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CHRONOMETRY OF THE FINAL ENEOLITHIC CEMETERIES AT ŚWIĘTE, JAROSŁAW DISTRICT, FROM THE PERSPECTIVE OF CULTURAL RELATIONS AMONG LESSER POLAND, PODOLIA AND THE NORTH-WESTERN BLACK SEA REGION

ABSTRACT

The research on archaeological materials from sites 11, 15, and 20 at Święte produced a series of 13 radiocarbon dates for niche graves of the Corded Ware culture (CWC). The results are coherent and point to a range of 2550-2350 BC. This corresponds well with other results obtained for nearby CWC cemeteries in the Rzeszów Foothills, and is consistent with dates obtained for CWC graves in other regions in Lesser Poland: the Lesser Poland Upland, the Sokal Ridge, and the Lublin Upland. At the same time, the obtained absolute age range corresponds with a wave of influences from the North Pontic circle of steppe cultures and the Middle Dnieper culture. It can be synchronized with the beginning of the development of the classic variants of the Catacomb culture: the Ingul and Doniec variants.

Key words: absolute chronology, Final Eneolithic, Corded Ware culture, south-eastern Poland, Yamnaya culture, Catacomb culture

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INTRODUCTION

The excavations of site 11 at Święte produced a vessel characteristic of Early Bronze Age cultures of the north-western Pontic area [Kośko *et al.* 2012; 2018]. The discovery has already been discussed in the context of relations linking Corded Ware culture (CWC) groups from Lesser Poland (Małopolska) with cultures of the steppe/forest-steppe zone [Kośko *et al.* 2012; Włodarczak 2014]. The full analysis of the Final Eneolithic materials from the Święte cemeteries, including a series of radiocarbon dates, has made it possible to refine the chronology of contacts between these two cultural areas. Another important aspect is the chronological position of the finds from Święte in relation to other recently published Final Eneolithic discoveries from the Rzeszów Foothills, in particular to CWC cemeteries from sites 5 and 6 at Szczytna, Jarosław District [Hozer *et al.* 2017]. When we also take into account the materials from sites 24 and 27 at Mirocin, Przeworsk District [Machnik et al. 2019], site 7 at Skołoszów, Jarosław District [Rybicka *et al.* 2017], and site 26 at Chłopice, Jarosław District [Ligoda, Podgórska-Czopek 2011: 159; Szczepanek *et al.* 2018], it becomes possible to discuss local characteristics of the cluster of Final Eneolithic cemeteries in the Rzeszów Foothills, a mesoregion with intense traces of occupation from the 3rd millennium BC that have only recently been unveiled thanks to large-scale rescue excavations preceding construction of the A4 motorway.

Spectacular discoveries of artefacts revealing connections with the steppe/forest steppe areas (a round-based vessel from Święte 11 and a copper shaft-hole axe from grave 4 at Szczytna 6) suggest the validity of chronometric comparisons with cultural groups from the north-west Pontic area. An opportunity for refining chronology has come with the publication of a series of radiocarbon dates obtained for burials in barrows from the vicinity of Yampil in the middle Dnieper basin [Goslar *et al.* 2015]. This is currently the longest published list of results for a site from the western part of the forest-steppe and steppe zone. Moreover, it comes from a region being the north-western margin of the Yamnaya complex, not very distant from the CWC range in the Dniester basin, and partly overlapping with the area occupied by the Globular Amphora culture (GAC).

Table 1
Radiocarbon age determinations for Corded Ware culture graves from the cemeteries at Święte, Jarosław District

Feature	Lab. no.	Age ^{14}C BP	Calendar age BC (68.2%)
Święte 11			
876	Poz-90875	3890±35	2460-2340
1134	Poz-90877	4020±30	2573-2490
1149A	Poz-90884	3925±35	2473-2348
1149A*	Poz-42368	3710±35	2190-2036
1290D	Poz-90876	3875±35	2455-2297
Święte 15			
173	Poz-90779	3935±30	2480-2348
407	Poz-90882	3855±35	2452-2214
408A	Poz-90780	3890±35	2460-2340
409	Poz-90781	3990±30	2565-2473
427	Poz-90874	3890±35	2460-2340
431	Poz-90782	4020±35	2574-2489
Święte 20			
40A	Poz-90777	3950±35	2563-2350
43	Poz-90778	3950±35	2563-2350

*Kośko *et al*. 2012

1. ABSOLUTE CHRONOLOGY OF CEMETERIES FROM SITES 11, 15, AND 20 AT ŚWIĘTE

The series of 12 radiocarbon dates for CWC cemeteries at Święte (Table 1) was obtained within the framework of the "Final Neolithic communities in south-eastern Poland in light of archaeological research and interdisciplinary analyses" project, led by Anita Szczepanek (grant from National Science Centre, OPUS no. 2015/19/B/HS3/02149). One ^{14}C date had been obtained earlier for grave 1149A, when the round-based pot discovered in that grave was studied [Kośko *et al.* 2012: 73-74]. Thus, the series includes a total of 13 age determinations. Its length is limited by the availability of materials containing collagen of sufficient quality. The examinations only used bones from human burials. Except for a few artefacts made of animal bone (mainly tools), the analysed features did not yield any other type of radiocarbon datable materials.

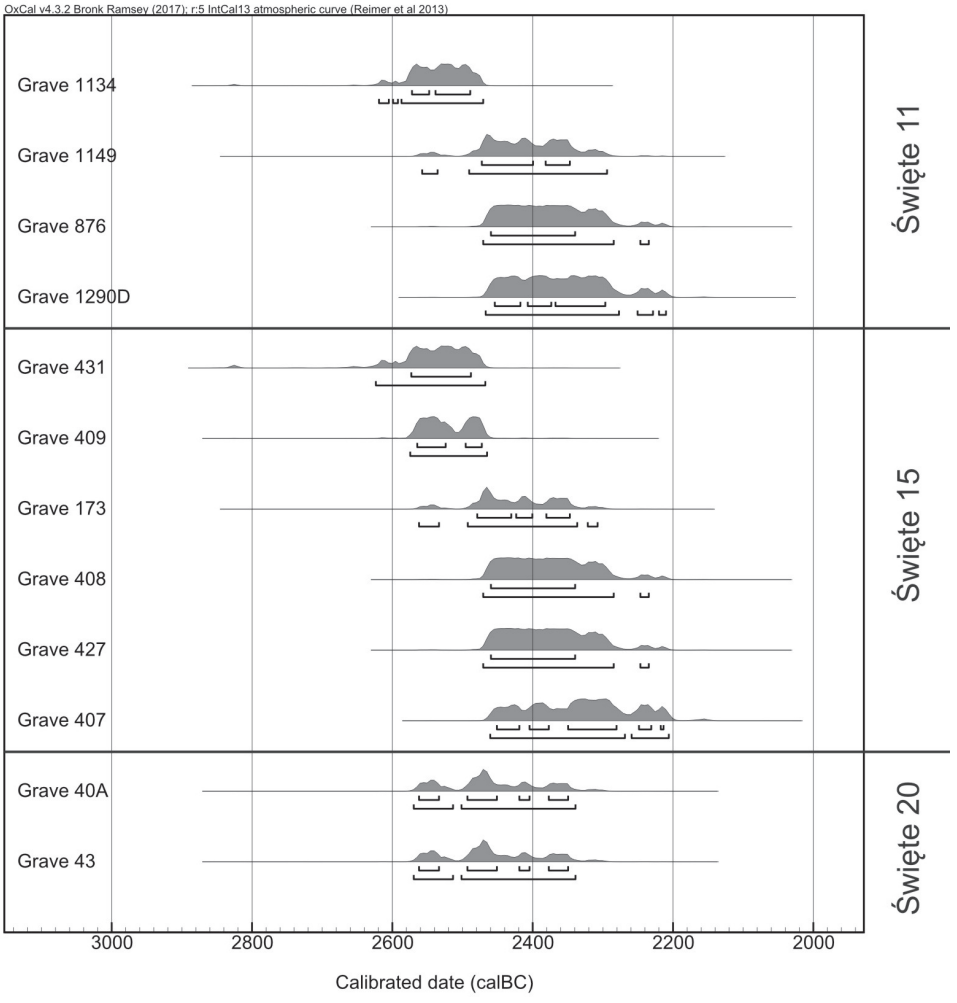

Fig. 1. Radiocarbon age determinations for CWC cemeteries at Święte, Jarosław District

^{14}C determinations were performed using the AMS technique in Poznań Radiocarbon Laboratory, directed by Professor Tomasz Goslar. Comparative analyses presented further in the text are based in the first place on date series which also come from the Poznań laboratory. Owing to their number, quality, and contexts of sample acquisition, the results produced by this laboratory are today of fundamental importance for chronological models created for the Eneolithic and the Early Bronze Age in Lesser Poland.

