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GRAVE OF THE GLOBULAR AMPHORA CULTURE FROM KOSZYCE IN THE CHRONOLOGICAL PERSPECTIVE

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ABSTRACT

The grave of the Globular Amphora culture from site 2 in Koszyce, near Kraków, has already been the subject of a separate monograph and specialised analyses. This article addresses the chronology of the mass burial, resulting from a comparison of 23 radiocarbon dates obtained in three laboratories. The chronometric data were then juxtaposed with the results of isotopic analyses of strontium ($^{87}Sr/^{86}Sr$), carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$). The analysis of the results indicates that the burial from Koszyce should most likely be dated to around 2880–2870 BC, which is slightly earlier than assumed in previous studies. It comes from a time when the Final Eneolithic barrow communities of the Corded Ware culture had already been present in the loess uplands of western Lesser Poland, and the burial ritual of some of the GAC groups was evolving towards the ritual of the Złota

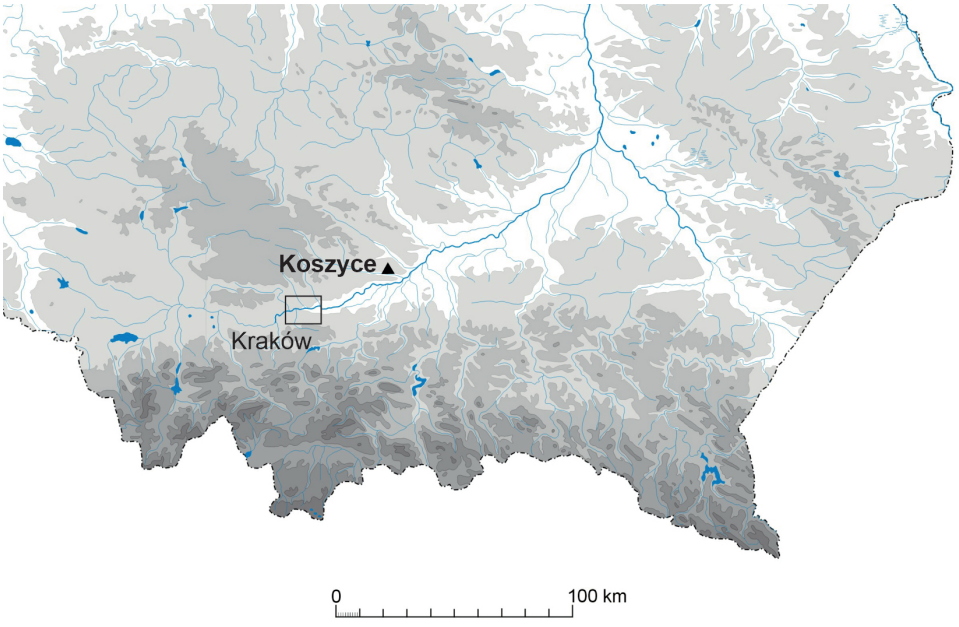
culture. The similar dating of these cultural phenomena makes it difficult to determine which community was responsible for the mass murder committed at Koszyce.

Keywords: Globular Amphora culture, Lesser Poland, radiocarbon chronology, stable isotopes, strontium isotopes, mass grave

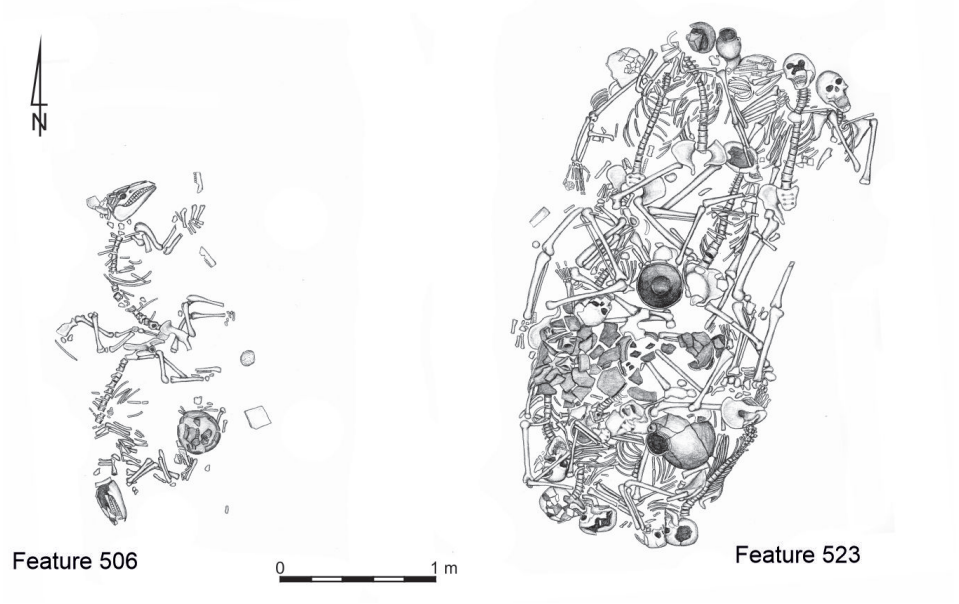
INTRODUCTION

In 2011, two funerary features of the Globular Amphora culture (GAC) were discovered at site 2 in Koszyce, Proszowice district (Fig. 1). These were grave 523 and pit 506, the latter with the skeletons of five pigs (Fig. 2). These finds have been comprehensively studied [Przybyła *et al.* 2013] and have been the subject of additional specialist analyses [Konopka *et al*. 2016; Schroeder *et al*. 2019]. Tested by various analyses, including archaeogenetic ones, the grave with the remains of 15 murdered individuals (Figs 3 and 4) has become one of the most spectacular discoveries in the history of research on the Neolithic of Lesser Poland. Since its publication, it has been the subject of discussion in the scientific community. This has brought up the question of explaining the 'Koszyce massacre' [Przybyła *et al*. 2013; Schroeder *et al*. 2019]. The absolute dating of the grave, to the beginning of the Late Eneolithic (generally: c. 2900–2700 BC), seemed to indicate a link between the dramatic events and the increased population movements during this period, and above all with the arrival of the people of the Corded Ware culture (CWC). The simplest solution to the riddle would be to assume an execution of a Late Eneolithic population, the GAC, at the hands of a Final Eneolithic people, the CWC. The initial publications of the mass grave from Koszyce appeared at the same time as the ground-breaking works presenting archaeogenetic data [Allentoft *et al*. 2015; Haak *et al*. 2015]. Hence, one of the first interpretations of the event already suggested the involvement of a Final Eneolithic (CWC) population [Schroeder *et al.* 2019]. So far, however, no evidence has been obtained to support this supposition.

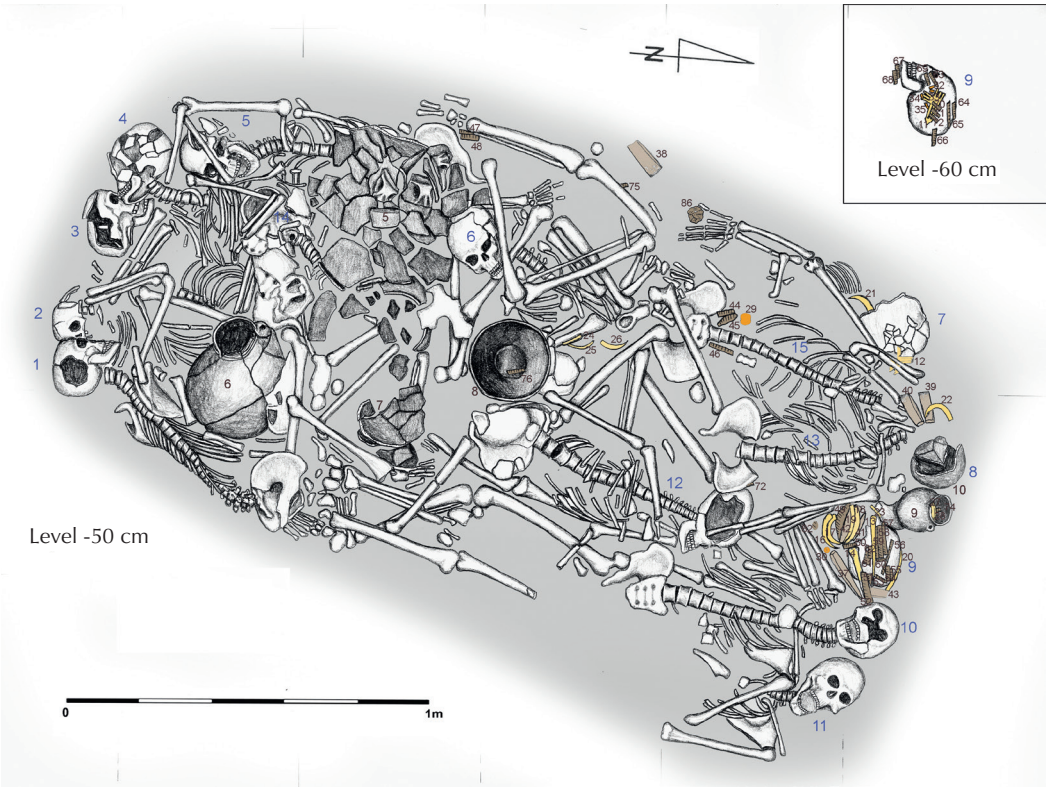
A fundamental issue, one with implications for further prehistoric interpretations, is the dating of the features from Koszyce and their positioning against the background of cultural changes in south-eastern Poland in the first half of the 3rd millennium BC. It is also important to compare chronometric data with the results of carbon ^{13}C, nitrogen ^{15}N and strontium $^{87}Sr/^{86}Sr$ isotope analyses. This is because these analyses contribute valuable data to the discussion on the mobility and economic characteristics of the Late Eneolithic community under study. These in turn contribute to considerations of the chronology of cultural processes in the Late and Final Eneolithic in Lesser Poland.



