

**THE FOUNDATIONS OF RADIOCARBON
CHRONOLOGY OF CULTURES BETWEEN
THE VISTULA AND DNEIPER:
4000-1000 BC**

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BALTIC-PONTIC STUDIES

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Editor's Foreword

This volume of the *Baltic-Pontic Studies* is a record of investigations carried out under the research project begun earlier in vol. 7 ("The Foundations of radio-carbon chronology of cultures between the Vistula and Dnieper: 3150-1850 BC", Poznań 1999). Here, the approach is broader in terms of chronology and culture. Our purpose has been to fill taxonomic gaps hitherto present in the discussion (supplementing the dating of cultures, groups or phases) or reanalyze the grounds for findings considered particularly controversial. In the latter case, a very enlightening debate was provoked by the comparative chronology of the Yamnaya and Catacomb cultures presented by A.N. Nikolova. We hope that a large series of ^{14}C dates and a revision of the foundations of "archaeological knowledge" (stratigraphy, typochronology and groups of co-occurrence of traits), brought together in the paper by D.Y. Telegin, S.Z. Pustovalov, N. Kovalyukh, lay the ground for a stabilization of views on this important dividing line in the chronology of the Bronze Age in the Pontic zone.

A vast majority of the new ^{14}C dates have been obtained under an international research project financed by the Polish Committee for Scientific Research.

Editorial comment

1. All dates in the B-PS are calibrated [BC; see: Radiocarbon vol.28, 1986, and the next volumes]. Deviations from this rule will be point out in notes [bc].
2. The names of the archaeological cultures and sites are standarized to the English literature on the subject (e.g. M. Gimbutas, J. P. Mallory). In the case of a new term, the author's original name has been retained.
3. The spelling of names of localities having the rank of administrative centres follows official, state, English language cartographic publications (e.g. *Ukraine, scale 1 : 2 000 000*, Kiev: Mapa LTD, edition of 1996; *Rèspublika BELARUS', REVIEW-TOPOGRAPHIC MAP*, scale 1:1 000 000, Minsk: BYELORUSSIAN CARTOGRAPHIC AN GEODETIC ENTERPISE, edition 1993).

Andrzej Bronicki, Sławomir Kadrow, Anna Zakościelna

**RADIOCARBON DATING OF THE NEOLITHIC
SETTEMENT IN ZIMNE, VOLHYNIA, IN LIGHT OF THE
CHRONOLOGY OF THE LUBLIN-VOLHYNIA CULTURE
AND THE SOUTH-EASTERN GROUP OF THE FUNNEL
BEAKER CULTURE***

1. GENERAL OBSERVATIONS

The Neolithic settlement in Zimne is located on the right, Ukrainian bank of the upper Bug River (Fig. 1), on the loess soils of the West-Volhynia Uplands. Owing to this geographic location, the Zimne settlement, together with the surrounding settlement cluster, was sometimes believed to belong to the “Bug group” or to the “Lvov-Bug group” [Sulimirski 1957-1959:202], or to the “Gribovichi group” [Zakharuk 1955:115] of the Funnel Beaker culture (FBC). In terms of territory, the settlement cluster was believed to include other settlements situated in the upper Bug area, both on the right and on the left bank. However, the exact range of the “group” was not specified. The only mention about the territory was that the (sub)-group was located in the east Lublin area, west Volhynia and probably in a part of Polish and Ukrainian Roztocze. The group, apart from the settlement in Zimne, also comprised settlement 1C in Gródek Nadbużny. Yet, it is unknown whether the group in question was meant to be a part (subgroup) of the South-Eastern group (SEG) or it was rather its taxonomic counterpart that appeared at the south-western limit of the FBC range.

In our opinion there is insufficient archaeological evidence to distinguish the “Bug group” or something like. For example elements regarded as characteristic for this group became not so conclusive in this respect. There are (a) the lack of the influence of the Baden culture on the “beaker” substrate, and (b) the strong “late-Tripolye” impact [cf. e.g. Ścibior 1994; Koško, Langer, Szmyt 1999], which

* Chapters 4-6 were written by Andrzej Bronicki whose research was made possible by Polish Committee for Scientific Research (grant 1 H01G00911 provided in 1996-1999).

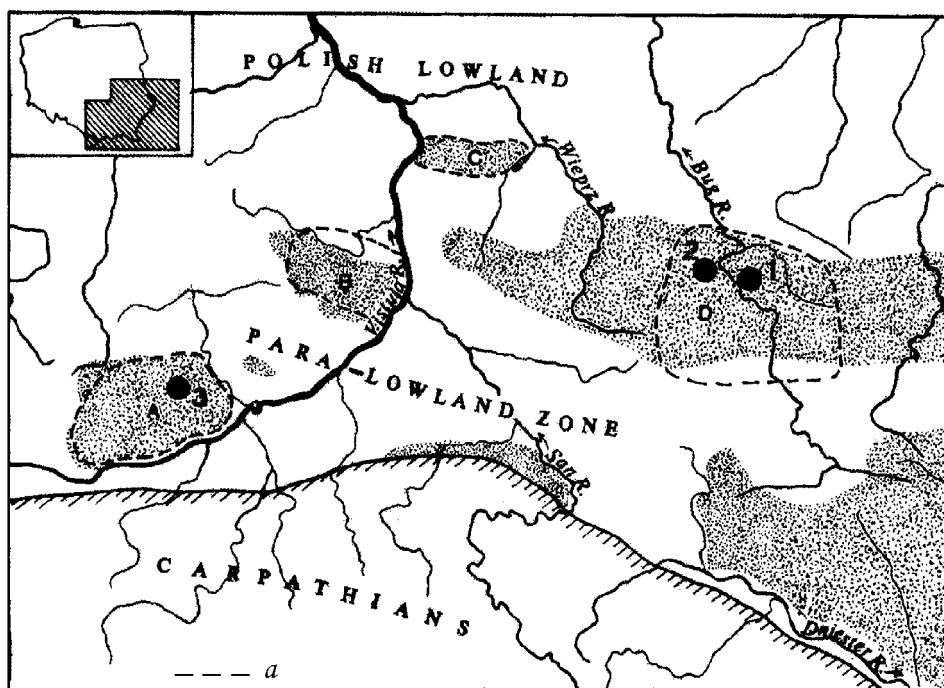


Fig. 1. South-Eastern Group of the Funnel Beaker culture (a) A - the Kraków area, B - the Sandomierz area, C - the Lublin area, D - the Volhynia area (according to Burchard, Jastrzębski, Kruk 1991); 1 - Zimne, 2 - Gródek Nadbużny, 3 - Bronocice; the dotted area — loess soils

included numerous imports of pottery, technological, morphological and ornamental influences in the production of vessels, “ploshchadki” in construction as well as cremation in burial ceremonies (e.g. an urn grave of Zimne). Still, it should be remembered that the impact of the Baden culture was limited to a relatively small territory in the Szreniawa and Nidzica drainage basins located on the loess soils of western outskirts of Małopolska [Kruk, Milisaukas 1999:174-175; Zastawny 2001:Fig. 7]. On the majority of the SEG territory (e.g. not only the upper Bug drainage, but also the Sandomierz-Opatów Uplands, the Lublin Uplands) the impact of the Baden culture was never observed. In fact, the imports of painted “table” pottery of the Tripolye culture (TC) found at FBC sites appear mostly on the south-eastern peripheries of the FBC [Jastrzębski 1985]. However, such imports are additionally present west of the Vistula River [Kempisty 1968] and their imitations even as far as western Małopolska [Kruk, Milisaukas 1981]. Moreover, nowhere did the import of Tripolye pottery or its imitations introduce so many cultural changes as did the impact of the Baden culture on the FBC on the western Małopolska loess soils, which consequently led to the emergence of a new culture. Structures of the

“ploshchadki” type are also recorded in Bronocice [Kruk, Milisuaskas 1999:146]. Similarly, a single case of cremation should be explained as the impact of the Baden culture rather than the Tripolye culture. In the latter, cremation was also clearly connected with the increasingly strong influence of the late Baden culture and the cultures of the lower Danube drainage that appeared at the same time [e.g. in the Sofievka group; cf. Kadrow, Koško, Videiko 1995:213; Videiko 1999:55-67; Kadrow 2001b:193-195]. It should be emphasised that the material of the late phase of the FBC on the Zimne II site was “impermeable” to foreign influences (including the impact of the TC), which can be seen from the analysis carried out later in this article.

Therefore, it appears that the FBC settlement cluster on the upper Bug River should be interpreted as a “Volhynia cluster”, which had a taxonomically equivalent status to the Kraków, Sandomierz and Lublin clusters (the loess varieties of the SEG) [Fig. 1; cf. Burchard *et al.* 1992:96-97].

For the above reasons and for other reasons not mentioned so far, further discussion shall comprise the broad area of the whole classic SEG [Jażdżewski 1936:258-259; Wiślański 1979:207-212].

2. ABSOLUTE CHRONOLOGY OF THE LATE PHASE OF THE LUBLIN-VOLHYNIA CULTURE: CURRENT STATE OF RESEARCH

The main characteristic of the late phase of the Lublin-Volhynia culture (LVC) is the continuation of vessel forms produced in its classic phase. The ornaments of pottery made with white paint and chequer patterns, which were typical of the classic phase, disappeared almost completely. Instead, elements representative of phase A of the Bodrogkeresztur culture appeared: groups of shallow round dents arranged in triangles [Kadrow, Kłosińska 1989:Figs. 8g, 9g] and similar dents on both sides of the handles placed below the lip rim of amphora-shaped vessels [Kadrow, Kłosińska 1989:Fig. 8f]. Quite frequently, grave materials feature tulip-shaped beakers clearly corresponding to analogous vessels of the Baalberge/Michelsberg culture [Kokowski, Zakościelna 1988:Fig. 6d; Kadrow, Zakościelna 2000:Fig. 25d]. In one case grave-goods contained a cup (probably the oldest in Poland) decorated with vertical chevron bands [Kadrow, Zakościelna 2000:Fig. 29a], which demonstrated a relationship with the Balaton-Lásinja culture. Unlike the vessels of this culture found in Pannonia, where the ornaments were incised, the cup was decorated with white paint. Sometimes the pottery of the late LVC is marked by the influence of the latest stage of the Polgar cultures, i.e. the Lažňany group [Kruk, Milisauskas 1983:80-82].

In light of stratigraphic data, the settlement features of the late phase of the LVC from Bronocice, are younger than the settlement features of phase I of the FBC but still they are older than the FBC cemetery dated at phases II and III [Kruk, Milisauskas 1985:74-77]. Thanks to radiocarbon datings of the discussed settlement horizons in Bronocice [Kruk, Milisauskas 1983:77-79; 1999:135] it is possible to set the absolute chronology of the fortified settlement of the Lublin-Volhynia culture in Bronocice at the period between 3700 and 3650 BC.

Table 1

Radiocarbon datings from features of the late phase of the Lublin-Volhynia culture

Site	Lab. No.	Feature	Type of sample	BP	Ranges of dating (cal BC) of 1 sigma (68,2%) probability distribution	Probability level (%)
Strzyżów, site 26	Ki-6972	Grave 1	Human bone	4875±50	3710-2630 3550-3540	67,2 1,0
Strzyżów, site 26	Ki-6974	Grave 2	Human bone	4810±55	3660-3620 3600-3520	19,3 48,9
Strzyżów, site 26	Ki-6973	Grave 4	Human bone	4740±60	3640-3550 3540-3500 3430-3380	35,2 15,0 18,0
Gródek Nadbużny, site 1C	Ki-10027	Grave III	Human bone	4620±70	3520-3330 3210-3190 3160-3130	61,3 3,7 3,2
Gródek Nadbużny, site 1C	Ki-10028	Grave V	Human bone	4570±70	3500-3460 3380-3260 3240-3100	8,3 23,1 36,9
Gródek Nadbużny, site 1C	Ki-10026	Grave VI	Human bone	4490±70	3350-3090	68,2
Bronocice	Dic-364	Pit 15-C2	Charcoal	4690±240	3700-3050	68,2

Site 1C in Gródek Nadbużny [Kokowski, Zakościelna 1988:59-61] featured the remains of a settlement from the classic phase (three oldest radiocarbon dates, see Table 2) and from the late phase of the LVC, as well as a cemetery from the late phase of the LVC (Table 1). That is why, it may be assumed that in Gródek Nadbużny, like in Bronocice, the LVC existed only until approximately 3650 BC at the latest. Subsequently, the whole site was subject to intensive settlement activity of FBC populations. Yet, even though there is little archaeological evidence to explain it, the fact is that three graves from the LVC cemetery (Table 1) received

Gródek Nadbużny site 1C. Settlements of the Lublin-Volhynia culture and Funnel Beaker culture. Radiocarbon datings

Lab. No.	Locality of sample		Type of sample	BP	Ranges of dating (cal BC) of 1 sigma (68,2%) probability distribution	Probability level (%)	References
	Feature No.	Depth in [m]					
Gd-2439	Ditch (A)	Bottom of ditch	?	5110±60	3970-3910 3880-3800	28,2 40,0	Jastrzębski 1991
Gd-2163	Pit 2/83	0,8-0,9	Charcoal	5030±90	3950-3710	68,2	Jastrzębski 1991
Gd-2160	Pit 2/83	0,8-0,9	Charcoal	5010±110	3950-3710	68,2	Jastrzębski 1991
Gd-4099	Pit 11/84	?	?	4900±140	3940-3870 3810-3620 3610-3520	9,5 44,2 14,6	Jastrzębski 1991
Gd-2454	Pit 6/84	?	?	4840±120	3770-3500 3420-3380	62,7 5,5	Jastrzębski 1991
Gd-2441	Pit 5/84	0,25-0,35	Charcoal	4830±90	3710-3510 3400-3380	66,2 2,0	Jastrzębski 1991
KN-I.243	Pit 13/54	?	Charcoal	4820±40	4770-4750 4730-4610	8,7 59,5	Kowalczyk 1968, Breunig 1987, Jastrzębski 1991
GrN-16123	Pit 4	?	Animal bones	4815±40	3650-3620 3590-3530	21,9 46,3	Gumiński 1989
Gd-6222	Trench 4/88, house with "ploshchadka"	0,25-0,30	Burnt corn grains	4760±80	3640-3500 3430-3380	53,8 14,4	Information of J. Buszewicz and W. Koman
Gd-1918	Pit 7/83	1,45	Charcoal	4750±50	3640-3510 3410-3380	58,7 9,5	Jastrzębski 1991
Gd-2468	Ditch (B)	?	?	4750±120	3650-3490 3470-3370	43,3 24,9	Jastrzębski 1991
Gd-2427	Pit 22/85	?	?	4690±70	3630-3590 3530-3370	11,5 56,7	Jastrzębski 1991
GrN-16124	Pit 18	?	Animal bones	4665±40	3520-3400 3390-3360	60,2 8,0	Gumiński 1989
GrN-16125	Pit 15 a	?	Animal bones	4665±40	3520-3400 3390-3360	60,2 8,0	Gumiński 1989
Gd-6225	Pit 2/89	0,96	Charcoal	4630±110	3650-3300 3250-3100	54,6 13,6	Information of J. Buszewicz and W. Koman
Gd-2440	Pit 10/85	?	?	4580±90	3500-3430 3380-3260 3240-3100	15,2 23,0 30,1	Jastrzębski 1991
Gd-4545	Pit 2/89	0,60	Charcoal	4570±120	3510-3420 3390-3090	13,4 54,8	Information of J. Buszewicz and W. Koman
Gd-4544	Pit 9/3/89	0,97	Charcoal	4560±110	3500-3430 3380-3090	10,3 57,9	Information of J. Buszewicz and W. Koman
GrN-16126	Concentration XIV	?	Animal bones	4565±35	3370-3330 3220-3180 3160-3120	29,8 18,0 20,4	Gumiński 1989
Gd-242	Pit 23/85	?	?	4530±70	3360-3260 3240-3100	27,2 41,0	Jastrzębski 1991
Gd-2455	Pit 7/84	?	?	4330±80	3100-2870	68,2	Jastrzębski 1991

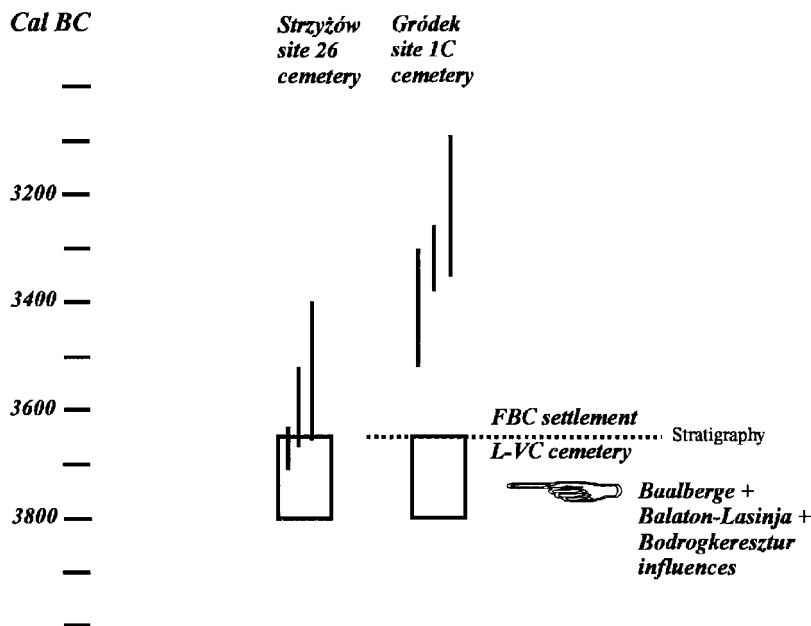


Fig. 2. A graph showing discrepancies between the radiocarbon dating of the cemeteries of the late phase of the Lublin-Volhynia culture and the outcomes of stratigraphic and stylistic-typological analysis. LVC - Lublin-Volhynia culture, FBC - Funnel Beaker culture

later radiocarbon dates (about 3500–3100 BC). The outcomes of the horizontal stratigraphic analysis, as well as stylistic and typological analyses of the material found in the cemetery (impacts of the Bodrogkeresztur, Baalberge/Michelsberg and Balaton-Lasinja cultures) clearly contradict the results of the radiocarbon chronology (Fig. 2). Evidently, analogous grave assemblages at site 26 in Strzyżów [Zakościelna 1997; Zakościelna, Gurba 1996; Kadrow, Zakościelna 2000:224, 225, 252] have an earlier chronology (Table 1), although, as in the above case, they are dated at the end of the 37th and the beginning of the 36th century BC and at the 36th century BC (Fig. 2), i.e. the period when the population of the FBC classic phase dominated. Relevant literature describes cases of surprising discrepancies between absolute chronology dates obtained on the basis of examining bone samples [e.g. Calderoni *et al.* 1994; Kadrow 1994; Müller 2002]. However, the present authors do not believe that the cemetery of the LVC population and the settlements of the FBC populations could function simultaneously at the same site. Consequently, the authors see it appropriate to carry out a new radiocarbon analysis of bones

found at this site, but this time in a different laboratory. The reanalysis should — as was the case with the cemetery in Trebur [Müller 2002] — explain this problem.

