested by the fact that these materials rationally fill the aforementioned gap in the development of local, better defined ceramic styles.

Stylistic elements typical of what Szamałek calls “stage II, Pomeranian-Cloche culture phase” (“post-Lusatian-Pomeranian stage” according to Dzięgielewski) are not clearly evident in the ceramic material from feature Z55, although such materials, as mentioned, have been found in small numbers in other features on the site (Koszkul *et al.* 2011, pl. XVII:2, Kirschke, Narożna-Szamałek 2011: 313, figs. 18:11, 21:3, 26:2,6, 27:4). In pit Z55, the only element linkable with this younger “Pomeranian” style are spherical vessels with a smooth neck, separated from the roughened belly by a horizontal band of incisions (Fig. 6:1), and in one case with two prominent knobs as well (Fig. 5:4). Such an association may be additionally suggested by the presence of a pronounced fault at the border of the neck and belly (Fig. 7:1). An almost identically decorated specimen (although slightly less spherical and not coarsened on the belly) is known from a Pomeranian culture grave in Sońnica, Pleszew District (Łuka 1958: 163, fig. XIII:16). However, even in this case, the decorative elements, i.e. a band of oblique incisions and pairs of prominent knobs, do not quite correspond to typical ‘markers’ of late Pomeranian ceramics, in which plastic knobs are usually flatter and the decoration is applied on a plastic cordon rather than directly on the vessel’s wall. Similar forms with decorated transition between the neck and belly can be found in assemblages much earlier than the beginnings of the pre-Roman period, for example in those related to the horizon of fortified settlements (e.g. Malinowski 1958, fig. 33:3.8; Durczewski 1985, pl. 13; Harding *et al.* 2004, pl. 7:5,13, 8:15, 14:4 – unfortunately, information about their exact context is usually difficult to find in the cited reports), those from the late phase of Lusatian

³ In K. Szamałek’s (2006: 58) approach, the younger ceramic style described above – corresponding to the “post-Lusatian-Pomeranian stage” in Dzięgielewski 2016 – is referred to as “stage II, i.e. the Pomeranian-Cloche Graves culture phase”.

culture in the Chełmno region (Chudziakowa 1968, pl. XXVI:72/1, XXVII:78/1; 1992, pl. 1:EIII), and even in such a distant context as the early Hallstatt period cemetery at Domasław in Silesia (Gediga, Józefowska 2018b, pl. 441:N7).

The described decoration of spherical vessels finds equally convincing analogies among Early Iron Age assemblages of settlement pottery from Pomerania, with examples including the inventory of a pit from site 12 in Koszalin (Skrzypek 1982, fig. 5), with a general profile of ceramic vessels very similar to Ludwinowo; the assemblage from Łosino, site 15, Słupsk District (Piotrowska 2013, pl. 77:7); and the inventory of pit 130 in Łukocin, site 19, Tczew District (Ostasz 2007: 145, figs. 45-48). In the same group of sites, one may indicate counterparts for other stylistic traits recorded in Ludwinowo, such as decorating the bellies with hatching, or thickening the rims of pots (Figs. 5:7, 10; 6:9; cf. Skrzypek 1982, figs. 4:c, 5:a; Ostasz 2007, fig. 48). Horizontal ribs resembling 'saddle-like' handles but with no holes were noted in pit Z55 on a large bowl (Fig. 5:11) and an S-shaped pot (Fig. 6:3). They are not common motifs in Pomeranian ceramics (see, however, Ostoja-Zagórski 1993, pl. I-II; Gałęzowska 2003, fig. 4:5; Stępnik *et al.* 2009, fig. 10:9; and also materials from a multi-urn grave in nearby Ludwinowo, site 3: Marchelak 2017, pl. 152:1, including the 'arched' version: Marchelak 2017, pls. 150:2,7, 151:2, 15). On the other hand, such ribs were a popular decorative element on various forms of Lusatian culture vessels (mainly bowls) of the early Hallstatt period (e.g. Harding *et al.* 2004, pl. 15:25, 18:4, 13; Przybyła 2007: 75, pls. I:4, 7, V:5, VI:7, XI:5, XVI:2, XXV:5, 6 [here only pierced specimens]).

