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

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BALTIC-PONTIC STUDIES

V O L U M E 12 • 2003

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ADAM MICKIEWICZ UNIVERSITY
INSTITUTE OF EASTERN STUDIES
INSTITUTE OF PREHISTORY
Poznań 2003
ISBN 83-86094-11-7
ISSN 1231-0344

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V O L U M E 12 • 2003

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Cover Design: Eugeniusz Skorwider

Linguistic consultation: Ryszard J. Reisner

Printed in Poland

Computer typeset by PSO Sp. z o.o. w Poznaniu

Druk i oprawa: Zakład Poligraficzny Antoni Frąckowiak w Poznaniu

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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 radiocarbon 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, typochronolgy 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 archaelogical 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).

Baltic-Pontic Studies
vol. 12: 2003, 7-21
PL ISSN 1231-0344

Mihailo Y. Videiko

RADIOCARBON CHRONOLOGY OF SETTLEMENTS OF BII AND CI STAGES OF THE TRIPOLYE CULTURE AT THE MIDDLE DNIEPER

For settlements of the Tripolye culture of stages BII and CI at the Middle Dnieper some ^{14}C dates were taken before. These were two dates for the Evminka-I settlement and two dates for the Chapaevka settlement [Kruts 1977:147; Telegin 1985:10-21; Mantu 1998:251-252; Wechler 1994:16]. All of them are represented in the table [calibration after Zovalyukh, Nazarov 1999].

Table 1

Old dated settlement stages BII and CI at the Middle Dnieper

Settlement	Material	Stage	Lab.No.	Date BP	Date BC
Chapaevka	charcoal	BII	Bln-631	4870±100	3944-3378
Chapaevka	charcoal	BII	Ki-880	4810±140	3950-3146
Evminka	?	CI	UCLA-1466B	4790±100	3780-3350
Evminka	?	CI	UCLA-1671B	4890±60	3893-3528

Earlier this year, a set of 11 isotope dates[1] for three settlements of stages BII and CI at the Middle Dnieper has been obtained at the Kiev laboratory. Therefore, the total number of available dates, including the new set, is 15 absolute dates for settlements of stages BI and CI of the Tripolye culture at the Middle Dnieper.

It should be noted that in the light of the isotope dates, the inclusion of Chapaevka to the transition period from stage CI to stage CII by V.O. Kruts [1977:147-148], appears to be less probable. Not only the isotope dates, but also

[1] The date-taking was financed from a grant KBN 5H01H02121

archaeological materials give no reasons to regard complexes of the Chapaevka type as later than settlements of the Kolomiyshchina-I type. Chapaevka is synchronous with settlements of the Kolomiyshchina-II type, i.e., stage B-II [Videiko 1998:2-15].

1. LIST OF NEW DATA

In the tables below there are descriptions of complexes of settlements in the Khatyshche ravine and Ihnatenkova Hora near the village of Hryhorivka of the Kaniv District of the Cherkasy Region, and Khomyne near the town of Rzhyshchiv of the Kaharlyk District of the Kiev Region (Fig. 1), from which the materials for date-taking were collected. The materials selected for the date-taking included fragments of cattle bones, and in one case (settlements in the Khatyshche ravine near the village of Hryhorivka), clay plaster of a hut wall with some inclusions of coal.

The above settlements were studied by the author in 1993–1994. Based on analysis of the archaeological materials, they were referred to different local groups of stages BII (Khatyshche — to the Kaniv group) and CI (Ihnatenkova Hora and Khomyne — to the Hryhorivka group) of the Tripolye culture. These complexes are of interest both in terms of their location — the southern zone of dissemination of the Tripolye settlements at the Middle Dnieper — and because they belonged to the local groups of the Tripolye community that were little studied and were not ^{14}C-dated.

