SPRAWOZDANIA ARCHEOLOGICZNE 77/2, 2025
PL ISSN 0081-3834
DOI: 10.23858/SA/77.2025.2.4056

Kalina Skóra[1], Anna Lasota-Kuś[2], Beata Borowska[3],
Justyna Marchewka-Długońska[4]

ONCE AGAIN ABOUT 'MISSING' CREMATED SKELETAL REMAINS. AN EXAMPLE OF THE CEMETERY IN RACZKOWICE IN THE CONTEXT OF TRANSFORMATIONS OF FUNERARY RITUALS OF THE PRZEWORSK CULTURE IN THE YOUNGER AND LATE ROMAN PERIOD

ABSTRACT

Skóra K., Lasota-Kuś A., Borowska B., and Marchewka-Długońska J. 2025. Once again about 'missing' cremated skeletal remains. An example of the cemetery in Raczkowice in the context of transformations of funerary rituals of the Przeworsk Culture in the Younger and Late Roman Period. *Sprawozdania Archeologiczne* 77/2, 149-176.

The aim of this paper is to evaluate the contents of cremation pit graves, urns and pyre sites from the cemetery of the Przeworsk Culture in Raczkowice from an osteological perspective, which is related to the issue of the small number of burnt skeletal remains. The collection was analysed in terms of weight, state of preservation, anatomical differentiation and frequency of different skeletal parts, addressing the question of whether the skeletal remains were selected from the cremation pyre and what proportion of them was deposited in the grave. The results obtained for Raczkowice are presented against the background of the Przeworsk Culture's funerary customs in the declining phases of the Roman Period.

Keywords: Raczkowice, cemetery, Roman Period, Przeworsk Culture, burial rites, osteological analyses
Received: 26.02.2025; Revised: 06.03.2025; Accepted: 15.05.2025

1 Institute of Archaeology and Ethnology, Polish Academy of Sciences, Tylna St. 1, 90-364 Łódź, Poland; k.skora@iaepan.edu.pl; ORCID: 0000-0002-3197-6060
2 Institute of Archaeology and Ethnology, Polish Academy of Sciences, Sławkowska St. 17, 31-016 Kraków, Poland; a.lasota-kus@iaepan.edu.pl; ORCID: 0000-0002-0603-846X
3 Department of Anthropology, Faculty of Biology and Environmental Protection, University of Łódź; Poland; beata.borowska@biol.uni.lodz.pl; ORCID: 0000-0001-6449-6955;
4 Institute of Biological Sciences, Faculty of Biology and Environmental Sciences, Cardinal Stefan Wyszynski University in Warsaw, Warsaw, Poland; j.marchewka@uksw.edu.pl; ORCID: 0000-0003-1816-556X

1. INTRODUTION

In the funerary rites of the Przeworsk Culture from the Younger Roman Period onwards, it is noted that only a small part of the human skeletal remains collected from the cremation pyre is deposited in the burial pit (on this topic, recently, *e.g.*, Kaczanowski and Rodzińska-Nowak 2015; for the state of research and summary of the discussion, see Madyda-Legutko *et al.* 2015; also Makiewicz 2008; 2009). This situation has repercussions for anthropological and demographic research, significantly affecting the possibility of studying communities of Late Antiquity from the perspective of elementary identifications of personal characteristics (gender, age, biological condition) and relations to status, as expressed in funerary rites. Biological information on the deceased is thus reduced to a minimum, which excludes palaeodemographic studies within the basic scope, including the determination of age and sex structure, order of mortality, or the size of the cemetery-using population. From an archaeological perspective, the increasing tendency to reduce grave offerings on both quantitative and qualitative scales also has specific consequences, which result in problems in assessing the chronological stratification of the necropolis.

The Raczkowice cemetery exemplifies this change. We will present this problem in the article by analysing one aspect, namely the study of the conditions affecting the weight of bones in graves, as well as the anatomical representation in urns, cremation pit graves, and ossuaries. Cremation leads to bone fragmentation, deformation and shrinkage. The low number of skeletal elements observed in cremation graves may be influenced by cultural factors, post-funeral factors (weight of soil, frost stress, method of exploration, transport and storage), biological factors (elderly or osteoporotic individuals with significantly lower bone weights than younger individuals), taphonomic processes (erosion, animal action, depth of grave location – *cf.*, Großkopf 2004, 102, 106). The high variation in the weights of remains in the cemetery may indicate some causes responsible for this state of things (Großkopf 2004, 104). As C. J. Knüsel and J. Robb (2023, 99) note, 'the specific aim of funerary taphonomy is to identify patterns that are the result of human funerary practices'.

In the case of the Przeworsk Culture, it is assumed that ritual circumstances and the transformation of funerary customs in the later phases of the Roman Period to a large extent had an important influence on this phenomenon. We would like to analyse these issues using the example of the Raczkowice cemetery, emphasising the need for interdisciplinary anthropological and archaeological research, without which we cannot expect the development of research into past funerary rituals.

1.1. The burial ground in Raczkowice

The burial ground of the Przeworsk Culture in Raczkowice, Częstochowa District (Upper Silesia Voivodship), is located between the upper reaches of the Pilica and Warta rivers

(Fig. 1). The settlement situation in this area during the Roman and Migration Periods is currently poorly understood. The evidence for studying this comes not from regular archaeological research, but rather from accidental discoveries and surface surveys conducted in the second half of the 20th century. To the left of the Warta, there is a better archaeologically studied region on the Liswarta River, with cemeteries and settlements that functioned at a similar time to Raczkowice (for a general discussion of these, see Zagórska-Telega 2019, literature references there). To the east of Raczkowice, 20 km in a straight line, there is a cemetery at Drochlin, largely destroyed but dating from a similar time horizon (Kaczanowski 1987).

Raczkowice is a medium-sized necropolis with 90 features (Fig. 2). It is characterised by the presence of three *ustrina* and a feature that, according to the criteria proposed by J. Zagórska-Telega (2019), we classify as a cremation layer. It consisted of seven concentrations of human bones and accompanying artefacts. Most of the graves are cremation pit graves, with a minority of burials deposited in urns (Figs 3 and 4). The site has been damaged to some degree, and it is currently difficult to assess the extent of this damage. Excavations were carried out in 1976-1984 by Bożena Błaszczyk (from the Stanisław Sankowski Regional Museum in Radomsko). According to B. Błaszczyk, the western, southern, and northern boundaries of the cemetery have been identified. The situation in the eastern part of the cemetery is not fully known. The cemetery in this area is situated on a private parcel of land, where additional residential and farm buildings have been constructed since 1946. According to the owners of the land, ceramic vessels were discovered during the construction of a house in 1972. A 1984 survey located just off this lot revealed the presence of scattered materials of Roman Period grave goods.

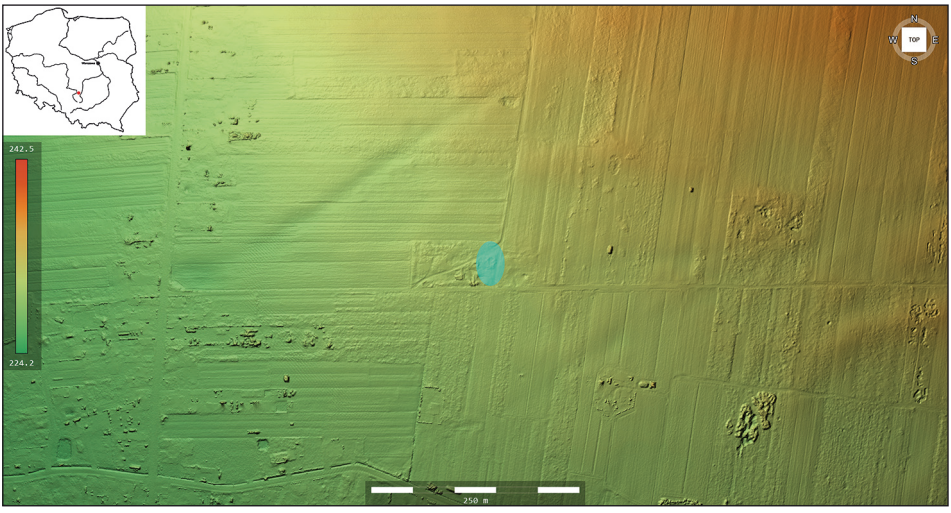


Fig. 1. Raczkowice, Site 3. Location of the burial ground. Graphic design: R. Zdaniewicz and K. Skóra