The cited analogies do not therefore help to unequivocally assess the chronology and cultural attribution of the discussed series of ceramics from Ludwinowo. However, they seem to allow two hypotheses to be made in this respect: 1) the chronology of stylistic traits falls within the younger phase of the Hallstatt period – Ha D (although the close of Ha C cannot be ruled out due to a number of references to ceramic assemblages typical of the “fortified Biskupin type settlements” stage); 2) despite fairly precise analogies in the Pomeranian culture materials from Pomerania (e.g. Koszalin, site 12) and Wielkopolska (Sośnica), the stylistic traits alone do not allow for unambiguously proving the ‘Pomeranian’ connotations of the analysed ceramic series and thus improving the chronology of the onset of the “Lusatian-Pomeranian cultural transformation” in the Greater Poland-Kuyavian Lowland. If, however, one was to accept the relationship of the whole series with the ‘Pomeranian’ style (irrespective of socio-cultural mechanisms behind this phenomenon; see Szmałek 2009: 164-165; Dziegielewski 2010; 2016: 31), it would be a surprisingly early chronology (Ha D1) compared to what has so far been proposed in the literature (Malinowski 1989, map 27; Kaczmarek 2005: 162-165, 175; Szmałek 2006: 58; Woźniak 2010: 46-47, map 1). Recently, there are more and more grounds to suggest such an early appearance of classic elements of the “Pomeranian cultural package” in the areas south of the Noteć River (e.g. a new, updated chronology of multi-part breastplates – Dziegielewski, *forthcoming*; cf. Krzysiak *et al.* 2017: 264). However, detailed argumentation for such a view would exceed the scope of this study. Besides, it might prove to be unfounded after a comprehensive publication of the context of Early Iron Age pottery from Ludwinowo.

DISCUSSION

As demonstrated in the above analysis, all items constituting the hoard and the ceramic materials accompanying them in pit Z55 must have been deposited at the end of Ha C at the earliest, and most likely at the beginning of the Ha D phase. The metal ornaments themselves, which are the most accurate indicators of the assemblage's chronology, seem to place this moment within the Ha D1 subphase. Despite the processes of archaeological record formation in settlement sites being open and potentially long-lasting, there are serious reasons to assume that the fill of the discussed pit formed over a fairly short period. The slight formal distinctiveness of the pottery accompanying the metals does not allow it to be undoubtedly associated with the phase of the "Lusatian-Pomeranian cultural transformation", although this seems to be suggested by some Pomeranian analogies. If this suggestion is indeed correct, this would be the first case in which this stylistic and cultural phenomenon can be precisely (and at the same time quite early) dated in settlement materials from the northern part of the Polish Lowlands. However, before a full publication of materials representing the Lusatian-Pomeranian cultural cycle in site 7 in Ludwinowo it is difficult to draw definite conclusions in this respect, or to speak conclusively about the nature of feature Z55 and its chronological and functional relationship to other traces of Early Iron Age occupation recorded within the site. In particular, data on the distribution of materials from particular phases of Lusatian-Pomeranian occupation identifiable in the site (including from the phase of functioning of pit Z55) require re-evaluation. The chronology of this feature seems older than that of some other features in the immediate vicinity, e.g. feature Z59 (cf. Koszkuł *et al.* 2011, pl. 27:2 – pit with a clay plate with a "braided" rim).