1.1. THE KHATYSHCHE SETTLEMENT

Table 2

Dated complexes from the settlement in the Khatyshche ravine

Settlement	Material	Stage	Lab.No.	Date BP	Date BC
Khatyshche, dig 3	plaster with coal	BII	Ki-9622	4800±90	3592±112
Khatyshche, dig 3	bone	BII	Ki-9623	4840±90	3616±107
Khatyshche, dig 2, pit	bone	BII	Ki-9624	4740±90	3500±107
Khatyshche, dig 2, pit	bone	BII	Ki-9749	4830±90	3611±107

The settlement was located 1.5 km to the north of the village of Hryhorivka near the road to the village of Lukovitsa, at a cape formed by the “horns” of the Chernechiy Yar 1. The excavated materials (ceramics, fragments of plaster) were

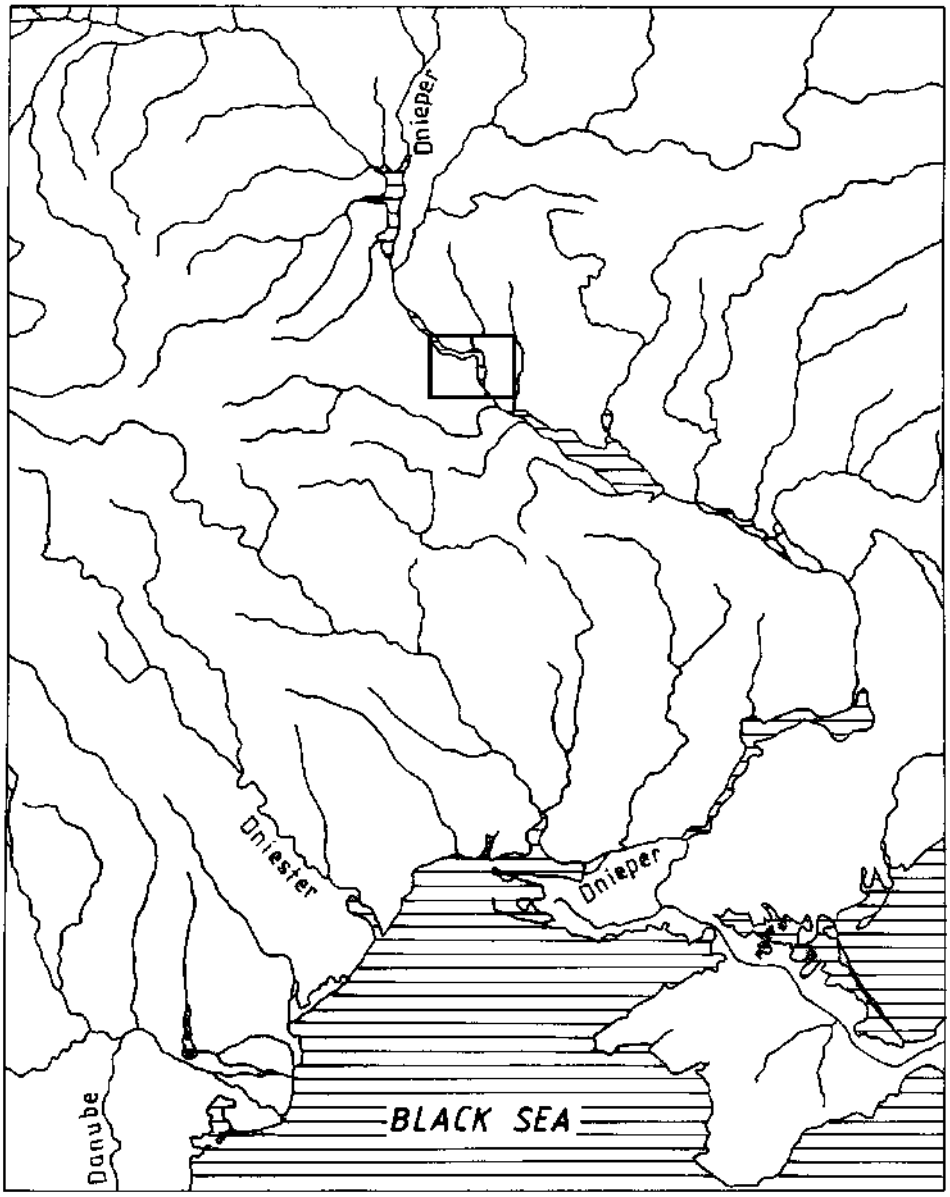

Fig. 1. Map of location dated complexes from the Tripolye culture of BII and CI stages in the Middle Dnieper