3. ABSOLUTE CHRONOLOGY OF THE SOUTH-EASTERN GROUP: CURRENT STATE OF RESEARCH

So far only the settlement in Bronocice (Figs. 3, 4) has received an adequate absolute chronology based on radiocarbon dates. These dates were tested with positive results against other independent data, obtained from the stratigraphy of below-ground features, as well as from stylistic and typological analyses of abundant ceramic materials [Kruk, Milisauskas 1981; 1983; 1990; 1991; 1999]. The Bronocice settlement existed in the period from 3800/3700 to 2600/2500 BC. For the sake of further considerations it was absolutely necessary to determine that the beginning of the great settlement stage fell at 3650/3600 BC and the Baden culture influence began to be felt at about 3050/3000 BC, which was connected with the stage of reduction and concentration of settlement activity [Kruk, Milisauskas 1999:120, 135].

Analysing the ceramic materials found at the sites of medium settlement stage, which, generally speaking, are either contemporaneous with the Bronocice I phase [Kruk, Milisauskas 1990:198-199] or slightly earlier [Burchard *et al.* 1991:96-99], leads one to a discovery that these materials are clearly marked by northern characteristics, i.e. the early Wiórek phase [Jażdżewski 1936:261; Koško 1982:57] and western characteristics, i.e. the Baalberge/Michelsberg culture [Las Stocki, site B, grave 12; cf. Gajewski 1953:99; Klementowice, site 14, grave 4; cf. Wiślański 1979:187]. However, there were no elements whatsoever typical of the SEG “classic phase” [e.g. Kraków — Nowa Huta, site 49; cf. Burchard 1981; Turkowice; cf. Gurba 1989:220; Bronocice I; Kruk, Milisauskas 1991:174-175].

Among the materials of the medium settlement stage located on loess soils, there are both older ones, which probably appeared before the Lowlands early Wiórek phase (e.g. Kraków — Nowa Huta, site 49) and later ones contemporaneous with this phase (e.g. Bronocice I). Still, all the materials found on the upland-loess soils of Małopolska and in west Volhynia are clearly different from the “classic phase” materials. The end of the medium settlement stage and the start of the great settlement stage in Bronocice is dated at 3650 BC [Kruk, Milisauskas 1999:135]. The same date refers to the early Wiórek and Wiórek phases in Kujawy [Czerniak *et al.* 1991:68; Czerniak 1994:34]. Determining the date when FBC populations first appeared in Małopolska is much more problematic. Since the materials of the LVC

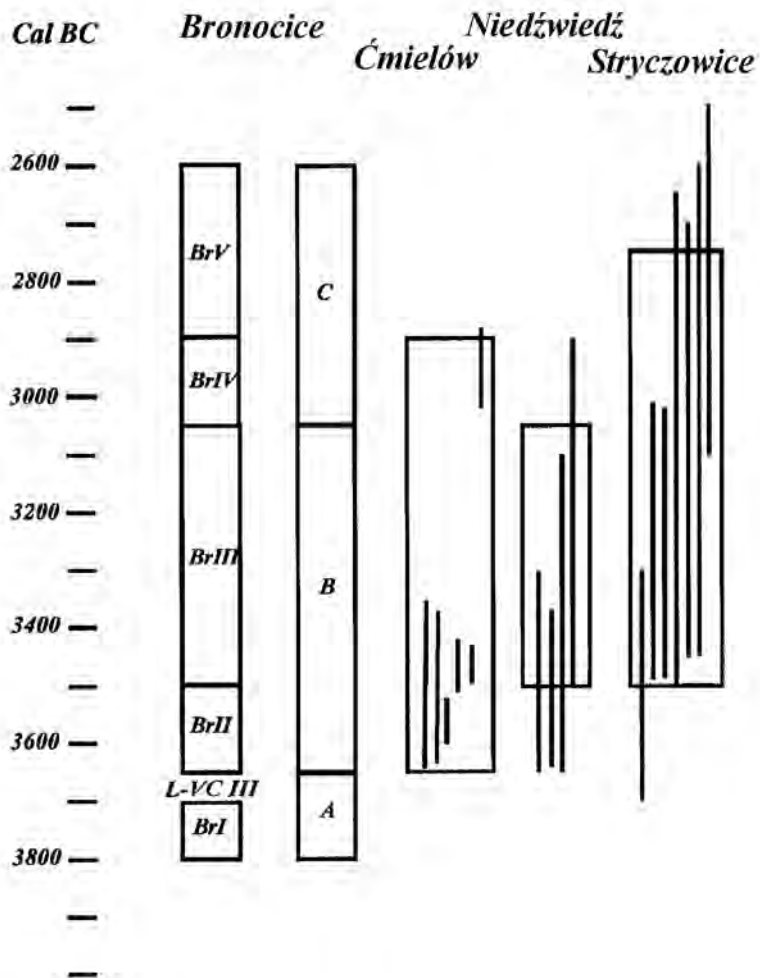


Fig. 3. A graph showing the absolute chronology of the Funnel Beaker culture settlement in the Kraków and Sandomierz areas, based on radiocarbon dating. The vertical lines show the probable distribution of particular ^{14}C dates within sigma 1 range. A - medium settlements stage, B - central places stage, C - stage of reduction and concentration of settlement, Br - Bronocice, LVC - Lublin-Volhynia culture

classic phase at the sites of Las Stocki and Wąwolnica on the Nałęczów Plateau bear traces of “Early-Beaker” imports [Zakościelna 1981; 1984; 1986], it may be assumed that the earliest representatives of the FBC appeared in these areas already at the beginning of the 4th millennium BC. Most assemblages of the “pre-classic” phase of the FBC in Małopolska had the so called Baalberg elements (mainly tulip-shaped

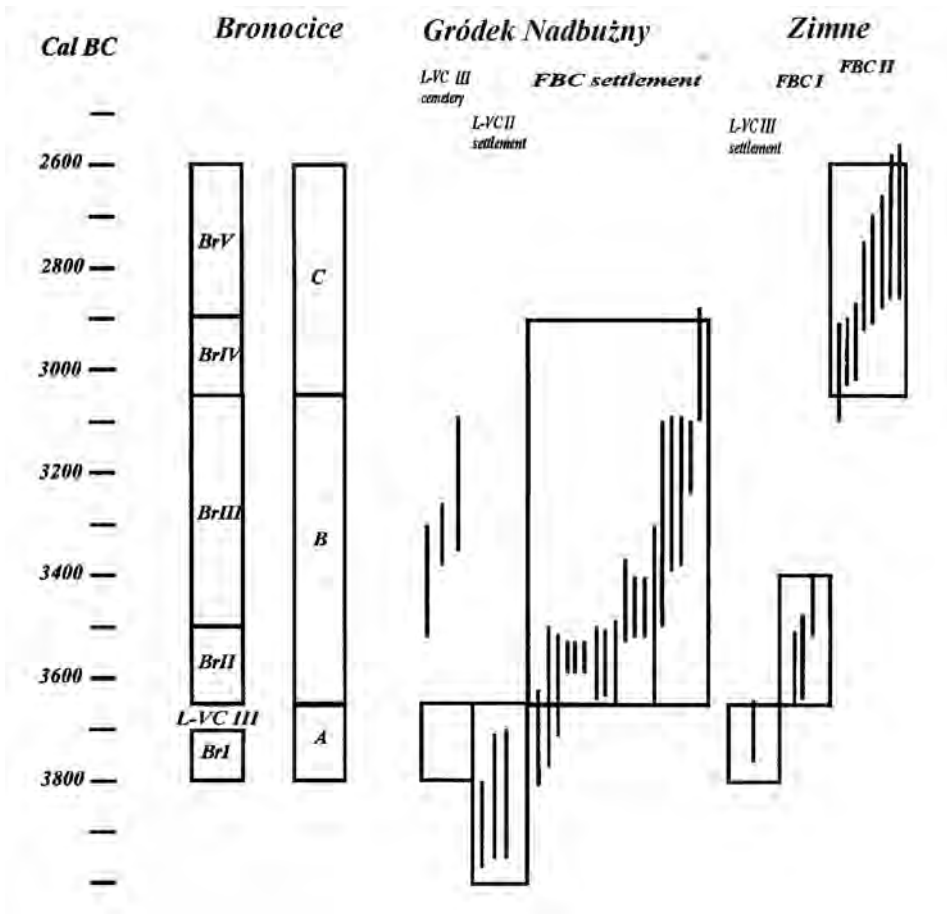


Fig. 4. A graph showing the absolute chronology of the Funnel Beaker culture settlement in the Kraków and Volhynia areas, based on radiocarbon dating. The vertical lines show the probable distribution of particular ^{14}C dates within sigma 1 range. A - medium settlements stage, B - central places stage, C - stage of reduction and concentration of settlement, Br - Bronocice, LVC - Lublin-Volhynia culture

beakers). Hence, these assemblages should be dated at 38th and 37th centuries BC [cf. the only ^{14}C date for Baalberge/Michelsberg assemblages in the Elbe-Saale Region relating to a tulip-shaped beaker from Alsleben: Bln-3690 4790 ± 90 BP; Müller 1999:89]. Also, phase I of the FBC settlement (3800–3700 BC), as well as the LVC fortified settlement (probably about 3700–3650 BC) in Bronocice are dated at the same period.

The period between 3800 and 3600 BC refers also to the majority of assemblages of the late phase of the LVC [Kadrow, Zakościelna 2000:249-254]. The assem-

blages feature numerous imports from the Bodrogkeresztúr culture [e.g. Łañcut, site 10; Kadrow, Kłosińska 1989], the Baalberge/Michelsberg culture [e.g. Gródek Nadbużny, site 1C; Kokowski, Zakościelna 1988:Fig. 6d] and the Balaton-Lásinja culture [e.g. Gródek Nadbużny, site 1C; Kadrow, Zakościelna 2000:Fig. 29a]. Such a correlation of various cultures was confirmed in a number of publications [e.g. Kalicz 1991:381; Pavúk 2000:18; Müller 2001:266-267] and the absolute chronology follows from the radiocarbon datings of the graves of the LVC late phase [e.g. Strzyżów, site. 26; cf. Kadrow, Zakościelna 2000:252-254].

The already known ^{14}C date of feature 13 from site 1C in Gródek Nadbużny [KN-243 5050±110 BP; cf. Kowalczyk 1968] was substantially corrected in the Cologne Laboratory [KN-I.243 4820±40 BP; cf. Breunig 1987]. What is more, it was discovered that there were stratigraphic relationships between the cemetery [Kokowski, Zakościelna 1988:Fig. 2] of the late phase of the LVC [Kadrow, Zakościelna 2000:Figs. 28, 29] and the FBC settlement in which the whole chronological variety of the FBC materials known so far appeared [Gumiński 1989]. As a result of that, the absolute chronology of the settlement in question can be looked at from a different perspective (Fig. 4).

Similarly to Bronocice, in Gródek Nadbużny, the central places stage occurred directly after the settlement of the late LVC phase receded. Therefore, the earliest possible date for the central places stage in Gródek Nadbużny is about 3650 BC. However, unlike Bronocice, in Gródek Nadbużny, it was not preceded by the medium settlement stage (i.e. in the sense of style with the “pre-classic” materials). The ^{14}C date of the debris filling a ditch, i.e. Gd-2439 5210±60 BP [Jastrzębski 1991:190] indicates that in Gródek Nadbużny, as early as since the classic phase (since about 4000 BC), there had been a fortified settlement and in the late phase, the LVC cemetery was used there as well (3800–3650/3600 BC; Fig. 3). From the publication of materials found in pit 2/83 [Jastrzębski 1989:Fig. 1] on the basis of which two ^{14}C dates were determined, i.e. Gd-2160 5010±110 BP and Gd-2163 5030±90 BP, it may be seen that the pit contained some redeposited material of the LVC classic phase [Jastrzębski 1989:Figs. 1:2, 11, 13, 14]. Accordingly, the above ^{14}C dates should be related to the settlement materials of the LVC (4000–3800 BC) rather than to the suggested emergence of the “Gródek I” stage, dated at about 3900–3500 BC [Burchard *et al.* 1991:99].

In light of radiocarbon dates, the beginning of the FBC settlement in Gródek Nadbużny should be dated at about 3650 BC (i.e. at the same time as the start of the Bronocice II phase) while its end appears to fall at about 2900/2800 BC (contemporaneously with the end of the Bronocice IV phase). Yet, the presence of pottery from the Gorodsk TC group in the context of late FBC assemblages [Jastrzębski 1985:Fig. 5:1; 1991:Figs. 5:8, 10] allows us to move the dates marking the end of the FBC settlement to about 2700/2600 BC, i.e. the same time as the end of the Bronocice V phase and phase CII TC. Similar artifacts, mainly bowls

with rims cut obliquely inwards and decorated with cord impressions, recorded also at the FBC settlement in Majdan Nowy [Bronicki, Kadrow 1988:Fig. 20:11] are known also from numerous Balkan assemblages of the Sitagroi Va — Radomir II-I — Junacite XIII-IX horizon [Némejcová-Pavúková 1999:Figs. 7:1-4; 8:9-10; 9:12]. This horizon is confidently correlated with the Foltești and Usatovo groups, as well as the Coțofeni culture [Raczky 1991:340].

In light of the new findings, the development stages of the FBC settlement in Gródek Nadbużny, distinguished by Sławomir Jastrzębski, should have the following absolute chronology: Gródek I (3650–3500 BC), Gródek II (3500–2600 BC). Between 4000 and 3650 BC in Gródek Nadbużny there was a settlement and between 3800 and 3650 there was also a LVC cemetery (Fig. 4).

The Gródek II stage did not witness any serious cultural changes, i.e. the so-called “tripolysesation”. Pottery is not substantially different from the “classic” assemblages. Likewise, in the Ćmielów assemblages, the classic pottery forms were generally continued and they seemed to be “impermeable” to impacts of other cultures (Fig. 2). One of the dates, i.e. Hv-1339 4330±60 BP inclines one to believe that in the Ćmielów settlement, like in Gródek Nadbużny there appeared equally late FBC assemblages. The same can be said of the situation in Stryczowice [Uzarowicz-Chmielewska 1979; 1989] and Zimne, which will be discussed later in this article. The only exception is the FBC settlement in Niedźwiedz [Burchard 1991:185] existing, according to the ¹⁴C dates, only until the end of the Bronocice III phase (Fig. 2).

4. ZIMNE — THE RESULTS OF RADIOCARBON DATING

The Ukrainian researchers who carried out excavations in Zimne between 1951 and 1964 with a pause between 1953 and 1955 [cf. Bronicki 1998] failed to perform any radiocarbon datings. It was not until 1997 that the Polish-Ukrainian expedition, during the verification and probing works carried out at the Zimne site [Bronicki, Ochrimienko, Zakościelna 1998], took 12 samples (animal bones) from 7 pits (Figs. 5, 6). All the samples were earlier analysed by Alicja Lasota-Moskalewska, an archaeozoologist. The ¹⁴C dates were determined by Nikolay Kovalyukh of Kiev.

The data concerning the dates are listed in Table 3. Calibration was carried out by means of the computer program OxCal Program v. 3.5 [Bronk Ramsey 2000]. The data are supplemented by pictures (Figs. 7-22) depicting the layouts of the features, their vertical cross-sections, two graphs synchronised with the cross-sections showing the percentage and amount, as well as the distribution of all the FBC pottery items

Table 3

Zimne. Settlements of Lublin-Volhynia culture and Funnel Beaker culture. Radiocarbon datings

Lab. No.	Locality of sample		Type of sample	BP	Ranges of dating (cal BC) of 1 sigma (68,2%) probability distribution	Probability level (%)
	Feature No.	Depth in [m]				
Ki-6873	30/97	2,3-2,5	cattle bone (phalanx prima)	4920±50	3760-3640	68,2
Ki-6874	30/97	2,0-2,1	pig bone (fr. of calcaneus)	4770±60	3650-3510 3400-3380	64,5 3,7
Ki-6878	8/97	1,2-1,3	cattle bone (fr. of ulna)	4740±45	3640-3550 3540-3510 3420-3380	40,9 13,6 13,7
Ki-6877	8/97	1,0-1,1	cattle bone (fr. of skull); hare bone (fr. of vertebra)	4660±55	3520-3400 3390-3360	59,3 8,9
Ki-6875	2/97	1,0-1,1	two unidentified bones; bone of sheep-goat (fr. of rib); goat bone(fr. of scapula)	4390±55	3100-2910	68,2
Ki-6879	5/97	1,1-1,2	cattle bone (fr. of rib); bone of aurochs (coronet)	4350±55	3030-2900	68,2
Ki-6872	3/97	1,0-1,1	cattle bone (fr. of scapula); bone of sheep-goat (vertebra)	4295±60	3020-2870	68,2
Ki-6880	5/97	1,0-1,1	three unidentified bones; cattle bone (phalanx prima); bone of sheep-goat (fr. of tibia); pig bone (fr. of ulna)	4260±50	2920-2860 2810-2750 2720-2700	45,2 18,3 4,7
Ki-6876	2/97	1,2-1,3	two unidentified bones; cattle bone (unidentified); bone of sheep-goat (fr. of milk tooth)	4230±50	2910-2850 2820-2750 2730-2700	25,3 32,2 10,7
Ki-6871	3/97	0,9-1,0	fr. of a deers antler	4160±50	2880-2830 2820-2800 2790-2660 2650-2630	13,3 6,1 47,0 1,9
Ki-6870	31/97	1,1-1,2	one unidentified bone; cattle bones (fr. of radius, fr. of carpus, fr. of pelvis)	4120±50	2860-2810 2760-2720 2710-2580	19,0 10,8 38,4
Ki-6869	32/97	1,1-1,2	cattle bones (fr. of rib, two frs. of mandible, tooth, fr. of humerus, metacarpus, two phalanxes prima, phalanx tertia); bone of sheep-goat (fr. of tibia)	4080±55	2860-2810 2700-2560 2530-2490	14,0 45,6 8,6

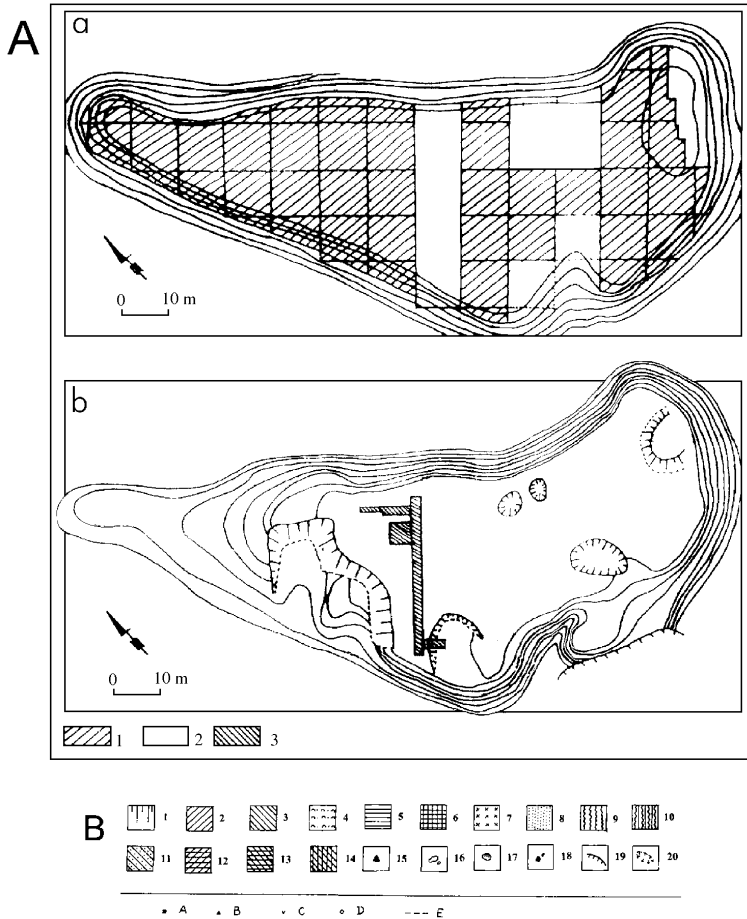


Fig. 5. A. Defenced settlement in Zimne. Location of archaeological excavations: a - area excavated before 1997 (1) and not excavated area (2), according to Aulich 1972; b - area excavated in 1997 (3), according to the location and altitude map drawn up in 1997 (according to Bronicka, Ochrimenko, Zakościelna 1998). Drawings by A. Bronicka, E. Hander.