^{14}C dates obtained for all the three sites at Święte are similar, with the age of the samples falling, after calibration, within a generalised range of 2600-2200 BC

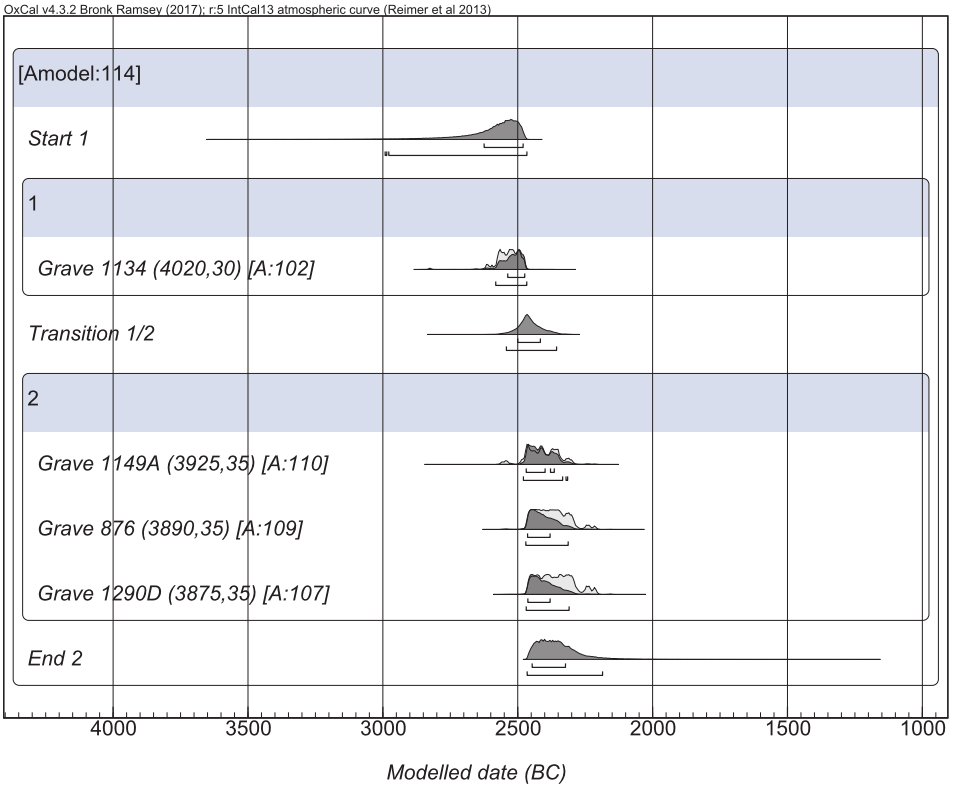

Fig. 2. Model assuming two phases of CWC cemetery at Święte, site 11

(Fig. 1), which corresponds well with dates available for graves from the younger phase of CWC in other parts of Lesser Poland [Jarosz, Włodarczak 2007; Włodarczak 2006; 2013; 2016]. These results corroborate the results of typological analyses, according to which all the materials from the Święte cemeteries fall within the "niche grave phase", chronologically corresponding with the finds of the Kraków-Sandomierz group of CWC in western Lesser Poland and the Sandomierz Upland.

Proceeding from short series of determinations and using the highest probability ranges (1σ), one can attempt to distinguish two phases for sites Święte 11 and 15. The older phase would be dated to ca. 2575-2470 BC. It is represented by grave 1134 in site 11 and graves 409 and 431 in site 15. The remaining graves link with the younger phase, dated approximately to 2480-2215 BC. Next, assuming that all the graves from the younger stage form one coherent phase, its chronological span can be narrowed down to 2434-2323 BC for site 11 (Fig. 2) and 2454-2338 BC for site 15 (Fig. 3). The ranges (each spanning more than 100 years) calculated in this

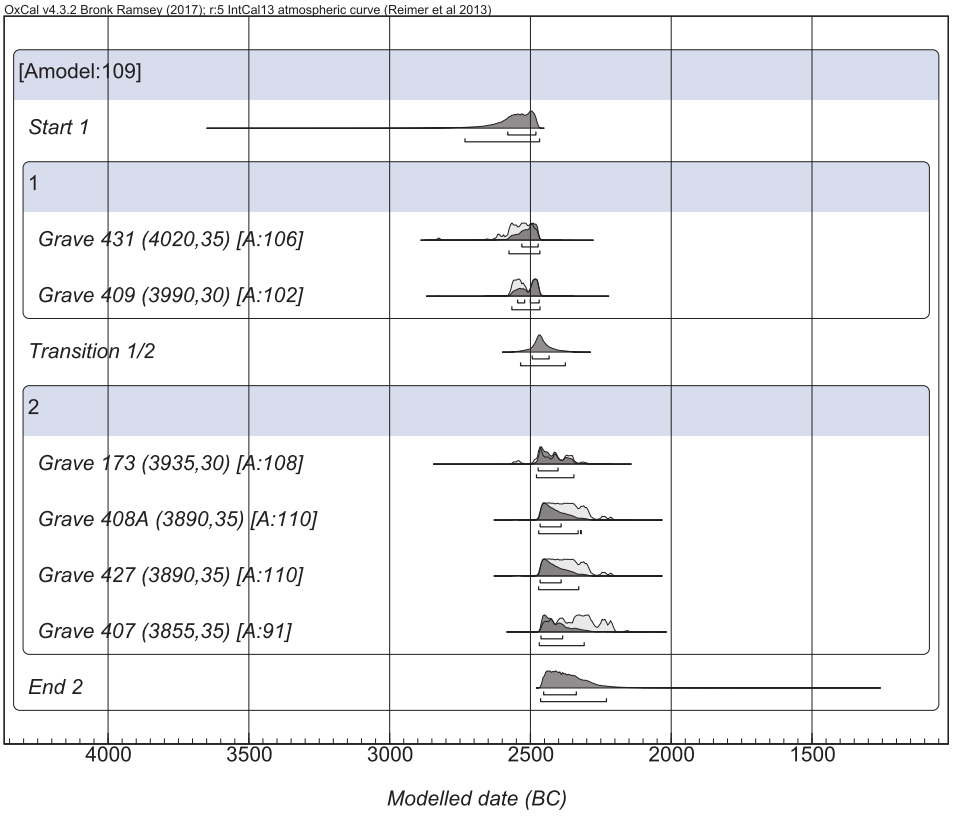

Fig. 3. Model assuming two phases of CWC cemetery at Święte, site 15

manner are quite broad due to the flattening of the calibration curve (Figs 4 and 5). Moreover, the projection of dates on the calibration curve clearly shows that the division into two phases – suggested by calibration ranges of particular determinations – can be only apparent, and the most likely interpretation is a maximum narrowing of the period of the site occupation to one short stage. Such a possibility has been positively verified by placing all the dates in one period ("Phase" function in the OxCal programme – Figs 4 and 5). The outcome is a range of 2530-2374 BC for site 11 and 2525-2382 BC for site 15.

One radiocarbon date was earlier published for grave 1149A from Święte 11 on the occasion of analysing the round-based pot discovered in its vicinity (in feature 1149B) [Kośko *et al.* 2012]. This date (3710±35 BP, which is 2190-2036 BC[1]) was

[1] All radiocarbon dates have been calibrated with C. Bronk Ramsey's OxCal v.4.3.2 and using calibration curve INTCAL13 [Reimer *et al.* 2013]. The calibration results given in the text are with the probability range of 1σ (68.2%).