found in an area over 2 hectares. In 1993, the excavation found heavily damaged remainders of three huts and three garbage pits, in which there was a large number of fragments of pottery, as well as anthropomorphic and zoomorphic modeled objects [Videiko 1997].

Materials for date-taking were selected from digs 2 (remainders of the hut) and 3 (pit). In dig 2 there was a dark smear, filled with fragments of pottery; it was studied to the depth of 0.4 m from the present-day surface. The pit was of irregular shape, 4.8x3 m in size, and maximum 1.02 m deep from the present-day surface. In the filling of the pit that consisted of dark soil there was a large number of fragments of ceramics, mostly 0.84 m deep; the fragments lay almost in an uninterrupted layer in the central part of the pit. In the north-western corner of the pit there was a layer of burnt clay covering an area up to 1 sq. m.; the layer was from 0.2 m to 3.1 m thick. In addition to the fragments of pottery, the pit contained animal bones, several stones, a flint arrowhead, and a fragment of a schematic anthropomorphic figurine. It should be noted that in the central part of the pit to the depth of about 1 m (i.e., to the bottom of the pit) there was a crater that had been gradually filled. Possibly, the process was connected to the battle at Bukryn in 1943.

The dig no 3 contained remainders of a flat ground — hut (hut no 2) and two "household" pits. Remainders of hut no 2 were excavated to the area of 2.1 sq.m. The finds included red-brown burnt plaster and individual melted fragments. The plaster contained admixtures of chaff. There were also individual black fragments. One of them was selected for date-taking. Under the plaster there was a pile of kitchen pots, a conical bowl and fragments of table vessels, as well as a sandstone with traces of processing. The finds also included a large number of fragments of vessels and several piles connected to remainders of huts no 1 and no 2.

The finds represented two technological groups of vessels: kitchenware and tableware (Fig. 2). The kitchen vessels were made of clay with an admixture of large-grain sand; the table vessels were made of processed clay. The kitchenware was represented with fragments and piles of fragments of pots; it comprised up to 10 percent of the whole ceramic complex of the settlement. The vessels were decorated with scratches at the neck of the vessel, plastered-on shapes, and cuts. The tableware was more diverse; all of the vessels were painted. Regretfully, it was badly preserved, except for materials from the deep part of the pits. The forms of the vessels included conical bowls, cups, small amphorae, bi-conical vessels. The painting was done with dark-brown paint; the surface was polished. The shapes and painting represented wide ribbons with fine lines inside, festoons — typical for the Kaniv group of the Tripolye monuments.

The settlement may be dated back to stage BII of the Tripolye culture and referred to the Kaniv group.