B. Key to Figs. 7-22. Layouts and cross-sections of features: 1 - contemporary humus (loess black-earth), 2 - dark-grey homogeneous loess with a shade of brown, 3 - dark-grey loess with a shade of grey, 4 - yellowish non-homogeneous loess with dark patches, 5 - brown and beige homogeneous loess with small lumps of pisé, 6 - dark-brown non-homogeneous loess with yellow patches, 7 - beige, homogeneous loess, 8 - undisturbed soil (yellow, homogeneous loess), 9 - light-grey loess with lumps of pisé and small charcoals, 10 - dark-grey loess with the shade of grey mixed with yellowish loess, 11 - dark grey loess with the shade of light grey one mixed with yellow undisturbed soil, 12 - dark grey loess with the shade of brown one mixed with brown and beige loess and lumps of pisé, 13 - brown and beige loess mixed with dark grey loess with the shade of light grey one and small lumps of pisé, 14 - tar-black loess mixed with grey loess, 15 - potsherd, 16 - lump of pisé, 17 - stone, 18 - charcoals, 19 - border of a former archaeological excavation, 20 - burrows of a burrowing animal. Graph markings: A - the presence of LVC materials, B - the presence of TC materials, C - the presence of Pomorze culture materials, D - the presence of early medieval materials, E - the floor of layers containing materials from periods later than the Neolithic. Drawings by A. Bronicka, E. Hander

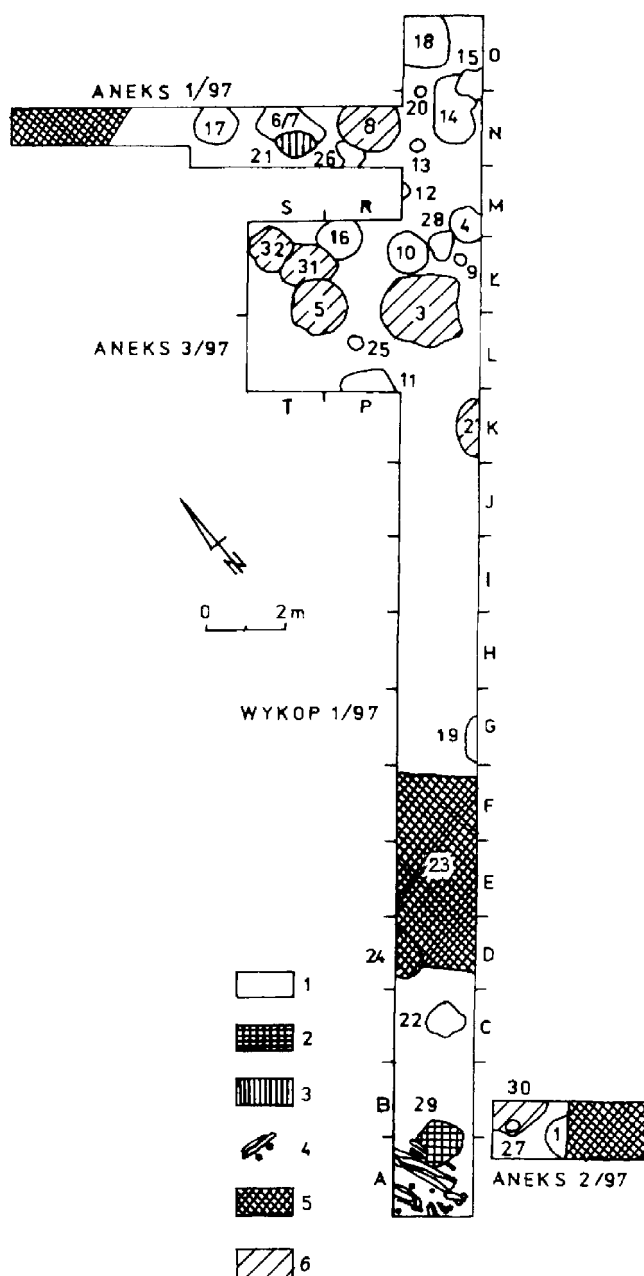


Fig. 6. Defenced settlement in Zimne. A collective map of features excavated in 1997. 1 - feature of the Funnel Beaker culture, 2 - feature of the Pomorze culture, 3 - early medieval feature, 4 - relics of timber defensive structures of an early medieval stronghold, 5 - area analysed before 1997 (old archaeological excavations), 6 - features dated by radiocarbon chronology (according to Bronicki, Ochrimenko, Zakościelna 1998, complemented by the authors). Drawings by A. Bronicka, E. Hander

in the mechanical layers of pits, the ^{14}C dates accompanied by notes where the samples were taken, the depth at which materials from other cultures occurred and the illustrations of all characteristic potsherds and other clay artifacts. Their numbers correspond to the relevant graphs. Therefore, it is easy to establish at which level and in which layer the artifacts were found. However, the tables do not contain information about the finds from later cultures (the Pomorze culture and the early-Slavic culture).

Pit 30/97 (Fig. 7). It was a basin-shaped feature filled with homogeneous material: dark-beige loess mixed with lumps of pisé. Dimensions of the ceiling: 1.80 by 1.50 metres, thickness: 0.90 metre. Materials from later periods: 1 potsherd of a vessel of the Pomorze culture found in the layer 2.10-2.20 metres below the ground. Materials from other Neolithic cultures: 3 potsherds from the LVC in the 2.10-2.30 layer. In the debris filling the pit there were altogether 17 fragments of FBC vessels. Two samples were analysed: one from the layer at the depth of 2.30-2.50 metres (Ki-6873; 4920 ± 50 BP), and the other from the layer of 2.00-2.10 metres (Ki-6874; 4770 ± 60 BP).

The fact that pit 30/97 contained LVC materials may suggest that the bovine bone — the oldest of all samples — might have been redeposited in the FBC feature (like the LVC potsherds). Hence, the bone corresponds to the period when the LVC settlement functioned. An individual vessel potsherd from the Pomorze culture found in the debris filling the pit space means that the debris was contaminated later.

As a result of calibration, the following dates were obtained: 3701 ± 47 BC for the older sample (Ki-6873) and 3569 ± 81 BC for the younger sample (Ki-6874). The former date corresponds to the late phase (III) of the LVC [Kadrow, Zakościelna 2000:253] and the latter one to the classic phase of the FBC. This date should be placed within the time brackets referred to as Gródek I [Jastrzębski 1991:189] or Bronocice II [Kruk, Milisauskas 1981:89].

The following potsherds were taken from the debris filling the pit: potsherds of small goblets (LVC redeposit; Fig. 7:1-3) and of a funnel beaker (Fig. 7:5). The artifacts were ornamented by: an open polygon (Fig. 7:5) and a relief strip on the vessel shoulder (Fig. 7:5).

Pit 8/97 (Fig. 8). This feature probably had a basin-shaped vertical cross-section. Material filling the pit was composed of homogeneous brown and beige loess mixed with small lumps of pisé. In the eastern part there was one “interlayer” of dark-grey loess with a shade of grey and below it there was some light-grey loess containing lumps of pisé and small charcoals. This could have been a younger dig. Pit 8/97 partially destroyed pit 26/97. Dimensions of the ceiling: 1.63 by 1.52 metres, thickness: 0.60 metre. The debris was mixed with younger materials — the total of 7 potsherds of the Pomorze culture, found in almost all mechanical layers, including the bottom layer, as well as one fragment of an early Medieval vessel (in the layer located 1.00-1.10 metres below the ground). No materials from other Neolithic cul-

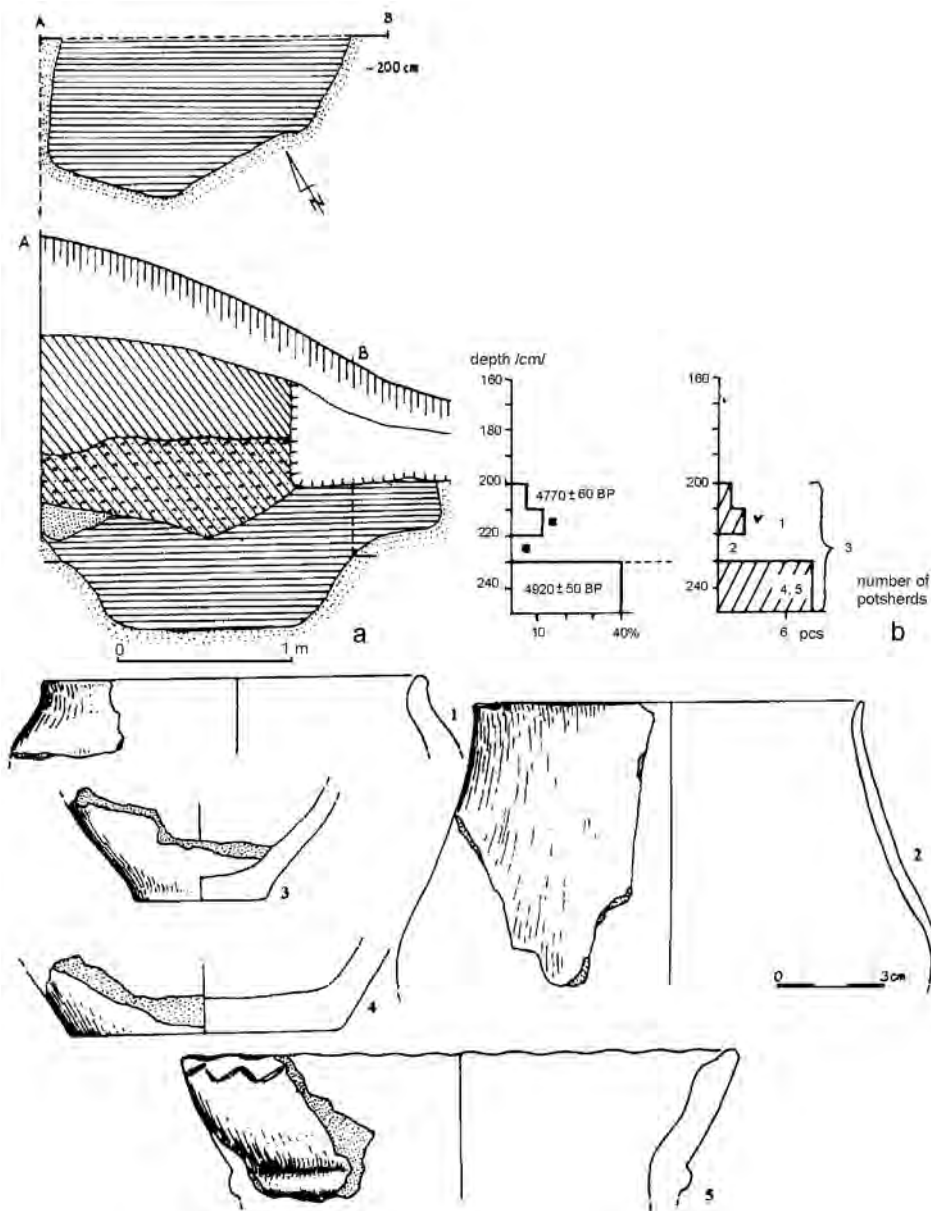


Fig. 7. Defenced settlement in Zimne. Feature No. 30/97. Layout at the depth of 2.00 metres and a vertical cross-section along the A-B cut; 1-3 - potsherds of the Lublin-Volhynia culture; 4, 5 - potsherds of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

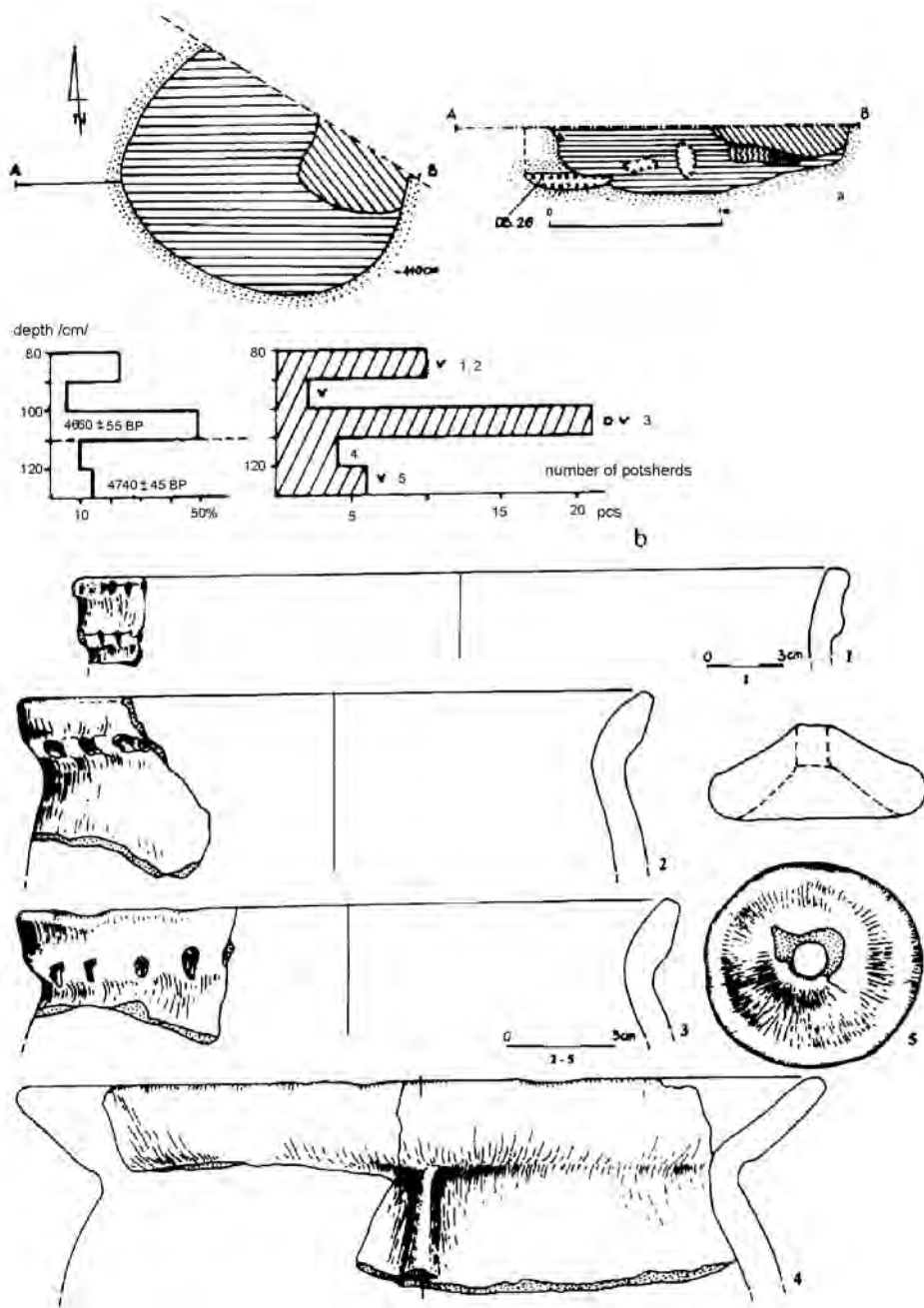


Fig. 8. Defenced settlement in Zimne. Feature No. 8/97. Layout at the depth of 1.40 metres and a vertical cross-section along the A-B cut; 1-5 - potsherds and a spindle whorl of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

tures were found. The debris filling the pit featured 43 potsherds and one spindle whorl that are believed to belong to the FBC.

Two samples were analysed: one was taken from the layer located 1.20-1.30 metres underneath the ground (Ki-6878; 4740±45 BP), the other — from the layer at the depth of 1.00-1.10 metres (Ki-6877; 4660±55 BP).

Since the pit in question contained potsherds of the Pomorze culture (also in the bottom layer), it is highly likely that the feature may be related to this culture. Such view is supported by a stratigraphic analysis of this pit and an older, i.e. “beaker” pit (26/97). Consequently, the FBC materials might have been redeposited in the discussed feature.

As a result of calibration, the following dates were obtained: 3533±93 BC for sample Ki-6878 and 3431±75 BC for sample Ki-6877. They both correspond to the classic phase of the FBC — Gródek I [Jastrzębski 1991:189] or Bronocice II [Kruk, Milisauskas 1981:89], alternatively to the end of the Bronocice II phase and the beginning of the Bronocice III phase [Kruk, Milisauskas 1999:117-118, 175].