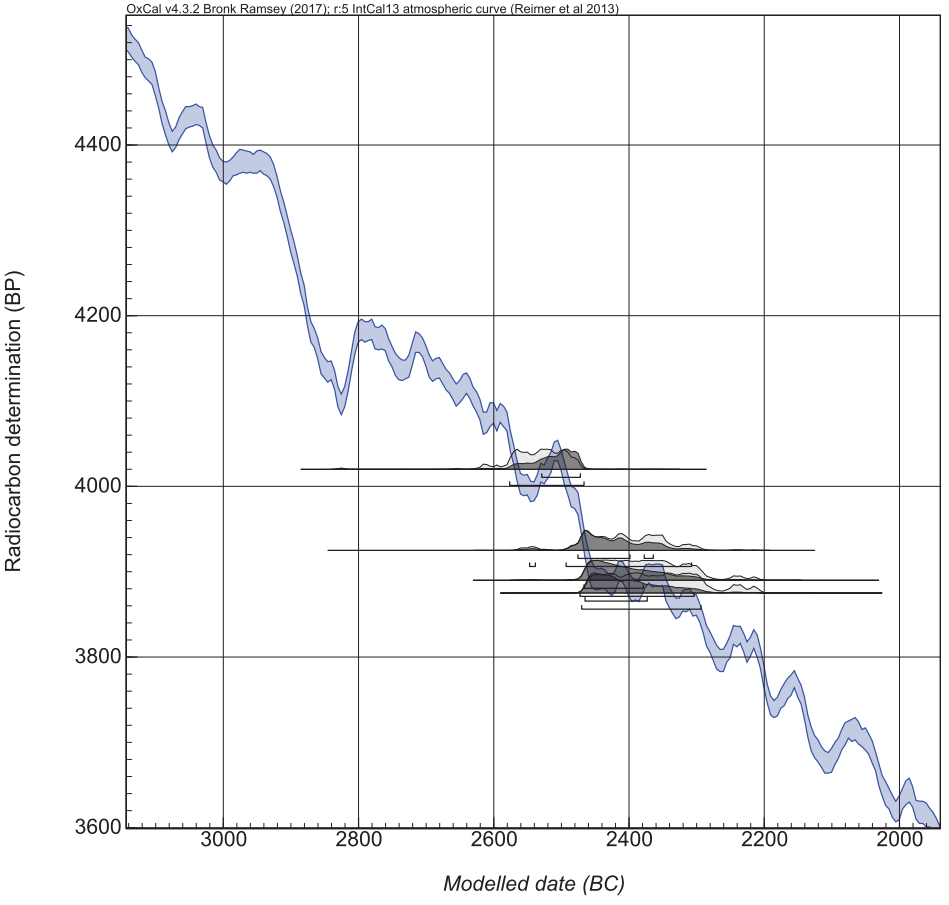

Fig. 4. Model assuming one chronological phase of CWC cemetery at Święte, site 11, plotted against calibration curve INTCAL13

surprising, as it pointed to the early phase of the Mierzanowice culture, a period previously not taken into account in the context of CWC niche graves [Górski *et al.* 2013; Włodarczak 2017: 380-381]. Similar dates come from Mierzanowice culture settlement features discovered in sites not far away from Święte, for example Jarosław, site 158 [Rybicka, Pelisiak 2013: 114, Table 11] and Dobkowice, site 39 [Jarosz *et al.* 2018: 57, Table 7]. However, the new radiocarbon date obtained for feature 1149A is earlier (2473-2348 BC) and is consistent with the chronology of other CWC graves from the Święte sites. No such late date is known thus far for a CWC grave in south-eastern Poland. The youngest result comes from a feature from Łagiewniki in the Lublin Upland (Poz-58106: 3770±35 BP) and it was obtained for a burial combining late CWC traits with elements characteristic of Early Bronze Age burial rites [Kubera, Zawiślak 2016: 356].

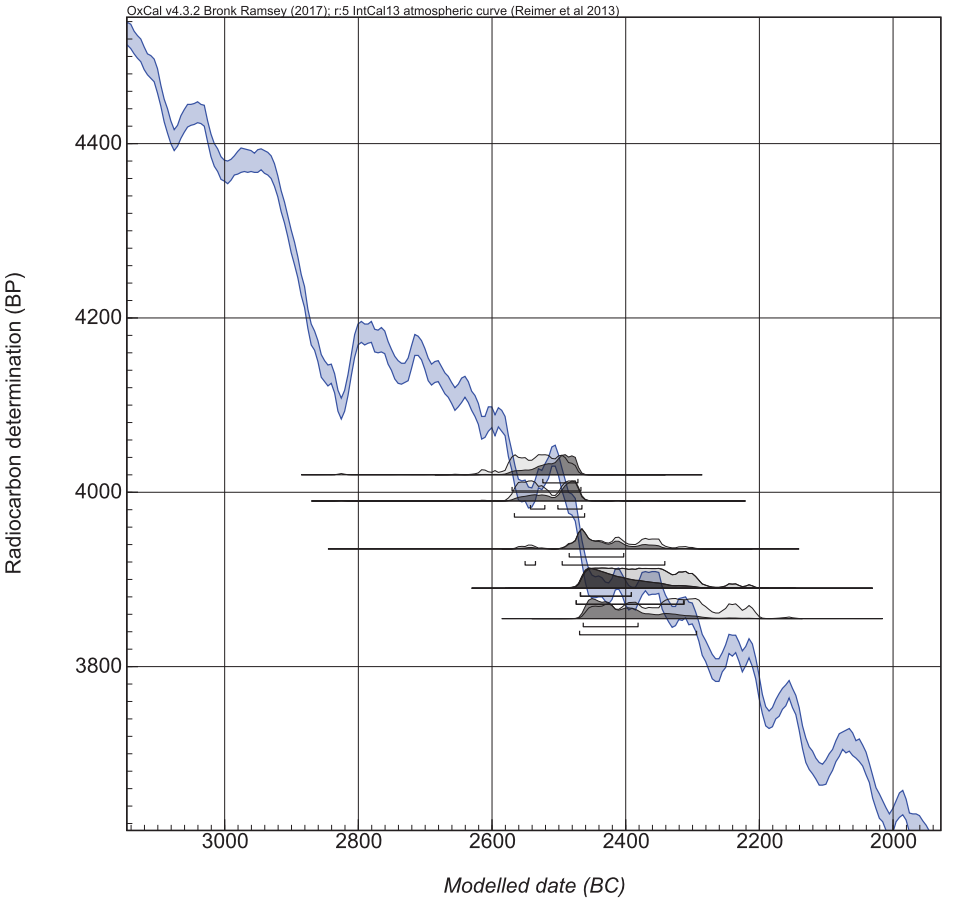

Fig. 5. Model assuming one chronological phase of CWC cemetery at Święte, site 15, plotted against calibration curve INTCAL13

It is impossible to accept both dates obtained for grave 1149A, so the earlier published determination of Poz-42368 should be considered as significantly diverging from the true age of the burial[2]. This is indicated by the data available for other graves, both from the site in question and throughout south-eastern Poland. The reason for such a huge discrepancy between the two dates obtained from bones retrieved from the same burial has not been established.

[2] After the writing of this article, the result of the second dating of the sample Poz-42368 was obtained. The new result (Poz-109990) is 3905±30 BP and is similar to the age of sample Poz-90884 [see Kośko *et al.* 2018].

Table 2

Radiocarbon age determinations for CWC features from the Rzeszów Foothills

Feature	**Lab. no.**	**Age ^{14}C BP**	**Calendar age BC (68.2%)**	**Literature**
Chłopice 26				
11	Poz-90881	3985±35	2566-2471	Szczepanek *et al*. 2018
Jankowice 9 (settlement pits?)				
44	MKL-1618	4080±90	2860-2492	Dębiec *et al*. 2015
146	D-AMS00001566	4071±24	2831-2504	Dębiec *et al*. 2015
Mirocin 24				
16	Poz-54042	3815±35	2333-2155	Machnik et al. 2019
50	Poz-90880	3935±35	2481-2348	Szczepanek *et al*. 2018
53/1	Poz-91015	3835±35	2344-2206	Szczepanek *et al*. 2018
53	Poz-54041	3855±25	2434-2233	Machnik et al. 2019
54	Poz-54038	3940±35	2546-2348	Machnik et al. 2019
110	Poz-90885	3880±35	2456-2307	Szczepanek *et al*. 2018
Mirocin 27				
360 (burial 1)	Poz-54043	3870±35	2455-2293	Szczepanek *et al*. 2018
360 (burial 2)	Poz-90887	3860±30	2454-2286	Szczepanek *et al*. 2018
396	Poz-54045	4010±35	2570-2482	Machnik et al. 2019
Skołoszów				
256	Poz-52608	3915±25	2469-2348	Rybicka *et al*. 2017: 128, Table 2
620	Poz-49278	3895±35	2461-2345	Rybicka *et al*. 2017: 128, Table 2
Szczytna 5				
217	Poz-90878	3935±35	2481-2348	Hozer *et al*. 2017
220 (burial 1)	Poz-90889	3890±35	2460-2340	Hozer *et al*. 2017
220 (burial 2)	UB-28881	3845±37	2431-2208	Hozer *et al*. 2017
Szczytna 6				
2	MKL-1033	4320±90	3261-2780	Hozer *et al*. 2017
4	MKL-1047	4050±60	2834-2481	Hozer *et al*. 2017
4	UB-28880	3951±37	2564-2350	Hozer *et al*. 2017

2. CHRONOLOGICAL RELATION TO OTHER CWC CEMETERIES IN THE RZESZÓW FOOTHILLS AND IN CARPATHIAN FOOTHILLS

Short series of ^{14}C dates were also obtained for other CWC sites from the Rzeszów Foothills excavated prior to the construction of the A4 motorway. Of particular importance are the results from site 6 at Szczytna where, in grave 4, unique copper artefacts have been discovered (a shaft-hole axe and earrings of the "steppe" type). Two slightly different dates were obtained for this grave in two different laboratories (Table 2). An attempt at reconciliation of these results (R_Combine function) produces a range of 2565-2468 BC, corresponding with the beginning of the younger CWC stage in Lesser Poland ("niche grave phase"). Dated to an analogical period are richly furnished male burials from western Lesser Poland, including from Bronocice (grave XI), Malżyce (barrow 2, grave 10), Smroków (grave 1), and Zielona (grave 3) [cf. Kruk *et al.* 2018: 53, Fig. 11]. Assuming that grave 4 dates to the older section of the presented range (which means still within the 26th century BC), we can at the same time point towards its older chronological position in relation to the majority of the other burials in the Rzeszów Foothills, which already originate from the second half of the 3rd millennium BC.