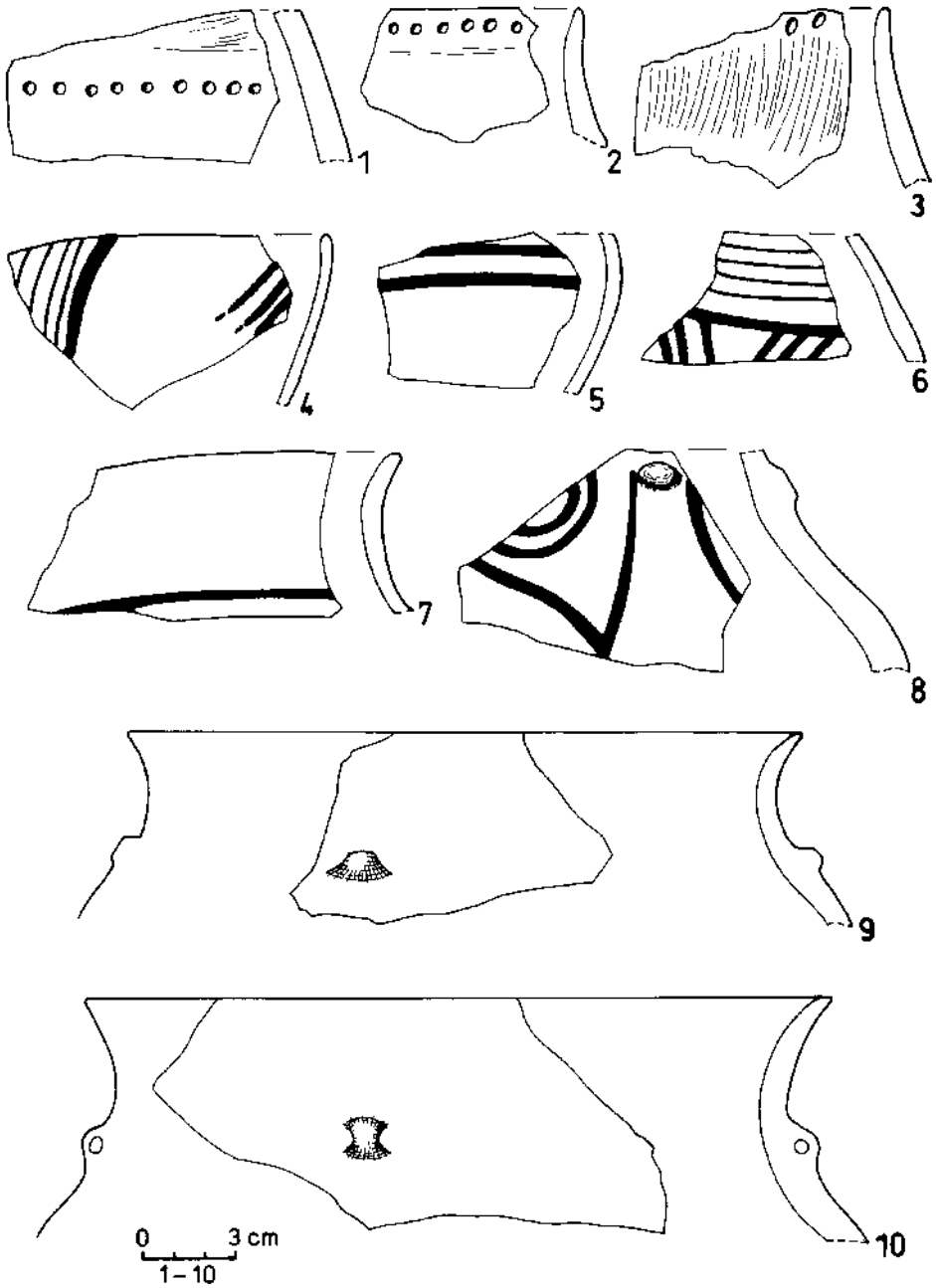

Fig. 2. The Khatyshche ravine, Cherkasy Region. Settlement of the Tripolye culture, stage BII: ceramics from dig no 2

Table 3

Dated complexes from the settlement in the Ihnatenkova Hora ravine

Settlement	Material	Stage	Lab.No.	Date BP	Date BC
Ihnatenkova Hora, pit 15	bone	CI	Ki-9613	4520±80	3215±125
Ihnatenkova Hora, pit 15	bone	CI	Ki-9614	4590±80	3248±158
Ihnatenkova Hora pit 15	bone	CI	Ki-9615	4570±80	3236±137
Ihnatenkova Hora, pit 16	bone	CI	Ki-9618	4500±80	3200±129

The settlement of the Tripolye culture in the Ihnatenkova Hora narrow valley near the village of Hryhorivka was discovered during an archaeological reconnaissance in 1960 and was studied by M. Shmahliy in 1961. In 1993, the author of this article studied a number of garbage pits in the area of 1,200 sq.m. [Videiko, Burdo 1977].