The debris covering the pit hole contained: fragments of bag-shaped vessels (Fig. 8:1-3), vases (Fig. 8:4) and a non-decorated concavo-convex spindle whorl (Fig. 8:5). The fragments were ornamented by the following: an arcade-shaped decoration made with a fingernail (Fig. 8:2), irregularly shaped finger-made dents (Fig. 8:3), fingernail impressions just under the rim (Fig. 8:1), pseudo relief strips bearing fingernail and finger impressions, located under the rim (Fig. 8:1-3) and a vertical relief strip on the vessel belly (Fig. 8:4).

Apparently the feature was not homogeneous so there are reasons to doubt whether all the potsherds should be dated at the same time. It is possible that the material in this pit was mixed with materials from the earlier period, i.e. the FBC classical phase, which was dated by means of radiocarbon chronology, and from the later period, e.g. the FBC late phase, in which animal bones did not appear.

Pit 2/97 (Fig. 9-11). This feature had a trapezium-shaped cross-section. The pit was filled with debris composed of alternately arranged loess interlayers of different colours. The second natural layer (above the bottom) and the basin in the upper part of the pit contained small lumps of pisé. Dimensions of the ceiling: 1.50 by 1.40 metres, thickness: 1.10 metres. Materials from periods later than Neolithic were not found. The layer located 1.10-1.20 meters below the surface contained 3 LVC potsherds and the layer 1.40-1.45 metres deep, just above the bottom, contained one fragment of TC pottery. In the backfill material there were altogether 106 FBC potsherds.

Two samples were analysed. The older one was taken from the layer 1.00-1.10 metres deep (Ki-6875; 4390±55 BP). The younger one was obtained from the layer of 1.20-1.30 meters (Ki-6876; 4230±50 BP), i.e. from the bottom part of the pit located above the hardly distinguishable backfill cone, but below the basin formed by the collapsed pit walls [cf. Kadrow 1991:29-30].

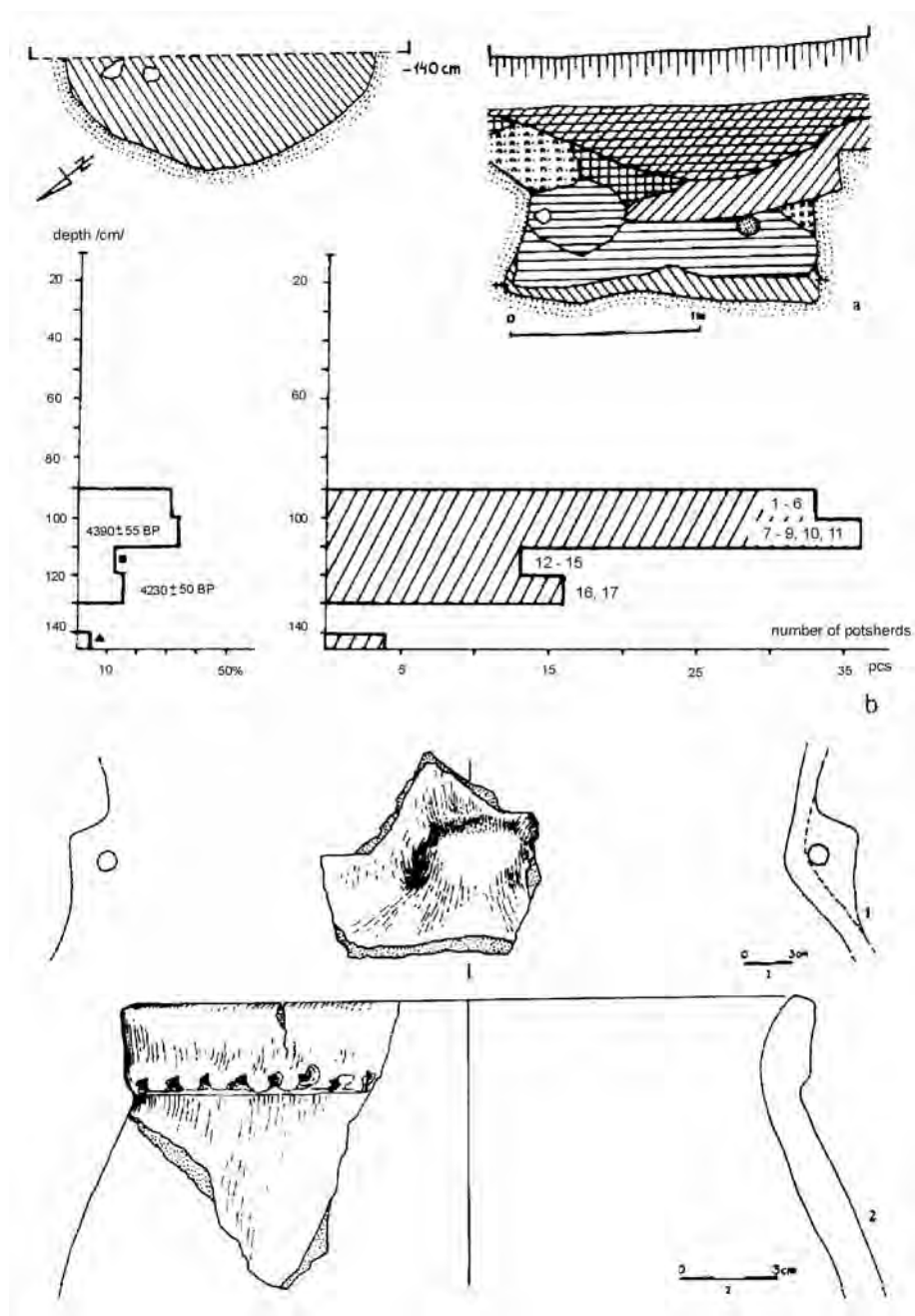


Fig. 9. Defenced settlement in Zimne. Feature No. 2/97. Layout at the depth of 1.10 metres and a vertical cross-section along the profile cut; 1-2 - potsherds of the Funnel Beaker culture. Key - see Fig. 5. Drawings by A. Bronicka

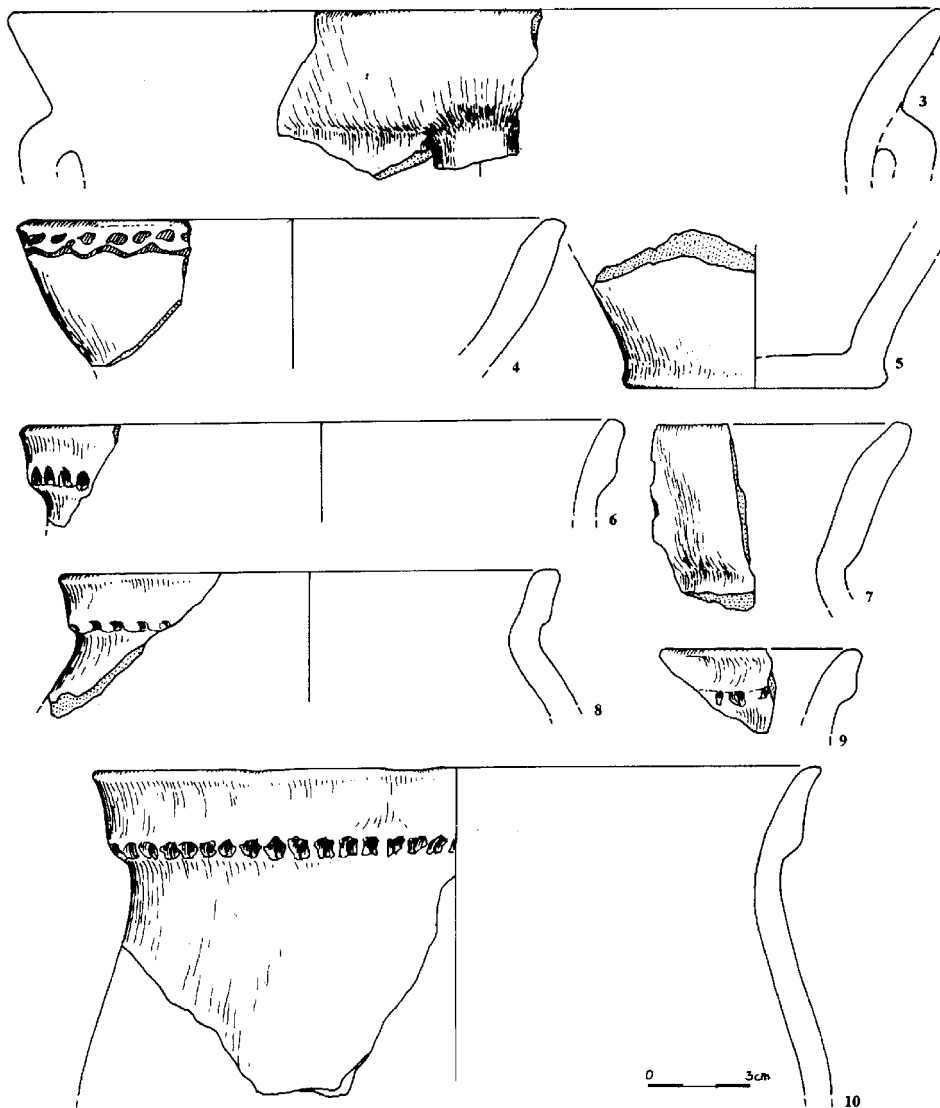


Fig. 10. Defenced settlement in Zimne. Feature No. 2/97, continued. 3-10 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

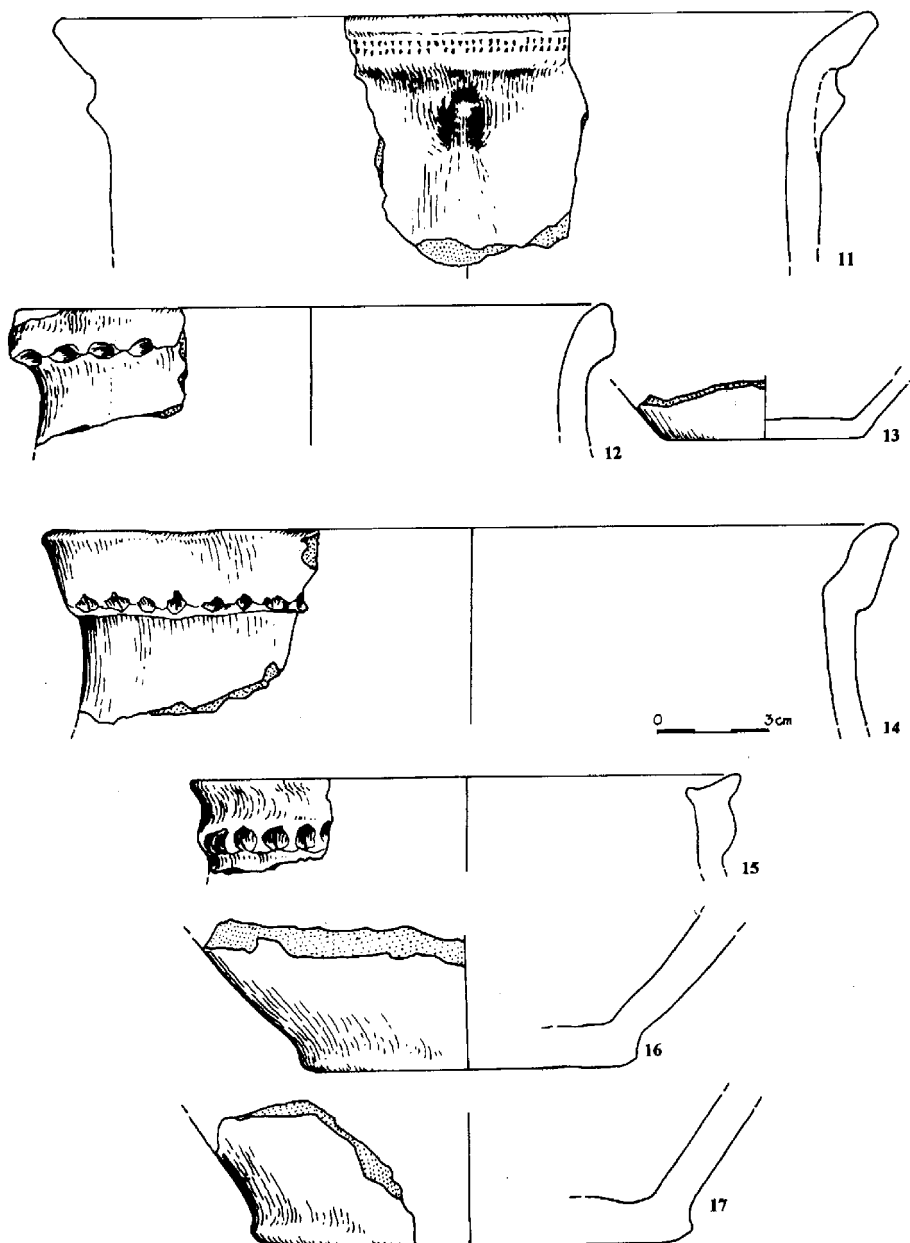


Fig. 11. Defenced settlement in Zimne. Feature No. 2/97, continued. 11-17 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

The older date was probably determined on the basis of a redeposited bone (from the FBC, as in the above case), while the younger date marked the beginning of the first phase of filling the hole after it stopped being used.

As a result of calibration, the following dates were obtained: 2987 ± 77 BC for the older sample (Ki-6875) and 2799 ± 83 BC — for the younger sample (Ki-6876). They both belong to the late phase of the FBC — Gródek II [Jastrzębski 1991:189] and correspond to the FBC-Baden phases — Bronocice IV and Bronocice V [Kruk, Milisauskas 1981:89; 1999:117-118, 175].

All the fragments come from bag-shaped vessels (Fig. 9:2, 10:6, 8-10, 11:12, 14, 15), potsherds of amphorae with handles on sharp shoulders (Fig. 9:1, 10:3), funnel beakers (Fig. 10:4,7) and vases (Fig. 11:11). The fragments were ornamented with the following: an arcade-shaped decoration made with a fingernail (Fig. 9:2, 10:6, 8-10, 11:12, 14, 15), a sloppy impression of a vertical stanchion plus a faint open polygon inlaid with white paint (Fig. 10:4), a stanchion composed of densely arranged double triangular stamps plus a button serving as a handle (Fig. 11:11). The bottoms had a clearly marked “foot” (Fig. 11:16,17). The number of “short-necked” vessels prevailed. One fragment featured a cut made for a lid (Fig. 11:15), which probably is a far echo of a TC impact.

Pit 5/97 (Figs. 12-17, 23). This feature had a trapezium-shaped cross-section. It was filled with debris composed of alternately arranged loess interlayers of different colours (mainly dark-grey with various shades) and numerous lumps of pisé found in all layers. There was no distinct backfill cone. Dimensions of the ceiling: 1.70 by 1.50 meters, thickness: 0.94 metre. The debris was mixed with materials from later periods: isolated potsherds of the Pomorze culture appeared up to 1.50-1.60 centimetres under the surface and early Medieval pottery fragments up to 1.40-1.50 metres. In total, there were 5 Pomorze culture potsherds and 8 early Medieval ones, which constitutes only 5.2 per cent of all materials taken from this pit. Most of the vessel fragments of periods later than the Neolithic were found in the upper part of the feature up to 1.00-1.10 metres, i.e. in the backfill basin [cf. Kadrow 1991:29-30]. Neolithic materials (other than the “beaker” materials) appeared in several layers: the LVC redeposits at 0.70-0.80 metre, 1.20-1.30 metres and 1.40-1.50 metres, and fragments of TC vessels at 0.80-0.90 metre, 1.00-1.10, 1.10-1.20 and 1.20-1.30 metres. Altogether there were 5 fragments of the LVC pottery and 7 of the TC vessels. In total, the debris filling the pit contained 222 vessel fragments, 2 spindle whorls and one weaving weight from the FBC.

Two samples were analysed. The older one was taken from 1.10-1.20 metres (Ki-6879; 4350 ± 55 BP). The younger one was obtained from 1.00-1.10 metres (Ki-6876; 4230 ± 50 BP), i.e. from the middle part of the pit that marked the border between the material covering the bottom and the upper basin. The latter sample was used to date the basin's bottom.