F i g . 1. Location of site 2 at Koszyce, Proszowice district, Lesser Poland



F i g . 2. Koszyce, site 2, Proszowice district. Features 506 (animal sacrifice) and 523 (mass grave). Prep. by M. Podsiadło



F i g . 3. Koszyce, site 2, Proszowice district. Feature 523. Prep. by M. Podsiadło

F i g . 4. Koszyce, site 2, Proszowice district. Feature 523. Photo by M. Podsiadło

The first radiocarbon age determinations for features 506 and 523 from Koszyce were obtained in laboratories in Poznań (5 results) and Uppsala (4 results) [Włodarczak, Przybyła 2013: 235, Tables 5 and 6]. Then, on the occasion of an archaeogenetic project carried out in Copenhagen, 15 further ^{14}C dates were obtained for human skeletons from feature 523 in the Århus laboratory [Schroeder *et al*. 2019]. In total, therefore, we have an impressive series of 23 results for human bones from grave 523 (Table 1) and one date for a pig bone from pit 506 (Table 2). It can be assumed with a high degree of probability that the grave (523) and the sacrificial pit (506) were created at the same time. Similarly, the date of death should be the same (or very close) for all the individuals buried in the mass grave. Chronometric studies of the features from Koszyce are therefore important not only because they pertain to spectacular finds. The large number of dates for a single burial also offers an interesting contribution to the study of the efficiency and precision of the radiocarbon method in determining the absolute age of prehistoric features. On the occasion of the analysis undertaken here, it is worthwhile to give some consideration to the dating of GAC mass burials by means of single and multiple ^{14}C dates.

The results of the absolute dating allow us to confidently place the features from Koszyce in the first half of the 3rd millennium BC (Tables 1 and 2; Fig. 5). More precise dating, however, is difficult to establish. For most of the ^{14}C results obtained, the absolute age falls into the interval corresponding to the extensive flattening of the calibration curve around 2880–2580 BC [Müller 1999; Raetzel-Fabian 2000; Furholt 2003; Włodarczak 2009]. This is a period when distinct changes can be seen in the funerary rituals of communities inhabiting Lesser Poland: the CWC barrow ritual becomes widespread, and the syncretic Złota culture (ZC) rite also appears. In general terms, one can expect a sequence in which the GAC ritual would undergo changes under the influence of the strong allochthonous CWC current (barrows, chamber graves, individualisation of burials), with the ZC rite representing the intermediate stage of this process. However, within the period of 2880–2580 BC detailed here, retardations are also possible, which means we cannot rule out the parallel occurrence of the GAC, CWC, and ZC rites. Moreover, these sequences may differ in character among the different micro-regions of Lesser Poland. The flattening of the curve makes it difficult to systematise these phenomena chronologically.

The second source of inaccuracy lies in the method itself. The differences in the ages obtained for the same material do not allow the age to be determined with the precision sufficient for establishing the dynamic sequence of cultural changes during the analysed period. The series of 23 age determinations obtained for one mass burial from Koszyce provides an excellent demonstration of the difficulties of

Table 1

Koszyce, site 2, Proszowice district. Feature 523. Results of chronometric, isotope and archaeogenetic analysis. After Włodarczak, Przybyła 2013; Schroeder *et al.* 2019

Individual no.	Chromosomal sex	Age, years	14C BP			δ13C‰ VPDB	δ15N‰ AIR	87Sr/86Sr	DNA no.	mtDNA haplogroup	ChrY haplogroup
			Poznań	Uppsala	Århus						
1	XX	25-30	Poz-47439: 4085±35	Ua-45617: 4226±46	AAR-28702: 4208±35	-20.1	10.8	KF1240: 0.71053 ±0.000004	RISE1159	T2b	–
2	XY	1.5-2			AAR-28703: 4187±36	-19.9	12.9	KF1241: 0.71048 ±0.000006	RISE1160	T2b	I2a2a
3	XX	30-35			AAR-28704: 4230±36	-20.1	10.9	KF1242: 0.71145 ±0.000008	RISE1161	H27+16093	–
4	XY	16-17			AAR-26315: 4239±33	-20.4	10.4	KF1243: 0.71179 ±0.000009	RISE1162	K1a1b1e	I2a2a
5	XY	20-25	Poz-47441: 4190±35		AAR-28705: 4202±36	-20.1	11.7	KF1244: 0.71022 ±0.000009	RISE1163	HV0a	I2a2a
6	XX	13-14		Ua-45618: 3960±44	AAR-26316: 4014±45	-20.2	8.5	KF1245: 0.71151 ±0.000006	RISE1164	K1a1b1e	–
7	XY	2-2.5			AAR-28706: 4220±34	-19.6	12.5	KF1246: 0.70991 ±0.000006	RISE1165	HV16	I2a2a
8	XX	30-35			AAR-26317: 4330±34	-20.3	11.4	KF1247: 0.71201 ±0.000006	RISE1166	J1c3f	–

Individual no.	Chromosomal sex	Age, years	14C BP			δ13C‰ VPDB	δ15N‰ AIR	87Sr/86Sr	DNA no.	mtDNA haplogroup	ChrY haplogroup
			Poznań	Uppsala	Århus						
9	XX	15-16	Poz-47442: 4165±35	Ua-45619: 3985±38	AAR-26318: 4204±44	-20.5	10.0	KF1248: 0.71188 ±0.000005	RISE1167	J1c3f	–
10	XY	18-20			AAR-26319: 4126±36	-20.1	10.4	KF1249: 0.71151 ±0.000005	RISE1168	HV0a	I2a2a
11	XY	40-50			AAR-28707: 4215±35	-20.3	11.6	KF1250: 0.71152 ±0.000008	RISE1169	HV0a	I2a2a
12	XX	30-40	Poz-47440: 4215±35		AAR-28708: 4211±40	-20.3	11.1	KF1251: 0.71132 ±0.000007	RISE1170	K1a1b1e	–
13	XY	5-6			AAR-28709: 4264±34	-19.9	11.6	KF1252: 0.71045 ±0.000006	RISE1171	J1c3f	I2a2a
14	XX	50-60		Ua-45620: 4119±38	AAR-28710: 4379±32	-20.3	11.1	KF1253: 0.70963 ±0.000006	RISE1172	HV0a	–
15	XY	40-50			AAR-26320: 4099±53	-21.1	11.3	KF1254: 0.71099 ±0.000005	RISE1173	HV0a	I2a2a

Table 2

Koszyce, site 2, Proszowice district. Radiocarbon dating of Feature 506

Feature No.	Dated material	Laboratory code	Age ^{14}C BP	Calendar age BC (68.2%)
506	pig bone	Poz-47437	4125±35	2858–2625

radiocarbon dating. A comparison of the results obtained in the three laboratories generally indicates the effectiveness of the method: most results oscillate within a similar section of the first half of the 3rd millennium BC. At the same time, differences between individual results are evident (Fig. 6). They concern the BP values obtained for the series from each laboratory, with the range of results being greatest for the analyses from the Uppsala laboratory (Fig. 7). In the longest series of 15 dates from the Århus laboratory, there were as many as five outliers: two older and three younger. If we had only the oldest result from this series, the age of the Koszyce grave would be determined as between 3022 and 2922 BC (68.2%), while based on the youngest result alone we would obtain a range of 2574–2472 BC (68.2%). These are therefore significantly different ranges, indicating at the same time different cultural-chronological connotations: in the first case, the Koszyce grave would be contemporary with the late Baden culture, and in the second case with the cemeteries of the Kraków-Sandomierz group of the CWC.

In the case of the Koszyce grave, the stratigraphic situation is suggestively clear: the burials are certainly contemporaneous and establishing their age is facilitated by the statistical coincidence of most of the numerous ^{14}C determinations made. Nevertheless, this example highlights the difficulties in the dating of GAC mass graves. Sometimes, the long-term use of a ceremonial-funeral site is assumed on the basis of a longer [e.g. Kierzkowo, *see* Pospieszny 2017] or shorter [e.g. Nakonowo, see Szmyt 2017] series of age determinations. The results obtained for the burial from Koszyce demand caution be taken in such interpretations: radiocarbon age determinations can relatively easily lead to erroneous conclusions of a long duration of a ceremonial-funeral site.