The settlement was located on a high hill over the Kaniv water reserve outside the north-western vicinity of the village (400 m away). The hill was limited with a deep ravine from the south-west, and with a new ravine from the north. The surface was turned down towards the water reserve. Towards the Dnieper, the Ihnatenkova Hora ended up in a precipice and was gradually ruined while sliding down the hill. Its height over the level of the water reserve was about 12 m. A number of garbage pits were studied; bones for date-taking were selected from two of them (15 and 16).

Pit no 15 was found after the excavation 0.2 m from the present-day surface. Pit no was amorphous in projection, up to 9.5 m long, up to 5 m wide. The deepest part of the pit goes down to 1 m from the clearance level (Fig. 3). The pit is filled with uneven finds. The filling contains occasional inclusions of shells; some parts are filled with fragments of vessels or animal bones. Some major fragments of vessels also occur — probably, they represent single major vessels, but none of them could be assembled in at least half of a vessel. Ash-like smears with inclusion of pieces of coal were also found in the filling layer.

Pit no 16 was studied next to pit no 15. It was also amorphous in projection, 6 x 5 m in size; it goes down to 0.5 m from the clearance level. The walls were inclined to the middle of the pit (Fig. 3). The filling with finds was uneven and contained fragments of vessels, animal bones, sharp pieces of flint and a large number of shells.

The most prolific category of finds was ceramics. The site contained all major groups of vessels, typical for the Tripolye monuments of the Middle Dnie-