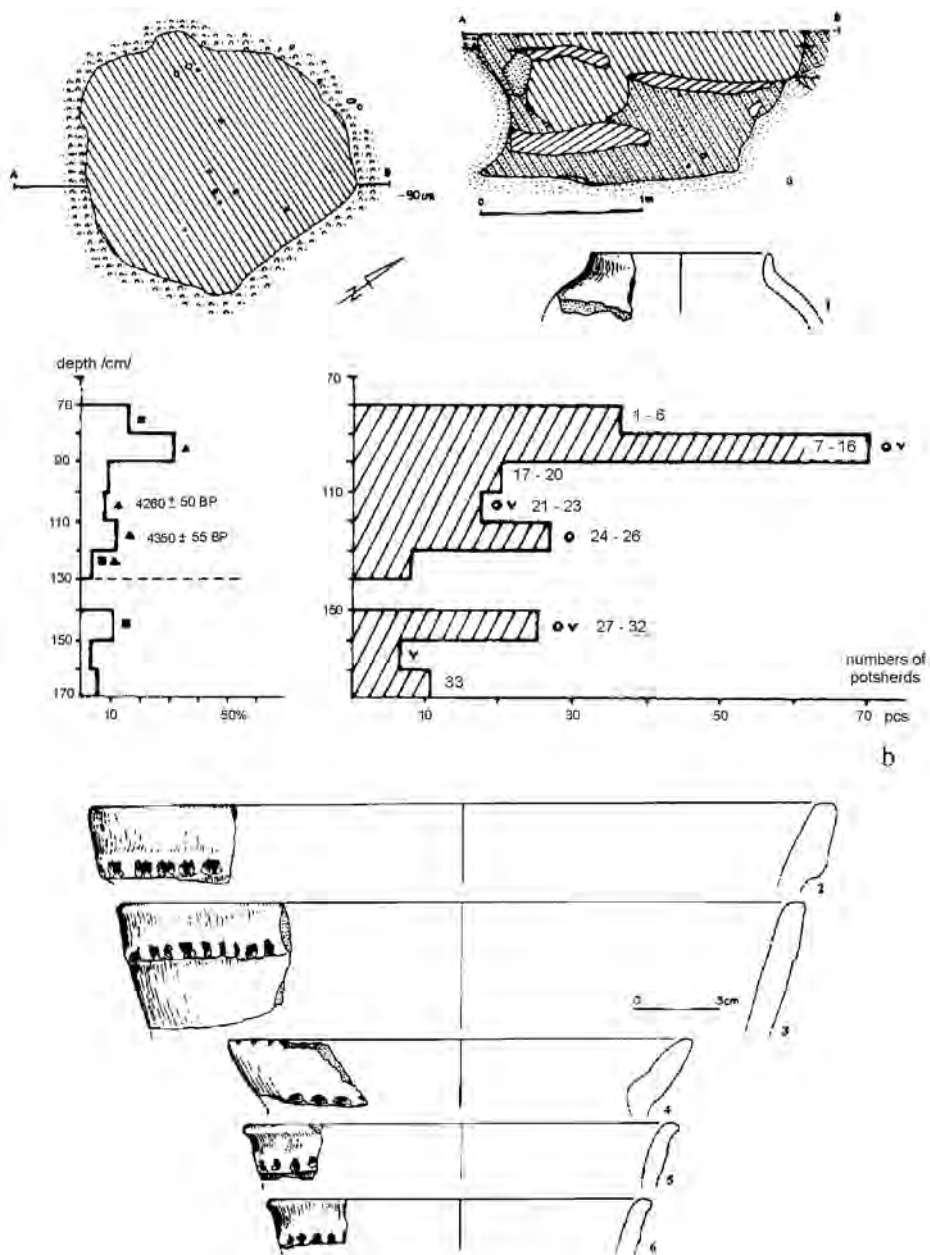


Fig. 12. Defenced settlement in Zimne. Feature No. 5/97. Layout at the depth of 0.90 metre and a vertical cross-section along the A-B cut; 1 - potsherd of the Lublin-Volhynia culture; 2-6 - potsherds of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

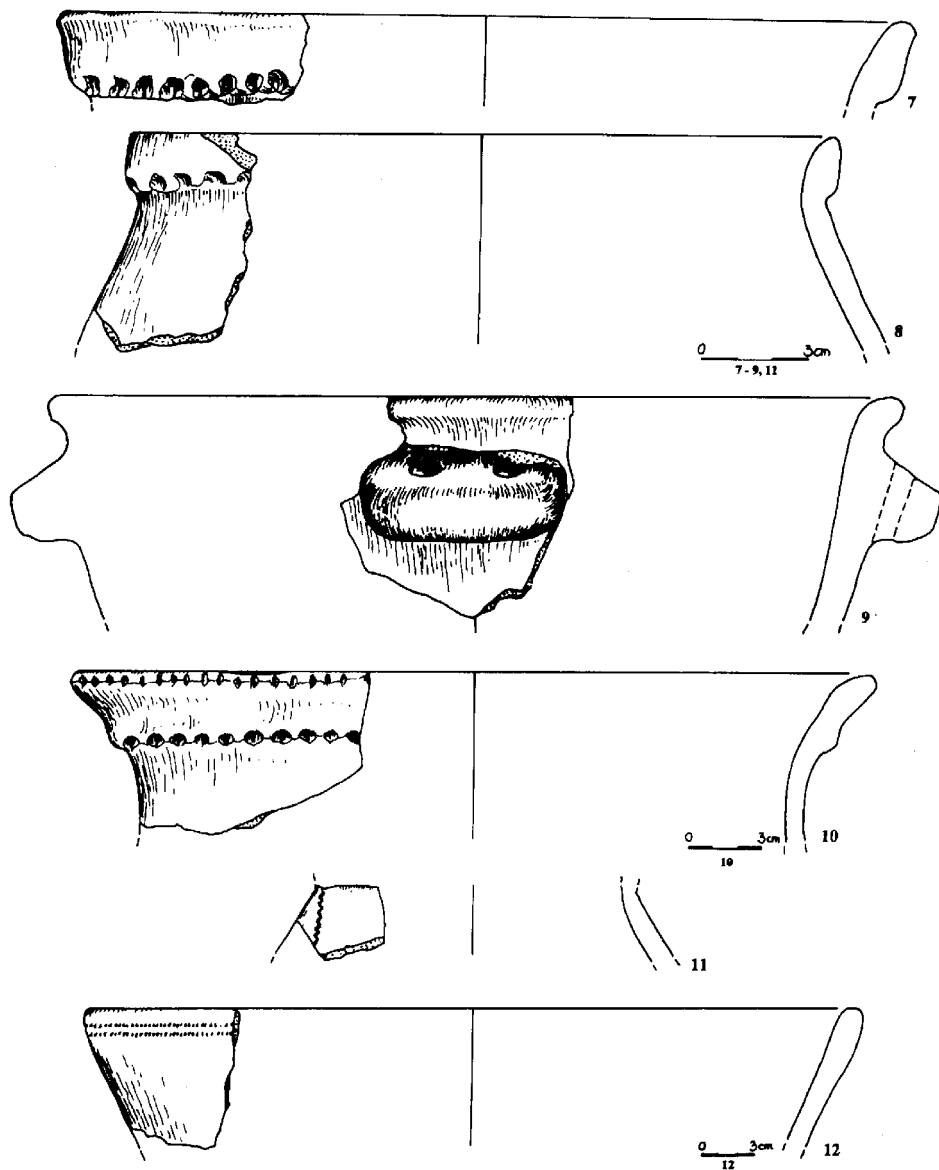


Fig. 13. Defenced settlement in Zimne. Feature No. 5/97, continued. 7-12 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

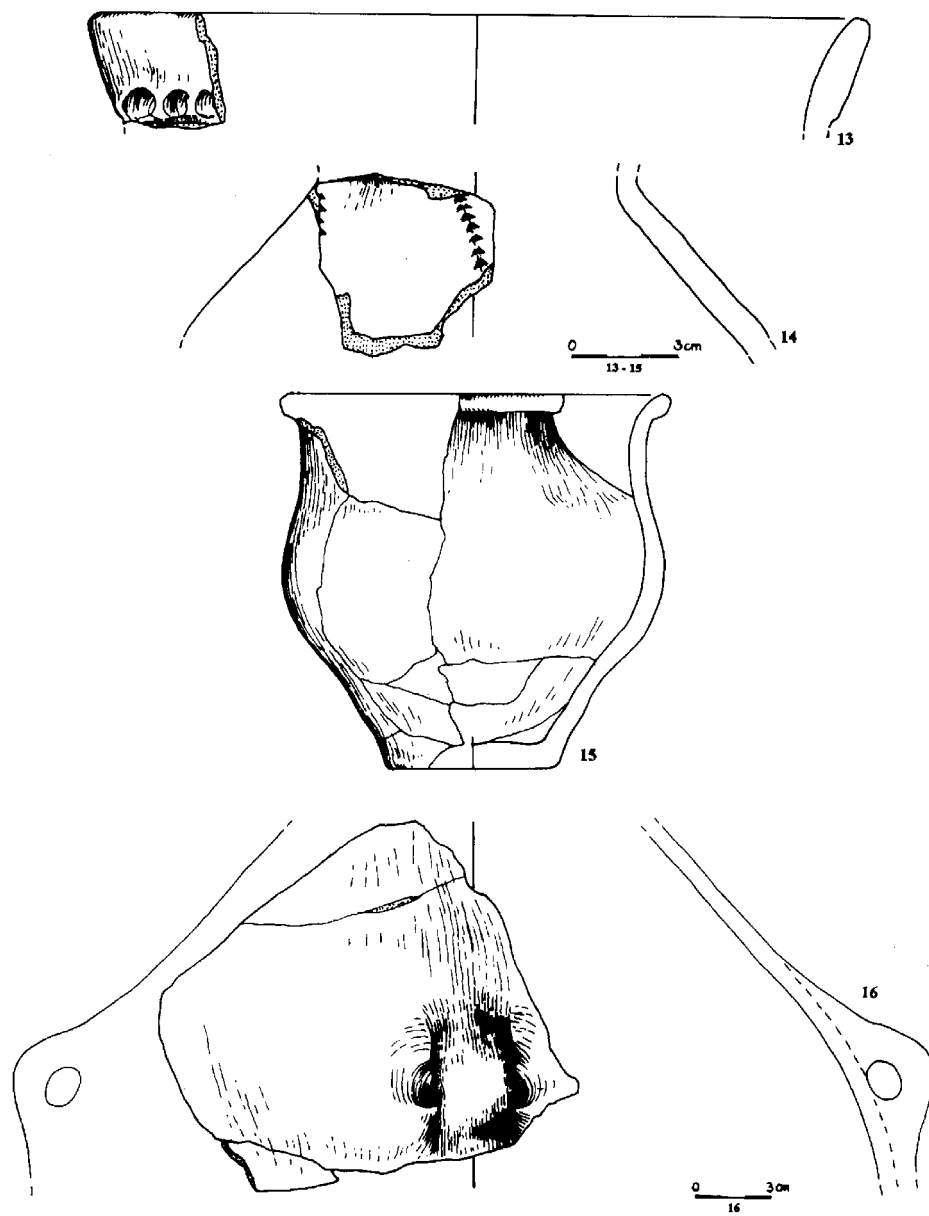


Fig. 14. Defenced settlement in Zimne. Feature No. 5/97, continued. 13-16 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

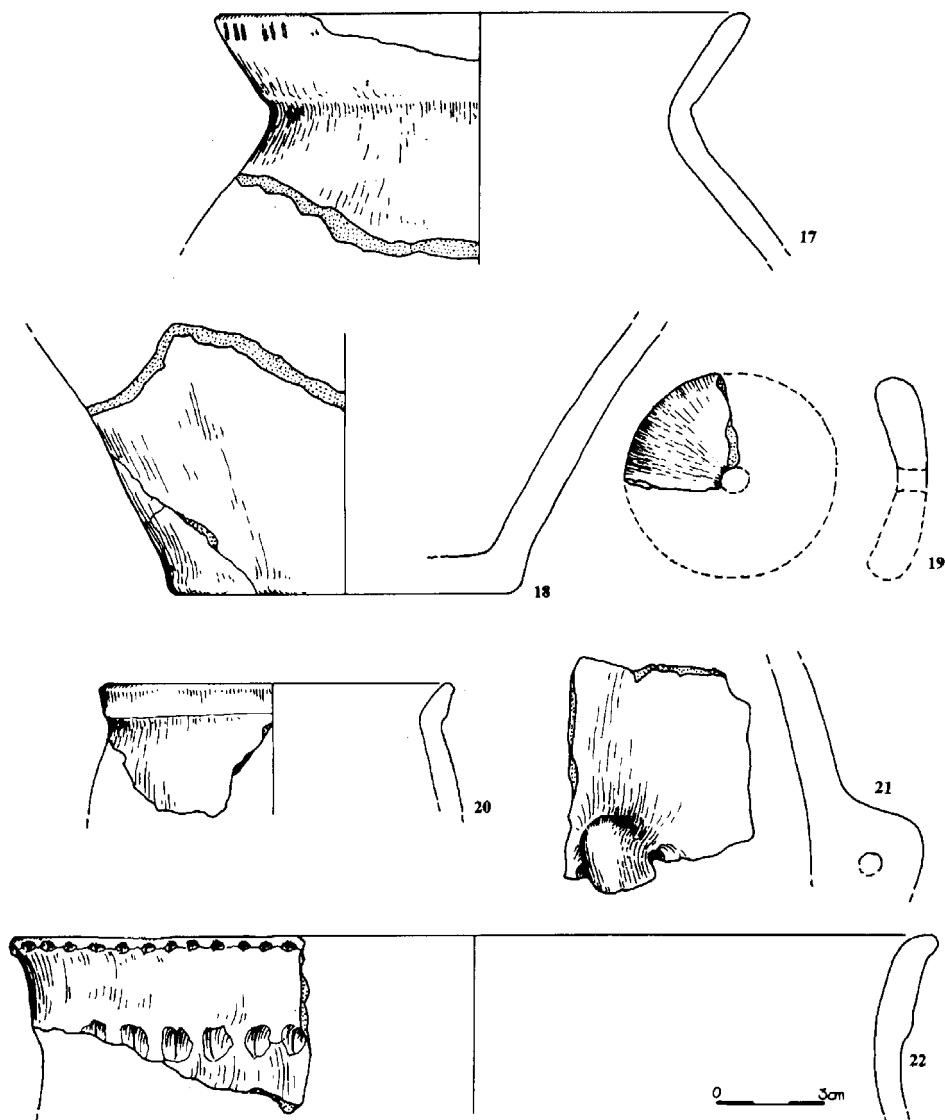


Fig. 15. Defenced settlement in Zimne. Feature No. 5/97, continued. 17-22 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

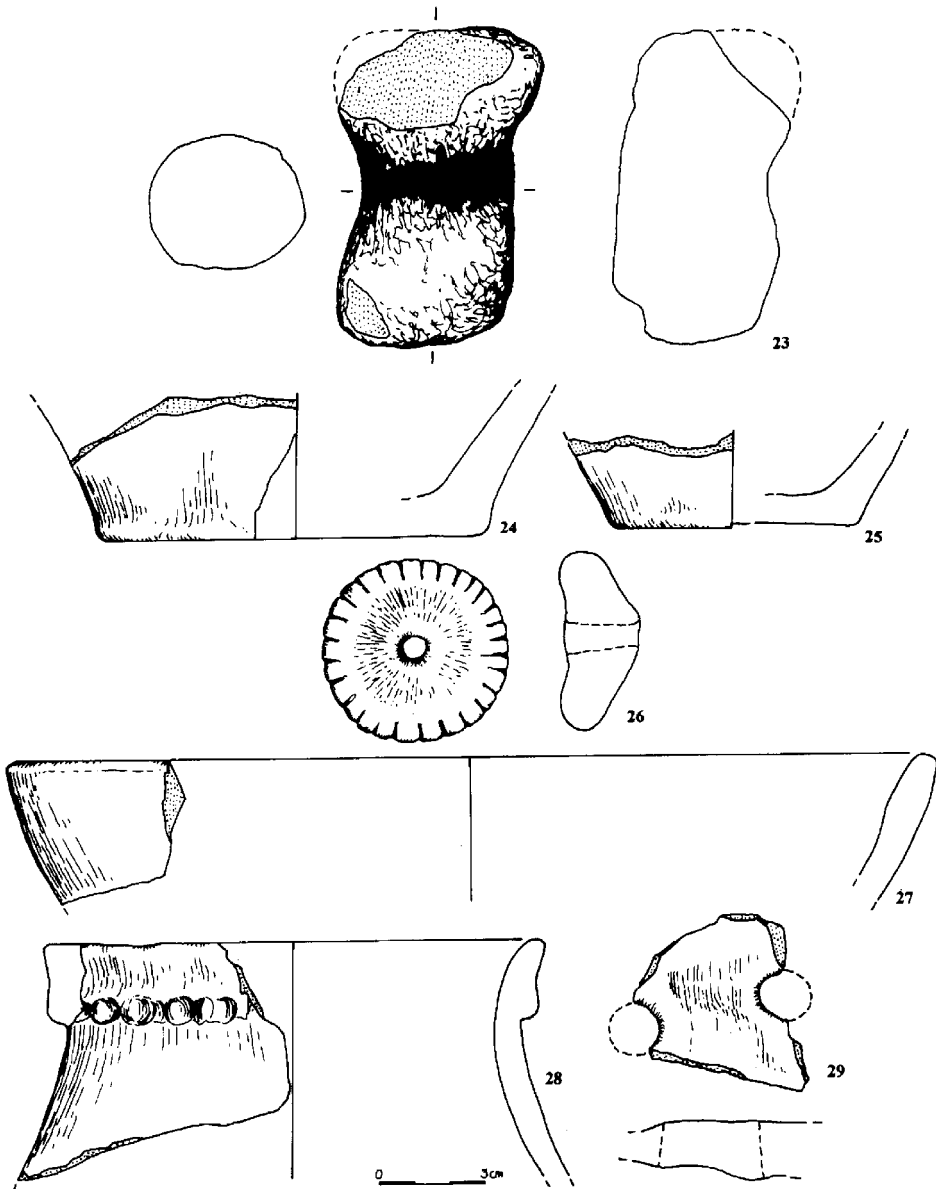


Fig. 16. Defenced settlement in Zimne. Feature No. 5/97, continued. 23 - figure-of-eight-shaped weaving weight; 24-29 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

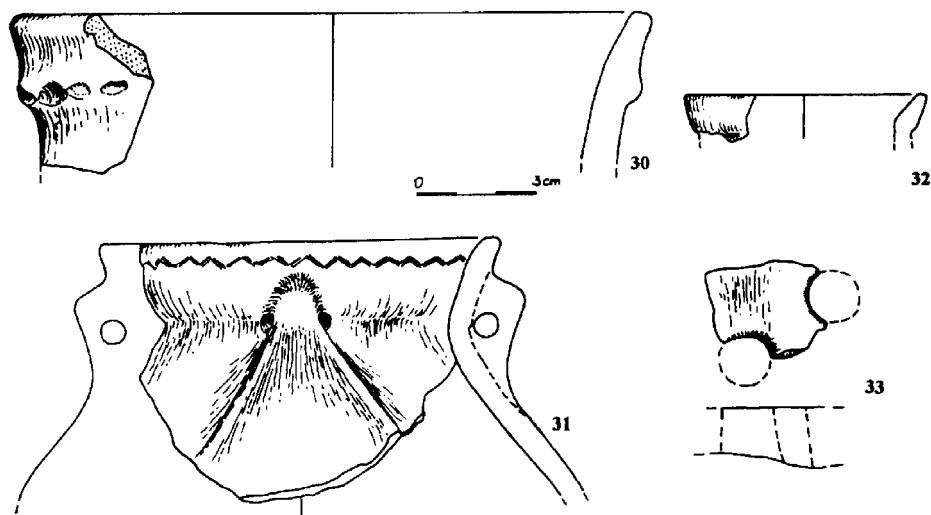


Fig. 17. Defenced settlement in Zimne. Feature No. 5/97, continued. 30-33 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

As a result of calibration, the following dates were obtained: 2959 ± 63 BC — for the older sample (Ki-6879) and 2830 ± 83 BC — for the latter sample (Ki-6880). It is strongly believed that the pit was used before the basin appeared. Consequently, it is more probable that the older date determines the period in which the pit functioned. Both dates belong to the late phase of the FBC — Gródek II (to the latter period of this phase) [Jastrzębski 1991:189] and correspond to the FBC-Baden phases — Bronocice IV and Bronocice V [Kruk, Milisauskas 1981:89; 1999:117-118, 175].