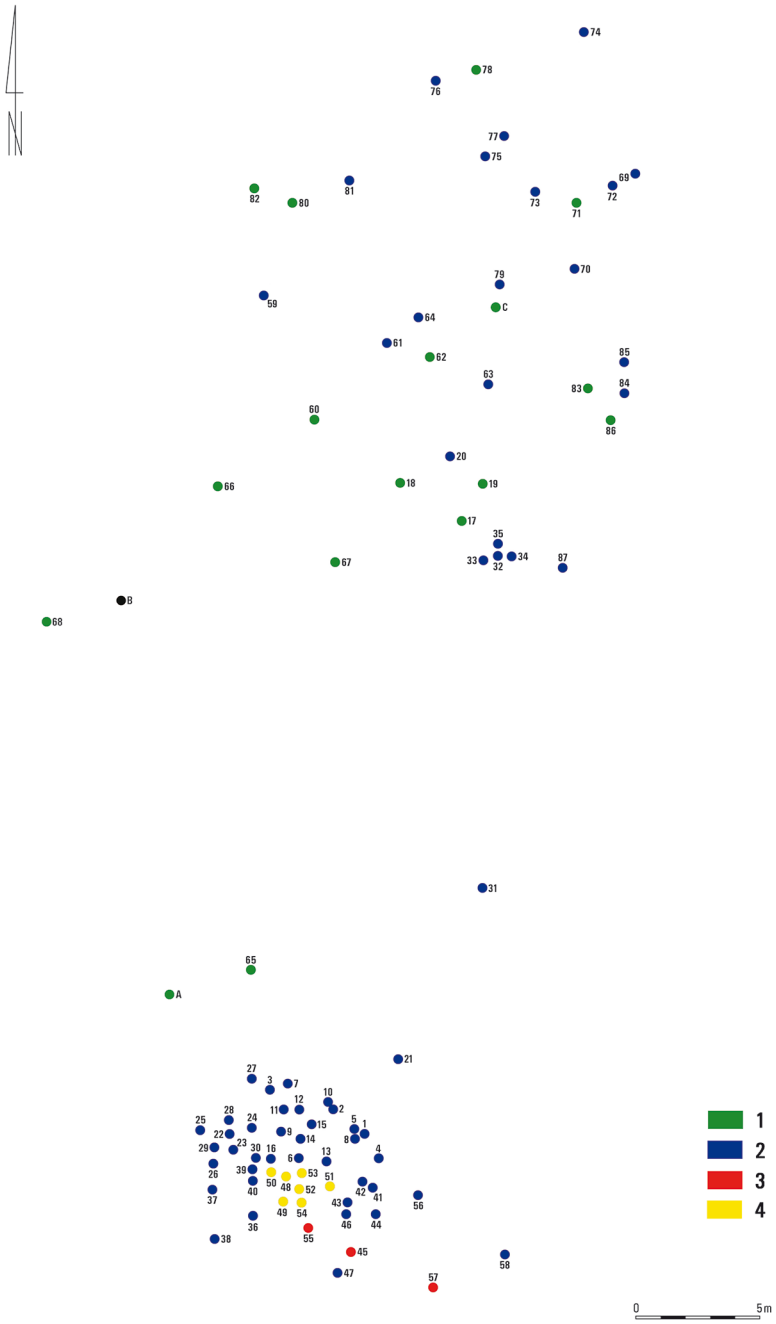


Fig. 2. Raczkowice, Site 3. 1 – cremation pit grave; 2 – urn grave; 3 – pyre site (*ustrinum*); 4 – cremation layer with concentrations of bones (Features 48-54). Graphic design: K. Skóra

Fig. 3. Raczkowice, Site 3. Urn Grave 60. Photo: Archive of the S. Sankowski Museum in Radomsko

Fig. 4. Raczkowice, Site 3. Urn Grave 78. Photo: Archive of the S. Sankowski Museum in Radomsko

The origins of the cemetery at Raczkowice correspond to phase B_2 of the Roman Period, rather its younger subphase. No materials have been distinguished that would allow the initial phase to be extended further into the Roman Period.

During the pre-Roman Period and phase B1, settlement of the Przeworsk Culture gradually developed in the area of Małopolska and parts of Silesia. The existence of a settlement vacuum in the upper basins of the Warta and Pilica rivers, as well as in most of Upper Silesia, was noted by Kazimierz Godłowski (1985, 47) when discussing cultural and settlement transformations. These areas were to remain unpopulated until the beginning of the younger stage of the Early Roman Period (B_2). The beginning of the colonisation of the Warta and Pilica riverside by the people of the Przeworsk Culture is referred to the stage B_{2b}. At this time, the same process is observed in Opole Silesia (Godłowski 1985, 59, map 4). During the stage B_2/C_1-C_{1a}, a settlement centre begins to take shape on the lower Liswarta River, accompanied by an extensive necropolis in Opatów, Kłobuck District (Madyda-Legutko *et al.* 2011a, 2011b). There are other cemeteries close to Opatów, *i.e.*, Mokra, Kłobuck District (Biborski 1998; 2000a; 2000b; 2001; 2002; 2004a; 2004b; 2006a; 2006b; 2010), Prusicko, Pajęczno District (*cf.*, Tyszler 2012, 66 and unpublished material by J. Ziętek from the State Archive in Piotrków Trybunalski) and Rybno, Site 1, Kłobuck District (see Zagórska-Telega 2019, 11, further literature there). On the right side of the upper Warta and in the upper Pilica zone, the development of settlements of the Przeworsk Culture can be observed, a significant example of which is the aforementioned cemetery in Drochlin, established in the stage B_2/C_1 (Kaczanowski 1987; Godłowski 1985, 86, 87, map 5).

The end of the use of the Raczkowice necropolis probably falls in phases C_3-D. There is little material of well-dated value from this phase. These include buckles with a bold frame (Group H, according to Madyda-Legutko 1987), tongue-shaped belt end fittings (Type 12, Variety 2, Madyda-Legutko 2011), and fragments of metal fittings for wooden buckets.

The typological-chronological analysis of the materials allowed us to recognise two zones of use of the cemetery, the northern (older) and the southern (younger). The northern part, referred to phases B_{2b} – C_{1a}-C_{1b}, is the initial part of the graveyard, which contains mainly the urn graves. The southern area contains only cremation pit burials, three pyre sites (ustrina), and a cremation layer, dating to the Younger and Late Roman Periods. The area between these two zones contains a few burials chronologically associated with the northern zone, as well as large areas without burials. The absence of graves in this part is to some extent due to the destruction of the site, but the lack of stray finds indicates the 'separate' functioning of these two concentrations of graves. The new (southern) burial zone may have been initiated by another kin group, marking its distinctiveness by designating a separate space for burials.

1.1. General characteristics of the population

The anthropological analysis was carried out on the skeletal remains from all the features (80 graves, three *ustrina* (45, 55, 57) and a cremation layer (48-54, in which seven bone assemblages were distinguished). The study was conducted using the methodology for handling cremation remains developed by Jacqueline I. McKinley (1994, 2004). No *infans* II remains were recorded in the bone material. There is a small representation of individuals who died before the age of 7 years, adolescents from the *iuvenis* group and old people (*senilis*). A low proportion of females relative to males was also observed in the bone material (Table 1).

Table 1. Raczkowice, Site 3. Age and sex structure of the population in the light of anthropological studies: pyre sites (*ustrina*), concentrations of bone remains within the cremation layer, graves

Age	Sex						Σ
	Unspecified	Σ	F	Σ	M	Σ	
infans I	8, 44, 70, 73, 82	**5**	-	**-**	-	**-**	**5**
infans II	-	**-**	-	**-**	-	**-**	**-**
infans I/*infans* II	3, 38	**2**	-	**-**	-	**-**	**2**
infans II/*iuvenis*	63	**1**	-	**-**	-	**-**	**1**
iuvenis	56 (?)	**1**	-	**-**	-	**-**	**1**
iuvenis/*adultus*	6, 12	**2**	-	**-**	-	**-**	**2**
adultus	18, 84	**2**	1, 13, 43 (?), 65 (?), 87 (?)	**5**	45 (?), 59, 75	**3**	**10**
adultus/*maturus*	40, 83	**2**	-	**-**	66	**1**	**3**
maturus	41 (?), 48 (?), 52 (?)	**3**	-	**-**	60 (??), 86 (?)	**2**	**5**
senilis	10, 62	**2**	-	**-**	-	**-**	**2**
Child	25, 30 (?), 35 (?), C	**4**	-	**-**	-	**-**	**4**
Juvenile/Adult	46 (?)	**1**	-	**-**	-	**-**	**1**
Adult	2, 15, 16, 20 (?), 31, 39, 47, 50, 54, 67, 69, 71, 80, 81, B	**15**	8 (?), 9 (?), 51	**3**	4, 19, 22, 37, 42, 49 (?), 68, 74 (?), 78	**9**	**27**
Unspecified	5, 10, 14, 17, 21, 23, 24, 26, 27, 28, 29, 32, 33, 34, 36, 57, 58, 61, 64, 72, 76, 77, 79, 85	**24**	7 (?)	**1**	53 (?), 55 (?)	**2**	**27**
Σ	**64**		**9**		**17**		**90**

The general poor state of preservation of the skeletal remains at Raczkowice does not allow far-reaching conclusions to be drawn about the mortality structure of the population. Although in terms of specific age, there was a predominance of individuals in the *adultus* category, it should not be forgotten that in most cases the age of individuals was only identified as 'adult'. The remains of children were identified in only 11 graves (including one double grave). The picture of the population from Raczkowice obtained as a result

of the anthropological evaluation is far from the expected demographic profile for a Roman Period community (*e.g.*, Czarnecka 1990; Skóra 2020).

2. ANALYSIS

2.1. General remarks

The temperature of the cremation pyre acting on the bone remains has a profound effect on their external appearance as well as their structure. Bones become extremely brittle and vulnerable as a result of burning. The skeletal remains are usually in the form of larger or smaller fragments, and in extreme cases, only a mass of small bone fragments remains. The delicacy of such material means that great care must be taken when handling it. The peculiarity of cremated material has given rise to several different types of research that can help extract the necessary information from it, despite the difficulties arising from the permanent modifications caused by burning (Mamede *et al.* 2017).

The main factor responsible for bone fragmentation and fragility is the pyre temperature (Piontek 2007). The effect of bone shrinkage is caused by the loss of water and organic components, including collagen, when exposed to high temperatures (Imaizumi 2015).

To determine the degree of bone shrinkage, studies were conducted in which domestic sheep ribs were burned at temperatures between 400°C and 1000°C, checking their effect at 100°C intervals. Temperatures up to 600°C showed no significant bone shrinkage. An increase occurred among samples at 700°C and 800°C, and the greatest bone shrinkage occurred at 900°C and 1000°C (Ellingham and Sandholzer 2020).

Changes in bone colour following heat treatment can be influenced by several factors, including the amount of oxygen and soft tissue, variation in soil composition or other environmental factors. However, recent studies have shown that heat-induced discolouration is not significantly affected by gender, age, or skeletal element type (Krap *et al.* 2019; Rubio *et al.* 2020).