A comparison of the three series of radiocarbon age determinations from Koszyce also reveals statistical differences in the ages obtained in different laboratories (Fig. 7). Averaging the results from Århus indicates an age slightly older than that of the Poznań series, with the youngest results coming from the laboratory in Uppsala. It should be noted here that the averaged series of age determinations from Poznań is the only one for which the OxCal calibration software does not indicate a low concordance test result.

Determining – using the R_Combine function – the averaged BP age for all 15 results from the Århus laboratory, we arrive at the calendar age range of the analysed grave: 2890–2789 BC (68.3%), with the narrow range of 2890–2874 BC being the most likely (62.8%) (Fig. 8). Rejecting the five outliers from this

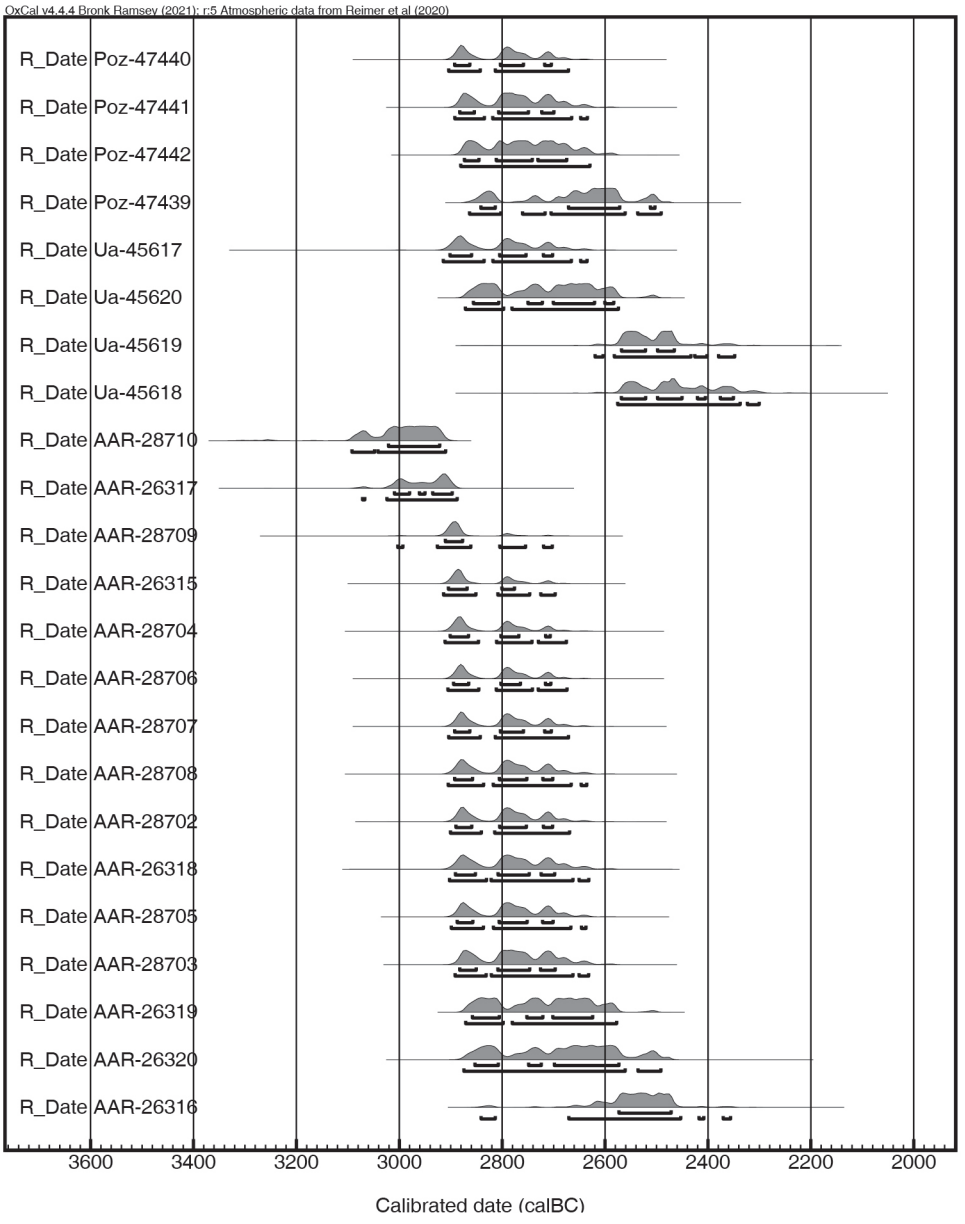
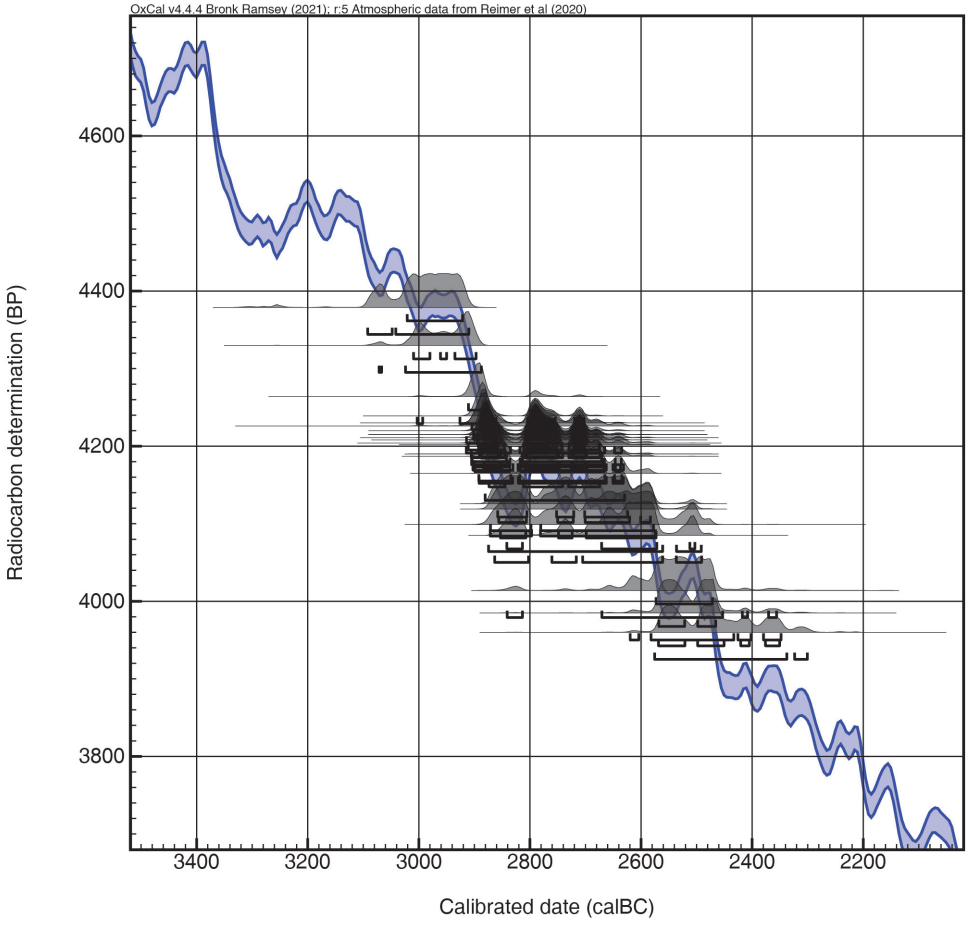
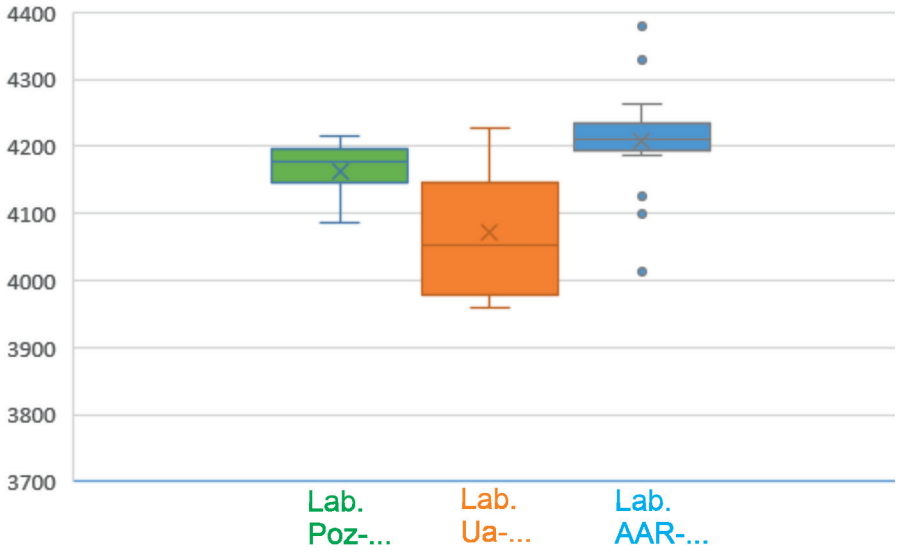