The ^{14}C date for grave 2 from Szczytna site 6 suggests a very early age: 3261-2780 BC (obtained in the laboratory at Skała from a charcoal sample). Similar dates were obtained in the 1990s in the Kiev laboratory for bones from several CWC burials in Lesser Poland, including graves from Wierszczyca and Zielona [Machnik 1999: 233, Table 1; Włodarczak 2006: 125, Table 35]. In light of a large series of new dates (including results which verify some of the earlier determinations), these older dates should be rejected [cf. Włodarczak 2007; 2009]. In the case of grave 2 from Szczytna as well, one cannot help doubting the correctness of the mentioned date. As well, one can consider challenging its connection with the CWC complex, for example by proposing an earlier, pre-CWC origin and a connection with cultural groups from the north-west Pontic zone. Such a connection is supported by the following: (a) the position of the body (although the arrangement is disturbed, the position of the long bones suggest a burial in a supine position with the legs contracted and the knees pointing upwards, and the head pointing to the west), (b) the pit nature of the burial, and (c) the presence of a characteristic monopartite beaker, a form known from the Eneolithic, and in particular Early Bronze Age cultures of the Pontic area. In the Yamnaya culture such vessels are known primarily from the younger phase [Ivanova 2013: Figs. 3.40-3.41], although the radiocarbon date in question does not point to that period. Burials with steppe connotations, dated to the turn of the 4th and 3rd millennia BC, have recently been confirmed in a barrow site at Hubinek [unpublished material; mentioned in: Juras *et al.* 2018: supplementary information text]. However, the grave from Szczytna

Table 3

Radiocarbon age determinations for CWC barrows in Subcarpathian Foothills

Feature	**Lab. no.**	**Age ^{14}C BP**	**Calendar age BC (68.2%)**	**Literature**
Wieliczka Foothills				
Jawczyce				
1	Poz-9454	4050±35	2626-2491	Jarosz, Włodarczak 2007
Strzyżów Foothills				
Bierówka, kurgan A				
?	Gd-1877	4240±40	2907-2763	Gancarski, Machnikowie 1990
?	Gd-3129	4030±100	2857-2462	Gancarski, Machnikowie 1990
Bierówka, kurgan B				
?	Gd-2759	4120±80	2864-2580	Gancarski, Machnikowie 1990
?	Gd-2760	4070±60	2850-2492	Gancarski, Machnikowie 1990
Krajowice, kurgan 1				
	Gd-6009	3840±40	2401-2206	Machnik 1992; Gancarski, Valde-Nowak 2011
Niepla, site 14				
	Gd-5796	4030±40	2581-2481	Machnik 1992
Dynów Foothills				
Średnia, site 3, kurgan 1				
grave	Gd-10402	4390±100	3320-2902	Machnik, Sosnowska 1996
grave	Gd-10397	4290±90	3086-2703	Machnik, Sosnowska 1996
Średnia, site 3, kurgan 2				
3	Poz-9458	4015±35	2573-2487	Jarosz, Włodarczak 2007
Wola Węgierska, site 3, kurgan 1				
grave	Gd-11353	3920±80	2559-2291	Machnik, Sosnowska 1998
barrow ditch	Gd-11354	3860±70	2459-2212	Machnik, Sosnowska 1998
Przemyśl Foothills				
Przemyśl, site 81				
	Poz-9582	4005±35	2569-2478	Jarosz, Włodarczak 2007

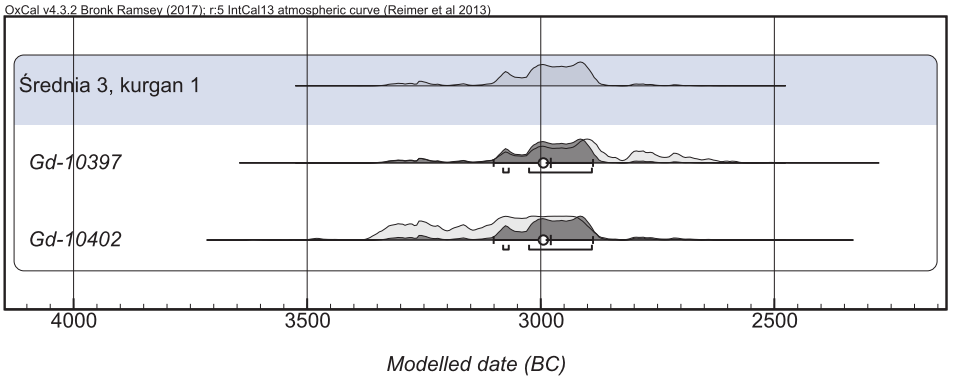

Fig. 6. Attempted age determination for central burial from barrow 1 at Średnia, site 3 (Dynów Foothills) – assuming the contemporaneity in terms of calendar age of two charcoal samples from the grave structure.

discussed here is not sufficiently distinctive and its early dating requires additional verification.

Other ^{14}C results obtained for CWC cemeteries in the Rzeszów Foothills (Chłopice, site 26, Mirocin, sites 24 and 27; Skołoszów, site 7, and Szczytna, site 5) are similar to those from the three cemeteries at Święte, and can be synchronised with them within a range of ca. 2550-2400/2350 BC. The only results pointing to a slightly older age are absolute age determinations for two settlement pits (?) from site 9 at Jankowice (Table 2) [Dębiec *et al.* 2015: 109]. They may correspond either to an older, "barrow" phase (its later section) or a transitional stage between the older and younger phases (ca. 2600-2500 BC). Unfortunately, the material recovered from these features is modest and undistinctive, which makes any credible attempts at refining their chronology impossible.

Comparative analyses are more difficult in the case of ^{14}C results for barrows from Carpathian foothills (Table 3). This group also includes data from sites situated relatively close to Święte, in the Dynów Foothills (Średnia and Wola Wegierska) and the Przemyśl Foothills (Przemyśl, site 81). These dates were obtained from charcoal or bone samples, and in many cases the sample context was not as good as in the previously discussed dates from the Rzeszów Foothills. The results fall within a broader timespan than the results obtained for the Święte cemeteries. First of all, there are features present which confidently date to the older stage of the Final Eneolithic (ca. 2900-2600 BC). The chronological relation between barrow graves and CWC niche graves secondarily dug into barrow mounds or occurring in flat cemeteries is a separate problem.