The point of comparison for research into the question of the weight of burnt human bones going into graves in the Roman Period is the contemporary estimates obtained during archaeological experimental studies or collected from gas crematoria. The weight of the bones depends on gender, age and health, among other factors. According to various sources, the average weight of burnt bones of men is 3375-3379 g, while that of women is 1887-2625 g (Koczorski *et al.* 2014, 90, further literature there). The skeleton of an average man (70 kg) weighs 4159 g, while after cremation this value is reduced to 2829 g; for women, the weights are 2700 and 1840 g, respectively (Goldhahn and Oestigaard 2008, 231). Slightly lower values were obtained from experimental studies in a crematorium by A. Malinowski and R. Porawski (1969, 392-410): males – about 2000 g, females – about 1540 g. These data are partially reflected in the weight of bone remains from some prehistoric cemeteries (*cf.*, Malinowski 1969). However, they differ from the averaged results of the

weight of burnt bones compiled by Janusz Piontek for cemeteries, mainly from the Bronze Age. The ranges for men are 500-1150 g, for women: 350-1070 g, and for children, only 18-160 g (Malinowski 1969; Malinowski and Porawski 1969; Piontek 1996, 2002, 95-108, tab. 2; 2007, 64, tab. 2).

Also, from the studies done for selected cemeteries of the Przeworsk Culture, the conclusion emerges that the mass of burnt bone remains deposited in the graves is lower than expected (*cf.*, Szczepanek 2013, 88-91, figs 44 and 45). These differences are surprising, mainly as the bones from modern crematoria are characterised by a higher degree of burning and fragmentation (high cremation temperatures and mechanical grinding of the bones) (Wahl 2001, 158). It should be emphasised that modern cremation site data show a high degree of similarity in the issue considered here, something that is not observed in prehistoric cemeteries. The influence of several factors must therefore be assumed, shaping the revealed disparities in bone mass in the grave.

For comparison, calculations carried out for 11 sites of the Wielbark Culture (822 graves in total) revealed an average weight per grave of 390.8 g, with a cremation pit grave of 239.6 g, an urn grave of 697.1 g, a female grave of 528.4 g, a male grave of 718.3 g, a child grave of 47.7 g and a mass grave of 461.2 g (Skóra 2014, 54, fig. 1).

2.2. The manner of bone deposition in urn graves and cremation pit graves

In the documentation from the archaeological research at Raczkowice, an observation was made several times about the arrangement of the bone remains, regarding the deposition of the bones of the deceased into the vessel according to anatomical order, *i.e.*, from the cremation pyre in order, the remains were collected from the feet towards the skull. At the same time, this principle of deposition would only apply to urn graves. The bones of the crania would have been placed in the upper part of the urn. Little is known about the method of exploration of the interior of the urns from Raczkowice (Fig. 5).

Fig. 5. Raczkowice, Site 3. Vessels – urns: 1 – grave 66; 2 – grave 78. Photo: K. Skóra

We only have a description of the arrangement of the artefacts in relation to certain parts of the skeleton – the skull bones are the only point recorded. We can therefore assume that they were indeed deposited last into the vessel in several of the urns, but what principle was adopted in the deposition of the other parts of the skeleton cannot be ascertained.

The evaluation of whether the burnt bone remains were deposited in the burial pit with or without the remains of the cremation pyre is based on the drawn documentation and the survey diary. It is also unclear how the bones were treated after excavation, whether they were sieved, cleaned, or separated from the charcoal. This aspect of the funerary rites is challenging to analyse, given the above comments. Charcoal in small quantities was separated between vessel fragments and human skeletal remains during analytical work in the cabinet. The black or brownish-black fill of the grave pits, sometimes with charcoal fragments marked separately, makes it possible to identify the graves into which the remains of the cremation pyre were poured.

The separation of the burnt bone remains from the charcoal of the cremation pyre was one of the stages of the funerary ceremony. Clean bones were the result not so much of their selection from the pyre in a certain way, but also of their cleaning or washing. Little is known about this stage, from the removal of the bones from the cooled cremation pyre to their placement in the grave pit in relation to the materials of the Przeworsk Culture. We do not know who was responsible for this, how many days passed and how the remains, not only human but also the bones of animals and elements of equipment deposited on the pyre, were treated.

We know that the remains of the dead were subjected to various treatments, among other things, from written sources relating to other communities from different eras. Roman funerary practices are a case in point: most of the bones were collected from the cremation pyre with washed hands and wrapped in a linen cloth, then washed in wine and milk before being dried. However, they were placed in an urn with the ashes. The remaining bones from the cremation pyre (*os resectum*) were collected by the family of the deceased for additional burial in a domestic tomb or altar. However, the so-called Law of the Twelve Tables forbade this practice (Kuryłowicz 2020, 131).

2.3. Cremated human bone remains from Raczkowice

2.3.1. Condition of bone remains

The degree of burning of the bones from the Raczkowice cemetery was most often classified as high (78% of the features), followed by medium to high (13%), medium (6%) and, only exceptionally, very high (3%). The colour of the remains varies from light, light grey or light brown to dark, dark grey or dark brown (Fig. 6). Occasionally, colour variation, indicative of heterogeneous stack temperatures, characterises the remains of the same individual.

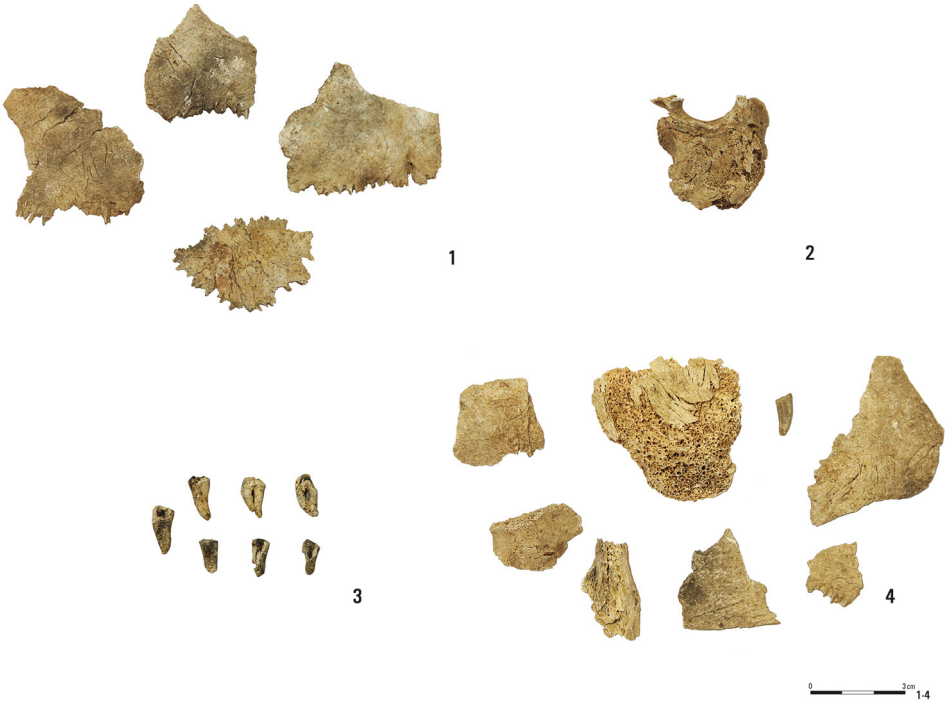


Fig. 6. Raczkowice, Site 3. State of preservation of bones from urn graves:
1 – Grave 18; 2-3 – Grave 66; 4 – Grave 83. Photo: K. Skóra

It is important to remember that a human skeleton exposed to heat is severely fragmented, and many of its parts are visibly deformed. Bone fragments that were collected into an urn or deposited in a burial hundreds of years ago are subject to external influences all the time before archaeologists discover them. It is therefore clear that the amount of information that can be obtained from anthropological studies of these materials will be limited. Another factor that affects the cognitive value of osteological materials is how they were stored after excavation and how their degradation is prevented.

2.3.2. Weight of the cremated bones

In Raczkowice, the total weight of the bones from the graves, the cremation layer and from the *ustrina* is nearly 16.5 kg (Table 2). Based on the analysis of the bone remains, it can be assumed that the bones belong to 91 individuals. It was not possible to determine whether the remains of the individuals discovered in the pyre sites (*ustrina*) were in any of the graves.

The graves contain the bone remains of one person. A double grave was selected once (Grave 8) – the remains of an adult female and a child (*infans* I), weighing a total of 274.8 g, were deposited there.

The sum of the weights of the skeletal remains from the urn and cremation pit graves is 14768 g, with an average (N = 77) of 191.8 g.

Table 2. Raczkowice, Site 3. Weight of cremated human bones in relation to the feature category

	Total weight of bones [g]	Average weight of bones in the feature [g]	Minimum weight [g]	Maximum weight [g]
Urns (n=15)	11142.1	742.8	8	2850
Cremation pit graves (n=62)	3625.9	58,5	0.01	316.3
Pyre sites / *ustrina* (n=3)	279.3	93.1	4.6	165.6
Cremation layer	1107	158.1	22.9	500

Sex and age

In Raczkowice, the average weight of skeletal remains in female graves is 242.9 g, while that of male graves is considerably higher – 485.9 g. Several factors contribute to this disproportion. In addition to those resulting from biological conditions (such as the greater bone mass of male individuals), another factor is the type of ritual and the chronology of the features. In the analysed group of male graves (n=13), five are urn graves, while in the case of women (n=8), there is only one burial in a vessel. The urn graves belong to the older horizon of the necropolis and stand out in terms of the number and assortment of equipment, and the quantity of bone remains corresponds to or is close to the expected mass obtained by cremation (2-3 kg).