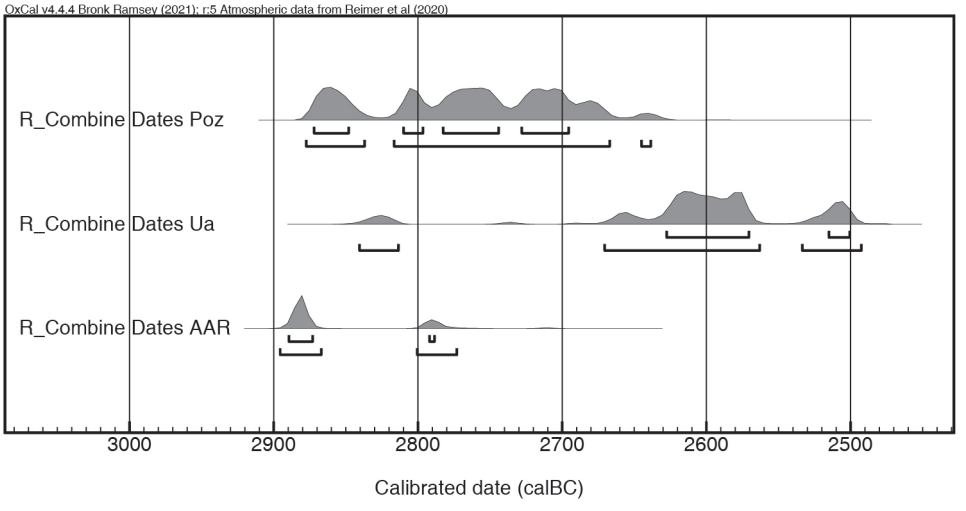
Fig. 5. Koszyce, site 2, Proszowice district. Radiocarbon dates of Feature 523. Calibration by OxCal program v4.4.4



F i g . 6. Koszyce, site 2, Proszowice district. ^{14}C dating of Feature 523 on calibration curve. Calibration by OxCal program v4.4.4



F i g . 7. Koszyce, site 2, Proszowice district. Feature 523. Comparing of BP values from three radiocarbon laboratories. Prep. by P. Włodarczak



F i g . 8. Koszyce, site 2, Proszowice district. Feature 523. Calendar age BC obtained for averaged BP values from three radiocarbon laboratories (function R_Combine in OxCal program v4.4.4)

group yields a range of 2889–2786 BC (68.3%), with 2889–2873 BC as the most probable range. The series from the Poznań laboratory gives quite similar results: 2873–2696 BC. In this case, after the removal of one result for individual no. 1 (4085±35 BP), a slight outlier, we obtain a range of 2880–2704 BC, which correlates quite well with the results from Århus. What is impossible to reconcile with all these findings, however, are the results obtained in Uppsala, among which only one of the four (for individual no. 1) is consistent with the results from the other two laboratories.

As can be seen from the comments above, even with the numerous ^{14}C determinations obtained using the AMS method in three different laboratories, establishing an exact calendar age for the grave from Koszyce is not an easy matter. Based on the relatively concordant series from Århus and Poznań, this age can be estimated to be in the first half of the 29th century BC, with a range of approx. 2880–2870 BC being the most likely. This result cannot be correlated well with the dating of a pig bone from sacrificial pit 506 (Table 2), which should indicate the same calendar age. However, this single determination can hardly be weighed against the statistically more significant age estimate for the human grave based on numerous radiocarbon age determinations. It should also be noted that two alternative options of dating the human burial from Koszyce – to the second half of the 29th century, or to approx. 2800–2700 BC – are statistically only slightly less likely.

COMPARISON WITH THE DATING OF OTHER LATE AND FINAL ENEOLITHIC GRAVES FROM THE LESSER POLAND UPLAND

In the last 20 years, a large number of radiocarbon dates have been obtained for GAC, ZC, and CWC graves, allowing the chronological scheme to be refined. First of all, the age of the features from Koszyce can be compared to the dating of other GAC burials. Most relevant here are the data available for the closest cemeteries in the Sandomierz Upland: Malice, Sandomierz district [Witkowska *et al.* 2021]; Sadowie, Opatów district [Pasterkiewicz 2021]; and Złota-*Gajowizna*, Sandomierz district [Witkowska *et al.* 2020]. For all these sites, results were obtained that were troublesome in a way similar to the case of Koszyce. This is because there are values among them that clearly diverge from the others. The dates obtained for the mass grave from Malice are internally the most consistent and, as in Koszyce, they point to the 29th century BC as the most likely time range. A similar chronology of the Sadowie and Złota sites is also possible, although in these cases the individual results are surprisingly divergent.

What all the cemeteries discussed above have in common is the co-occurrence of human graves (mainly mass graves) and sacrificial pits with animal skeletons.

The spatial arrangement of ceremonial-funeral sites there consisted mainly of pairs of such features; less frequently, human burials were accompanied by two pits with animal skeletons, with examples known from Sadowie and Złota-*Gajowizna*. So far, ordered arrangements formed by human graves and associated sacrificial pits have only been recorded in the Sandomierz Upland, at Malice, Sadowie and Złota. From the broader perspective of south-eastern Poland, single human burials accompanied by animal sacrifices are also known from the Nałęczów subgroup and the East Lublin subgroup [Włodarczak, Przybyła 2013: 220–222]. It is noteworthy that the radiocarbon dates obtained for such burials place them among the older features of the GAC in Lesser Poland (e.g. Raciborowice-Kolonia, Hrubieszów district or Parchatka, Puławy district) [Włodarczak 2016: 538, Tables 1 and 2]. This could indicate a continuation of a slightly older (Baden) tradition of matching human and animal burials [e.g. Szmyt 2008], which gradually disappeared and by around 2600–2500 BC (when the Kraków-Sandomierz CWC group began to develop) was already absent from the funerary rites of Lesser Poland communities.

A weak point in the general chronology of the CWC is the limited possibility for precise dating of the oldest phase in many areas of Central Europe, including Lesser Poland. In addition to the aforementioned problems with the flattening of the calibration curve, there is also a lack of suitable materials for making precise absolute age determinations. This situation is likely to change over time, as evidenced by a series of early dates, around 2900 BC, recently obtained for CWC graves from the Czech Republic [Dobeš *et al*. 2021]. These results disprove the suggestion of correlating the A horizon with the dendrochronologically dated oldest phase of the CWC in Switzerland [Włodarczak 2007; 2009]. They also indicate unequivocally that the grave from Koszyce and most of the other GAC graves from Lesser Poland come from a period when the tradition of CWC barrow cemeteries was already present in Central Europe. Proving the synchronicity of the two rituals in the area of western Lesser Poland remains another matter.

When evidence from different regions is brought together, the contemporariness of the GAC cemeteries and the oldest CWC barrow graves in south-eastern Poland must be considered to be very likely [see Włodarczak 2018; Jarosz, Włodarczak 2022]. In western Lesser Poland, the only AMS date for a barrow of the older CWC phase comes from grave 1 from Gabułtów: 2850–2580 BC (68.2%) [Jarosz, Włodarczak 2007]. This is only slightly younger than the calendar age indicated above for the Koszyce grave. In the Carpathian zone, barrow burials from Bierówka and Średnia point to the very beginning of the 3rd millennium BC. They are therefore even older than most of the GAC graves in Lesser Poland [Włodarczak 2018; Jarosz, Włodarczak 2022].

The age of the grave from Koszyce is also close to the oldest dates obtained for ZC burials (Table 3), although it should be noted that most of the results indicate a slightly younger age for the ZC graves. For example, the graves from Sandomierz (Mały Rynek site) and Samborzec (graves 12 and 20) were certainly younger. The

ZC cemeteries illustrate a process in which the influence of the Final Eneolithic CWC ideology, associated with the expansion of a barrow population of Eastern European origin, leads to the transformation of the essentially Late Eneolithic funerary ritual of the GAC. Thus, the dating of the ZC features also emphasises the presence of CWC cultural influences in south-eastern Poland between c. 2900 and 2600 BC. This is particularly important for the older part of this range, as we still do not have many radiocarbon dates from Final Eneolithic barrows for it.