An assemblage of finds from barrow 1 in Średnia, site 3, linked with the oldest CWC phase in Lesser Poland, is a unique discovery [Machnik, Sosnowska 1996]. Two dates obtained from charcoal samples from the central burial construction are

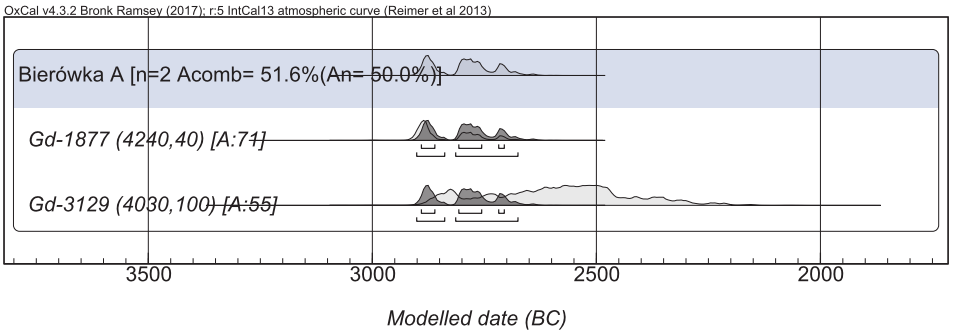

Fig. 7. Attempted reconciliation of two absolute dates (from charcoal samples) obtained for barrow A at Bierówka (Strzyżów Foothills)

divergent, but both point to the very beginning of the Final Eneolithic (the range determined using function R_Combine: 3081-2891 BC; Fig. 6). This is a surprisingly early date as compared with recent ^{14}C-AMS dates for features containing artefacts from horizon A. The latter, as well as the majority of other barrow graves in Lesser Poland, commonly produce dates within a range of 2800-2600 BC (e.g. grave 1 from Gabułtów in western Lesser Poland) [Jarosz, Włodarczak 2007: 72--73]. An interesting contribution to the revision of chronology of horizon A graves was the renewed dating of the burial from Krusza Zamkowa in Kuyavia, which corrected the previous determination and set the age of the burial at the above-mentioned range of 2800-2600 BC [Goslar, Kośko 2011]. The earliest absolute age determinations for CWC barrow graves in the Polish Plain come from graves from Kruszyn [Pospieszny *et al.* 2015: 202, table 6] and Żygląd [Kurzyk 2011: 463--464]. They are only slightly later than the age of the Średnia barrow and can most likely be placed within ca. 2900-2800 BC. At present, there is no other individual CWC burial in a barrow known from south-eastern Poland that would be dated as early as the one from Średnia. Comparable results were obtained for features linked with this culture discovered in Ulów site in the Roztocze region [Moskal del Hoyo *et al.* 2017: 1401, Table 1]. However, the context of the results does not allow them to be fully confidently linked with CWC. The central burial from a barrow in Hubinek also yielded a ^{14}C date from the 3000-2900 BC range [Juras *et al.* 2018]. In this case, the burial rite recorded in the site suggests associating the grave with the older wave of migrations from the North Pontic steppe/forest steppe area.

Accepting the results for barrow 1 at Średnia as correct, one should assume a long duration of the earliest CWC phase in south-eastern Poland: from around 3000/2900 BC to ca. 2600 BC (as suggested by dendrochronology) or to ca. 2700 BC (assuming that the youngest among barrow graves can be assigned to a later phase, defined as "Central European horizon" for example). In light of the Średnia case, one should also consider a possibility of sub-dividing the materials within

the 3000-2600 BC range. The central grave in this barrow contained a burial which was exceptional in terms of both the orientation and position of the body, and the grave goods. It is worth noting that the body was placed on the left side, with the head to the east. The burial was furnished with a vessel (a broadmouthed beaker) which reveals stylistic references both to artefacts of type A and to forms linked with the GAC. Therefore, the burial from Średnia can be seen as a reflection of an exceptionally early cultural transformation towards the Old Corded horizon. Perhaps it is exactly because of this early chronological position that classic attributes of the older CWC horizon are absent in the burial rite here.

Relatively early dates were also obtained for barrows A and B at Bierówka [Gancarski, Machnikowie 1986; 1990]. The first barrow, as in the case of the Średnia grave, produced two considerably diverging results. Assuming they are parallel, with a low compliance threshold, we arrive at a range of 2891-2706 BC (Fig. 7). This is also relatively early for a CWC feature, although the younger section of this range already overlaps with the dating of the oldest phase from a pan-European perspective [cf. Włodarczak 2007]. Artefacts recovered from the barrow reveal traits of horizon A [Machnik 1998: 107; Jarosz 2012: 329]. Two results available for barrow B point to a similar, although slightly broader range (2851-2504 BC – function R_Combine). The central burial was placed in a wooden chest, with the body aligned along the W-E axis, which is characteristic of the older phase of CWC. It seems most likely that the two closely situated barrows from Bierówka, sharing similar parameters of the mounds and traits of central burials, represent a unique complex associated with the oldest stage of CWC development in Lesser Poland. The low precision of the results allows the age of this complex to be only estimated at a generalised, rather broad range of ca. 2850-2700 BC.

The barrow in Wola Węgierska [Machnik, Sosnowska 1998] produced dates analogical to those from CWC graves in the Rzeszów Foothills: ca. 2500-2300 BC. This data proves contemporaneity of niche grave cemeteries at Święte, Mirocin, and Szczytna with a number of barrow graves, including the barrow clusters at Średnia and Wola Węgierska some 20 km from Święte. This indicates the overlapping of two "horizons": barrow and niche grave, at the same time confirming the correctness of typological conclusions, as artefacts from late barrows find analogies in materials from niche graves. The number of barrow graves in Lesser Poland furnished with artefacts analogical to those from niche graves has risen considerably due to discoveries made over recent years. One should mention here, among others, features from Ulów and Sługocin in the Lublin region [Niezabitowska-Wiśniewska, Wiśniewski 2011; Bienia *et al.* 2016]. In the absence of good absolute age determinations, one can only assume that the majority of these features most likely come from the turn of the older and younger CWC phases, which is from ca. 2600-2500 BC.

Table 4

Radiocarbon age determinations obtained for CWC graves from Roztocze

Site	Feature no.	Lab. no.	Age ^{14}C BP	Calendar age BC (68.2%)	Literature
Brzezinki, kurgan I	?	Bln-…	4030±100	2857-2462	Machnik, Ścibior 1991
Brzezinki, kurgan I	?	Bln-…	3870±100	2472-2202	Machnik, Ścibior 1991
Brzezinki, kurgan III	?	Bln-…	4100±100	2866-2500	Machnik, Ścibior 1991
Łukawica, kurgan K	?	Bln-…	3800±100	2453-2058	Machnik, Ścibior 1991
Ulów		Poz-73135	4045±35	2621-2491	Moskal del Hoyo *et al.* 2017

3. CHRONOLOGICAL RELATION TO CWC CEMETERIES FROM OTHER REGIONS OF SOUTH-EASTERN POLAND

Apart from the Subcarpathian zone, concentrations of CWC sepulchral finds in south-eastern Poland which are the subject of the presented chronometric analyses also come from loess uplands of western Lesser Poland, the Sandomierz Upland, and the broadly understood Lublin region. In the latter area, barrow clusters in the Sokal Ridge and in the Roztocze region are of particular importance.

The barrow cluster near Narol in Roztocze, known as the Lubaczów cluster [Machnik 1966], is the closest to Święte, being situated approx. 60 km to the north. Barrows at Brzezinki and Łukawica belonging to this cluster produced four dates, although they are burdened with significant standard errors and are therefore unsuitable for comparison with the Subcarpathian materials. The context of acquisition of the charcoal samples from which these dates were obtained is also unknown. Given the typological and technological similarities in ceramic materials between the Lubaczów cluster and the Święte cemeteries, understanding the chronological relation between these two clusters is important. These similarities are seen primarily in finds from graves secondarily dug into Lubaczów barrows.

The chronological diversity of graves from the Lubaczów barrows is confirmed by comparative data – quite abundant today – from other regions. In their context, typological differences between materials from central graves and from features dug into barrow mounds (as in the case of barrow III at Brzezinki) become very clear. However, in the discussed cluster we also have inventories of central graves which show resemblance to materials from niche graves, including to artefacts

Table 5
Radiocarbon age determinations for CWC graves from the Sokal Ridge [after Machnik *et al*. 2009]

Site	Feature no.	Lab. no.	Age ^{14}C BP	Calendar age BC (68.2%)
Hubinek, site 3, kurgan 1	2	Ki-6889	3995±55	2617-2462
Hubinek, site 3, kurgan 1	3	Ki-6890	4070±60	2850-2492
Klekacz, site 10, kurgan 1	1	Poz-25614	4045±35	2621-2491
Łubcze, site 2, kurgan 2	1	Ki-6297	4210±60	2899-2681
Łubcze, site 2, kurgan 2	2	Ki-6298	4160±50	2874-2675
Łubcze, site 37, kurgan 1	3	Ki-6300	4050±55	2833-2486
Machnówek, site 1, kurgan 1	8	Poz-25616	3940±35	2546-2348
Nedeżów, site 22, kurgan 2	1	Ki-6894	4020±55	2619-2471
Nedeżów, site 22, kurgan 2	2	Ki-6895	3940±50	2558-2346
Wierszczyca, site 1, kurgan 1	2	Ki-6301	4305±45	3010-2884
Wierszczyca, site 30, kurgan 1	3	Ki-6891	4125±50	2862-2620
Wierszczyca, site 31, kurgan 1	2	Ki-8955	3845±50	2437-2207
Wierszczyca, site 31, kurgan 1	4/5	Ki-8952	3850±60	2453-2209
Wierszczyca, site 31, kurgan 1	6	Ki-8953	3850±50	2453-2209

discovered in the Święte cemeteries. This is best demonstrated by the finds from the central burial of barrow I at Brzezinki [Machnik 1966: pl. XIX: 2], which contained an amphora and beakers characteristic of the younger CWC phase in Lesser Poland (including Święte sites 11 and 15). Thus, barrow I at Brzezinki is a good piece of evidence for a late chronology of some of Lesser Polish barrows. Typologically similar (= chronologically late) inventories of central graves are also known from Ulów in Roztocze [Niezabitowska-Wiśniewska, Wiśniewski 2011] and from Sługocin in the Nałęczów Plateau [Bienia *et al.* 2016]. Therefore, the large spread of the dates obtained for the Lubaczów barrows (Table 4) may simply reflect the diversified chronology of the graves, with both the older and younger CWC phases represented.