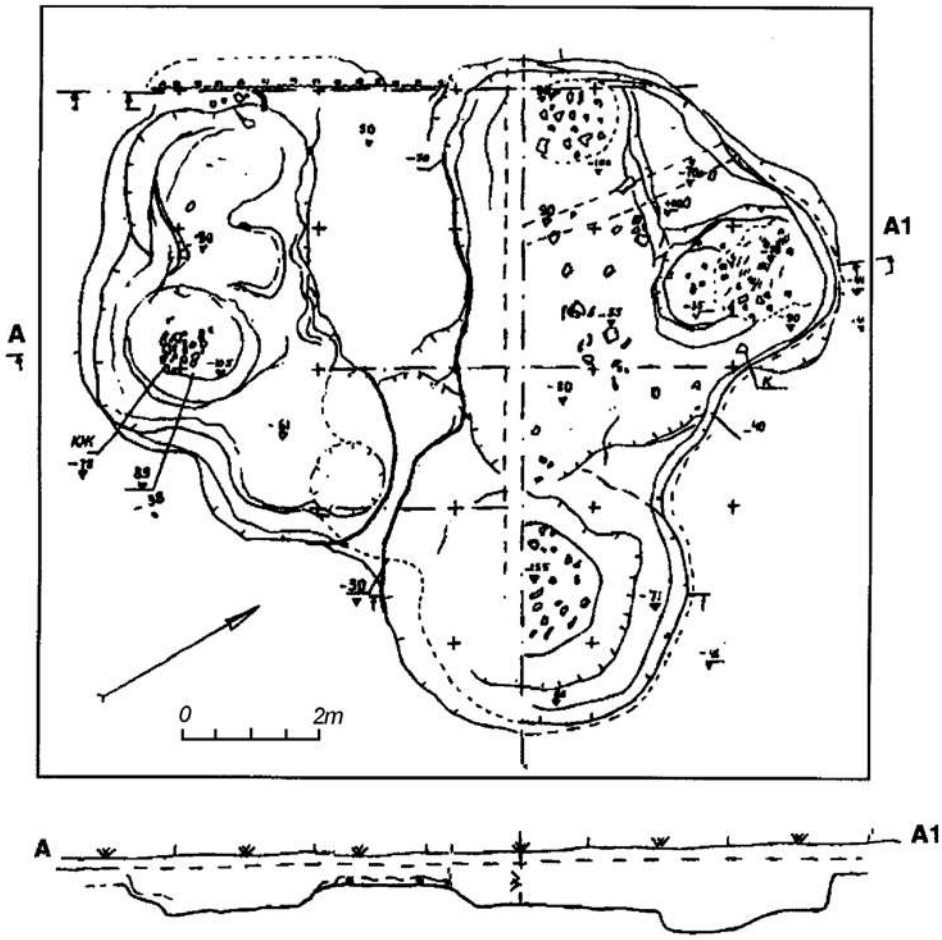

Fig. 3. Ihnatenkova Hora, Cherkasy Region. Settlement of the Tripolye culture, stage CI. Plan of the dig and section of pits no 15 and no 16

per; the finds allow rather accurate culture identification of the monument as a Kolomiyshchina-I site [Movsha 1985].

The vessels could be classed into two groups: kitchenware and tableware (Fig. 4 and 5). The kitchenware was of two types: with an admixture of shells in the mass and with an admixture of shell and sand. Vessels of the first type were light, while vessels of the second type were heavy. The quality of baking was medium, the colour of ceramics was from terracotta to dark brown. The most frequently used shape of the vessel was represented by pots of different sizes with turned-out high rims. The surface was covered with "strip-like smoothing". Typical decoration patterns

included various cuts, pinches, impression of cliché and a cord. Less frequently, the pots had plastered-on shapes and handles. On some of the fragments the scratches formed some ornamental compositions.

The tableware vessels were of three types. The first type was decorated with an impressed ornament. The vessels of that type are the least common in the group of table vessels — some dozens of fragments. The most numerous were fragments of the second type — without any ornament but with slightly polished surface, brown or black. Those were conical bowls, cups, cups with handles and bi-conical vessels.

The next most numerous kind were painted vessels. The finds included fragments of conical and semi-spherical bowls, a zoomorphic bowl, cups and bi-conical vessels of different sizes. In the group of painted vessels there were two subtypes of distinct manufacturing techniques and painting patterns, related to the Kaniv and the Tomashivka groups.

The imported painted vessels allow including the monument to stage CI of the Tripolye and synchronising Hryhorivka (the Ihnatenkova Hora ravine) with the 2nd or 3rd phases of the Tomashivka group (according to S.M. Ryzhov) [Kruts, Ryzhov 1985:45-56; Ryzhov 2000:459-471].

1.3. THE KHOMYNE SETTLEMENT

Table 4

Dated complexes from the settlement in the Khomyne ravine

Settlement	Material	Stage	Lab.No.	Date BP	Date BC
Khomyne, pit 1	bone	CI	Ki-9740	4470±80	3181±138
Khomyne, pit 1	bone	CI	Ki-9741	4490±90	3191±132
Khomyne, pit 1	bone	CI	Ki-9742	4390±90	3022±142

The site is located behind a ravine, the Khomyn Lis, or Khomyne, behind the eastern end of the town of Rzhyshchiv on a plateau on the right-hand side of the Dnieper River. Its area is 3.4 hectares. The investigated part of the site includes remainders of two clay-based huts and a garbage pit.

Samples for taking dates — fragments of animal bones — were selected from pit no 1. The pit was oval in projection, its upper part was 4 x 2.5 m. In the section the pit was of a linear shape, narrowed to the bottom; its maximum depth from the level at which it was found was 1.2 m from the current surface level.