Table 3

List of ^{14}C dates obtained for graves of the Złota culture

Site	Grave no., skeleton no.	Laboratory code	Dated material	Age ^{14}C BP	Calendar age BC (68.2%)	Literature
Kleczanów 8		Poz-121192	human bone	4225±35	2898-2707	Bajka, Florek 2020
Samborzec 1	12	Poz-34687	human bone	4170±35	2877-2695	Włodarczak 2013
Samborzec 1	20	Poz-34731	human bone	4085±35	2838-2506	Włodarczak 2013
Sandomierz 9 (*Salve Regina*)		Gd-6094	charcoal	4390±100	3320-2902	Ścibior 1993
Sandomierz 1 (*Mały Rynek*)		Poz-57504	human bone	4140±35	2864-2634	Bajka *et al.* 2018
Sandomierz 1 (*Mały Rynek*)		Poz-57502	pig bone	4040±35	2619-2490	Bajka *et al.* 2018
Święcica 30	1a	Poz-101614	human bone	4160±35	2872-2679	Bajka, Sieradzka 2019
Święcica 30	1a	Poz-101615	human bone	4120±35	2858-2621	Bajka, Sieradzka 2019
Wilczyce 90	10	Poz-34732	human bone	4165±35	2874-2680	Włodarczak 2013
Złota–*Grodzisko I*	33(325), skeleton D	GrN-9143	human bone	4260±80	3011-2696	Krzak 1989
Złota–*Grodzisko I*	10(169), skeleton B	GrN-9141	human bone	4220±40	2897-2708	Krzak 1989
Złota–*Grodzisko I*	43(355), skeleton B	GrN-12514	human bone	4155±30	2870-2695	Krzak 1989
Złota–*Grodzisko I*	42(354), skeleton A	GrN-9142	human bone	4080±55	2851-2498	Krzak 1989

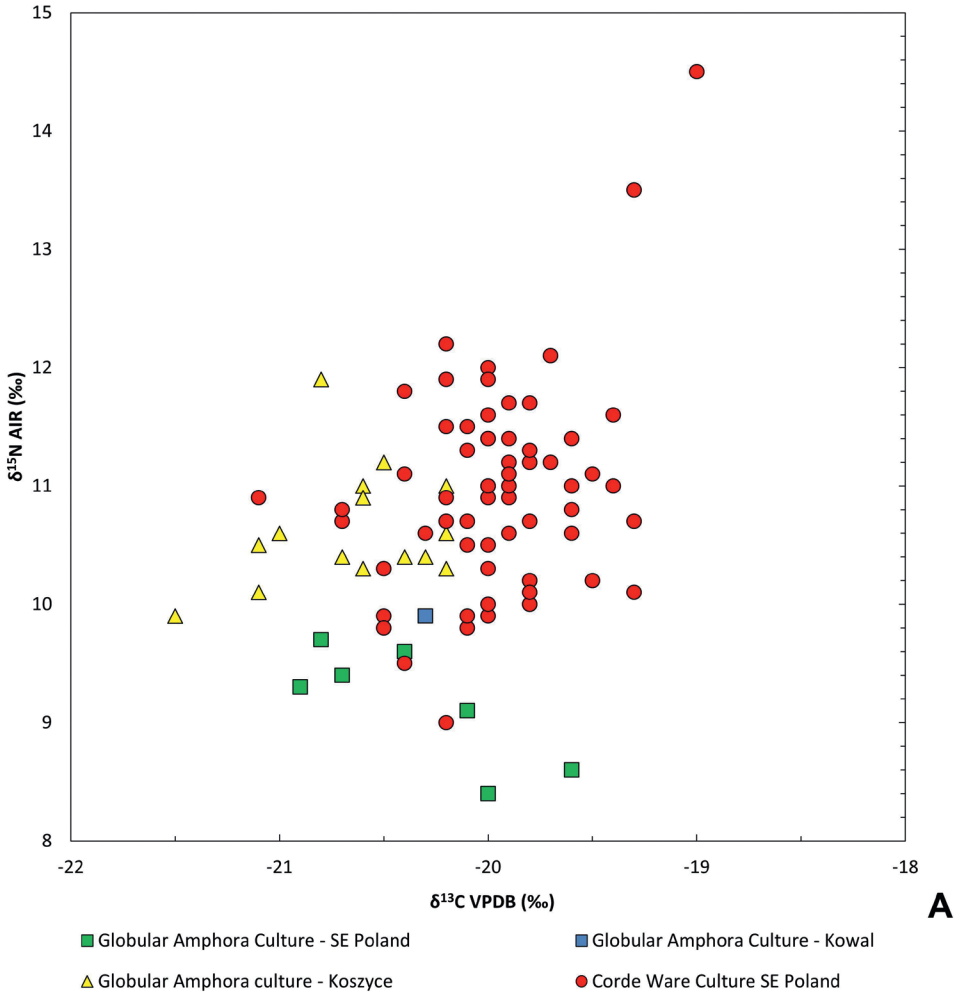
Site	Grave no., skeleton no.	Laboratory code	Dated material	Age ^{14}C BP	Calendar age BC (68.2%)	Literature
Złota–*Grodzisko I*	10(169), skeleton C	GrN-9147	human bone	4070±55	2848-2492	Krzak 1989
Złota–*Nad Wawrem*	10, skeleton XIII	GrN-9145	human bone	4195±35	2886-2701	Krzak 1989
Złota–*Nad Wawrem*	4, northern skeleton	GrN-9144	human bone	4180±35	2880-2696	Krzak 1989

There are sites of the Baden complex known from the loess uplands of western Lesser Poland, in the vicinity of Koszyce, although they date from its early phase (Beaker-Baden). These are undoubtedly traces of settlement clearly predating the GAC features analysed here. The same is indicated by the radiocarbon dating of a settlement pit from the nearby, well-known site 1 at Książnice Wielkie: c. 3300–3100 BC [Brzeska-Zastawna, Zastawny 2020: 309, 310], which is consistent with the results obtained for the BR IV phase at Bronocice [Kruk *et al*. 2018]. So far, chronometric evidence of the contemporaneity of the Baden and GAC settlement in western Lesser Poland is lacking.

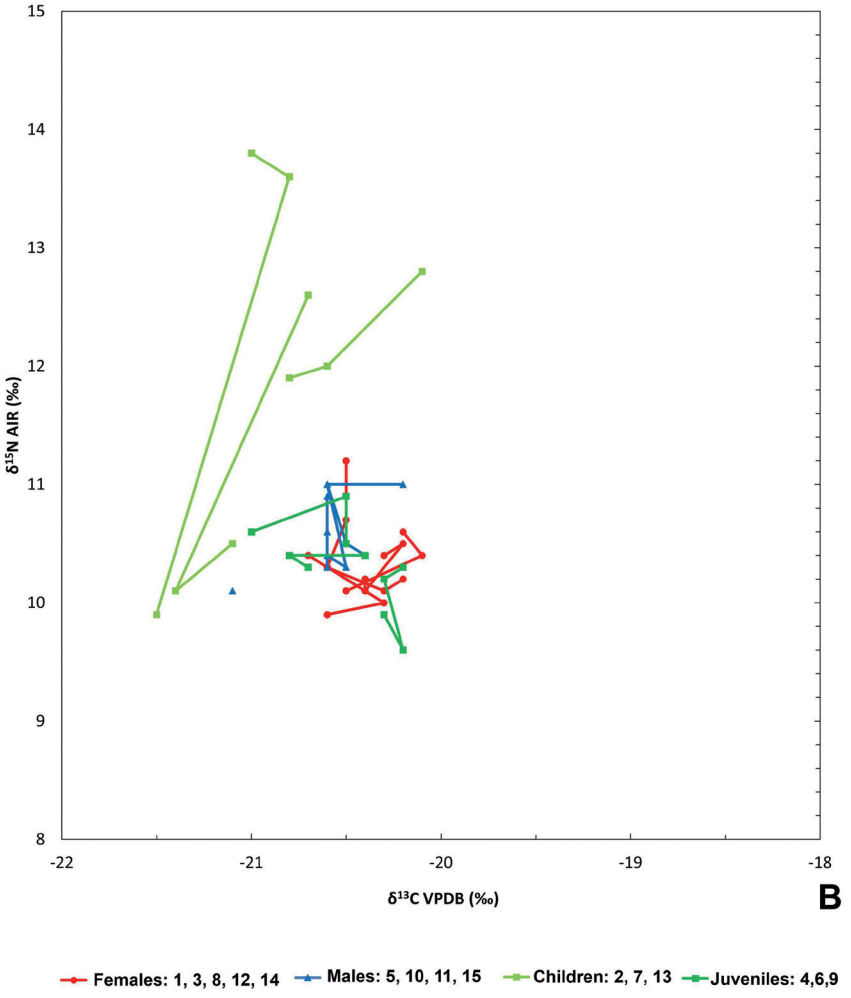
STABLE CARBON AND NITROGEN ISOTOPE ANALYSIS OF HUMAN SKELETAL REMAINS BURIED IN THE MASS GRAVE IN KOSZYCE – SOME REMARKS

The detailed analysis of stable carbon and nitrogen isotopes to determine the diet of the individuals buried in Koszyce was presented by G. Eriksson and R. Howcroft [2013] and summarised by Schroeder *et al*. [2019]. In recent years, analyses of the aforementioned isotopes were carried out for representatives of the CWC from south-eastern Poland [Szczepanek, Jarosz 2022]. The results of these studies along with the analyses of strontium isotope composition and genetic studies [Schroeder *et al.* 2019] allowed us to enrich the previously published syntheses, which only concerned the diet of those buried in the mass grave from Koszyce (Fig. 9).