Given the specific shape of pit Z55, which resembles an inhumation grave in plan, it is worth discussing at this stage the hypothesis about the possible interpretation of the hoard as a literal 'substitute sacrifice' for grave gifts (cf. Hundt 1955; Blajer 2001: 23), and by implication regarding the pit as a symbolic grave (no human bones were found in the feature). In this regard, it may be helpful to compare the deposit with typical burial inventories of that period. Due to the presence of large bronzes, such as necklaces, adequate references can be found only in richly furnished early Hallstatt period cemeteries, among which Gorszewice in northern Greater Poland (Pieczyński 1954), Kietrz in Upper Silesia (Gedl 1973) and Domasław near Wrocław (Gediga, Józefowska 2018a; 2018b; 2018c) are worthy of particular note. Grave inventories from these necropolises testify that necklaces were most often worn as a single piece (often together with a pair of stylistically similar bracelets), and in rare cases – in twos. Sets of three necklaces are absolute exceptions. The same is confirmed by smaller or less investigated cemeteries like Szadek (Szczyrek, Pudelko 2015) or Chojno-Golejewko (Woźniak 1959) in Greater Poland. R. Heynowski came to similar conclusions when analysing the dress patterns of the Hallstatt period population in the Mittelgebirge region in Germany (1992: 151–166). The same is true for *Wendelringe* necklaces in central and northern Europe (Heynowski 2000: 51). The analysis of sets of necklaces worn jointly with spectacle brooches (*Spiralbrillenfibeln*) in central Europe, which are more or less contemporary to the discussed assemblage, also indicates they appeared singly (in graves) or in pairs (sometimes more than one pair), and occasionally in threes (in hoards)

(Pabst-Dörrer 2000, table 1). The above data justify the statement that the arrangement of the necklaces found in Ludwinowo probably was meant to reflect two sets, possibly belonging to two women (cf. Bradley 1990: 111). One of those sets (consisting of ornaments Nos. 1 and 2) also included a pair of bracelets/armrings (Fig. 4). Relationship of the alleged earring with a glass bead (Figs. 4; 13) to one of these combinations is ambiguous. However, whether the arrangement itself was to imitate a grave – and a double one – seems doubtful. The significant number of large bronzes, unusual for burials from that time in the Polish Lowlands and possibly explainable only in a double burial, as well as the arrangement of bronzes by the northeast wall of the pit, do not support the burial hypothesis. Inhumation graves from the Late Bronze Age and the Early Iron Age in the Lusatian culture were oriented along the N-S axis, with the head of the deceased turned most often to the south. During the Hallstatt period, however, single cemeteries appeared in Upper Silesia where the deceased was laid with the head to the north (Szydłowska 1974: 156–157). Such cases have not yet been reported in Kuyavia, from where dozens of inhumation graves are known, with the deceased oriented always to the south (Szamalek 2009: 137). Therefore, in order to accept the hypothesis about the hoard being symbolic burial furnishings, one would need to make a number of preliminary assumptions concerning the atypical nature of this burial, including a rare burial rite (inhumation), a rare (and locally unknown) orientation of the body/bodies, the pit's width adjusted to one instead of two bodies (the latter suggested by the number of sets of ornaments), excessive length of the pit, and finally the non-anatomical arrangement of the rings. It seems that these circumstances, as well as the irregular outline of the pit in longitudinal section (Figs. 2:4; 3:IV), disqualify the above interpretation, at least at the level of a literal reference to the form of the grave.

This does not disprove a more general observation regarding the relationship between hoards and graves, namely that the former – as a form of sacrificial removal of some precious items from use – are more frequently recorded in territories and periods marked by the absence of richly furnished graves (cf. Bradley 1990: 102–103). We certainly observe such a situation (absence of lavishly furnished graves) in the Hallstatt period in Kuyavia (and throughout Poland except for Silesia and southern Greater Poland; cf. Blajer 2001; Dziegielewska *et al.* 2020). Symbolic deposition of two sets of female ornaments (instead of one, like in a common grave), would allow for – to use the words of Richard Bradley (1990: 111) – *more extravagant consumption of metalwork* (cf. also Hansen 1994: 389). In the area of Kuyavia and north-eastern Greater Poland, at the turn of the Hallstatt C and D periods, the “consumption” of bronze – regardless of its (possibly social or votive) reasons – certainly followed other paths than the ostentatious, rich furnishing of graves. This role was fulfilled by intentional depositions of single items, mainly large ornaments (see Durczewski 1961, *passim*) and hoards (Blajer 2001, maps 7–8). There are 17 hoards known from the districts of Bydgoszcz, Toruń, Aleksandrów Kujawski, Mogilno, Inowrocław, Nakło and Żnin, and these are as follows: Biskupin, Bydgoszcz, Bydgoszcz-Czersko Polskie, Bydgoszcz-Łoskoń, surroundings of Bydgoszcz, Gopło, Jaroszewo, Kołuda Mała, Lachmirowice, Mirosławice, Słupy, Stanomin, Szczepanowo, Toruń-Stawki, Wojnowo, Zalesie, and Żurawia (Blajer 2001). Only a few of them were associated with aquatic environments (rivers, lakes and wetlands: two hoards from Bydgoszcz, one from Lake Gopło, one from peat near Jaroszewo). Against this