The debris filling the pit contained the following pottery forms: a miniature vessel (a LVC redeposit; Fig. 12:1), stocky bag-shaped vessels (most common; Fig. 14:15, 15:20, 17:32), bulging pots with heavily protruding bellies (Fig. 13:8, 15:17), amphorae with „whiskers” at the handle base (Fig. 17:31), other amphorae (Fig. 13:11, 14:14), large amphorae with handles at the points where bellies are most protruding (Fig. 10:16, 15:21), vessels with perforated bottoms (Fig. 16:29, 17:33), mortar-shaped vessels with handles twice vertically perforated (Fig. 13:9), as well as a plano-convex spindle whorl with notches on the rim (Fig. 16:26) and a plano-concave spindle whorl (not decorated; Fig. 15:19) plus a figure-of-eight-shaped weaving weight (Fig. 16:23). The pottery was ornamented with the following: an arcade-shaped decoration made of finger and fingernail impressions (Fig. 12:2-6, 13:8,10, 14:13, 15:22, 16:28, 17:30), vertical stanchions arranged in sequences (Fig. 15:17), an open polygon (Fig. 17:31), “ladders” on the bellies (Fig. 13:11, 14:14),

small stamps (pinholes) arranged in horizontal lines (Fig. 13:12), fingernail impressions just under the lip rim (Fig. 13:10, 15:22) or directly on the rim (Fig. 12:4) and notches around the spindle whorl rim (Fig. 16:26). The lip rims frequently had pseudo-cordons, usually bearing an arcade-shaped decoration (Fig. 12:2,3,6, 13:7-8,10, 14:13, 15:22, 16:28, 17:30). Normally the potsherds found in the pit had short necks (Fig. 12:4, 13:10, 15:17,20, 16:28, 17:30-32). In most cases, the bottoms were only slightly marked (Fig. 15:18, 16:24).

Pit 3/97 (Fig. 18-20). It was a shallow rectangular pit filled by homogeneous brown and beige loess and small lumps of pisé. Dimensions of the ceiling: 2.20 by 1.90 metres, thickness: 0.58 metre. In the surface layer of the debris (0.80-0.90 metre down) there was one fragment of an early Medieval vessel. Neolithic material other than the “beaker” material was represented by one potsherd of an LVC vessel found at the depth of 0.90-1.00 metre. Altogether, the debris featured 109 fragments of FBC vessels and 3 weaving weights.

Two samples taken from the bottom were analysed: an older one from 1.00-1.10 metres (Ki-6872; 4295±60 BP) and a latter one from 0.90-1.00 metre below the surface (Ki-6871; 4160±50 BP). Both samples were obtained from the same natural backfill layer. Thus, presumably the older sample constitutes a fragment of an older FBC redeposit.

As a result of calibration, the following dates were obtained: 2941±93 BC for the older sample (Ki-6872) and 2754±99 BC for the latter sample (Ki-6871). Both dates belong to the late phase of the FBC — the end of Gródek II [Jastrzębski 1991:189] and correspond to the Baden phase of Bronocice V [Kruk, Milisauskas 1981:89].

The debris contained fragments of the following pottery types: mortar-shaped vessels with vertically perforated handles (Fig. 18: 6, 20:16), amphorae (without „whiskers” at the handle base; Fig. 20:15), bag-shaped vessels (Fig. 18:4, 19:13, 20:14), a bulging pot with heavily protruding belly (Fig. 19:11), a funnel beaker (Fig. 18:2), a cup with *ansa lunata* handle (specific proportions; Fig. 20:19), vessels with perforated bottoms (Fig. 19:10), and figure-of-eight-shaped weaving weights (Fig. 18:1, 19:8,9). The vessels were ornamented with the following: an arcade-shaped decoration made of finger and fingernail impressions (Fig. 18:4, 19:11-13), vertical incised lines on the *ansa lunata* handle (Fig. 20:19), an open polygon impressed with a small square stamp (in the form of a stanchion; Fig. 20:18), round buttons affixed to vessel bellies (Fig. 18:3, 19:11), small, square stamp impressions arranged in a complex pattern (just under the lip rim they are randomly arranged, further below they make up a groove stitch; Fig. 18:2). Regardless of vessel forms, “short” necks prevailed (Fig. 18:4, 19:11,13, 20:14,15,19). Bottoms are clearly distinguishable and take the form of a quasi-foot (Fig. 18:5, 20:17).

Pit 31/97 (Fig. 21-22). It was a trapezium-shaped feature filled with homogeneous tar-black loess mixed with grey loess. In the upper mechanical layer (1.10-1.20

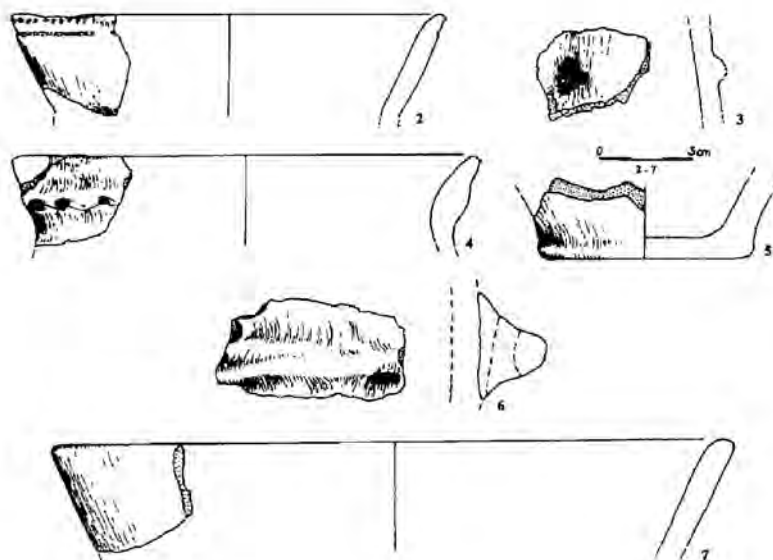
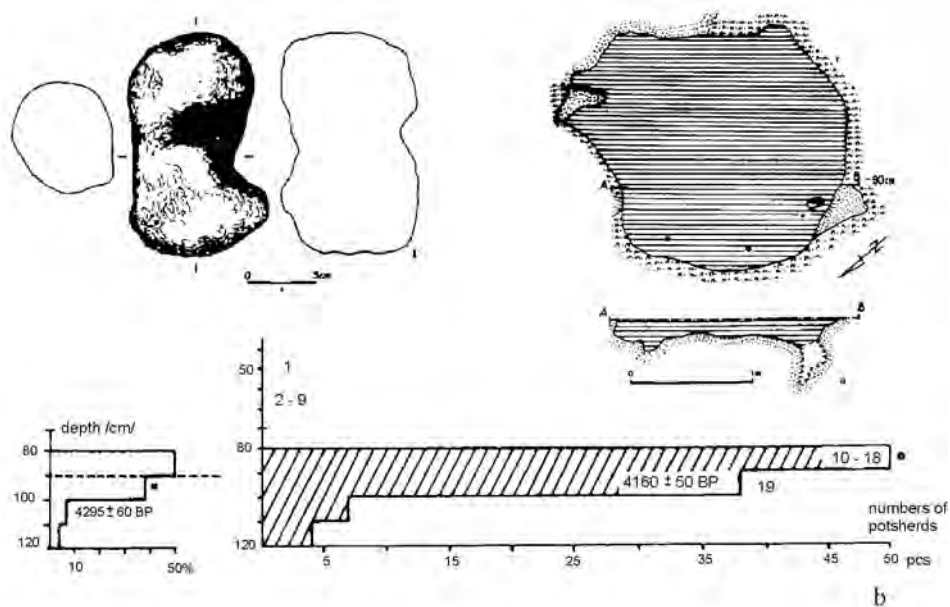


Fig. 18. Defenced settlement in Zimne. Feature No. 3/97. Layout at the depth of 0.90 metre and a vertical cross-section along the A-B cut; 1 - figure-of-eight-shaped weaving weight; 2-7 - potsherds of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

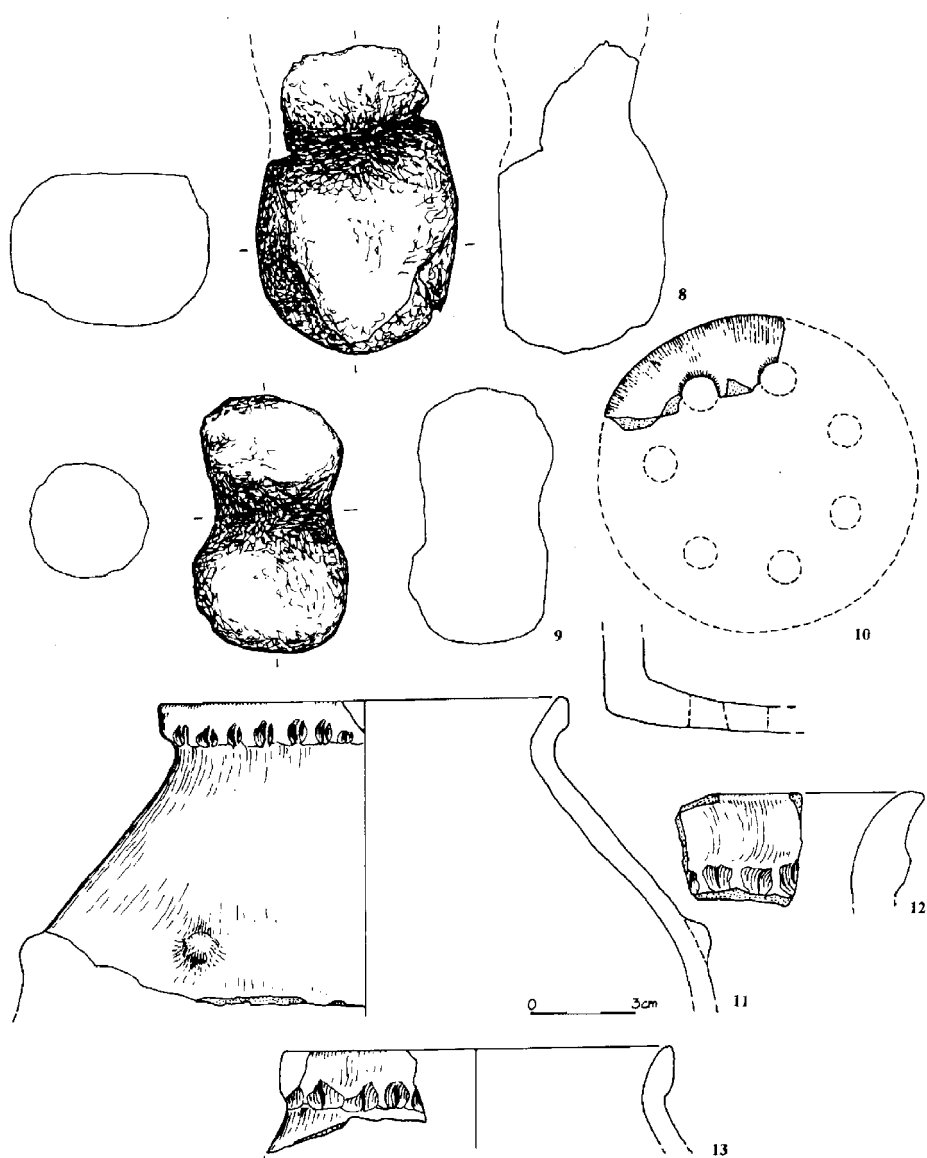


Fig. 19. Defenced settlement in Zimne. Feature No. 3/97, continued. 8, 9 - weaving weights; 10-13 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

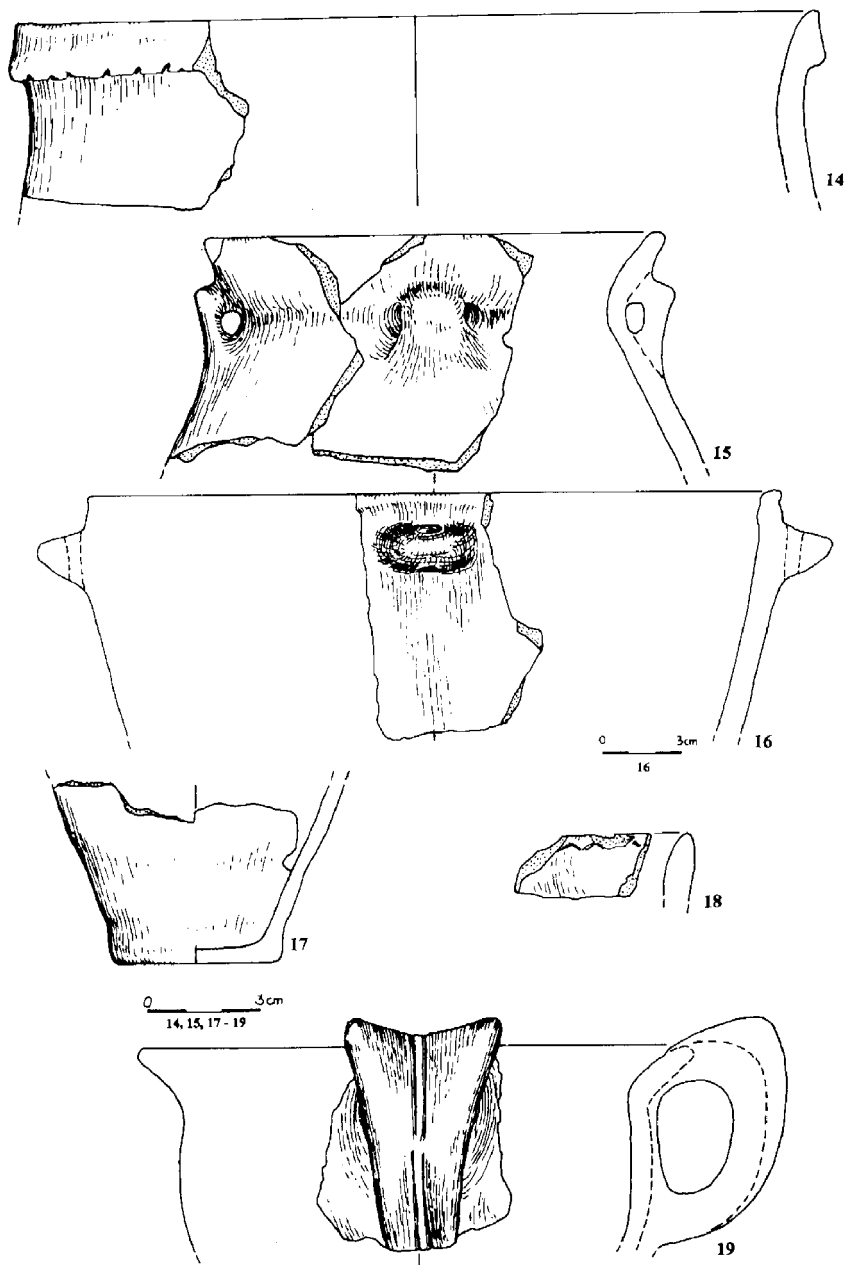


Fig. 20. Defenced settlement in Zimne. Feature No. 3/97, continued. 14-19 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

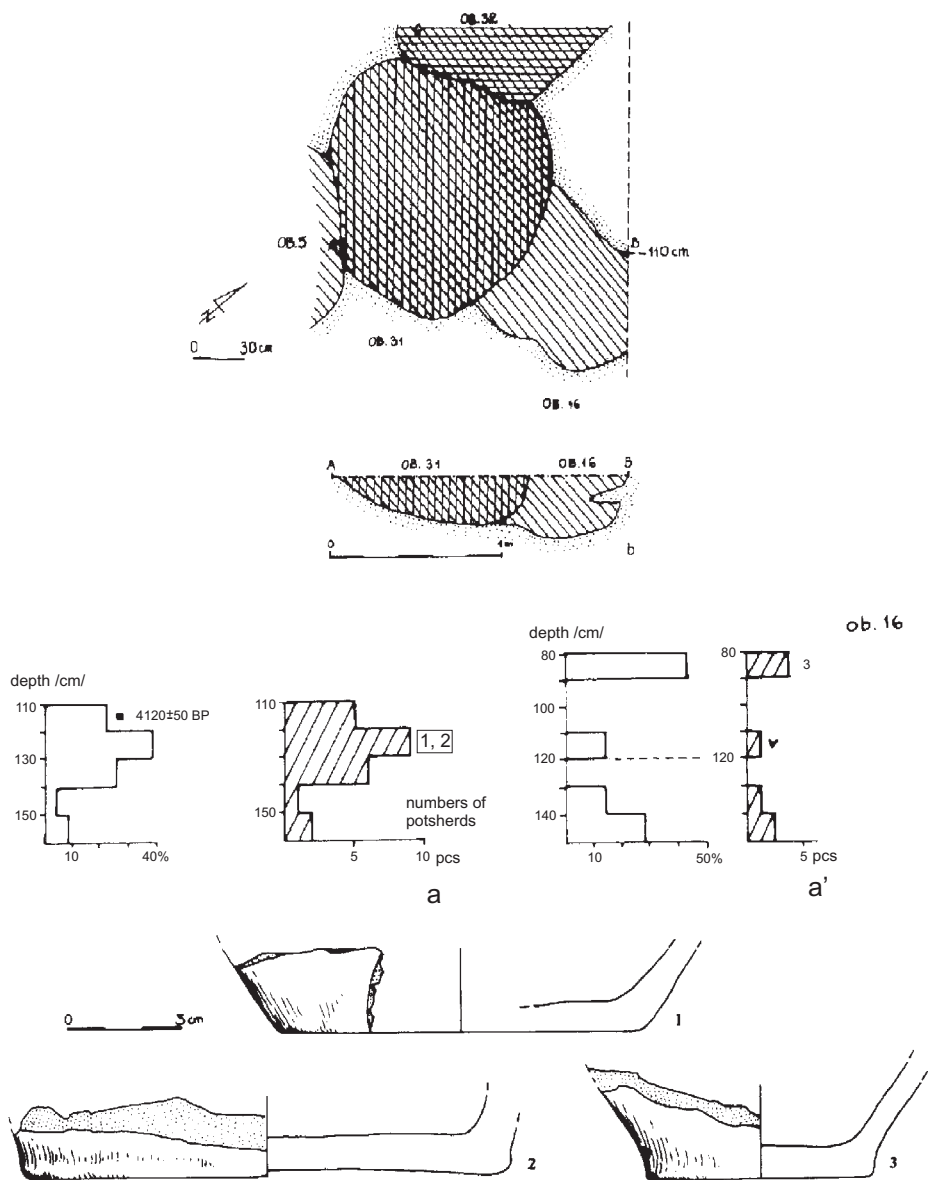


Fig. 21. Defenced settlement in Zimne. Features No. 16/97 and 31/97. Layout at the depth of 1.10 metre and a vertical cross-section along the A-B cut; 1-3 - potsherds of the Funnel Beaker culture (1, 2 - potsherds from pit 31/97; 3 - potsherds from pit 16). Key — see Fig. 5. Drawings by A. Bronicka