The filling of pit no 1 consisted of light loam that contained a large number of *Unio* shells. The shells lay in separate layers up to 5 cm thick in an area of 40

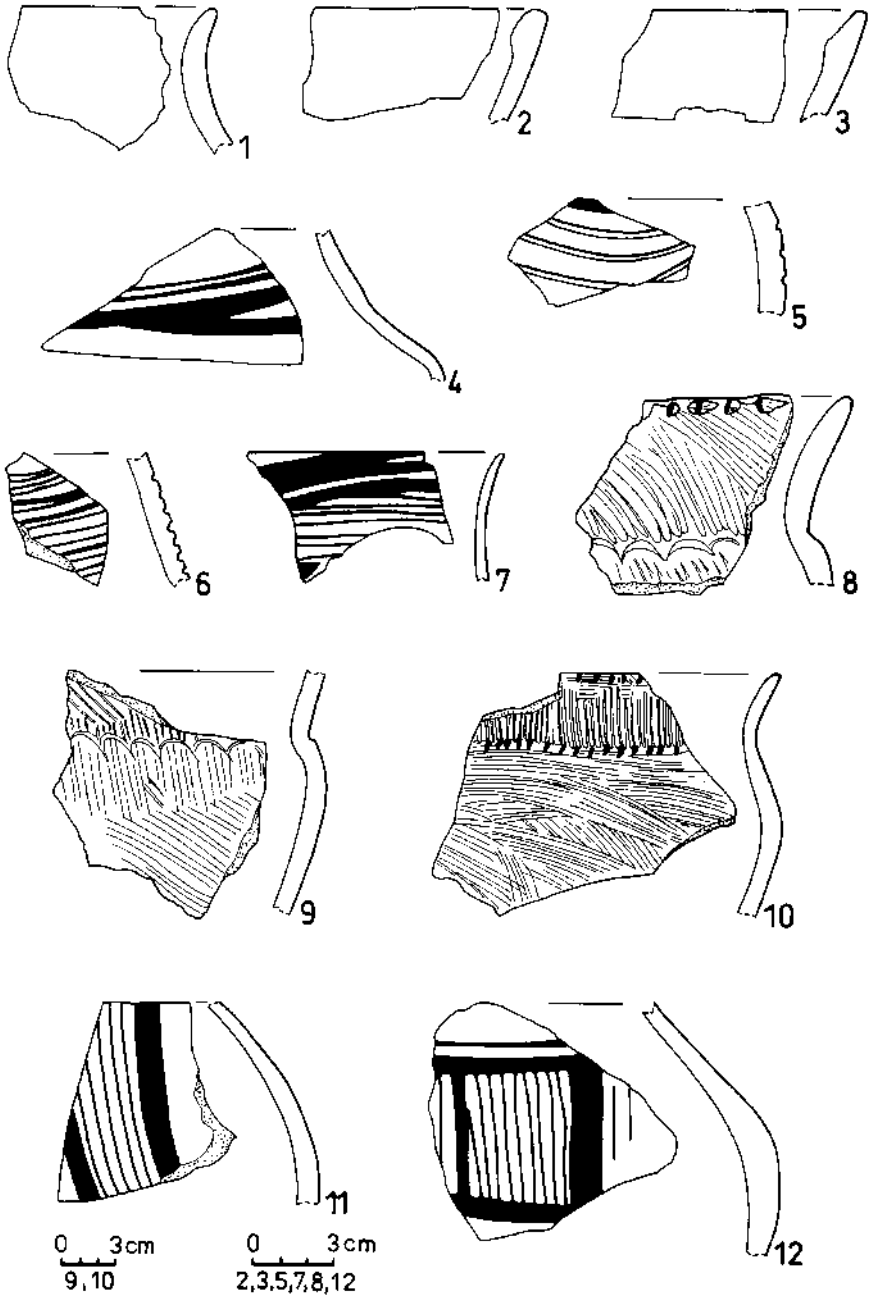

Fig. 4. Ihnatenkova Hora, Cherkasy Region. Settlement of the Tripolye culture, stage CI. Ceramics from pit no 15