background, the “dry” find from Ludwinowo fits well within the local cultural norm, and the fact that it provided a whole range of new, additional information sheds new light on past finds, the context of which is almost completely missing.

Looking from a perspective wider than regional, the find from Ludwinowo should be considered as further evidence for the persistence (deep into the Early Iron Age) of the phenomenon of depositing metal objects in the north-eastern part of the Urnfield cultures, which include the Lusatian culture, and to some extent also the Pomeranian culture. This phenomenon disappeared in the Early Iron Age in favour of richer furnishing of graves with metal products among the Hallstatt culture communities and in areas influenced by this cultural centre (cf. Blajer 1992; Westhausen 2018; Dziegielewski et al. 2020). This shift can be seen as confirmation of the complementarity, which has already been suggested many times in the literature, of both phenomena (grave furnishing and hoard deposition) and their functionally similar significance for communities of that period (cf. Hundt 1955; Bradley 1990; Hansen 1994; Kristiansen 1998; Blajer 2001).

REFERENCES

- Ablamowicz R. 2011 *Badania archeozoologiczne szczątków kostnych z wykopalisk w miejscowości Ludwinowo, stan. 7, woj. kujawsko-pomorskie*, (in:) W. Koszkuł, B. Pilarski, P. Cyganiewicz, *Opracowanie wyników ratowniczych badań archeologicznych przeprowadzonych na stanowisku 7 w Ludwinowie* (AUT. 112), gm. Włocławek, woj. kujawsko-pomorskie, Kraków, 209–218 (typescript of the report in the archives of Heritage National Board (NID) in Warsaw).
- Andrzejowska M. 1981 *Kolczyki ludności kultury pomorskiej*, *Wiadomości Archeologiczne* 46/2: 185–234.
- Baron J., Jarysz R., Laciak D., Łucejko J. L., Maciejewski M. 2019 *Nice bronzes in ugly pots. On the containers of the Bronze Age metal deposits from Karmin in SW Poland*, (in:) M. S. Przybyła & K. Dziegielewski (eds.), *Chasing Bronze Age rainbows. Studies on hoards and related phenomena in prehistoric Europe in honour of Wojciech Blajer*, *Prace Archeologiczne* 69, Kraków, 491–498.
- Blajer W. 1992 *Ze studiów nad skarbami okresu halsztackiego w Polsce*, (in:) S. Czopek (ed.), *Ziemia polskie we wczesnej epoce żelaza i ich powiązania z innymi terenami*, Rzeszów, 101–110.
- 2001 *Skarby przedmiotów metalowych z epoki brązu i wczesnej epoki żelaza na ziemiach polskich*, Kraków.
- Blajer W., Miczyk P., Biborski M., Kraszewska A., Valde-Nowak P. 2018 *The hoard of bronze objects from site 8 at Zagórze, Wadowice District*, *Recherches Archéologiques NS* 9 (2017): 319–338.
- Bradley R. 1990 *The passage of arms. An archaeological analysis of prehistoric hoards and votive deposits*, Cambridge.
- Chudziakowa J. 1968 *Cmentarzysko kultury łużyckiej w Małej Kępie, pow. Chełmno*, *Zeszyty Naukowe Uniwersytetu Mikołaja Kopernika w Toruniu* 26, *Archeologia* 1: 115–192.
- 1992 *Grodzisko kultury łużyckiej w Gzinie*, Toruń.
- Conwentz H. 1901 *Vorgeschichtliche Sammlung, Amtlicher Bericht über die Verwaltung der naturhistorischen, archaeologischen und ethnologischen Sammlungen des Westpreußischen Provinzial-Museums* 21: 30–50.