In the case of the children's burials, the average weight of the bones is low (children from all age categories, n = 10), at 22.6 g, which is due to the lower weight of the skeletons in this age group. However, it is also a result of the form of the graves: nine cremation pit graves and only one urn grave. Most of the child burials are dated to the Younger Roman Period or lack grave goods of dating value. Only one grave (no. 82, urn grave) is dated earlier, *i.e.*, to stage B_2. The differences noted are also evident in the subsequent chronological sections (Fig. 7).

Chronological considerations

The chronological ranking of the set of cremation pit graves and urn graves in relation to the mass of bone remains leads to the conclusion of a significant decrease in this mass during the subsequent phases of use of the Raczkowice necropolis (Fig. 8). The average obtained for the features from stage B_2 is high, for which the urn graves (which mostly come from this chronological phase), are largely responsible. The average weight of bones from urns from this period is 821.7 g, while that from cremation pit graves is only 86.2 g. With the abandonment of urn graves in favour of cremation pit graves over time, the analysed average value decreases to just over 40 g.

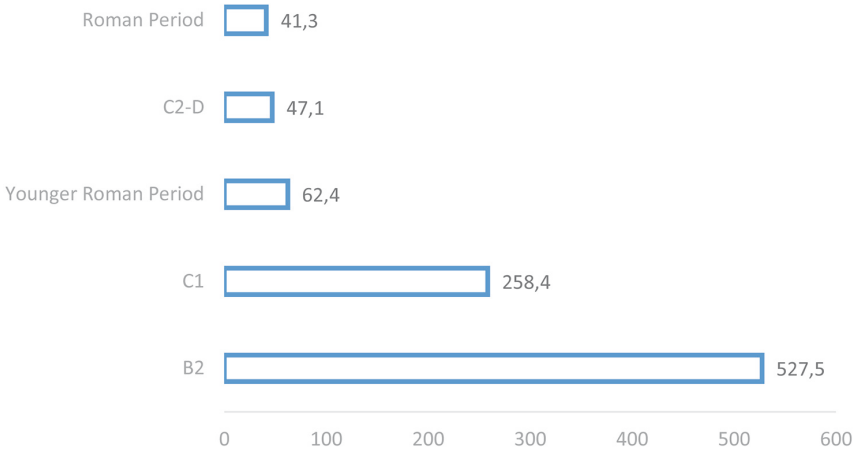


Fig. 7. Raczkowice, Site 3. Average weight of bones (g) from cremation graves in different stages of cemetery use – stages from B_2 to C_2-D, and separately features generally dated to the Roman Period (RP) and the Younger Roman Period (YRP) in relation to sex and age of the deceased

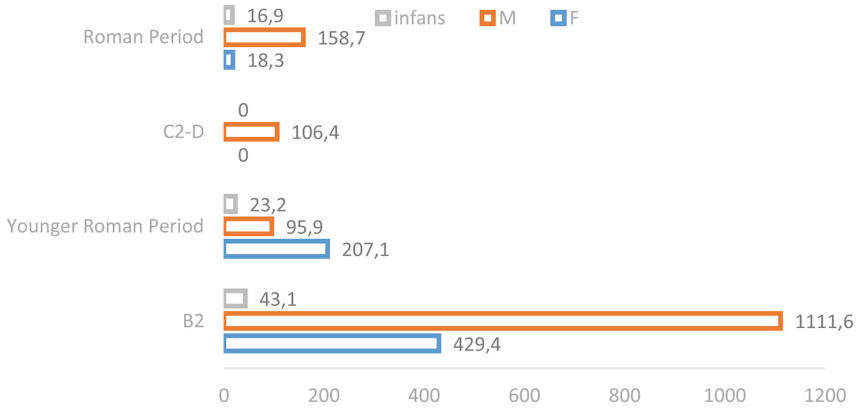


Fig. 8. Raczkowice, Site 3. Average weight of bones (g) from cremation graves in different stages of cemetery use – stages from B_2 to C_2-D, and separately features generally dated to the Roman Period (RP) and the Younger Roman Period (YRP)

In comparison, a clear decrease in the weight of bones in graves is also detectable in Opatów in the successive distinctive phases of cemetery use. The average weight is highest in the first phase (240.3 g) and decreases in the following phases, reaching values of 131.1, 140.68 and 106.15 g in the last of these (Szczepanek 2013, 88, 89, fig. 44). It is noted that most graves contain less than 100 g of bone. Higher average results were obtained in Mokra. The average for all graves is 279.6 g. In contrast, the initial two phases are 354.3 and 427 g and in the following phases, the averages fluctuate between about 200-300 g (from 175.2 to 262.8) (Szczepanek 2013, fig. 44). At the same time, throughout the life of

the cemetery, graves are present in each phase that deviate significantly from the norm. The weight of the bones in them is close to the actual weight expected from the cremation of the corpse of an adult person – in Mokra (range 713 to 1753 g) and in Opatów (range 1306 to 1830 g) (Szczepanek 2013, fig. 44).

2.3.3. Anatomical representation

Cremation pit graves and urns

In cremation pit graves, skull bones, upper limb bones, lower limb bones, teeth and vertebrae are most commonly identified in that order. Pelvic and thoracic bones are the least common. In urn graves, skull bones, teeth, lower and upper limb bones and vertebrae are most commonly identified in that order. The least represented are the bones of the thorax and pelvis. Thus, a similar proportion of individual skeletal parts is found in both types of graves. However, in the case of urns, several times we note situations in which all parts of the skeleton are represented, while in cremation pit graves, such a situation was not observed even once.

In both grave types, the presence of pelvic and thoracic bones is slight. This frequency of individual bone elements may be due to various factors. Leading the way are conditions related to the structure of the bones, and their different vulnerability to heat and soil conditions. Vertebrae, the epiphyses of long bones (practically unrecorded in the material studied) have a lot of spongy substance and are more rapidly subject to degradation processes (including burning). Another possible factor, which is difficult to assess objectively, is the attention paid to excavating these skeletal elements.

Ustrina (pyre sites)

Ustrina, which at Raczkowice are most likely to have been the site of a single cremation of corpses, were discovered in the southern part of the cemetery, which finds parallels in the cemeteries at Opatów and Mokra. They are dated from the Younger Roman Period to the stage C_3-D.

They are rectangular or near rectangular in shape, up to 200 cm long and sunk into the ground up to 60 cm. In addition to charcoal and burnt fragmented artefacts, a small number contained burnt bone remains, the anatomical arrangement of which was not recorded during the archaeological investigations. In addition, Feature 55 contained c. 400 burnt clay lumps, which are a trace of the preparation stage of the pit before the stack of wood was placed in it.

In contrast, no traces of long-term use were found, which could be manifested by the more numerous remains of the pyre or the enhancement of the structure with stones.

Based on the skeletal remains preserved in the three *ustrina*, it was determined that the skeletons belonged to a male (*adultus*), a male whose age could not be determined and a person whose age and sex could not be determined.

The degree of preservation of the bones from the *ustrina* was assessed as very poor. In Feature 45, the bone remains (weight 109.1 g) were light brown and burned to a medium to high degree. Skull bones, teeth, upper limb bones and vertebrae were distinguished. No pelvic, thoracic or lower limb elements were present.

In Feature 55, the skeletal remains (weight 165.5 g) were grey and distinguished by a very high degree of burn-through (Fig. 9). Skull bones, upper and lower limb bones were recorded there. No teeth were found, and, as in Feature 45, no thoracic or pelvic bones were identified.

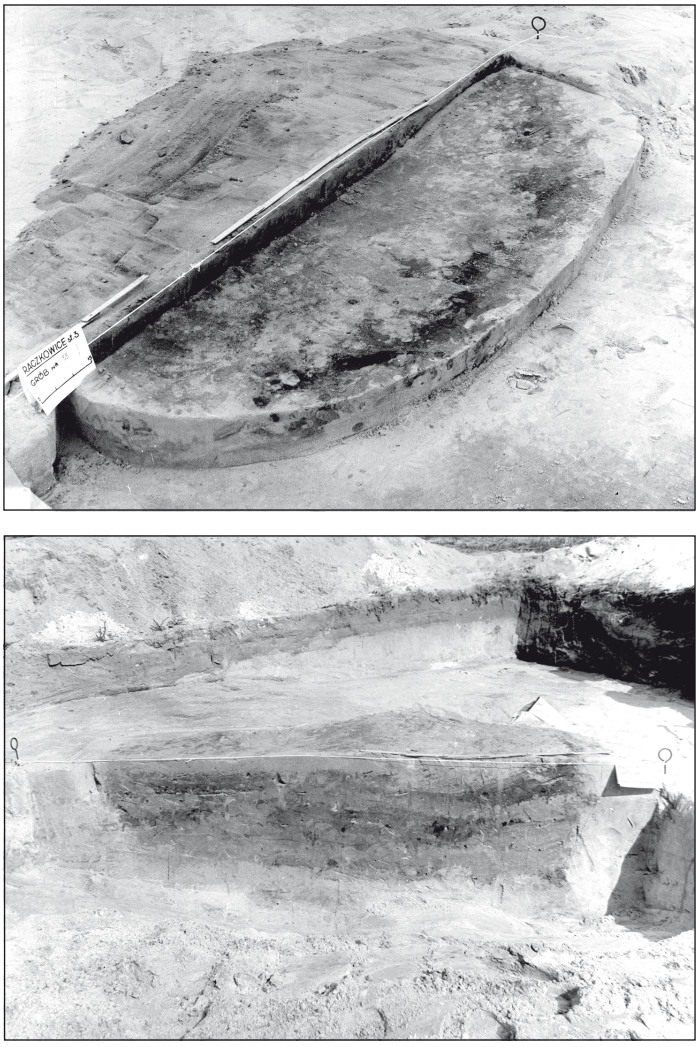


Fig. 9. Raczkowice, Site 3. Feature 55 – pyre site (*ustrinum*).
Photo: archive of the S. Sankowski Museum in Radomsko

Feature 57 contained clear bone fragments that could not be anatomically attributed (weight 4.6 g). They were distinguished by their high degree of burn-through.