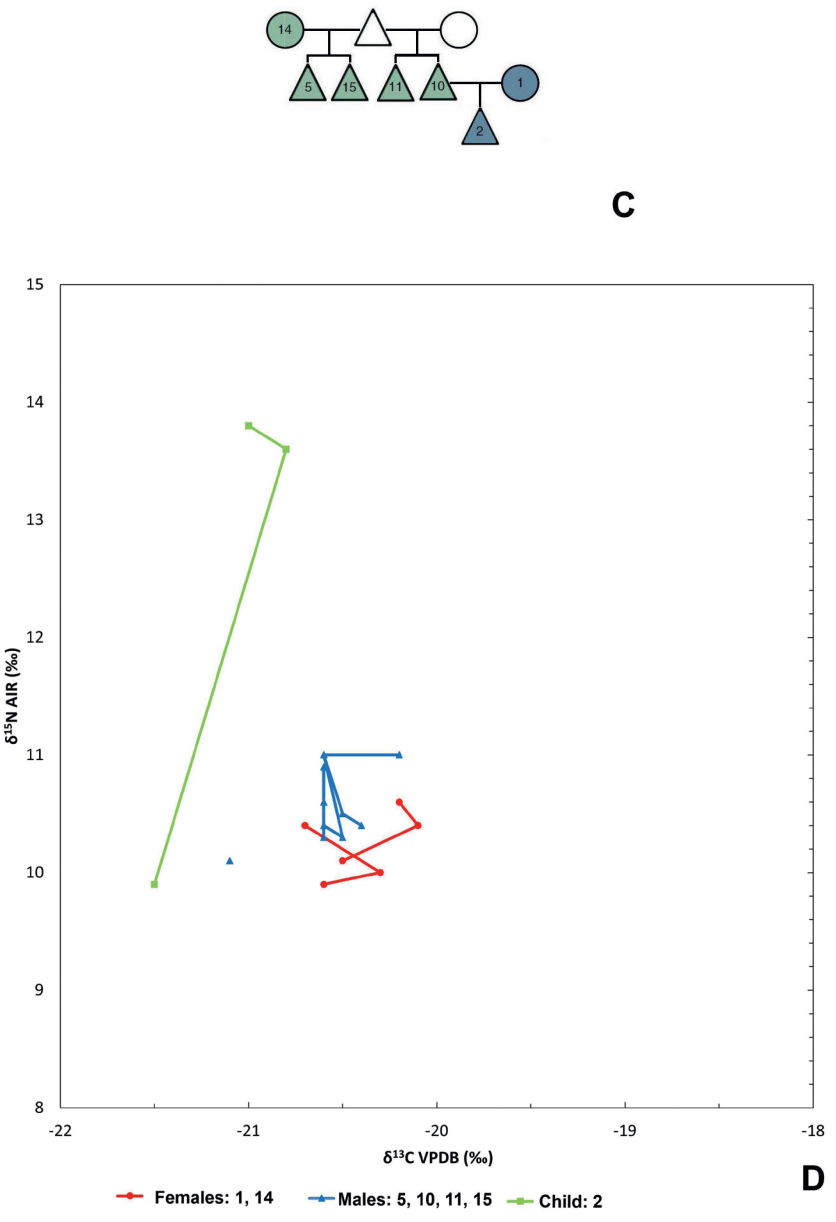
Comparing the content of stable carbon and nitrogen isotopes in the skeletal samples of the family group from Koszyce with the data available for the CWC, it



F i g . 9A. Koszyce, site 2, Proszowice district. Feature 523. $\delta^{13}C$ and $\delta^{15}N$ isotope values in collagen samples from human bones: A – family group from Koszyce on the background of late and final Eneolithic series. Prep. by A. Szczepanek



F i g . 9B. Koszyce, site 2, Proszowice district. Feature 523. $\delta^{13}C$ and $\delta^{15}N$ isotope values in collagen samples from human bones: B – isotope values for the group from Koszyce depending on the age and sex of the buried individuals [values acc. to Eriksson, Howcroft 2013, Table 2]. Prep. by A. Szczepanek



F i g . 9CD. Koszyce, site 2, Proszowice district. Feature 523. $\delta^{13}C$ and $\delta^{15}N$ isotope values in collagen samples from human bones: C – genetic structure of kinship of selected individuals from the mass grave in Koszyce [acc. to Schroeder *et al.* 2019, fig. 3]; D – isotope values obtained for a group of closely related individuals (C). Prep. by A. Szczepanek

should be noted that the group from the mass grave falls in the middle of the range of variation in isotopic values obtained for the CWC population (Fig. 9: A). The results for the group from Koszyce are clearly higher than the values recorded for other GAC graves [Kozłowski *et al.* 2014; Szczepanek, Jarosz 2022], pointing, among other things, to the higher proportion of animal protein in the diet of the group from Koszyce.

Analyses of the stable carbon and nitrogen isotope content in a series of samples obtained from both the bones and teeth of the Koszyce population [Eriksson, Howcroft 2013] show the typical variation resulting from the age at death of those buried (Fig. 9: B), with a distinctive group of the youngest children (individuals 2, 7, and 13). The differences between adult females and males are not clearly discernible, although for most of the males the obtained $\delta^{15}N$ values are slightly higher. Using the results of genetic studies (Fig. 9: C), the data acquired for the group of closely related individuals are presented (Fig. 9: D). In this case differences in the diet of the buried males and females are clearly visible, although it should be noted that the data are not numerous.

MOBILITY OF THE HUMAN GROUP BURIED IN THE MASS BURIAL FROM KOSZYCE

Analyses of the strontium ($^{87}Sr/^{86}Sr$) isotopic composition of human tooth enamel and the results of anthropological and genetic analysis [Schroeder *et al*. 2019], along with the determination of ranges of local strontium isotope values in south-eastern Poland [Bełka *et al.* 2022], have made it possible to refine previously published conclusions regarding the origin of the buried individuals. The article by Schroeder *et al*. [2019] concluded that on the basis of the local bioavailable $^{87}Sr/^{86}Sr$ values ranging between 0.7095 and 0.7105 it seems plausible that some of the Koszyce family members with Sr isotope within this range were born in the area around Koszyce, while the rest, who show a slightly more radiogenic Sr isotope composition ($^{87}Sr/^{86}Sr = 0.7113–0.7120$), might have been born elsewhere in the region of south-eastern Poland. Given the geological complexity of this region and the limitations of the $^{87}Sr/^{86}Sr$ isotope method, it is difficult to determine where exactly they might have originated. However, the latest studies [Błaszczyk *et al*. 2018; Bełka *et al*. 2022] point to the Świętokrzyskie Mountains and the vicinity of Sandomierz as the possible area of origin. The geological substrate there abounds with rocks and sediments characterised by high values of $^{87}Sr/^{86}Sr$ [Walczak, Bełka 2017]. Studies of early medieval burials from the Sandomierz area have established the local range of $^{87}Sr/^{86}Sr$ values as between 0.7106 and 0.7132 [Błaszczyk *et al*. 2018]. It is therefore possible that the non-local individuals