- Derrix C. 2001 *Frühe Eisenfunde im Odergebiet. Studien zur Hallstattzeit in Mitteleuropa*, Universitätsforschungen zur prähistorischen Archäologie 74, Bonn.
- Durczewski D. 1961 *Skarby halszackie z Wielkopolski*, *Przegląd Archeologiczny* 13 (1960): 7–106.
- 1985 *Gród ludności kultury łużyckiej z okresu halszackiego w Smuszewie, woj. pilskie*, Poznań.
- Dzięgielewski K. 2010 *Expansion of the Pomeranian culture in Poland during the Early Iron Age: remarks on the mechanism and possible causes*, (in:) K. Dzięgielewski, M. S. Przybyła & A. Gawlik (eds.), *Migration in Bronze and Early Iron Age Europe*, *Prace Archeologiczne* 63, Kraków, 173–196.
- 2015 *Południowa rubież kultury pomorskiej i trajektorie łużycko-pomorskiej transformacji kulturowej w świetle badań w okolicach Krakowa*, (in:) J. Chochorowski (ed.), *Od epoki brązu do czasów nowożytnych. Wybrane odkrycia i znaleziska*, *Via Archaeologica. Źródła z badań wykopaliskowych na trasie autostrady A4 w Małopolsce*, Kraków, 81–113.
- 2016 *Societies of the younger segment of the early Iron Age in Poland (500–250 BC)*, (in:) A. Rzeszotarska-Nowakiewicz (ed.), *The Past Societies. Polish lands from the first evidence of human presence to the early Middle Ages. Volume 4: 500 BC–500 AD*, Warszawa, 15–48.
- 2017 *The rise and fall of Biskupin and its counterparts*, (in:) U. Bugaj (ed.), *The Past Societies. Polish lands from the first evidence of human presence to the early Middle Ages. Volume 3: 2000–500 BC*, Warszawa, 341–366.
- Dzięgielewski K., Longa A., Langer J., Moskal-del Hoyo M. 2019 *Contextualisation of Early Iron Age bronze hoard found in Gdynia-Karwiny*, *Recherches Archeologiques NS* 10: 22–78.
- Dzięgielewski K., Rzońca J., Naglik R., Fraś J. 2020 *When iron was the new bronze. Three hoards from the early Hallstatt period from around Kraków, and the phenomenon of 'pure' deposits of iron objects*, *Praehistorische Zeitschrift* (in press).
- Eggers H. J. 1986 *Einführung in die Vorgeschichte*, wyd. 3, München – Zürich.
- Gałęzowska A. 2003 *Osady kultury pomorskiej i kultury wielbarskiej na stanowisku 1 w Stroszkach, gm. Nekla, pow. Września*, (in:) M. Brzostowicz (ed.), *Archeologia powiatu wrzesińskiego*, Poznań – Września, 131–153.
- Gediga B., Józefowska A. 2018a *Cmentarzysko wczesnej epoki żelaza w Domasławiu 10/11/12, powiat wrocławski. Tom I. Katalog*, Wrocław.
- 2018b *Cmentarzysko wczesnej epoki żelaza w Domasławiu 10/11/12, powiat wrocławski. Tom II. Tablice, część 1*, Wrocław.
- 2018c *Cmentarzysko wczesnej epoki żelaza w Domasławiu 10/11/12, powiat wrocławski. Tom III. Tablice, część 2*, Wrocław.
- Gedl M. 2001 *Die Bronzegefäße in Polen*, PBF II/15, Stuttgart.
- 1973 *Cmentarzysko halszackie w Kietrzu, pow. Głubczyce*, Wrocław – Warszawa – Kraków – Gdańsk.
- Głogowski Z., Szamałek K., Ignaczak M. 2004 *Osadnictwo społeczeństw kultur cyklu łużyckiego w strefie nadnotecko-nadgoplańskiej*, (in:) J. Bednarczyk, L. Czerniak & A. Koško (eds.), *Archeologiczne badania ratownicze wzdłuż trasy gazociągu tranzytowego*, t. 3: Kujawy, cz. 5: *Osadnictwo społeczeństw kultur cyklu łużyckiego*, Poznań, 203–333.
- Griesa I. 1999 *Die früheisenzeitlichen Funde der Lausitzer Kultur*, (in:) I. Griesa, R.-M. Weiss, *Hallstattzeit, Die Altertümer im Museum für Vor- und Frühgeschichte* 2, Mainz, 92–141.
- Hansen S. 1994 *Studien zu den Metalldeponierungen während der älteren Urnenfelderzeit zwischen Rhônetal und Karpatenbecken*, *Universitätsforschungen zur Prähistorischen Archäologie* 21, Bonn.