Cremation layer

A feature that, in our opinion, can be classified as a cremation layer (Features/concentrations 48-54) was identified in the southern part of the cemetery in the area of the *ustrina*. Chronologically, it is placed in the C_3-D phase. The top of the layer, it seems, was not properly recorded and documented during the investigation. There were concentrations of material, the matrix of which was described as dark brownish-grey or brownish-grey-black, containing charcoal, burnt bones, a large amount of pottery, and a much smaller number of glass and metal objects (the latter usually in fragments of a size that excluded identification). No discolouration of the subsoil resulting from the high temperature of a pyre was documented. At the same time, each of the concentrations contained burnt clay lumps, ranging from a dozen to almost 200 fragments, among them those of a structural nature (Features 49 and 54). The charcoal from the stratum in question came primarily from Scots pine, with a small admixture of larch or spruce (Skrzyński, forthcoming).

Within the layer, several concentrations of bones were identified and attributed to seven adult individuals (adult age, *adultus*, *maturus*). Indicators of the female sex were noted only once, male sex was noted twice, in the other four cases there were no corresponding bone elements to identify sex.

The total weight of the bones from the layer is 1107 g, with an average of 158.1 g. The minimum weight is 22.9 g (Feature 50) and the maximum is 500 g (Feature 51). The bones from the stratum are distinguished by their high degree of burn-through. The colour of the bones varies greatly from light to dark in shades of grey and brown. Skull bones are prominent in all concentrations. Teeth and bones of the lower limbs (four concentrations), vertebrae and bones of the upper limbs (in three concentrations) are next in terms of proportion. Thoracic bones were identified in two concentrations, and pelvic bones were identified once.

3. STATISTICAL ANALYSIS

A total of 77 cremation graves were statistically analysed, including 62 cremation pit graves (80.5%) and 15 urn burials (19.5%). The occurrence of the remains of the cremation pyre (charcoal) in the graves, the general state of preservation of the bone material, the presence of animal bones, and the degree of burning of the skeletal material were analysed (Table 3). A chi^2 test was used to compare the significance of differences between graves. It showed that, while there was no statistically significant relationship between the type of burial and the presence of pyre remains in the burial, the presence of animal bones was significantly more frequently recorded in urn burials, as well as an overall better state of preservation of the skeletal material. A significantly higher degree of burning of skeletal material was also observed in pit graves.

Table 3. Raczkowice, Site 3. Characteristics of the graves included in the examination

Type of burial (n=77)	**Cremation pit graves n [%]**				**Urn graves n [%]**			
	62 [80.5]				15 [19.5]			
presence of remains of a cremation pyre	yes n [%]		no n [%]		yes n [%]		no n [%]	
	40 [64.5]		22 [35.5]		7 [46.7]		8 [53.3]	
	chi square test p=0.2034 (chi square =1.62; df=1)							
state of preservation of skeletal material	very low n [%]		medium n [%]		very low n [%]		medium n [%]	
	62 [100.0]		-		10 [66.7]		5 [33.3]	
	chi square test p=**0.000** (chi square =22.10; df=1)							
presence of animal bone	yes n [%]		no n [%]		yes n [%]		no n [%]	
	3 [4.8]		59 [95.2]		5 [33.3]		10 [66.7]	
	chi square test p=**0.0012** (chi square =10.53; df=1)							
degree of burning	1 n [%]	2 n [%]	3 n [%]	4 n [%]	1 n [%]	2 n [%]	3 n [%]	4 n [%]
	2 [3.3]	55 [88.7]	4 [6.4]	1 [1.6]	0 [0.0]	5 [33.3]	5 [33.3]	5 [33.3]
	chi square test p=**0.0000** (chi square =28.30; df=3)							

Where: 1 – very high; 2 – high; 3 – medium to high; 4 – medium

As a next step, information on the differences in the mean values of the depth of the grave pits and the mean weight of the skeletal remains was analysed (Table 4). The Mann-Whitney U test was used to compare the significance of the differences (after checking for correspondence to a normal distribution). In the case of grave depth, no statistically significant differences were observed between cremation pit graves and urn graves. However, the mean weight of the skeletal remains taken from the urn graves was significantly higher.

Table 4. Raczkowice, Site 3.
Comparison of the depth of the grave pits and the weight of the bone remains

	Cremation pit graves				**Urn graves**				p U M-W
	n	mean	range	SD	n	mean	range	SD	
Depth [cm]	62	23.0	6.0-101.0	17.59	15	21.5	7.0-45.0	12.00	0.9744 (U=462.0; U=0.03)
Weight [g]	62	58.5	0.01-316.3	76.57	15	742.8	8.0-2850.0	858.88	**0.0001** (U=165.0; Z=3.8)

From an anthropological point of view, it was also important whether, depending on the type of burial, the possibility of assessing the biological parameters of the deceased, the most important of which are sex and age at death, changed. To this end, it was checked in what proportion of the burials it was possible to determine both of these parameters (Table 5). While the type of grave, and therefore the degree of preservation of the skeletal material, does not affect the possibility of assessing sex, it does significantly affect the possibility of assessing age at death.

Table 5. Comparison of the possibility of assessing sex and age at death in relation to burial type

	Cremation pit graves [n=62]		Urn graves [n =15]	
sex estimation	yes n [%]	no n [%]	yes n [%]	no n [%]
	14 [22.6]	48 [77.4]	6 [40.0]	9 [60.0]
	chi square test p=0.1674(chi square =1.91; df=1)			
age at death	yes n [%]	no n [%]	yes n [%]	no n [%]
	38 [61.3]	24 [38.7]	15 [100.0]	-
	chi square test p=**0.0037** (chi square =8.43; df=1)			

It was also crucial to determine which parts of the skeleton were present in the analysed graves. This is significant because, depending on which of these are preserved in the graves, it is possible to make an assessment of the basic biological parameters and also to detail the osteobiography of the deceased (*e.g.*, by indicating the presence of specific palaeopathologies). Table 6 summarises the percentage of graves that contained bone fragments of specific skeletal parts. Based on the data obtained and the results of the chi² test, it can be observed that in the material studied, the presence of skull bones, as well as bone fragments of the upper and lower limbs, was observed with similar frequency in cremation pit graves and urn graves. On the other hand, the presence of teeth and finer bones of the post-cranial skeleton, such as rib fragments, vertebrae and pelvic fragments, was observed significantly more frequently in urn graves. These results are not surprising, as they can be regarded as a result not only of the higher degree of bone burning observed in cremation pit graves but also as a result of the greater exposure of the remains to diagenetic processes in this type of grave.

Table 6. Raczkowice, Site 3. Fragments of skeletal parts identified in graves

Presence of bones of:	Cremation pit graves [n=62		Urn graves [n =15]	
	yes n [%]	no n [%]	yes n [%]	no n [%]
skull	46 [74.2]	16 [25.8]	13 [86.7]	2 [13.3]
	chi square test p=0.3057 (chi square =1.05; df=1)			
teeth	21 [33.9]	41 [66.1]	10 [66.7]	5 [33.3]
	chi square testp=**0.0201** (chi square =5.33; df=1)			
upper limb	34 [54.8]	28 [45.2]	9 [60.0]	6 [40.0]
	chi square test p=0.7179 (chi square =0.13; df=1)			
chest	6 [9.7]	56 [90.3]	5 [33.3]	10 [66.7]
	chi square test p=**0.0188** (chi square =5.52; df=1)			
vertebrae	15 [24.2]	47 [75.8]	9 [60.0]	6 [40.0]
	chi square test p=**0.0072** (chi square =7.21; df=1)			
lower limb (excl. pelvis)	33 [53.2]	29 [46.8]	10 [66.7]	5 [33.3]
	chi square test p=0.3469 (chi square =0.88; df=1)			
pelvis	7 [11.3]	55 [88.7]	5 [33.3]	10 [66,7]
	chi square test p=**0.0347** (chi square =4.46; df=1)			

4. DISCUSSION

4.1. Conclusions of the statistical analysis

Statistical analysis revealed in Raczkowice a correlation between the presence of animal bones and urn graves and a better state of preservation of human bones in vessels. In the cremation pit graves, on the other hand, a significantly higher degree of bone burning was noted, while the average weight of bone remains was higher in the urn graves. The results of the chi^2 test showed that, anatomically, skull bones, as well as fragments of upper and lower limb bones, were present with similar frequency in both types of graves in the material studied. In contrast, teeth and finer bones of the postcranial skeleton, as well as parts of the ribs, vertebrae and pelvis, were observed significantly more frequently in urn graves. This would infer a slightly different treatment of the corpse: a stronger reburning and fragmentation of the human remains, which were deposited directly into the ground. It seems that special care was taken to select the skull fragments from the cremation pyre. Similar conclusions to the materials of the Przeworsk Culture have been made before (concerning the cemetery in Kuny, *cf.*, Makiewicz 2009, 200, 201; to the materials of the Wielbark Culture, *cf.*, Skóra 2014, 60-66). Fragmentation may have a cultural cause and not just be due to the cremation process itself. It is difficult to assess what dictated the selection of bones from the pyre. As experimentally proven (Piontek 1975), after the remains of the wood had burned and the pyre had cooled, the selection of bone fragments (*e.g.*, phalanges) or teeth was not a problem. On the other hand, the presence of animal bones in the graves, resulting from the custom of depositing food with the deceased on the cremation pyre, relates more to the older phase of the necropolis and to that part of the population that used urns. Over time, this custom disappeared in Raczkowice – only single animal bones (domestic chicken and domestic pig) are present in cremation pit graves from the Younger Roman Period and in the cremation layer.