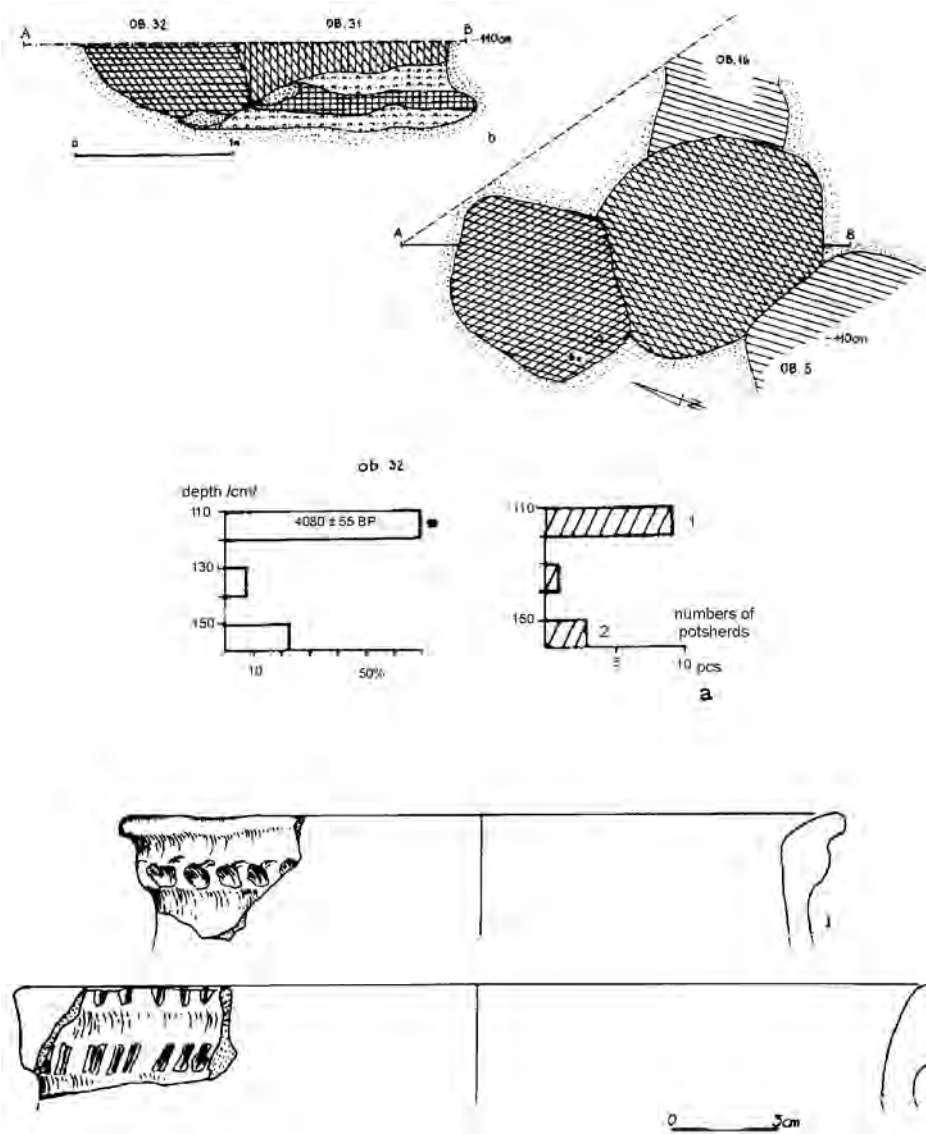


Fig. 22. Defenced settlement in Zimne. Features No. 31/97 and 32/97. Layout at the depth of 1.10 metre and a vertical cross-section along the A-B cut; 1, 2 - potsherds of the Funnel Beaker culture from pit 32/97. Key — see Fig. 5. Drawings by A. Bronicka

metres) there were lumps of pisé. Dimensions of the ceiling: 1.40 by 1.40 metres, thickness: 0.58 metre. Materials from later periods were not found. The layer 1.10-1.20 metres below the surface featured one fragment of an LVC vessel. Altogether, in the backfill debris there were 23 fragments of FBC pottery. The pit was partly dug into an older pit (16/97) and bordered on pit 5/97. The north edge of the discussed pit was damaged by a younger pit (32/97).

One sample taken from the layer of 1.10-1.20 metres was analysed (Ki-6870; 4120±50 BP).

The feature's calibrated date is determined at 2685±117 BC and it belongs to the late part of the Gródek II phase [Jastrzębski 1991:189], which corresponds to the Baden phase of Bronocice V [Kruk, Milisauskas 1981:89; 1999:117-118, 175].

The backfill debris contained only 2 characteristic potsherds, namely fragments of bottoms: one of them features a foot (Fig. 21:2), the other, unmarked, gently passes into a belly (Fig. 21:1).

Pit 32/97 (Fig. 22). It was a basin-shaped feature filled with homogeneous brown and beige loess, mixed with dark grey loess with a shade of grey and with lumps of pisé. Dimensions of the ceiling: 1.16 by 1.04 metres, thickness: 0.54 metre. Materials from later periods were not found. The layer 1.10-1.20 metres below the surface featured one fragment of an LVC vessel. Altogether, in the debris, there were 13 fragments of FBC vessels. The pit damaged the northern edge of pit 31/97.

One sample taken from 1.10-1.20 metres was analysed (Ki-6869; 4080±55 BP). The feature's calibrated date is determined at 2577±101 BC. It may fit into the decline period of the Gródek II phase [Jastrzębski 1991:189] or into a period extending beyond these time brackets. The date fits into the Bronocice V phase [Kruk, Milisauskas 1999:117-118, 175].

The backfill debris contained only 2 characteristic potsherds of bag-shaped vessels (Fig. 22:1,2). Decorations: carelessly made diagonal stanchion impressions and notches on the lip rim (Fig. 22:2), an arcade-shaped decoration made of finger and fingernail impressions (Fig. 22:1). Both ornaments were placed on pseudo-relief strips. One rim was flattened, probably to fit a lid (Fig. 22:1). This trait may be explained as a result of the TC impact.

5. THE RADIOCARBON CHRONOLOGY OF THE FBC SETTLEMENT IN ZIMNE

All samples collected in the Zimne settlement were taken from totally or partially revealed features (pits) during excavations in 1997. The investigation concerned a narrow strip of the central part of the settlement (Fig. 5A:b), because only

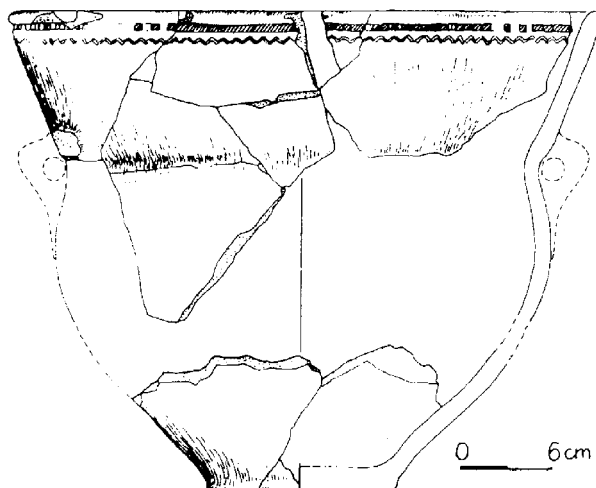


Fig. 23. Defenced settlement in Zimne. Potsherds of one vessel that appeared in the debris filling three pits: 5/97 (at the depth of: 0.7-0.8; 0.8-0.9; 1.1-1.2; 1.2-1.3; 1.4-1.5; 1.5-1.6 meters), 16/97 (at the depth of: 1.0-1.1 meters) and 31/97 (at the depth of: 1.1-1.2; 1.2-1.3; 1.4-1.5). Drawings by A. Bronicka

this area was left intact by previous excavations or other damage. Therefore, it is doubtful whether the research findings are applicable to the whole Zimne settlement.

Thanks to radiocarbon dates it is possible to distinguish two time brackets, i.e. the Zimne I and Zimne II phases separated by a chronological gap (Fig. 4).

The older materials were dated on the basis of two samples obtained from features 30/97 and 8/97. Undoubtedly, pit 8/97 was connected with the Pomorze culture, so the FBC finds taken from the debris may be either older or younger than the samples. Nevertheless, the bones used as dating material indicate that the site functioned in the older phase, i.e. Zimne I. Therefore, it may be concluded (though with certain reservations) that both the bones and the pottery of the FBC belong to the same time bracket.

Similarly to other features dated by the radiocarbon method, feature 30/97 is undoubtedly Neolithic, although it contained particularly few characteristic potsherds. Only one vessel was reconstructed (Fig. 24:4). Accordingly, it is very difficult to characterise the pottery inventory of the Zimne I phase.

Determining typical traits of the Zimne II pottery is also problematic but for other reasons. Features 2/97, 3/97, 5/97, 31/97 and 32/97 are definitely Neolithic and connected with the FBC. However, the radiocarbon dates clearly point out that they are younger. The problem is that the debris filling the Zimne II pits may contain redeposited items of the Zimne I phase which, at this stage of research, cannot be

distinguished from the whole set of artefacts. That is why, for the time being we must content ourselves with the descriptions of available reconstructed forms.

A few words should be devoted to the stratigraphic analysis carried out between the features dated by means of the radiocarbon chronology. Pit 5/97 was dug into pit 31/97, (i.e. the former is younger than the latter — Figs. 6 and 21). Pit 31 partly damaged pit 16/97 (Fig. 21) and pit 31/97 was damaged by pit 32/97 (Fig. 22). Consequently, it seems that pit 16/97 is the oldest (it does not have a radiocarbon date), pit 31/97 is younger and pits 5/97 and 32/97 are the youngest. In light of the ^{14}C dating, the chronological relation between pits 5/97 and 31/97 is reversed: samples taken from pit 5/97 are older. However, both pits contained potsherds of the same vessel (Fig. 23), which means that the pit was backfilled by debris containing contemporaneous items. The dates obtained upon analysis of samples from both pits correspond to the dates of the Zimne II phase.

6. DESCRIPTION OF DIAGNOSTIC TRAITS OF THE POTTERY FROM ZIMNE: FORMS, ORNAMENTS, MORPHOLOGY

Not many pottery forms were reconstructed. The whole group of potsherds of other vessel types found elsewhere at the site, e.g. flasks with a flange and “classic” cups with *ansa lunata* handles failed to appear in the debris filling the features dated by means of radiocarbon chronology (Bronicki, Ochrimenko, Zakościelna 1998). These forms, as well as numerous decorations not put up on the pottery from the discussed pits, had to be omitted.

6.1. PHASE ZIMNE I (FIG. 24)

There are very few vessel forms that belong to the first phase of the FBC settlement in Zimne. These were: slender bag-shaped vessels of various size, sometimes quite tall (Fig. 8:1-3, 24:1-3), a slender “classic” funnel beaker (Figs. 7:5, 24:4), a vase with a sharp shoulder between the heavily inclined, funnel-like neck and the belly (Figs. 8:4, 24:5) and a convexo-concave spindle whorl (Figs. 8:5, 24:6).

The vessels were decorated in the following manner: the “classic” funnel beaker had a vertical relief strip ornamented by an open polygon impressed with a small stamp, placed on the vessel shoulder (Figs. 7:5, 24:4), the bag-shaped vessels featured various, usually arcade-shaped finger- or fingernail-made dents often impressed on pseudo-cordons under the rim or sometimes on the lip rim (Fig. 8:1-3,

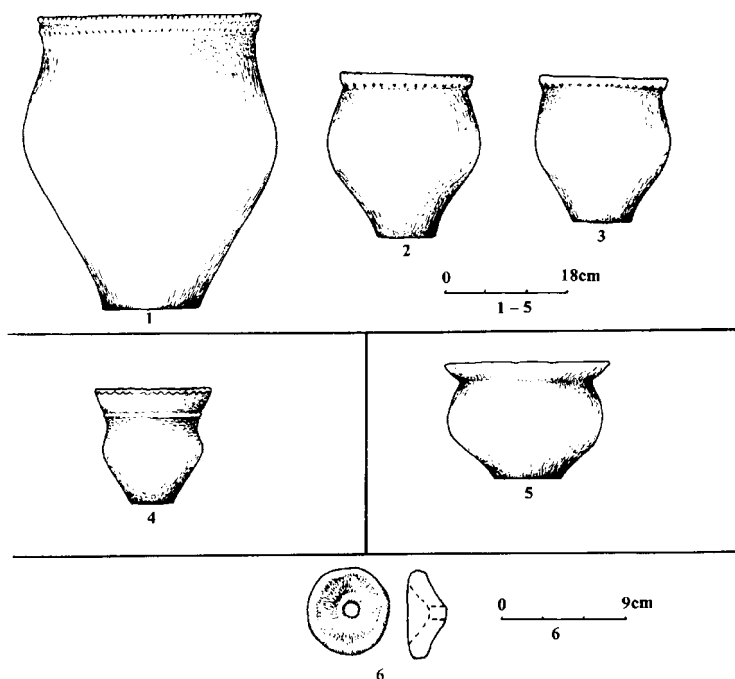


Fig. 24. Defenced settlement in Zimne. Reconstructed vessel forms and a plano-convex spindle whorl of the Zimne I phase. 1-3 - bag-shaped vessels; 4 - funnel beaker; 5 - vase; 6 - spindle whorl. Drawings by E. Hander

24:1-3) and the vase belly had a vertical pseudo-relief strip (Figs. 8:4, 24:5). The spindle whorl was not decorated (Fig. 8:5, 24:6).

Both the funnel beaker and the bag-shaped vessels belonged to a group of slender forms. Their bottoms are only slightly marked (Fig. 8:4) and the beaker has a corrugated lip rim and a long neck (Fig. 7:5).

6.2. PHASE ZIMNE II (FIG. 25-26)

In this phase, bag-shaped vessels definitely outnumbered other forms. Depending on general proportions, size and secondary features a few groups can be distinguished (Figs. 9:2, 10:6,8-10, 11:12,14,15, 14:15, 15:20, 16:28, 17:30, 18:4, 19:13, 20:14, 22:1,2, 25:1-7).

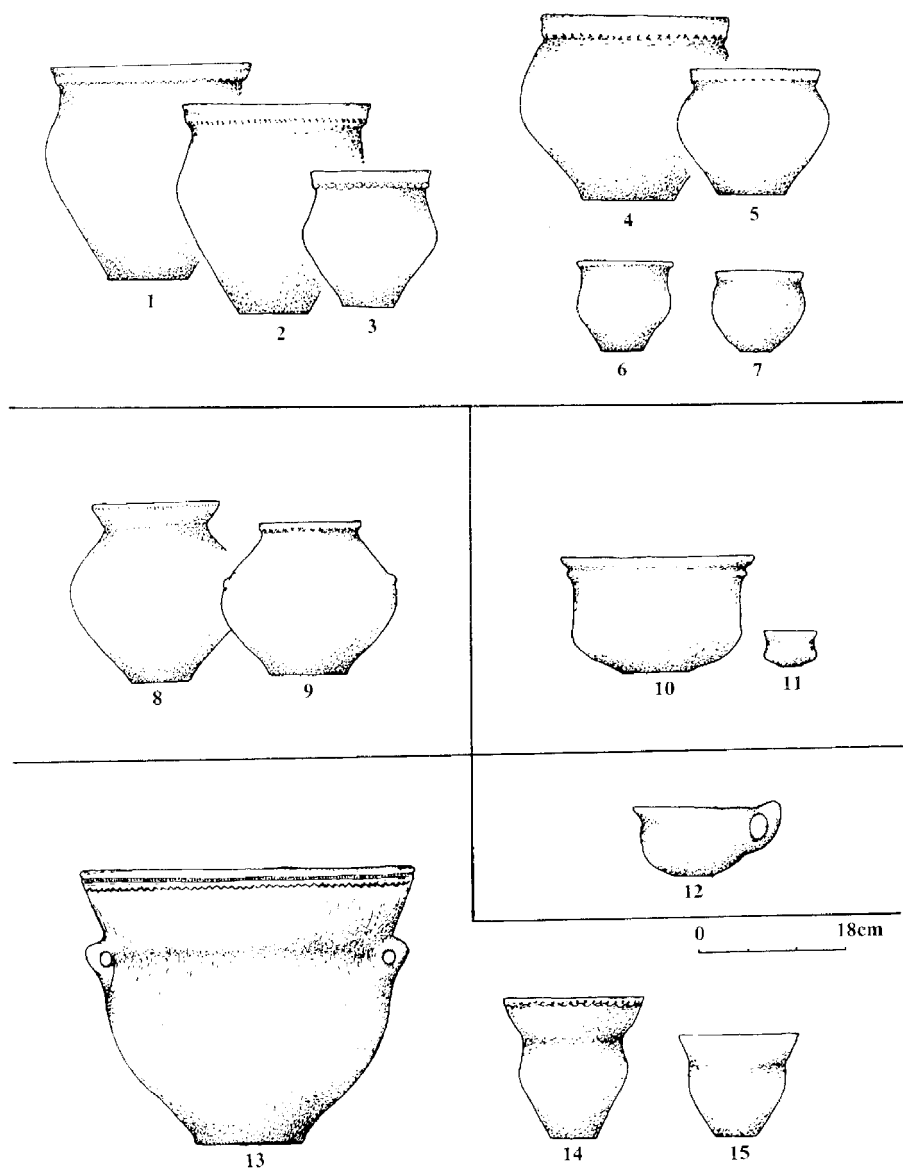


Fig. 25. Defenced settlement in Zimne. Reconstructed vessel forms, spindle whorls and weaving weights of the Zimne II phase. 1-7 - bag-shaped vessels; 8, 9 - bulging pots; 10, 11 - vases; 12 - cup with *ansa lunata* handle; 13-15 - funnel beakers. Drawings by E. Hander