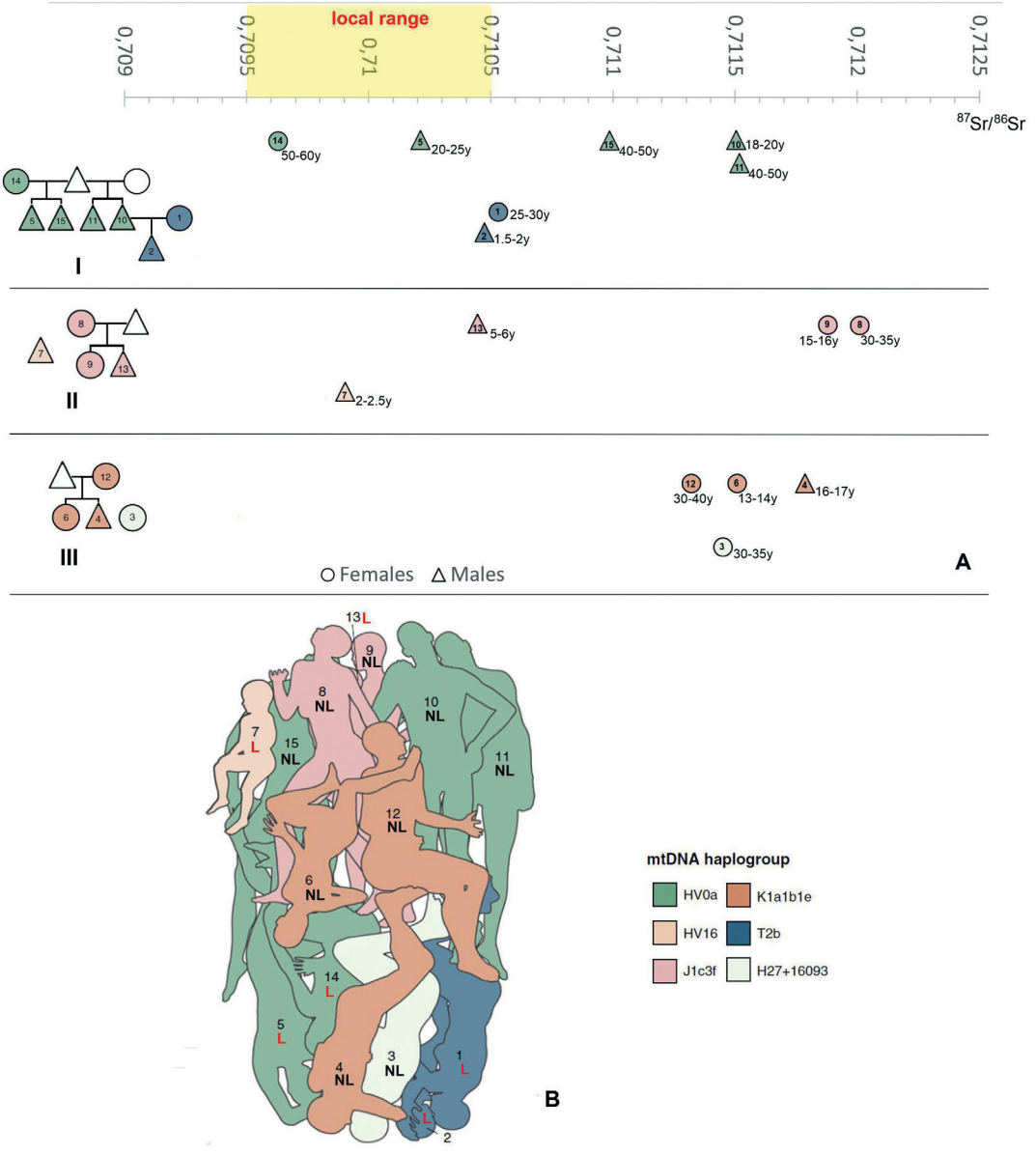


Fig. 10. Koszyce, site 2, Proszowice district. Feature 523: A – strontium isotope composition ($^{87}Sr/^{86}Sr$) of human tooth enamel; the range of $^{87}Sr/^{86}Sr$ values typical for the local population is marked in yellow; B – distribution of individuals of local (L) or non-local (NL) origin in the grave; I-III – genetically distinguished family groups [acc. to Schroeder *et al.* 2019, fig. 3, supplemented]. Prep. by A. Szczepanek

arrived from this area. A detailed analysis of the obtained isotopic signatures is presented below, also taking into account the kinship links established through aDNA studies (Table 1; Fig. 10).

1/ The group of individuals with local strontium isotope values of $^{87}Sr/^{86}Sr$:
– contains the remains of the oldest woman (14), as well as her younger son (5), the youngest unrelated children (2, 7 and 13), and a woman (1) who is the mother of child no. 2;
– the presence of the youngest children in this group, especially boy no. 13, the son of the non-local mother (8), who died at the age of 5–6, may mark the arrival of a 'foreign' group, as the older daughter (9) of this woman spent her childhood in another area.

2/ mtDNA family group HV0a – T2b:
– the oldest woman (14) is of local origin; she may have changed her place of living in her youth, as evidenced by the slightly higher isotopic signature obtained for her elder son (15); her younger son (5), on the other hand, had already spent his childhood in the Koszyce area;
– of local origin are woman (1) and her child (2), whose father is a non-local man (10) related to the sons of woman 14; the brother of man 10 is also a non-local (11).

3/ mtDNA family group J1c3f and individual HV16
– a boy aged 5–6 years (13) is of local origin, while his mother (8) and sister (9), who died aged 15–16 years, spent their childhood in an environment with higher strontium isotope values; a boy (7) aged 2–2.5 years who is related to these individuals is also of local origin.

4/ mtDNA family group K1a1b1e and individual H27+16093
– all individuals are of non-local origin and were buried next to each other in the upper part of the antipodal arrangement of the bodies.

5/ The arrangement of the remains of the deceased in the grave does not directly reflect their ancestry, but it can be seen that related individuals with similar isotopic values, e.g. individuals 1 and 2, individuals 8 and 9, and individuals 10 and 11, were buried close to each other.

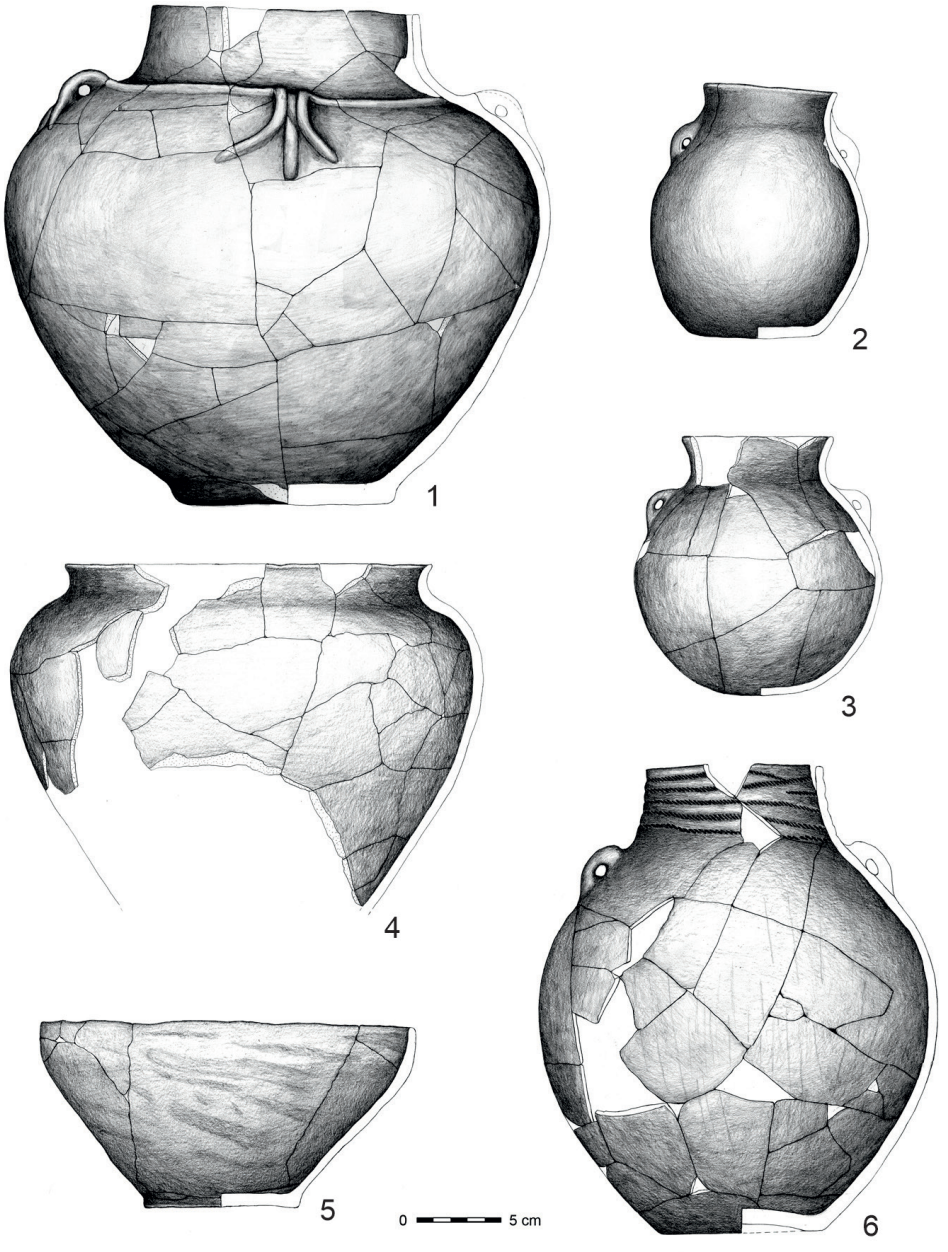
Missing from each of the distinguished family groups are the fathers of boys and men who share the same haplogroup of the Y chromosome (I2a-L801). It is therefore difficult to determine their origins. The presence of only a single Y chromosome lineage, combined with the high diversity of mtDNA lineages, is certainly consistent with a patrilocal residence system. The results of the genetic

study allowed us to reconstruct a network of close genetic links among almost all of the buried individuals, with the exception of female no. 3 [Schroeder *et al.* 2019]. Such a genetic structure of the group is of importance when considering the organisation of local communities.