4.2. The question of the fragmentation of grave goods

In comparing, among other things, the degree of bone fragmentation in cremation pit graves and urn graves, attention was also drawn to the issue of fragmentation of metal grave goods, made of iron or copper alloys (Fig. 10).

The analysis has shown that copper alloy items present an average level of fragmentation in terms of size. It should be noted, however, that they are known to be less numerous in the cemeteries of communities of the Przeworsk Culture than iron items. They also represent other categories, mainly items of clothing, such as brooches, belt elements, and ornaments (*e.g.*, pendants). In addition, they are more easily deformed in the fire of the pyre; perhaps for this reason, and as elements of the funerary dress of the deceased, they were subject to different ritual rules.

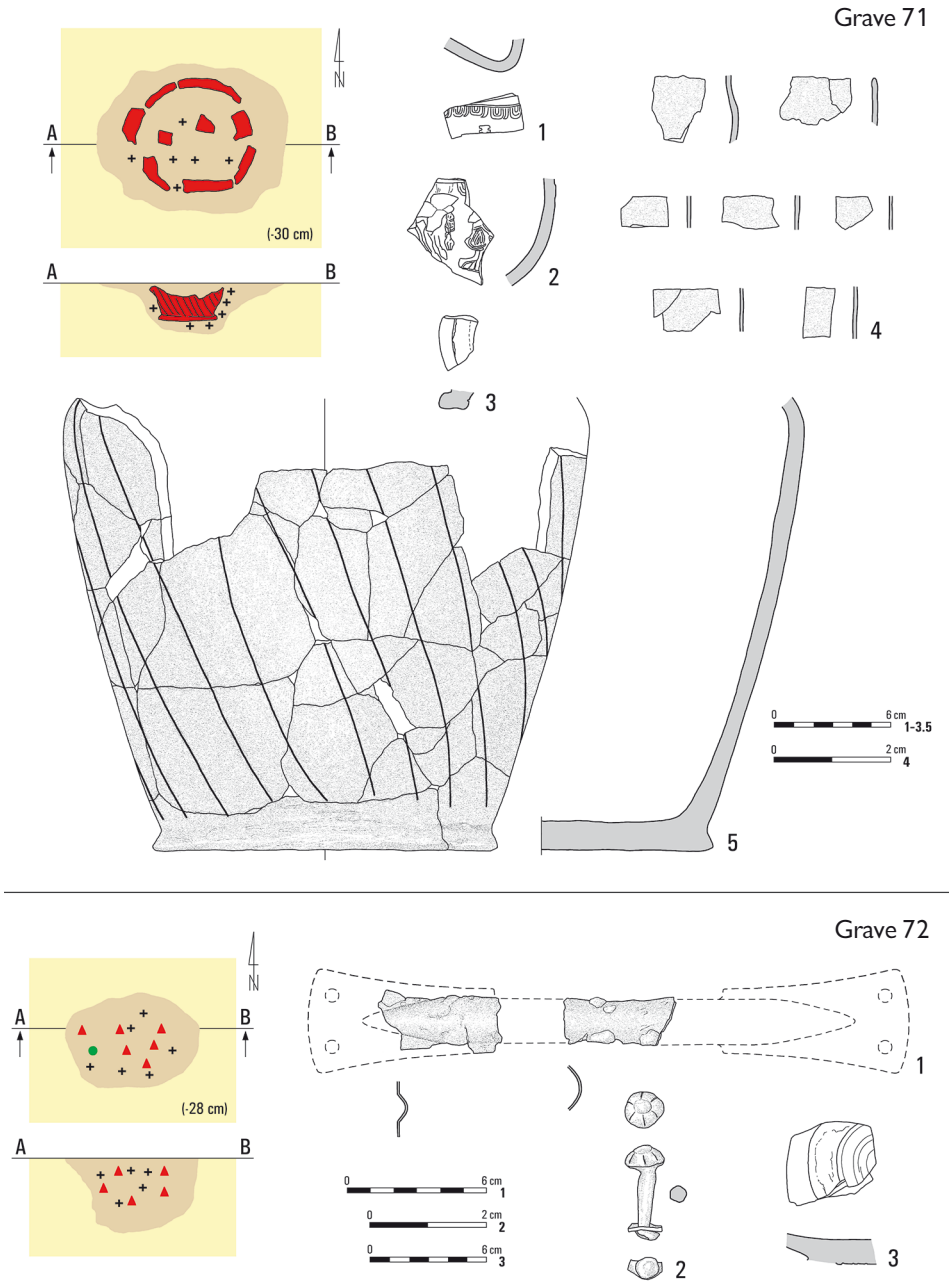


Fig. 10. Raczkowice, Site 3.
Example of cremation pit graves (Graves 71 and 72) with fragments of elements of the grave goods.
Drawing: E. Wtorkiewicz-Marosik

Iron artefacts, on the other hand, present different levels of damage: from very large damage (fragments of the order of up to 10 mm in size) to small damage (objects broken into larger fragments – up to 40-70 mm). However, with this, their degree of fragmentation is stronger. The presence in this assemblage of fragments a few millimetres in size allows one to wonder how the objects were selected after cremation and transferred to the burial pit. Such tiny fragments could not have been deliberately selected individually from the pyre. They may have been taken together with the bones en masse – using a pot, shifted by hand onto a linen shawl, into a pouch or a container. Notably, no correlation was observed between the type of grave (cremation pit grave or urn grave) and the degree of fragmentation of metal objects. The higher number of defaced objects from cremation pit graves is due to the greater number of artefacts in this category. Nor did the stronger fragmentation of metal items in the later grave assemblages become outlined as clearly as expected. Fractions of artefacts from phase B_2 graves belong to different size groups of up to 10, 20, and 40 mm, noting, however, that fractions of equipment items from graves dating from the Younger Roman Period to the Migration Period dominate the size range up to 20 mm.

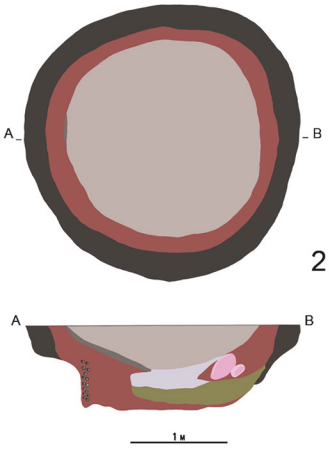
4.3. On the question of the low mass of cremated bone remains in graves

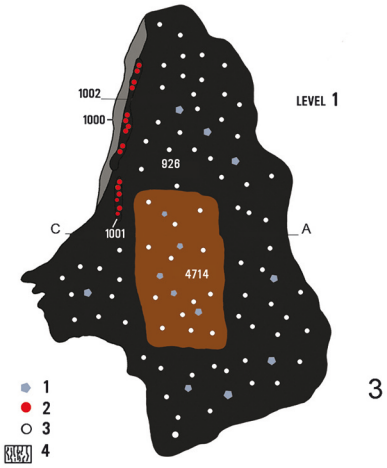
Due to the analogous time of use and burial ritual rules, the material from the nearby necropolises in Opatów and Mokra comprise direct comparative material for Raczkowice. The average result obtained at Raczkowice is between the values calculated for these two sites. The average bone mass in the grave at Opatów is 151.3 g and at Mokra it is 279.6 g (Szczepanek 2013, fig. 44). The tendency for the weight of the bone remains to decrease in the successive phases of necropolis use is evident in the case of each site.

The issue of the low mass of cremated human bones in the graves of the Przeworsk Culture has been the subject of previous research in the context of transformations of the funerary rituals of the Przeworsk Culture and the limitations of demographic studies (most recently: Szczepanek 2013; Madyda-Legutko *et al.* 2015) and the rituals of the Wielbark Culture (Skóra 2014). In the literature, the issue of the 'lack' of skeletal remains has been explained from different perspectives (for a summary, *cf.*, Madyda-Legutko *et al.* 2015).

The successive decrease during the Roman Period in the volume of cremated bones placed in graves, sometimes leading to the representation of the deceased symbolically, was inscribed in the process of the disappearance of urn graves, the widespread use of cremation pit burials, and then the birth of layer features and cremation layer cemeteries, of the Dobrodzień type, characteristic of the southern zone of Przeworsk settlements (northern part of Upper Silesia and the Częstochowa region) in phases C_2 and D (Szydłowski 1964; Godłowski 1981, 117-120).

In light of recent discoveries from aquatic sites, this aspect of funerary rituals can be analysed from a different perspective. The low weight of the bones in the cremation graves may be responsible for their partial remains being left at the cremation sites (*cf.*, for example,





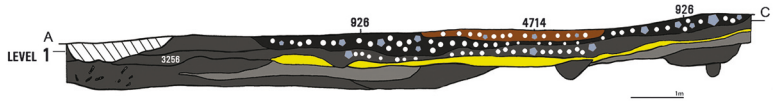


Fig. 11. Examples of sites from the Przeworsk Culture with deposits of burnt human skeletal remains in aquatic sites: 1 – well from Konarzewo, Site 5, Poznań District, Feature 1535, plan at a depth of 1.9 m (4670 g of bone, 30 individuals); 2 – Łęki Majątek, Site 2A, Kutno District, Feature 29, cremation pit grave in a rettery (780 g, M (?), adult and *infans* II); 3 – Modlniczka, Site 2537 ('bog deposit', 23280 g, at least 55 individuals). 1 – vessel fragments, 2 – charcoal, 3 – burnt human bones, 4 – wood. Based on: photo courtesy of Wojciech Kaczor (1); W. Siciński 2021 (2); Byrska-Fudali and Przybyła 2010 (3)

Arcini 2005). These, in turn, may have been periodically cleaned and the remains of the bones and cremation pyres moved to sites outside the cemeteries or in their surroundings (Fig. 11), for example, to aquatic environments, *i.e.*, ponds, wells, springs (*e.g.*, Konarzewo – Makiewicz *et al.* 2008; Modlniczka – Byrska-Fudali and Przybyła 2020; we do not take into account discoveries of unburned human skeletal elements in aquatic environments, *e.g.*, Polwica 5, Site P5/1407, *cf.*, Gralak 2019, 210). The discovery from Łęki Majątek, Kutno District, was also included in this group of objects (*cf.*, Skóra 2014, 65), but the issue remains unresolved. Feature 29 from this site, identified as a cremation pit burial (3rd-4th century) in a flax rettery, contained the burnt bones of an adult male and a child (*infans II*). It is uncertain whether the location of the bones in the centre of a disused rettery was intentional or accidental (Siciński 2021, 104, 105).