Table 6

Radiocarbon age determinations for CWC graves from the Lublin Upland

Site	Feature no.	Lab. no.	Age ^{14}C BP	Calendar age BC (68.2%)
Lublin-Rury (Gliniana str.)		Poz-58116	4115±30	2855-2620
Lublin-Sławinek, site 3	60	Poz-58115	3895±30	2460-2346
Lublin-Sławinek, site 3	59	Poz-58114	3870±30	2454-2293
Łagiewniki		Poz-58106	3770±35	2278-2138

In the Lublin region, ^{14}C dates were obtained for CWC graves from the Sokal Ridge and for a few graves from the Nałęczów Plateau[3]. Barrows from the Sokal Ridge produced the second largest – after western Lesser Poland – series of radiocarbon age determinations (Table 5) [Machnik 1999; Machnik *et al.* 2009: 221, Table 20]. They were obtained in the Kiev laboratory and included results pointing to a very early chronology of some graves (e.g. graves from barrow 1 at Wierszczyca and barrow 2 at Łubcze). Only a portion of these results corresponds with the dates available for the Święte cemeteries and the neighbouring sites in the Rzeszów Foothills. Two AMS determinations obtained in the Poznań laboratory fit well into the series of results from Subcarpathian sites. The central grave at Klekacz produced a date that, in accordance with the typological analysis, could be referred to the younger section of the older CWC phase. The second result is also important. It was obtained for grave 8 at Machnówek – a niche grave in which a small beaker typical of the Middle Dnieper culture was found. The date suggests that elements of this culture appeared either in the early or middle stage of the late phase of CWC in Lesser Poland (which means perhaps yet before the middle of the 3rd millennium BC). The appearance of Middle Dnieper culture vessels in CWC graves was dated to a similar period based on radiocarbon dates from the Kiev laboratory [Kadrow 2003: 244-245].

Some of the graves secondarily dug into barrows from the Sokal Ridge obtained dates pointing to a range of 2800-2600 BC, i.e. to the older phase of CWC (Table 5). Here belongs, for example, grave 2 from barrow 2 at Łubcze – a niche grave containing pottery with distinct traits of the late, or even final phase of CWC in Lesser Poland [Machnik *et al.* 2009: 49, Fig. 35]. This situation is analogical to that recorded for CWC finds from the Lesser Poland Upland discussed further in the text: some of the dates from the Kiev laboratory point to a slightly older age than series of dates obtained in other laboratories [Włodarczak 2007: 59; 2009].

[3] Radiocarbon dates of the graves from Lublin upland have been received thanks to the grant of the National Science Centre OPUS no. 2012/05/B/HS3/04138.

Table 7

Radiocarbon age determinations for CWC graves from loess uplands in western Lesser Poland and from the Sandomierz Upland (only the determinations obtained with the AMS technique

Feature	**Lab. no.**	**Age ^{14}C BP**	**Calendar age BC (68.2%)**	**Literature**
Bronocice 1				
XI	AA-90116	4000±40	2569-2474	Kruk *et al*. 2018
Gabułtów 1				
1	Poz-9451	4115±30	2740-2579	Jarosz, Włodarczak 2007
2	Poz-9452	3930±35	2476-2347	Jarosz, Włodarczak 2007
Łapszów 1				
1	Poz-9457	3870±35	2455-2293	Jarosz, Włodarczak 2007
Malżyce, 30, barrow 1				
2	Poz-59407	3860±35	2454-2236	Szczepanek *et al*. 2018
4	Poz-90765	3910±30	2467-2348	Szczepanek *et al*. 2018
5	Poz-90767	3870±30	2454-2293	Szczepanek *et al*. 2018
7	Poz-90768	3875±35	2454-2298	Szczepanek *et al*. 2018
Malżyce, 30, barrow 2				
10	Poz-27990	3940±40	2548-2348	Jarosz *et al*. 2009
11	Poz-27991	3910±35	2468-2346	Jarosz *et al*. 2009
12	Poz-27992	3930±40	2477-2346	Jarosz *et al*. 2009
Pełczyska 6				
32/2002	Poz-12580	3880±35	2456-2307	Jarosz, Włodarczak 2007
Smroków 17				
1	Poz-9600	3950±40	2564-2350	Jarosz, Włodarczak 2007
2	Poz-9588	3885±35	2457-2311	Jarosz, Włodarczak 2007
10	Poz-9584	3905±35	2466-2346	Jarosz, Włodarczak 2007
Szarbia 9				
3/VIII	Poz-9581	3840±35	2397-2207	Jarosz, Włodarczak 2007
Wilczyce 10				
28	Poz-80189	3960±30	2566-2458	Włodarczak *et al*. 2016
Zielona 3				
3	Poz-9585	3955±35	2565-2351	Jarosz, Włodarczak 2007
7	Poz-9577	3895±30	2460-2346	Jarosz, Włodarczak 2007
Żuków				
1[2]	Poz-9583	3885±35	2457-2311	Jarosz, Włodarczak 2007
3[4]	Poz-9579	3835±35	2344-2206	Jarosz, Włodarczak 2007

Table 8
Radiocarbon age determinations obtained for CWC barrows graves from western Lesser Poland

Site	Feature no.	Lab. no.	Age ^{14}C BP	Calendar age BC (68.2%)	Literature
Gabułtów	1	Poz-9451	4115±30	2740-2579	Jarosz, Włodarczak 2007
Koniusza	14	GrN-12517	4000±30	2567-2477	Tunia, Włodarczak 2002
Lelowice		Ki-9530	4110±100	2870-2573	Rodak 2012
Miernów, barrow 2	2	K-1837	3960±100	2618-2293	Kempisty 1978
Miernów, barrow 2	2	Ki-5833	4105±35	2850-2580	Włodarczak 2001

The few results available for CWC cemeteries from the eastern part of the Nałęczów Plateau (Table 6) are consistent with the data from the Subcarpathian area [Włodarczak 2016]. Certain interpretational difficulty is only posed by an exceptionally early date obtained for a grave from Lublin-Rury. It was, however, obtained from materials retrieved from a damaged grave (of unknown construction; the recovered artefacts point rather to the younger phase of CWC). It is worth noting one of the latest results for CWC in Lesser Poland, obtained for a grave from Łagiewniki (2278-2138 BC). In this case, the late chronology is confirmed by both the bi-ritual nature of the burial, and the nature of the grave goods. Dates obtained for graves from Lublin-Sławinek correspond with the chronology of the Święte cemeteries.

Loess uplands on the left bank of the Vistula River abound in CWC finds, and were the first region to have attracted intensive chronometric research [e.g. Machnik, Ścibior 1991; Włodarczak 1998; 2001; 2006; 2013; Jarosz Włodarczak 2007]. The region can be used as an example demonstrating the need to verify older series of ^{14}C dates by new results, obtained with upgraded techniques and having greater precision [Włodarczak 2008; 2009; a similar approach to finds from Central Germany: Fröhlich, Becker 2015]. In the 1990s the first longer series of results was produced for the Żerniki Górne cemetery [Włodarczak 1998]. These dates were accepted at that time as the benchmark for CWC chronometry in Lesser Poland. These results, however, applied to niche graves of the Kraków-Sandomierz group only. Despite the above, some of these dates pointed to an early age of the finds, corresponding with the period of the earliest barrow graves. In later years, such early determinations, within a generalised period of 2900-2600 BC, were obtained for several other graves in the Kraków-Sandomierz area, for example for Zielona, Kraków-Zesławice, and Samborzec [Włodarczak 2006]. A new series of AMS results obtained in the Poznań Radiocarbon Laboratory over the last 10 years

allowed for verification and rejection of these previous early dates for the Kraków-Sandomierz group (Table 7). The new results indicate a parallel age of cemeteries in the western and eastern parts of Lesser Poland, with the dates similar to those from Święte and the Rzeszów Foothills. Given the already assured repeatability of ^{14}C age determinations for niche graves in the Kraków-Sandomierz region, the biggest issue still remaining to be resolved is the chronology of barrows in western Lesser Poland, for which only single results are available (only 5 determinations from four different laboratories – Table 8).