- Harding A., Ostojka-Zagórski J., Palmer C., Rackham J. 2004 *Sobiejuchoy: a fortified site of the Early Iron Age in Poland*, Polskie Badania Archeologiczne 35, Warsaw.
- Heynowski R. 1992 *Eisenzeitlicher Trachtschmuck der Mittelgebirgszone zwischen Rhein und Thüringer Becken*, Archäologische Schriften des Instituts für Vor- und Frühgeschichte der Johannes Gutenberg-Universität Mainz 1, Mainz.
- 2000 *Die Wendelringe der späten Bronze- und der frühen Eisenzeit*, Universitätsforschungen zur prähistorischen Archäologie 64, Bonn.
- Hundt H.-J. 1955 *Versuch zur Deutung der Depotfunde der nordischen jüngeren Bronzezeit*, Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz 2: 95–152.
- Kaczmarek M. 2005 *Uwagi o wczesnej fazie kultury pomorskiej w Wielkopolsce*, (in:) M. Fudziński & H. Paner (eds.), *Aktualne problemy kultury pomorskiej*, Gdańsk, 159–181.
- Kirschke B., Narożna-Szamałek U. 2011 *Kultura łużycka i ślad osadnictwa kultury pomorskiej*, (in:) I. Sobkowiak-Tabaka (ed.), *Osadnictwo pradziejowe i nowożytnie na stanowisku nr 7 (AUT 112) w Ludwinowie, gm. Włocławek, woj. kujawsko-pomorskie*, Poznań, 302–362 (typescript of the report in the archives of Heritage National Board (NID) in Warsaw).
- Kola A. 1969 *Osada z okresu lateńskiego w Wielkiej Nieszawce koło Torunia*, Zeszyty Naukowe Uniwersytetu Mikołaja Kopernika w Toruniu 33, Archeologia 2, 13–28.
- Koszkul W., Pilarski B., Cyganiewicz P. 2011 *Opracowanie wyników ratowniczych badań archeologicznych przeprowadzonych na stanowisku 7 w Ludwinowie (AUT. 112), gm. Włocławek, woj. kujawsko-pomorskie*, Kraków (typescript of the report in the archives of Heritage National Board (NID) in Warsaw).
- Kristiansen K. 1998 *Europe before history*, Cambridge.
- Krzysiak A., Dzięgielewski K., Garbacz-Klempka A. 2017 *Pierścień brązowego napierśnika z wczesnej epoki żelaza z miejscowości Dziecholino-Leśnice koło Łęborka*, Wiadomości Archeologiczne 68: 257–265.
- Kunicka-Zyzman A., Zyzman A. 2012 *Eksperymentalna osada Stowarzyszenia Dziejba w Woli Radziszowskiej. Konstrukcje, narzędzia, edukacja*, (in:) J. Gancarski (ed.), *Skanseny archeologiczne i archeologia eksperymentalna*, Krosno, 241–256.
- Luka L. J. 1958 *Nowe cmentarzyska kultury pomorskiej w Wielkopolsce*, Fontes Archaeologici Posnanienses 8–9 (1957–1958): 150–178.
- Maciejewski M. 2016 *Metal – granica – rytuał. Badania nad depozytami przedmiotów metalowych w kontekście sieci osadniczej*, Archaeologia Bimaris. Monografie 7, Poznań.
- 2018 *Perspektywy badań nad skarbami z późnej epoki brązu i wczesnej epoki żelaza*, Śląskie Sprawozdania Archeologiczne 60/1: 279–313.
- Malinowski T. 1958 *Osadnictwo kultury łużyckiej wczesnej epoki żelaza w Słupcy*, Fontes Archaeologici Posnanienses 8–9 (1957–1958): 1–97.
- 1989 *Ekspansja kultury pomorskiej i charakter tej ekspansji*, (in:) J. Kmieciński (ed.), *Pradzieje ziem polskich, t. I: Od paleolitu do środkowego okresu lateńskiego, cz. 2: Epoka brązu i początki epoki żelaza*, Warszawa – Łódź, 570–573.
- Marchelak I. 2017 *Osadnictwo kultury pomorskiej i kultury grobów kloszowych*, (in:) I. Marchelak, A. Nierychlewska, I. Nowak, P. Papiernik, *Ratownicze badania archeologiczne na stanowisku 3 w Ludwinowie, pow. Włocławek, woj. kujawsko-pomorskie (trasa autostrady A-1)*, Via Archaeologica Lodziensis 7/1, Łódź, 159–197.