Such treatments would explain the 'scarcity' of bones in graves of the Przeworsk Culture from the Younger Roman Period onwards. However, it remains an open question whether similar practices, but on a smaller scale, were not already undertaken in the early Roman period.

In the case of Raczkowice, the pyre sites (*ustrina*), assessed as once used, are characterised by a minor number of human bones. Adding up the weight of the bones from these pyre sites (*ustrina*) with the highest weight of the bones from their contemporary cremation grave does not give a value that comes close to the expected weight of a cremated skeleton. We therefore do not know the answer to the questions raised about the fate of these missing remains.

5. CONCLUSION

The evaluation of the content of the graves from the Przeworsk Culture cemetery in Raczkowice from an archaeological and osteological perspective in the context of the 'missing' burnt bone remains has confirmed the previous observations and led to new conclusions, which, however, should be verified in the future, taking into account new materials and using new research methods. The collection of bones was analysed in terms of weight, state of preservation, anatomical differentiation and frequency of different parts of the skeleton, assuming an answer as to whether the skeletal remains were selected from the cremation pyre and what proportion of them was deposited in the grave. The results obtained for Raczkowice are presented against the background of the funerary customs of the Przeworsk Culture in the last phases of the Roman Period. It is extremely important to identify the taphonomic factors that are responsible for the state of preservation of the bone assemblages. This allows us to understand the social and cultural aspects of burials at a specific time and community (*cf.*, Knüsel and Robb 2023). 'The archaeology of cremation' is a developing discipline that is charting new research perspectives (*e.g.*, Cerezo-Román and Williams 2014; Harving 2015; Harvig and Lynnerup 2013). Cremation sites, once-used and reusable, are more widely analysed in the case of cemeteries between the

Oder and Vistula: features in the *bustum* type, groove features, layer features and cremation layers and pyre sites (*ustrina*) (*e.g.*, Zagórska-Telega 2019).

In the case of changes in the funerary rituals of populations using cremation during the Roman Period, it can be assumed that they occurred not only as a result of changes in belief and eschatology, but also to some extent as a result of shifting social relations. However, this assumption requires more extensive research, to which new data from studies conducted with new methods that take into account the research needs articulated here will be incorporated. Relying on archival research material brings with it too many cognitive limitations. A condition for progress in the study of funerary rituals is the interdisciplinary study of cemeteries and their infrastructures in the form of cremation sites using new documentation techniques.

Acknowledgements

The authors would like to thank W. Kaczor and M. M. Przybyła for sharing their photographs and drawings. The article was written as part of the project support by the Polish Ministry of Culture and National Heritage from the Culture Promotion Fund.

References

Arcini C. 2005. Pyre sites before our eyes. In T. Artelius and F. Svanberg (eds), *Dealing with the Dead. Archaeological Perspective on Prehistoric Scandinavian Burial Ritual*. Stockholm: National Heritage Board, 63-72.

Biborski M. 1998. Badania wykopaliskowe na cmentarzysku kultury przeworskiej z okresu wpływów rzymskich w Mokrej, województwo częstochowskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w 1995 roku*, 63-75.

Biborski M. 2000a. Wyniki badań wykopaliskowych na cmentarzysku kultury przeworskiej z okresu wpływów rzymskich w Mokrej, województwo częstochowskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w 1996 roku*, 81-92.

Biborski M. 2000b. Dalsze badania na stanowisku 8 w Mokrej, województwo częstochowskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w 1997 roku*, 100-109.

Biborski M. 2001. Badania ratownicze na cmentarzysku kultury przeworskiej w Mokrej, województwo częstochowskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w 1998 roku*, 125-133.

Biborski M. 2002. Ratownicze badania wykopaliskowe na cmentarzysku kultury przeworskiej z późnego okresu wpływów rzymskich i wczesnej fazy wędrówek ludów w Mokrej, województwo śląskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w latach 1999-2000*, 229-241.

Biborski M. 2004a. Dalsze ratownicze badania wykopaliskowe na cmentarzysku kultury przeworskiej z późnego okresu wpływów rzymskich i wczesnej fazy wędrówek ludów w Mokrej, województwo

śląskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w latach 2001-2002*, 125-139.

Biborski M. 2004b. Die Ergebnisse der Forschungen auf dem spätkaiserzeitlichen Gräberfeld von Mokra, Kreis Kłobuck, Woiw. Śląskie, Fundstelle 8. Forschungen von 1996-1998. *Recherches archéologiques de 1993-1998*, 103-114.

Biborski M. 2006a. Końcowe etapy badań wykopaliskowych na cmentarzysku kultury przeworskiej z okresu rzymskiego i wczesnej fazy wędrówek ludów w Mokrej, województwo śląskie. *Badania archeologiczne na Górnym Śląsku i ziemiach pogranicznych w latach 2003-2004*, 128-134.

Biborski M. 2006b. Die Fortsetzung der Ausgrabungen auf dem Gräberfeld der Przeworsk-Kultur der jüngeren römischen Kaiserzeit und frühen Völkerwanderungszeit in Mokra, Kr. Kłobuck, Woiw. Śląskie, Fst. 8. Forschungen von 1999-2003. *Recherches archéologiques de 1999-2003*, 169-189.

Biborski M. 2010. Chronologia cmentarzyska kultury przeworskiej z młodszego i późnego okresu rzymskiego oraz z wczesnej fazy wędrówek ludów z Mokrej na Śląsku. *Wiadomości Archeologiczne* 61, 137-151.

Byrska-Fudali M. and Przybyła M. M. 2010. Bog deposit of burnt human remains from site 2 in Modlniczka, dist. Cracow. *Sprawozdania Archeologiczne* 62, 439-492.

Cerezo-Román J. I. and Williams H. 2014. Future directions for the archaeology of cremation. In I. Kuijt, C. P. Quinn and G. Cooney (eds), *Transformation by Fire: The Archaeology of Cremation in Cultural Context*. Tucson: University of Arizona Press, 240-255.

Czarnecka K. 1990. *Struktura społeczna ludności kultury przeworskiej. Próba rekonstrukcji na podstawie źródeł archeologicznych i analizy danych antropologicznych z cmentarzyska*. Warszawa: Państwowe Muzeum Archeologiczne.

Ellingham S. and Sandholzer M. A. 2020. Determining Volumetric Shrinkage Trends of Burnt Bone Using Micro-CT. *Journal of Forensic Science* 65, 196-199.

Goldhahn J. and Oestigaard T. 2008. Smith and Death – Cremations in Furnaces in Bronze and Iron Age Scandinavia. In K. Chilidis, J. Lund and C. Prescott (eds), *Facets of Archaeology: Essays in Honour of Lotte Hedeager on Her 60th Birthday* (= *Oslo archaeological series* 10). Oslo: Unipub. Institutt for arkeologi, konservering og historiske studier. Universitetet i Oslo, 231.

Gralak T. 2019. *Osadnictwo z późnego okresu wpływów rzymskich i początku okresu wędrówek ludów na stanowiskach Polwica 4 i 5 oraz Skrzypnik 8* (= *Archeologiczne Zeszyty Autostradowe* 21). Wrocław: Instytut Archeologii i Etnologii PAN.

Großkopf B. 2004. *Leichenbrand. Biologisches und kulturhistorisches Quellenmaterial zur Rekonstruktion vor- und frühgeschichtlicher Populationen und ihrer Funeralpraktiken*. Ph Thesis. Leipzig: Universität Leipzig.

Godłowski K. 1981. Kultura przeworska. In J. Wielowiejski (ed.), *Prahistoria Ziem Polskich* 5. *Późny okres lateński i okres rzymski*. Wrocław, Warszawa, Kraków, Gdańsk: Zakład Narodowy im. Ossolińskich, Wydawnictwo PAN, 57-120.

Godłowski K. 1985. *Przemiany kulturowe i osadnicze w południowej i środkowej Polsce w młodszym okresie przedrzymskim i w okresie rzymskim*. Wrocław, Warszawa, Kraków, Gdańsk, Łódź: Zakład Narodowy im. Ossolińskich.

Harvig L. 2015. Past cremation practices from a bioarchaeological perspective. How new methods and techniques revealed conceptual changes in cremation practices during the late Bronze and early Iron Age in Denmark. In T. Thompson (ed.), *The Archaeology of Cremation. Burned Human Remains in Funerary Studies. Studies in Funerary Archaeology* 8. Oxford: Oxbow Books, 43-62.

Harvig L. and Lynnerup N. 2013. On the volume of cremated remains – a comparative study of archaeologically recovered cremated bone volume as measured manually and assessed by Computed Tomography and by Stereology. *Journal of Archaeological Science*, 40, 2713-2722.

Imaizumi K. 2015. Forensic investigation of burnt human remains. *Research and Reports in Forensic Medical Science* 5, 67-74.

Jaeger J. H. and Johansen V. L. 2013. The cremation of infants/small children: An archaeological experiment concerning the effects of fire on bone weight. *Cadernos do GEEvH* 2/2, 13-26.