4. TYPOCHRONOLOGICAL STUDIES AND THE ABSOLUTE CHRONOLOGY

It is worth noticing the concordance of the results of absolute age determination with the relative chronology of Final Eneolithic materials established on the basis of typological analysis of grave furnishings (primarily pottery) and traits of burial rites (e.g. grave construction and body position). For CWC, this is typically verified by testing the correctness of chronological models which are based on classical, benchmark studies of regions rich in sepulchral finds, in particular studies which have larger than local influence which provide a repeated, sometimes enriched, long-lasting pattern [e.g. Glob 1944; Struve 1955; Buchvaldek 1967]. For Lesser Poland, such a benchmark is provided by Jan Machnik's study [1966], whose main points were developed in later typochronological studies [first of all: Kempisty 1978; Włodarczak 2006]. It needs to be emphasised that these models only drew from stratigraphic observations to a small extent. Stratigraphy only provided grounds for concluding about the anteriority of at least some barrow graves ("early Corded") in relation to cemeteries with niche graves (younger CWC). Some of the barrow graves also revealed stylistic connections with materials described as "Pan-European" (= "type A" or early Corded). This early position of the "A type" style later found clear confirmation in dendrochronologically dated CWC materials from sub-Alpine lake settlements [for recapitulation *see*: Stöckli 2009; cf. Włodarczak 2007].

Chronological division of materials assigned to the younger phase, which in practice means the vast majority of the materials, is a more difficult task. Among graves from Lesser Poland, regarded as older were materials in which scholars suspected traits either of the older CWC horizon [phases II-IIIA acc. to Włodarczak 2006], or of earlier Eneolithic cultures, e.g. the Funnel Beaker culture [the concept of a horizon with vessels of the Książnice Wielkie type: Machnik 1966]. A later chronological position, on the other hand, was applied to inventories in

which scholars believed to notice traits characteristic of the Bell Beaker culture or the oldest phase of the Mierzanowice culture (e.g. P. Włodarczak's concept of subphase IIIC). Attempts were made to create typological developmental sequences for selected artefact categories, e.g. stone battle-axes. Models created in this manner (primarily Machnik 1966; Kempisty 1978; Włodarczak 2006) have not as yet been successfully verified by means of stratigraphic evidence or absolute dates.

There are two basic aspects to the critical analysis of the relation between absolute age determinations and results of typological analyses: (1) comparison of the age of the finds from the older phase and the younger phase, and (2) chronological relations within the clearly predominant group of finds linked with the younger phase.

1. In Lesser Poland, the older group of finds was defined by materials having stylistic associations with the early Corded style (i.e. "Pan-European horizon"/"horizon A") [Machnik 1966] and later refined by distinguishing finds belonging to the "Central European horizon" (younger phase of the older stage of CWC development) [Machnik 1979; cf. also Kempisty 1978]. However, the model positing a simple succession of finds from the younger stage after those from the older stage was challenged when late radiocarbon dates were obtained for graves from Lubaczów group barrows (previously regarded as early Corded) [Machnik, Ścibior 1991: 50], and next for some barrows from the Subcarpathian area as well (e.g. Krajowice in the Strzyżów Foothills, or Bykiv in the western fringes of Ukraine). It was demonstrated at that time that outside western Lesser Poland (the Kraków-Sandomierz group) the early Corded style continued longer, until the beginnings of the Bronze Age [Machnik 1994; 1997]. Then results of absolute age determinations called the validity of models based on pottery typologies into question. Similar results were obtained in other parts of Europe, and attempts to reconcile the relative and absolute chronologies included a conclusion positing a "survival" of early Corded style in younger stages of Final Eneolithic, or explanations involving other (other than chronological) factors affecting typological diversity of CWC amphorae and beakers [Müller 1999: 84; 2000: 67].

On the other end, some finds from Lesser Poland, typologically dated to the younger stage of the Final Eneolithic, produced very early ^{14}C dates, in some cases even pre-dating early CWC barrows (grave 3 at Zielona and grave 2 from barrow 1 at Wierszczyca, site 1). These results were used in some chronological models that did not take relative chronology into account, where they represented the oldest CWC horizon [Furholt 2003; 2004: 482-485]. Renewed dating with the more precise AMS technique, performed for some of the samples, did not confirm the exceptionally early chronology of the niche graves in question [Włodarczak 2007; 2009] and demonstrated that they are contemporary with other graves of this type.

Thanks to a long series of radiocarbon dates obtained in the Poznań laboratory (a total of 89 results for graves from Lesser Poland, as of the end of 2018), it has become clear today that barrow graves are generally older and that CWC cemeter-

ies with niche graves appeared only in the younger stage of the Final Eneolithic (ca. 2600/2500 BC). What remains unclear, on the other hand, are chronometric conclusions concerning the late stage of the barrow horizon, and its possible contemporaneity with cemeteries representing the younger CWC phase. This contemporaneity is suggested by examples of niche barrow graves of the Lesser Polish type in the Kraków-Sandomierz group (Miernów, barrow II, and Zielona, site 3), as well as some pit graves in barrows in eastern Lesser Poland, containing objects characteristic of the late phase (e.g. Ulów in Roztocze and Sługocin in the Lublin Upland).

2. The problem with assemblages from the younger stage of CWC development is that they cover a very broad range of 2600-2200 BC, although most likely their vast majority actually comes from a narrower timespan of ca. 2500-2400/2300 BC. In models based on relative chronology the finds in question were usually divided into stages, e.g. IIa and IIb [Machnik 1966], IIIa and IIIb [Machnik, Ścibior 1991], or IIb, IIIa, IIIb, and IIIc [Włodarczak 2006]. Yet it proved impossible to demonstrate the validity of these divisions by absolute age determinations. The ^{14}C results do not show any tendency for clustering in accordance with the suggestions derived from the relative chronology. However, the analysed timespan is relatively short and, without additional arguments (e.g. stratigraphic ones), radiocarbon age determinations do not allow for its sub-division, due to certain limitations of the method.

The nature of the calibration curve makes it difficult to determine the marginal dates of the range within which finds from the younger CWC phase place. The flattening of the curve is particularly clear for the period of 2450-2250 BC, which corresponds with the close of the CWC occupation. This often results in extending the lifespan of the CWC model and suggesting its contemporaneity with the Bell Beaker culture and the earliest phases of the Mierzanowice culture in Lesser Poland. Yet, the vast majority of the dates can be referred to before 2400 BC, as evidenced by the results of radiocarbon age determinations for the Święte cemeteries, presented above.

The determination of the beginning of the younger phase is slightly less of a problem. The older sections of relevant AMS dates suggest a range of ca. 2550--2450 BC. A period preceding this range is only indicated by the above-mentioned less precise determinations obtained in the 1990s – which have been rejected here as less credible (the decision to reject them is also supported by the results of renewed dating of some of the samples). Barrow graves with inventories having analogies in materials from the beginning of the younger CWC phase date to the 26th century BC as well. Grave 14 from Koniusza in western Lesser Poland, with a Ślęża type axe and a rich collection of tools, is a good example in this context [Tunia, Włodarczak 2002: 47, 50].

5. COMPARISON OF AGE DETERMINATIONS FOR EARLY BRONZE AGE CULTURES FROM THE NORTH-WEST PONTIC AREA AND FOR LESSER POLISH CWC

From the perspective of research on relationships between CWC communities in Lesser Poland and the north-west Pontic area, a comparison with chronometric data concerning the Yamnaya culture (YC) and the Catacomb culture (CC) is very important. The numerous age determinations available for these two cultural phenomena generate similar problems as the results obtained for CWC in Lesser Poland. Taking all the available dates into account results in improbably broad timeframes, and the approach has therefore been subject to critical interpretations [e.g. Telegin *et al.* 2003: 142-148, Table 1; Chernykh, Orlovskaya 2004: 86-92, Tables 1-2; Rassamakin, Nikolova 2008: 81-87, Table 1]. These problems stem, among others, from uncertain sample contexts and incomplete source publications. It was also noticed that some determinations obtained from charcoals had produced older results [Rassamakin, Nikolova 2008: 62-63]. Obtained in the 21st century and better documented, radiocarbon age determinations such as those from "Tarasova Mogila" at Orechov [Govedarica *et al.* 2006], or barrow 24 at Vinogradnoye [Görsdorf *et al.* 2004] have contributed to a better understanding of the dynamics of cultural development. Also of importance is the acquisition of the first dendrochronological dates supplementing the series of ^{14}C dates for "Sugokleyska Mogila" barrow at Kirovograd [Nikolova, Kaiser 2009, Nikolova 2012]. Another contribution to refining the chronometric data has come from a research project on barrows in the Yampil region – the north-westernmost barrow group on the left – Podolian – bank of the Dniester River [Goslar *et al.* 2015]. The focus of the project was the analysis of contacts between forest-steppe/steppe communities and those from the central European cultural circle [Kośko (Ed.) 2015]. Radiocarbon dates obtained for barrows from the Jampol cluster correspond well with other recent results. They unambiguously show that some YC graves pre-date the older CWC phase in central Europe [Goslar *et al.* 2015: 281-283]. The younger YC stage chronologically corresponds with barrow graves from older CWC horizons. This chronological order is confirmed by the discovery of an amphora of type A in grave 2/6 at Porohy, Yampil *raion*, dug into a barrow mound [Harat *et al.* 2014: 87, Fig. 2.3.4:9].