- Mikłaszewska-Balcer R. 1991 *Ceramika kultury łużyckiej ze stanowiska 4 w Biskupinie*, (in:) J. Jaskanis (ed.), *Prahistoryczny gród w Biskupinie. Problematyka osiedli obronnych na początku epoki żelaza*, Warszawa, 127–169.
- Mogielnicka-Urban M. 1984 *Warsztat ceramiczny w kulturze łużyckiej*, Wrocław – Warszawa – Kraków – Gdańsk – Łódź.
- Ostasz A. 2007 *Łukocin, gm. Tczew, woj. pomorskie. SAZ: 1508/19/03 (Osada łużycko-pomorska na stanowisku wielokulturowym)*, Gdańsk (typescript of the report in archives of the National Heritage Board of Poland in Warsaw).
- Ostoja-Zagórski J. 1993 *Mezoregion Sobiejuchy na Pałukach*, Warszawa – Żnin.
- Pabst-Dörrer S. 2000 *Untersuchungen zu hallstattzeitlichen Frauentrachten mit Spiralbrillenfibeln zwischen Alpen, Karpaten und Ostsee*, Internationale Archäologie 51, Rahden/Westf.
- Pieczyski Z. 1954 *Cmentarzysko z wczesnego okresu żelaznego (700–400 p.n.e.) w Górzewicach w pow. szamotulskim*, *Fontes Archaeologici Posnanienses* 4 (1951): 101–152.
- Piotrowska M. 2013 *Epoka żelaza w dorzeczu środkowej Słupi*, *Spatium Archaeologicum* 5, Łódź – Poznań.
- Purowski T. 2012 *Wyroby szklane w kulturze łużyckiej w międzyrzeczu Noteci i środkowej Odry. Studium archeologiczno-technologiczne*, Warszawa.
- 2019 *Od fajansu do szkła. Kontakty ziem polskich z głównymi centrami cywilizacyjnymi w II-I tys. p.n.e. w świetle badań archeometrycznych tworzyw szklanych*, Warszawa.
- Przybyła M. M. 2007 *Cmentarzysko kultury łużyckiej w Siemoni, gm. Bobrowniki, woj. śląskie*, *Śląskie Prace Prehistoryczne* 6: 54–204.
- Pyzel J. ed. 2019 *Ludwinowo, stanowisko 7. Osada neolityczna na Kujawach / Ludwinowo, site 7. Neolithic settlement in Kuyavia*, *Ocalone Dziedzictwo Archeologiczne* 8, Pętkowice – Gdańsk.
- Skrzypek I. 1982 *Archeologiczne badania ratownicze w Koszalinie na stanowisku 12*, *Koszalińskie Zeszyty Muzealne* 12: 13–28.
- Stępnik T., Dębski A., Bujak A. 2009 *Ratownicze badania archeologiczne na stanowisku 51 w Plewiskach, gm. Komorniki. Osada kultury pomorskiej i osada z fazy B wczesnego średniowiecza*, *Wielkopolskie Sprawozdania Archeologiczne* 10: 65–86.
- Stój B. 2019 *Uprząż sprzed 3000 lat*, *Archeologia Żywa* 3/2019 (73): 30–32.
- Szamałek K. 1987 *Kruszwicki zespół osadniczy w młodszej epoce brązu i w początkach epoki żelaza*, *Polskie Badania Archeologiczne* 26, Wrocław.
- 2006 *Zagadnienie ciągłości osadnictwa w cyklu łużyckim i okresie łużycko-pomorskiej transformacji kulturowej w świetle badań na wschodniowielkopolsko-kujawskim odcinku gazociągu tranzytowego*, (in:) W. Blajer (ed.), *Z badań nad osadnictwem epoki brązu i wczesnej epoki żelaza w Europie Środkowej*, Kraków, 35–62.
- 2009 *Procesy integracji kulturowej w młodszej epoce brązu i początkach epoki żelaza na Pojezierzu Wielkopolskim*, Poznań.
- Szczurek G., Pudęłko E. 2015 *Szadek. Cmentarzysko z przełomu epok brązu i żelaza w południowo-wschodniej Wielkopolsce / Szadek. The Late Bronze Age and Early Iron Age cemetery in south-east Wielkopolska*, *Hyperborea. Poznańskie studia nad epoką brązu i wczesną epoką żelaza / Hyperborea. Poznań Studies in the Bronze and Early Iron Ages* 2, Poznań.
- Szydłowska E. 1974 *Ze studiów nad cmentarzyskami brytualnymi z przewagą grobów szkieletowych w kulturze łużyckiej*, *Przegląd Archeologiczny* 22: 151–172.