Kaczanowski P. 1987. *Drochlin. Ciałopalne cmentarzysko kultury przeworskiej z okresu wpływów rzymskich*. Zeszyty Naukowe UJ DCCCXXVIII (= *Prace Archeologiczne* 40), Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.

Kaczanowski P. and Rodzińska-Nowak J. 2015. Uwagi o przydatności wyników analizy cmentarzysk ciałopalnych z okresu rzymskiego do studiów paleodemograficznych. *Barbaricum* 11, 215-227.

McKinley J. 1994a. Bone fragment size in British cremation burials and its implication for pyre technology and ritual. *Journal of Archaeological Science* 21/3, 339-342.

McKinley, J. 1994b. A pyre and grave goods in British cremation burials; Have we missed something? *Antiquity* 68, 132-134.

Knüsel C. J. and Robb J. 2023. Tafonomia funeralna: przegląd celów i metod. In A. Staniewska and E. Domańska (eds), *Ekshumacje polityczne. Teoria i praktyka*. Gdańsk, Lubin: Muzeum Historyczne w Lubinie, 93-156.

Koczorski T., Kajmowicz B. and Florkowski A. 2013. Analiza antropologiczna materiałów kostnych. In J. Szałkowska-Łoś and J. Łoś, *Zakrzewska Osada. Cmentarzysko kultury pomorskiej i wielbarskiej na Pojezierzu Krajeńskim* (= *Ocalone Dziedzictwo Archeologiczne* 2). Bydgoszcz, Pękowice: Muzeum Okręgowe w Bydgoszczy, Wydawnictwo i Pracownia Archeologiczna Profil-Archeo, 81-103.

Krap T., Nota K., Wilk L. S., van de Goot F. R. W., Ruijter J.M., Duijst W. and Oostra R. J. 2017. Luminescence of thermally altered human skeletal remains. *International Journal of Legal Medicine* 131/4, 1165-1177.

Kuryłowicz M. 2020. *Rzymskie prawo oraz zwyczaje grobowe i pogrzebowe. Studia i szkice*. Lublin: Wydawnictwo Werset.

Madyda-Legutko R. 1987. *Die Gürtelschnallen der römischen Kaiserzeit und der frühen Völkerwanderungszeit im mitteleuropäischen Barbaricum* (= *BAR International Series* 360). Oxford: Archaeopress.

Madyda-Legutko R. 2011. *Studia nad zróżnicowaniem metalowych części pasów w kulturze przeworskiej. Okucia końca pasa*. Kraków: Towarzystwo Wydawnicze 'Historia Iagellonica'.

Madyda-Legutko, J. Rodzińska-Nowak and Zagórska-Telega J. 2011a. *Opatów, Fst. 1. Ein Gräberfeld der Przeworsk-Kultur im nordwestlichen Kleinpolen* (= *Monumenta Archaeologica* 15/1 – Katalog).

Warszawa, Kraków: Fundacja Monumenta Archaeologica Barbarica, Państwowe Muzeum Archeologiczne, Instytut Archeologii UJ.

Madyda-Legutko, J. Rodzińska-Nowak and Zagórska-Telega J. 2011b. *Opatów, Fst. 1. Ein Gräberfeld der Przeworsk-Kultur im nordwestlichen Kleinpolen* (= *Monumenta Archaeologica* 15/2 – Tafeln). Warszawa, Kraków: Fundacja Monumenta Archaeologica Barbarica, Państwowe Muzeum Archeologiczne, Instytut Archeologii Uniwersytetu Jagiellońskiego.

Madyda-Legutko R., Rodzińska-Nowak J. and Zagórska-Telega J. 2015. Ponowna refleksja nad przyczynami występowania niewielkiej ilości ludzkich szczątków kostnych w grobach kultury przeworskiej z młodszego i późnego okresu rzymskiego oraz z wczesnej fazy okresu wędrówek ludów. In A. Michałowski, M. Teska and M. Żółkiewski (eds), *Viator per devia scientiae itinera. Studia nad problematyką okresów rzymskiego, wędrówek ludów i wczesnego średniowiecze* (= *Seria Archaeologia* 53). Poznań: Wydawnictwo Naukowe UAM, 291-296.

Makiewicz T. 2008. Ile kości w grobach? Intrygujący i niezauważony aspekt ciałopalnego obrządku pogrzebowego w kulturze przeworskiej. In A. Błażejewski (ed.), *Labor et patientia. Studia Archaeologica Stanislao Pazda dedicata*. Wrocław: Instytut Archeologii UWr, 289-300.

Makiewicz T. 2009. O sposobach traktowania szczątków kostnych w ciałopalnym obrządku pogrzebowym kultury przeworskiej. *Folia Praehistorica Posnaniensia* 15, 185-208.

Makiewicz T., Kaczor W., Krąpiec M., Makowiecki D., Miłosz E. and Polcyn M. 2008. Studnia – cmentarzysko z okresu wędrówek ludów w obrębie kompleksu osadniczego w Konarzewie (stan. 5), pow. Poznań ziemski. Nowy typ cmentarzyska kultury przeworskiej. In J. Skowron and M. Olędzki (eds), *Kultura przeworska. Odkrycia – interpretacje – hipotezy* 2. Łódź: Instytut Studiów Międzynarodowych, Wydział Studiów Międzynarodowych i Politologicznych UŁ, 299-355.

Malinowski T. 1969. *Obrządek pogrzebowy ludności kultury pomorskiej*. Wrocław, Warszawa, Kraków: Zakład Narodowy im. Ossolińskich.

Malinowski A. and Porawski R. 1969. Identifikationsmöglichkeiten menschlicher Brandknochen mit besonderer Berücksichtigung ihres Gewichts. *Zacchia di medicina legale, sociale e criminologica* 44, 392-410.

Mamede A. P., Gonçalves D., Marques M. P. M. and Batista de Carvalho L. A. E. 2017. Burned bones tell their own stories: A review of methodological approaches to assess heat-induced diagenesis. *Applied Spectroscopy Reviews* 53, 1-33.

Piontek J. 1975. Polish methods and results of investigations of cremated bones from prehistoric cemeteries. *Glasnik Antropološkog Društva Jugoslavije* 12, 23-34.

Piontek J. 1996. *Biologia populacji pradziejowych*. Poznań: Wydawnictwo Naukowe Uniwersytetu Adama Mickiewicza.

Piontek J. 2002. Wpływ procesu kremacji na morfologię kości szkieletu ludzkiego. Wyniki badań eksperymentalnych. In J. Wrzesiński (ed.), *Popiół i kość* (= *Funeralia Lednickie – Spotkanie* 4). Sobótka, Wrocław: Muzeum Ślężańskie im. S. Dunajewskiego, 95-108.

Piontek J. 2007. Metodyka antropologicznych badań materiałów kostnych z grobów ciałopalnych. In L. Bakalarska (ed.), *Materiały z konferencji konserwatorstwa archeologicznego zorganizowanych*

przez Ośrodek Ochrony Dziedzictwa Archeologicznego Jurata (8-20 V 2005 r.), Wigry (28-30 IX 2005 r.), Krynica (30 XI – 3 XII 2005 r.). Warszawa: Krajowy Ośrodek Badań i Dokumentacji Zabytków.

Rubio L., Díaz-Vico R., Smith-Fernández I., Smith-Fernández A., Suárez J., Martín-de-Las-Heras S. and Santos I. 2020. Spectrophotometric Color Measurement to Assess Temperature of Exposure in Cortical and Medullar Heated Human Bones: A Preliminary Study. *Diagnostics* 10(11), 979.

Siciński W. 2021. *Ratownicze badania archeologiczne na stanowisku 2-2A w Łękach Majątku, pow. Kutno, woj. łódzkie (trasa autostrada A-1)* (= *Via Archaeologia Lodziensis* 9). Łódź: Fundacja Badań Archeologicznych im. Profesora Konrada Jażdżewskiego, Muzeum Archeologiczne i Etnograficzne w Łodzi.

Skóra K. 2014. Trup nieobecny?... czyli o brakujących szczątkach kostnych w grobach kultury wielbarskiej. *Acta Archaeologica Lodziensia* 60, 45-68.

Skóra K. 2020. *Omnia mors aequat? Soziale Stratigraphien in der römischen Kaiserzeit und Völkerwanderungszeit im Gebiet der Wielbark-Kultur*. Łódź: Instytut Archeologii i Etnologii PAN.

Skrzyński G. forthcoming. Węgle drzewne z cmentarzyska kultury przeworskiej w Raczkowicach jako źródło danych paleośrodowiskowych i paleoetnobotanicznych.

Szczepanek A. 2013. *Archeotanatologia pochówków zbiorowych od pradziejów po czasy współczesne* (= *Collectio Archaeologica Ressoviensis* 25). Rzeszów: Wydawnictwo Mitel.

Szydłowski J. 1964. *Obrządek pogrzebowy na Górnym Śląsku w okresie wpływów rzymskich* (= *Rocznik Muzeum Górnośląskiego* 2). Bytom: Muzeum Górnośląskie w Bytomiu.

Tyszler L. 2012. *Ceramika rzymska na północ od Karpat i Sudetów* (= *Spatium Archaeologicum* 4). Łódź: Instytut Archeologii Uniwersytetu Łódzkiego.

Wahl J. 2001. Bemerkungen zur kritischen Beurteilung von Brandknochen. *Beiträge zur Archäozoologie und prähistorischen Anthropologie* 3, 157-167.

Zagórska-Telega J. 2019. *Obrządek pogrzebowy ludności kultury przeworskiej nadliswarciańskiego regionu osadniczego w młodszym i późnym okresie rzymskim* (= *Opera Archaeologiae Iagellonicae* 4). Kraków: Historia Iagellonica.