The comparison of radiocarbon dates for CWC in Lesser Poland and YC in the north-west Pontic area results in an important and previously unexpected conclusion. ^{14}C dates from the Święte sites and throughout the Rzeszów Foothills unambiguously show CWC niche graves to be younger than the finds from the Yampil region and the majority of other YC graves from the north-west Pontic zone. The determination of the age of these niche graves at the years after ca. 2600/2550-

-2300/2200 BC (with the majority falling within the 2500-2300 BC range) indicates that the younger CWC phase dates to a period when the CC[4] rite had already come to prevail in the forest-steppe and steppe areas.

The demonstration of the parallel spread of the specific catacomb construction and several other traits of funerary rituals in Lesser Poland and in the CC range opens up an interesting interpretational perspective. Absolute age determinations for early CC phases are available primarily for the Donets CC, and they suggest dating these phases to 2800-2500 BC [Kaiser 2009: 63-65]. This means that this stage was parallel with the late stage of YC development, and at the same time with the older phase of CWC. Therefore, only the closing stages of the early CC phase could have been contemporary with the cemeteries at Święte, and with the niche grave phase in Lesser Poland in general. Of importance is the conclusion about a similar age of the determinations obtained for early CC and for niche graves of the Złota culture from Lesser Poland [cf. Włodarczak 2008: 557-559; 2013: 379-381; Wilk 2013: 334]. The possibility of synchronisation with early CC corroborates the interpretation of the genesis of Złota type assemblages as resulting from mutual relationships between GAC and communities from the north-western Pontic area – the late phase (C/II) of the Trypilia culture and YC [cf. Włodarczak 2008; 2014]. A weak point of this reconstruction remains the still-insufficient chronometric research of CC finds from north-west Pontic forest-steppe areas, which means from the part of CC range closest to Lesser Poland. The finds from that area are sparse, and the lack of rich burial complexes makes them much less distinct than the Donets and Ingul clusters of CC [cf. e.g. Toschev 2013; Kaiser 2003; Ivanova 2013; Otroshchenko 2013]. Graves with burials in supine position, akin to those from the Ingul cluster, prevail here, while features confidently linked with the older CC phase (such as the grave from Ocniţa, Kamienka region [Klochko 1990] are few.

"T-shaped" niche/catacomb graves, specific for Lesser Polish CWC and classic CC [e.g. Kaiser 2003, Ślusarska 2006], became widespread around the middle of the 3rd millennium BC. It was roughly at the same time when artefacts testifying to connections with the territories to the east of Lesser Poland started to appear in CWC graves. These objects revealed traits of the Middle Dnieper culture and late YC/CC [for the cemeteries at Święte *see*: Janczewski *et al.* 2018; Olszewski, Włodarczak 2018].

[4] Presenting the phenomenon of the "Catacomb culture" and the most relevant terminology is beyond the scope of this paper [for review of discussion see: Otroshchenko 2013: 21-23].

6. RELATION TO CEMETERIES OF THE MIDDLE DNIEPER CULTURE

The investigation of cemeteries in Roztocze and the Sokal Ridge brought to scholarly attention the presence in grave inventories of vessels revealing traits of the Middle Dnieper culture [e.g. Machnik, Pilch 1997; Machnik 1999; Machnik *et al.* 2001; 2009]. Chronometric data [Machnik 1999] suggested dating these assemblages to around the middle of the 3rd millennium BC [Kadrow 2003]. Single new results obtained with the AMS technique for graves containing Middle Dnieper culture vessels confirmed these previous conclusions. Chronometric data for the Święte cemeteries, where pottery forms with references to the Middle Dnieper culture were present, are also of importance in this context [Janczewski *et al.* 2018]. Another important contribution comes from grave 54 at Mirocin, site 24, which contained a typical hourglass-shaped beaker [Machnik *et al.* 2019], and which has been dated (human bone sample) to 2546-2348 BC. All the above information allows for a conclusion that the appearance of Middle Dnieper elements took place at the stage of crystallisation of attributes typical of the classic (younger) CWC phase in Lesser Poland, including the Kraków-Sandomierz group, the Sokal group, and the Subcarpathian cemeteries with niche graves which are a particular focus of this study.

However, the above data are difficult to compare with the genetic-chronological model of the Middle Dnieper culture development. Absolute age determinations available for graves of this culture are few and apply to the upper Dnieper basin in Belarus, first of all to the Ragachov region [Krywalcewicz 2007: 66--69], while no dates have as yet been obtained for diagnostic assemblages from the Ukrainian cluster on the middle Dnieper River [Bunyatyan 2008: 10]. If we assume that the data from the upper Dniester area are representative for the chronometry of the Middle Dnieper culture, we arrive at a long timeframe spanning from ca. 2800/2600 BC until the mid-2nd millennium BC. This wide dispersal of results should, however, be verified in future using more precise techniques. It is worth noticing the earliest dates for Prorva 1 cemetery, which point to the first half of the 3rd millennium BC. If they are correct, they imply that the initial stage of the Middle Dnieper culture pre-dates the younger CWC phase in Lesser Poland. However, the author of the research himself prefers to establish the beginning of the earliest phase at this site at around 2500 BC, as indicated by other ^{14}C dates [Krywalcewicz 2007: 70]. In this approach, the age of flat cemeteries of the Middle Dnieper culture corresponds with CWC niche graves in Lesser Poland, and at the same time with the period when CC rites started to dominate in the north Pontic zone. What remains unknown, however, is the chronology of barrow cemeteries with inhumation burials, both in the upper Dnieper area (e.g. Khodosovichi-Moshka) and in the middle Dnieper area (e.g. Jackowica, nowadays Dolynka, barrow 29). Given the presence of early Corded elements in

the Middle Dnieper culture, these cemeteries should most likely be referred to a horizon of CWC phase I – late phase YC, which is ca. 2800-2600 BC.

In light of the above chronological conclusions, the relations between CWC in Lesser Poland and the Middle Dnieper culture are clearly detectable at the beginning of the second half of the 3rd millennium BC, which is parallel with the beginnings of the Donets and Ingul variants of CC. However, reliable data for assessing the connections in the earlier period, corresponding with the Pan-European horizon of CWC, are still lacking.

7. SUMMARY

The large number of high-quality radiocarbon age determinations for CWC graves in Lesser Poland has made it possible to set the Święte cemeteries within a chronometric sequence of cultural transformations, both on the micro- and macro-regional scales (SE Poland). Future analyses can be expected to refine chronometric data for cultural phenomena from territories to the east of Lesser Poland, associated with the Corded complex (first of all: the upper Dniester CWC and the Middle Dniester culture) and the steppe cultural circle (late YC, and first of all CC in the north-west Pontic area).

The series of dates for the Święte cemeteries has demonstrated a parallel cultural development in the Kraków-Sandomierz, Lublin, Sokal, and Subcarpathian areas. Beginning from the 26th century BC, deceased were predominantly buried in niche graves in all these areas, and a specific set of rules concerning body position and grave goods was observed. This tradition ceased around 2400-2300 BC (depending on the region).

Cemeteries with niche graves were contemporary with the youngest barrow burials (few?), as evidenced by the dates (Wola Węgierska) and characteristics of the furnishings of central graves.

Around 2550-2450 BC, artefacts reflecting connections with CC (perhaps also the late phase of YC) and Middle Dnieper culture communities appear in CWC graves.

The remarks presented here lead to the following conclusion: the sequence of absolute chronology for CWC graves can be synchronised with the typochronological dating, although the resulting model requires considerable refinement. Such a synchronisation makes it possible to address genetic problems concerning Final Eneolithic communities from Lesser Poland.

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