- Torbrügge W. 1995 *Die frühe Hallstattzeit (Ha C) in chronologischen Ansichten und notwendige Randbemerkungen. Teil II: Der sogenannte östliche Hallstattkreis*, Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz 38/2 (1992): 425–614.
- Trachsel M. 2004 *Untersuchungen zur relativen und absoluten Chronologie der Hallstattzeit*, Universitätsforschungen zur prähistorischen Archäologie 104/1–2, Bonn.
- Vachta T. 2016 *Bronzezeitliche Hortfunde und ihre Fundorte in Böhmen*, Berlin Studies of the Ancient World 33, Berlin.
- Westhausen I. 2018 *Early Iron Age hoards between Brittany and the Carpathian basin – a preliminary review*, (in:) L. D. Nebelsick, J. Wawrzeńniuk & K. Zeman-Wiśniewska (eds.), *Sacred space: contributions to the archaeology of belief*, Archaeologica Hereditas 13, Warsaw, 135–148.
- Woźniak Z. 1959 *Cmentarzysko kultury łużyckiej w Chojnie-Golejewku w pow. rawickim*, Przegląd Archeologiczny 12: 31–116.

With this (...) volume, the renowned university professor, Wojciech Blajer, is given a special “birthday present”, which is also a gift for all archaeologists wrestling with the knotty problems of hoards. The wealth of unpublished material, numerous comments, and discussions spans the whole spectrum of research on this topic. (...) It will become a reference volume for the research of bronze finds, just as the commemorative publications for Wilhelm A. von Brunn or Amália Mozsolics have done.

(from the review of Prof. Tudor Soroceanu)

The reviewed work is a collective monograph in English and German, running to a total of 22 chapters by 34 authors from several European countries. Whilst many of the authors are from Poland, scholars from Denmark, Germany, Romania, Slovakia, Ukraine, and Hungary have also contributed. The reason for its publication is the jubilee of Professor Wojciech Blajer from the Jagiellonian University in Kraków. However, this is a specific Festschrift, because the editors ensured that it was rigorously focused on one subject: the development of metallurgy (and especially the deposits of metal objects) in the period spanning the Bronze Age and the beginning of the Iron Age. This was all focused within a broadly understood geographical area of Central Europe. And it must be emphasized that this intention has been fully achieved. (...) The reader obtains a rich picture of current trends in these studies in the key areas of Bronze Age Europe.

(from the review of Prof. Janusz Czebreszuk)