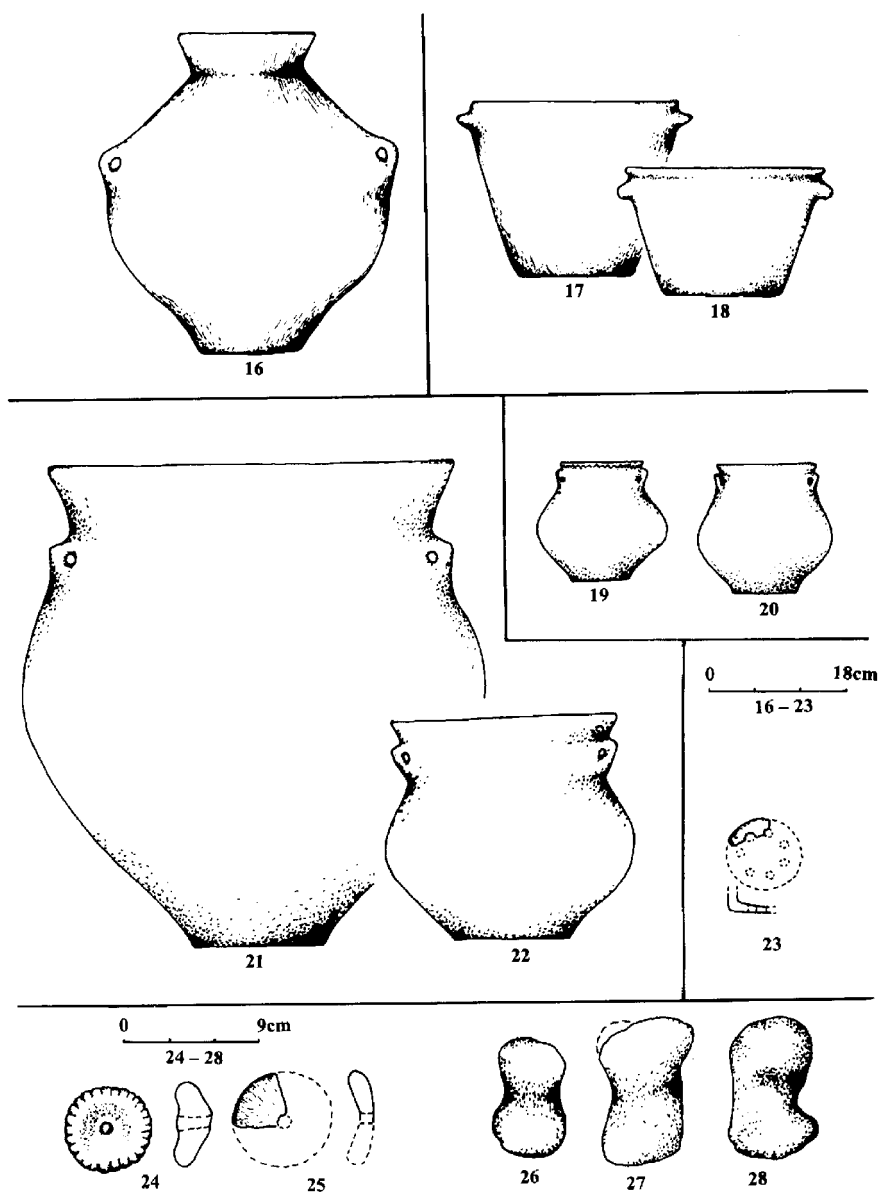


Fig. 26. Defenced settlement in Zimne. Reconstructed vessel forms, spindle whorls and weaving weights of the Zimne II phase, continued. 16 - amphora with handles affixed at the point of the greatest protrusion of the belly, 17, 18 - mortar-shaped vessels; 19, 20 - small-sized amphorae (19 - amphorae with "whiskers" at the handle base, 20 - amphorae without "whiskers"); 21, 22 - large-sized amphorae with handles on the vessel shoulder; 23 - a vessel with a perforated bottom; 24, 25 - spindle whorls (24 - plano-convex spindle whorl, 25 - plano-concave spindle whorl); 26-28 - figure-of-eight-shaped weaving weights. Drawings by E. Hander

The most common were bulging pots in which the greatest protrusion of the belly was located low down. The diameter of the protrusion was larger than the diameter of the lip rim (Figs. 13:8, 15:17, 19:11, 25:8,9). The next group included e.g. vases, sometimes very small, with large openings, (Figs. 11:11, 13:10, 17:32, 25:10,11) or occasionally with a pseudo-handle and a cup with atypically proportioned *ansa lunata* handle (Figs. 20:19, 25:12).

Another group comprised numerous funnel beakers (Figs. 10:4,7, 18:2, 25:13-15). These vessels either were stocky or had “classic” proportions. The really large items were equipped with elbow-like handles placed on the sharp shoulder. All the vessels had long necks.

Among the Zimne II vessels there were also typologically varied amphorae. For example, they had narrow apertures and handles affixed at the point of the greatest protrusion of the belly (Figs. 14:16, 15:21, 26:16). Apart from these, there were also such forms as vessels with large apertures and elbow-like handles placed at the shoulders. The forms were either “beaker-like” in terms of proportions (Figs. 9:1, 26:21) or stocky, with the greatest protrusion of the belly located low (Figs. 10:3, 26:22). The final type of form that belongs to this group was the small amphorae (Figs. 13:11, 14:14, 17:31, 20:15, 26:19,20), either with or without “whiskers” at the handle base.

A separate group is made up by mortar-shaped vessels (Figs. 13:9, 18:6, 20:16, 26:17,18) with handles under the lip rim, once or twice vertically perforated.

Besides, there were also finds of vessels with perforated bottoms (Figs. 17:33, 19:10, 26:23), which archaeologists failed to reconstruct. It is believed that such bottoms belonged to certain bag-shaped vessels, stocky pots or/and vases.

Among other categories of pottery forms, the Zimne II phase featured: plano-convex (Figs. 16:26, 26:24) and plano-concave (Figs. 15:19, 26:25) spindle whorls, as well as figure-of-eight-shaped weaving weights (Figs. 16:23, 18:1, 19:8,9, 26:26-28).

As concerns ornaments, the most popular are finger and fingernail impressions near the lip rims, normally made on the pseudo relief strip of bag-shaped vessels (Figs. 9:2, 10:6,8,10, 11:12,14,15, 12:2-6, 13:7,8,10, 14:13, 15:22, 16:28, 17:30, 18:4, 19:11-13, 22:1) and stocky pots (Fig. 19:11). The decoration was usually arcade-shaped or similar. In some cases, the pseudo-cordon additionally bears impressions of fingernails, either on the lip rim or just underneath it (Figs. 12:4, 13:10, 15:22).

The large beaker with handles (Fig. 23) was decorated with impressions of an interrupted groove stitch and an open polygon underneath. The pattern was filled with a white lime paste. The funnel beaker (Fig. 10:4) was ornamented in a similar way but the pattern was sloppy. The bag-shaped vessel also bore a diagonal stanchion and notches around the rim (Fig. 22:2). The lip rim of the vase had a pattern of densely impressed double triangle stamps, arranged in a form of stanchion (Fig. 11:11).

The vessels, e.g. a stocky pot, were also decorated by a pattern appearing in the “classic” and “Wiórek” phases, i.e. stanchions consisting of vertical rectangular stamp impressions. They are arranged in sequences, each of which is made up of three impressions (Fig. 15:17).

Sometimes the broken line occurred on its own, as on e.g. a small amphora (Fig. 17:31) or on the lip rim of an unidentified vessel (Fig. 20:18).

Two potsherds of amphora bellies were ornamented with a pattern forming a “ladder” (Fig. 13:11, 14:14), and one of the funnel lip rims bore small pinholes arranged in two vertical lines (Fig. 13:12).

The *ansa lunata* cup handle was decorated with two interrupted vertical incised lines (Fig. 20:19). The ornament that appeared on the funnel beaker of the “classic” phase (Fig. 18:2) consisted of: a scattered pattern made of small square stamp impressions under the lip rim and a groove stitch made with the same stamp, located immediately below.

Occasionally, the vessels featured small round buttons affixed to their bellies (Fig. 18:3, 19:11) showing affinities with the LVC and TC pottery.

Most of the vessels were stocky and short-necked. Their bottoms usually took the form of a foot (Figs. 11:16,17, 21:2) or a quasi-foot (Fig. 18:5, 20:17). Sometimes they were slightly marked (Fig. 15:18, 16:24) or gently passed into the belly (Fig. 21:1). In two vessels, the lip rim was made to fit a lid (Figs. 11:15, 22:1).

The lip rim of the bag-shaped vessels usually had an ornamented pseudo-cordon. Irrespective of the shape, the vessels (with the exception of the “classic” beakers) normally are short-necked and stocky.

7. SUMMARY: PREHISTORIC CONCLUSIONS

There is little doubt that the Neolithic settlement in Zimne gave rise to the LVC. This view is strongly supported by stratigraphy between trench I — connected with the LVC, and the FBC features dug into the material filling the trench. Only one, probably undisturbed pit was classified as belonging to the LVC.

The site abounded in goblets and other vessels decorated mainly with white paint. That is why the remains of LVC settlements should be related to the classic phase of the LVC that can be correlated with the late stage of the Tiszapolgár (B) culture development and the TC BII phase [Kadrow 1996:68]. The oldest ¹⁴C date obtained after the analysis of bone samples is 4920±50 BP (3701±47 BC; Ki-6873). This sample was taken from the feature which contained not only LVC but also FBC materials. Therefore, the sample belongs to the late (III) phase of the LVC [Kadrow, Zakościelna 2000:253].

In light of the radiocarbon datings and typological analysis of the pottery, it may be claimed that the LVC settlement in Zimne existed between 4000 and 3650 BC (Fig. 27). However, it is impossible to tell how many years it actually functioned.

The next stage of settlement on the discussed territory was the inflow of FBC populations to the defenced settlement. According to M. Peleshchyn, the FBC settlement functioned only for a short time (for one generation at most — oral communication from the researcher). This view, however, is incorrect because the stratigraphic analysis of relationships between the FBC features shows the opposite. It is believed that at least some of the pits constituting the so called “assemblages”, distinguished by the Ukrainian researchers, proved a longer existence of the FBC features. Yet, a detailed interpretation is precluded by the practice of collecting artifacts from the debris filling all the pits together. In the course of investigation carried out in 1997, archaeologists noticed that pit 31/97 was dug into pit 16/97, pit 32/97 into pit 31/97, pit 15/97 into pit 14/97 and pit 5/97 into pit 31/97. Since some pits contained little archaeological material and very few telltale potsherds, it is difficult to draw more precise conclusions.

In light of the radiocarbon chronology, the period of the defenced settlement in Zimne can be divided into two phases: Zimne I and Zimne II (Fig. 4, 27).

Phase I (classic) is marked by three radiocarbon dates that belong to the Gródek I phase [Jastrzębski 1991:189] and to the Bronocice II phase [Kruk, Milisauskas 1981:89-97] or to the Bronocice II and III phases [Kruk, Milisauskas 1999:117-118, 175]. Accordingly, the time brackets are as follows: 4770±60 BP (Ki-6874) to 4660±55 BP (Ki-6877). As a result of calibration, the “classic-beaker phase” in Zimne falls on the period from 3650 to 3400 BC.

During the investigation in Zimne in 1997, after the interpretation of radiocarbon chronology findings, it turned out that there is a chronological gap of over 300 years separating the classic and the late phase of the settlement.

The late phase of the FBC was established on the basis of 8 dates, with the oldest one determined at 4390±55 BP (Ki-6875), and the latest one set at 4080±55 BP (Ki-6869). In terms of chronology this period corresponds to Bronocice IV and V [Kruk, Milisauskas 1981:89-97; 1999:117-118, 175], as well as Gródek II (the latter sub-phase) set by S. Jastrzębski [1991:189]. These time brackets are also consistent with the dates — also very late — established for the site in Stryczowice (Fig. 3) [Uzarowicz-Chmielewska 1979].

The pottery from the TC co-occurred with the potsherds of the FBC late phase. In the course of the 1997 excavation works, the researchers found TC pottery fragments in two features and many more items in the cultural layer. The presence of globular amphorae, deep bowls decorated with black paint and handleless amphorae is the evidence of the impact of the late Trypolie horizon, i.e. C/II. According to T. Tkachuk (oral communication for which the authors are grateful), the painted pottery and globular amphorae bear traits of the Horodiștea group and both

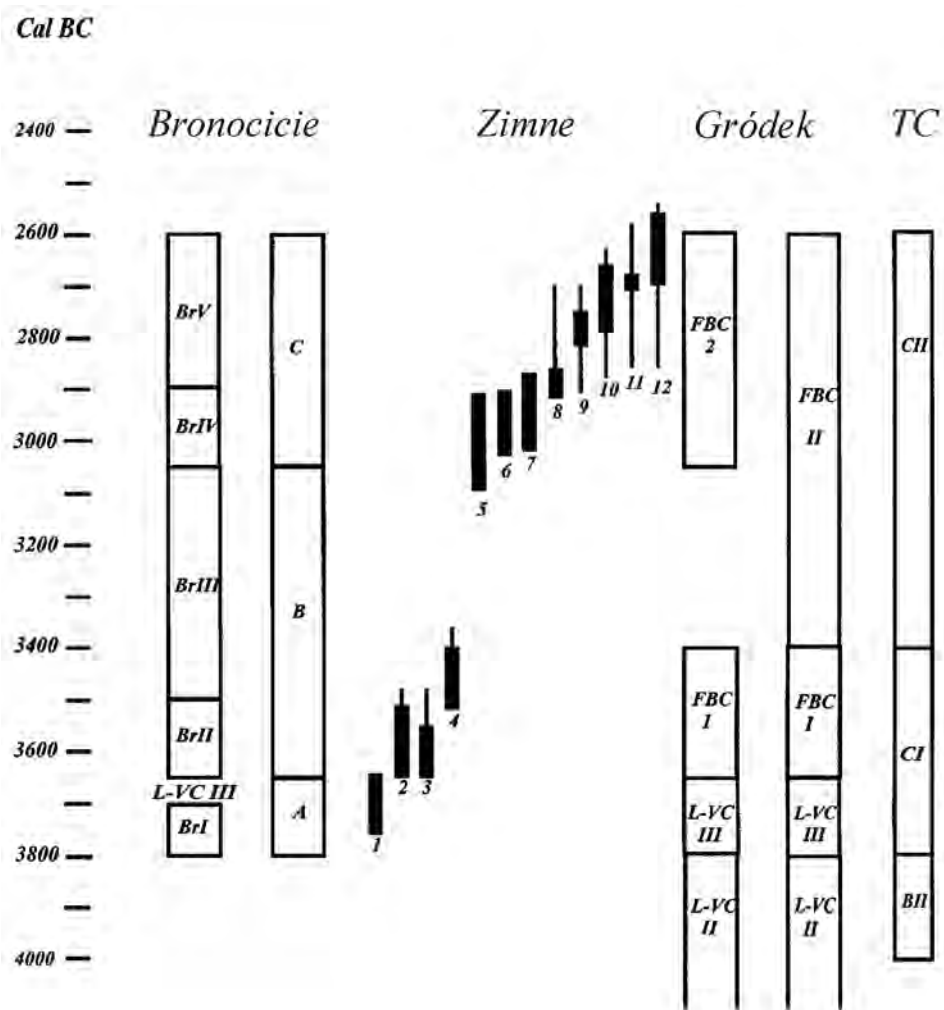


Fig. 27. Chronology of settlement phases in Zimne in light of contemporary cultural phenomena in Małopolska and west Ukraine. Partly on the basis of Jastrzębski 1991; Kadrow, Zakościelna 2000. Br - Bronocice, LVC - Lublin-Volhynia culture, FBC - Funnel Beaker culture, TC - Tripolye culture, A - medium settlements stage, B - central places stage, C - stage of reduction and concentration of settlement. Results of radiocarbon datings of the samples: 1 - Ki-6873: 4920±50 BP, feature No. 30/97; 2 - Ki-6874: 4770±60 BP, feature No. 30/97; 3 - Ki-6878: 4740±45 BP, feature No. 8/97; 4 - Ki-6877: 4660±55 BP, feature No. 8/97; 5 - Ki-6875: 4390±55 BP, feature No. 2/97; 6 - Ki-6879: 4350±55 BP, feature No. 5/97; 7 - Ki-6872: 4295±60 BP, feature No. 3/97; 8 - Ki-6880: 4260±50 BP, feature No. 5/97; 9 - Ki-6876: 4230±50 BP, feature No. 2/97; 10 - Ki-6871: 4160±50 BP, feature No. 3/97; 11 - Ki-6870: 4120±50 BP, feature No. 31/97; 12 - Ki-6869: 4080±55 BP, feature No. 32/97

vase-like vessels had the characteristics of the Gorodsk group. The impact of the C/II group of the TC was represented by the following characteristics: beakers with cuts for a lid, bowls with rims cut inwards, cord impressions (or imitations) and production technology used in some vessels.

After calibration of the dates, the late FBC settlement is dated between about 3050 BC and 2600 BC. These dates are fully supported by the whole set of dates established for Gródek [Jastrzębski 1991:190, Tab. 1].

The establishment of dates for both phases of the Zimne settlement has far-reaching prehistoric implications. It seems that after the classic phase, dated similarly in the whole SEG of the FBC, the forms started to differ in particular regions. In the upper Bug area and in Stryczowice (the area of Sandomierz) the style that refers to the classic phase continued for a long time (Fig. 3). On the other hand, the west Małopolska region witnessed the influence of the Baden culture on the FBC, while in the Bug area the characteristics of the classic phase continuously dominated.

In light of the above considerations, it is necessary to verify the chronology of the FBC settlement in Gródek Nadbużny. Both the origins of permanent settlements and their end (Gródek IIb) should be made “younger”. The beginnings should be dated at about 3650 BC, similarly to the beginnings of the great settlement stage in Bronocice, while the end must be moved to about 2600 BC (Fig. 4).

Translated by Piotr T. Żebrowski

ABBREVIATIONS

AAC	– Acta Archaeologica Carpathica, Kraków
Annales UMCS	– Annales Universitatis Mariae Skłodowska-Curie, Lublin
AP	– Archeologia Polski, Warszawa
APŚ	– Archeologia Polski Środkowoschodniej, Lublin
BerRGK	– Bericht der Römisch-Germanischen Kommission, Mainz
BPS	– Baltic-Pontic Studies, Poznań
BSA	– Annales of the British School of Archaeology at Athens
JIES	– The Journal of the Indo-European Studies, Washington D.C.
KSIA	– Kratkiye soobshcheniya Instituta Archeologii, Moskva
MANH	– Materiały Archeologiczne Nowej Huty, Kraków
NA IA NAN	– Nauchnyy Arkhiv Instituta Arkheologii Natsionalnoy Akademii Nauk Ukrainy, Kiev
PA	– Przegląd Archeologiczny, Wrocław
PBF	– Prähistorische Bronzefunde, München
PZP	– Prahistoria ziem polskich, Wrocław-Warszawa-Kraków-Gdańsk
RA	– Rossiyskaya Arkheologiya, Moskwa
SA	– Sovetskaya Arkheologiya, Moskwa
SIA	– Slovenska Archeologia, Bratislava
SPA	– Sprawozdania Archeologiczne, Kraków
WA	– Wiadomości Archeologiczne, Warszawa

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