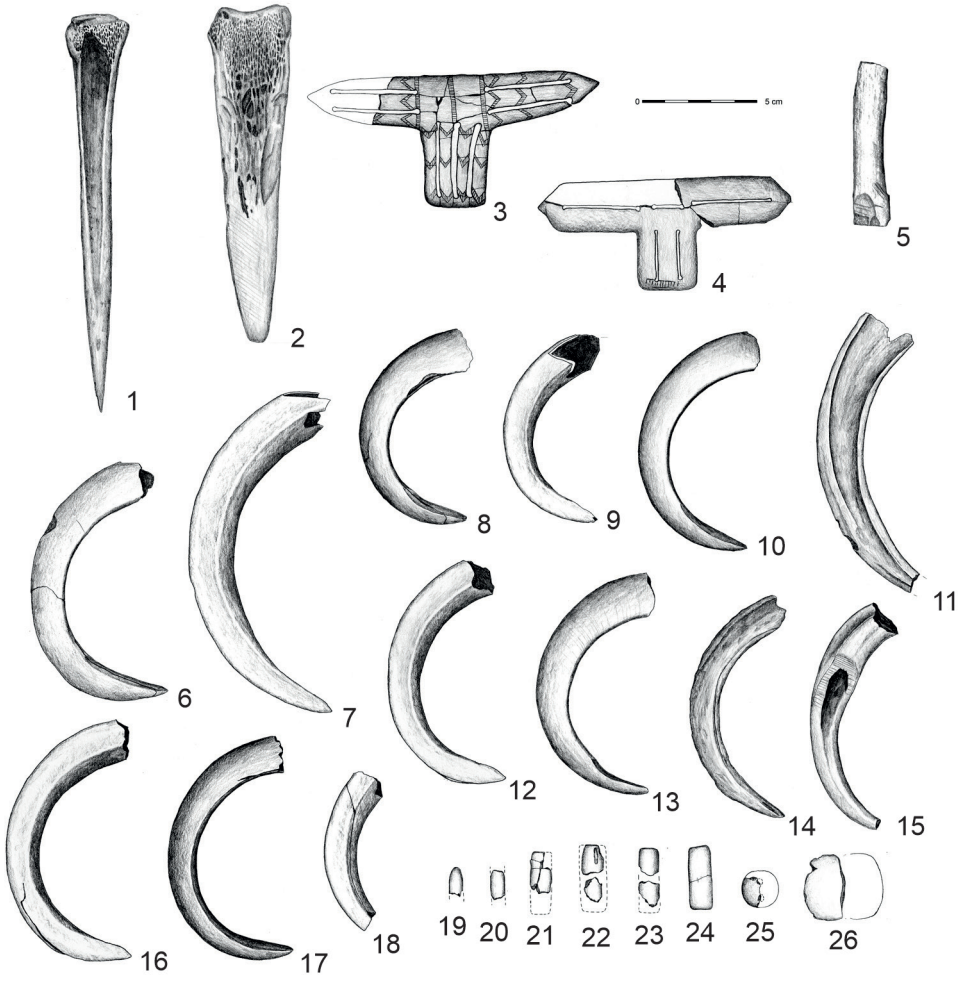
Taken as a whole, therefore, the strontium analyses indicate that the GAC group under study (or at least part of it) had been living in western Lesser Poland for several years. At the same time, isotopic indicators suggesting an allochthonous origin of some of its members are clear. They probably came from the area of the Świętokrzyskie Mountains – Sandomierz Upland, a suggestion which can also be supported by the results of archaeological analyses.

IN LIGHT OF GRAVE EQUIPMENT

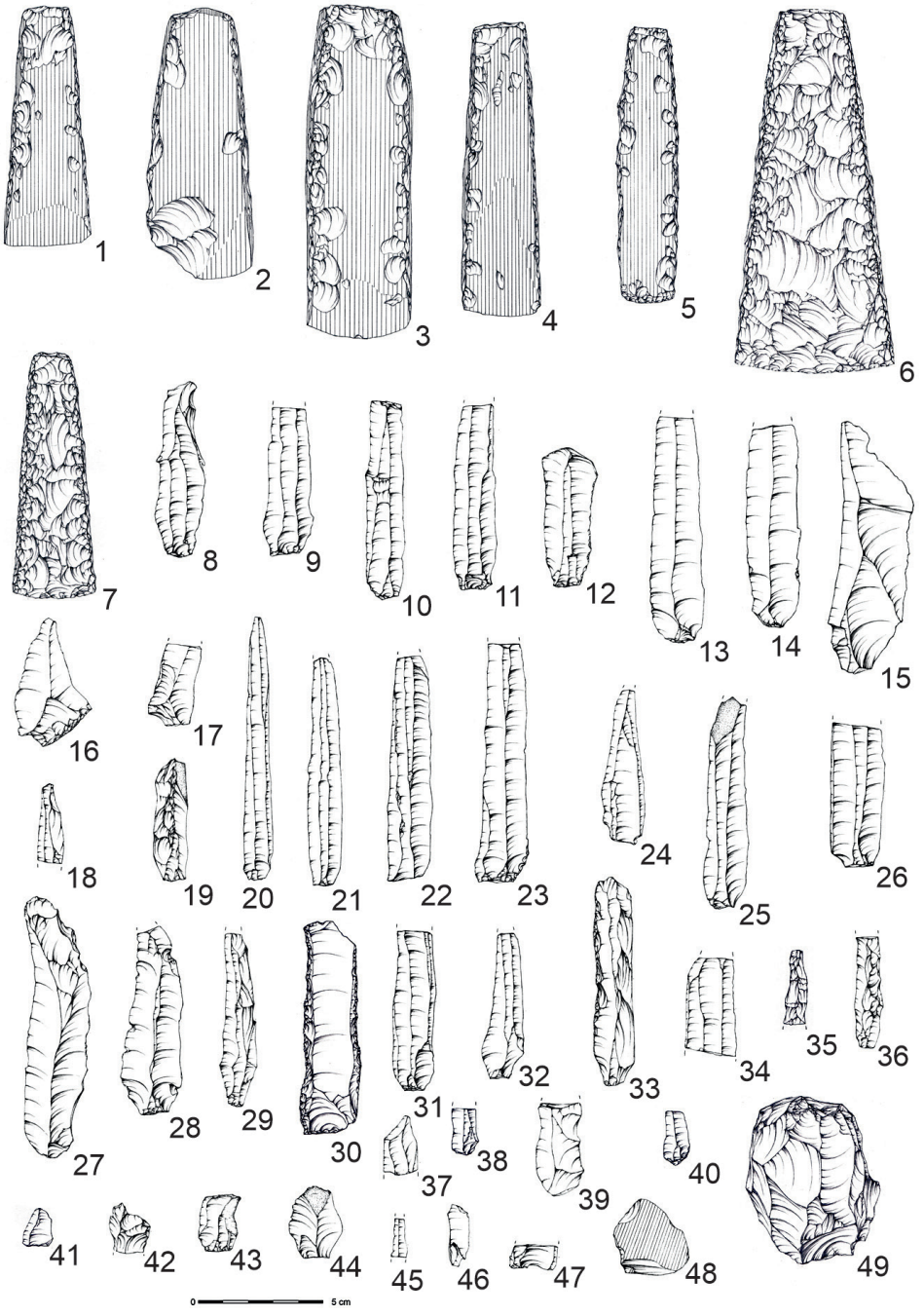
Rich furnishings were discovered in grave 523 from Koszyce, consisting of 88 items: six vessels (four amphorae, a bowl, and a vase-like vessel; Fig. 11), eight amber ornaments (Fig. 12: 19–26), two bone ornaments (T-shaped pendants; Fig. 12: 3, 4), two bone tools (a chisel and an awl; Fig. 12: 1, 2), an unspecified bone object (Fig. 12: 5), 13 boar tusks (Fig. 12: 6–18), 50 flint artefacts (five axes, two chisels, 41 blades and flakes, a core and a scale; Fig. 13), and six unworked animal bones. In sacrificial pit 506, an amphora and three grinding plate fragments were found next to pig skeletons. The artefacts are typical of the Lesser Poland GAC, including materials from the left bank of the Vistula. The pottery is characteristic of the late (third) developmental phase of this culture, belonging most probably to subphase IIIa [Włodarczak, Przybyła 2013: 234]. Unfortunately, the flint assemblage from the investigated site is so far the only so large flint inventory from the loess uplands of western Lesser Poland. Hence, it is difficult to determine whether these materials are local in character or typical of other areas. Comparative analysis has indicated the presence of good, close analogies to the finds from Koszyce primarily in the GAC materials from the Sandomierz Upland and the Nałęczów Plateau [Włodarczak, Przybyła 2013].



F i g . 11. Koszyce, site 2, Proszowice district. Inventory of Feature 523: 1–6 – ceramic vessels. Prep. by M. Podsiadło



F i g . 12. Koszyce, site 2, Proszowice district. Inventory of Feature 523: 1–5 – bone artefacts; 6–18 – boar tusks; 19–26 – amber ornaments. Prep. by M. Podsiadło



F i g . 13. Koszyce, site 2, Proszowice district. Inventory of Feature 523: 1–49 – flint artefacts. Prep. by A. Kosik-Roczkalska

SUMMARY

In the light of the chronometric analysis, the features from Koszyce date to the 29th century BC, and most probably to the older part of this period. By that time, groups of Final Eneolithic CWC had most likely started to appear in south-eastern Poland, which is supported by single radiocarbon dates from the Carpathian foothills [*see* Włodarczak 2018]. Moreover, a process of transformation in the funerary ritual of the Lesser Poland GAC had already been underway in that period, resulting in the emergence of a local Lesser Poland phenomenon: the ZC rite. This cultural differentiation was probably also a factor in the increased mobility of communities inhabiting south-eastern Poland in the first half of the 3rd millennium BC. Perhaps the increase in evidence of violence was also linked to the processes detailed here. Given these chronological circumstances, the question of who killed the 15 people buried in the grave from Koszyce – representatives of the CWC barrow population, or members of groups identified as inheritors of the Late Eneolithic GAC tradition – remains unanswered. What can be unequivocally confirmed, however, is that this event took place in the Final Eneolithic, during the period of the spread of the new CWC cultural pattern and the expansion of a population of Eastern European origin.

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