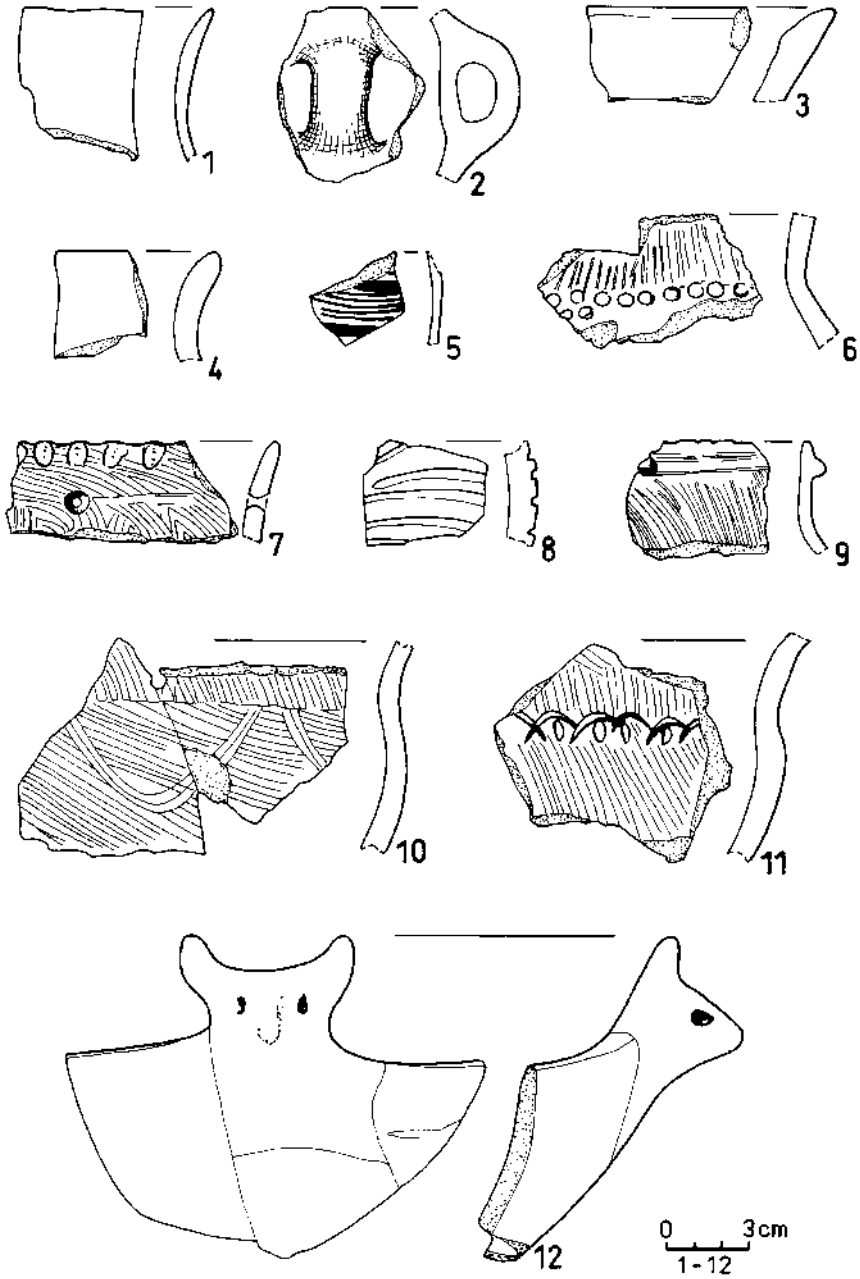

Fig. 5. Ihnatenkova Hora, Cherkasy Region. Settlement of the Tripolye culture, stage CI. Ceramics from pit no 16

x 50 cm, and 80 x 70 cm in the form of a smear of an irregular shape; there were fragments of ceramics (about 800), anthropomorphic figurines (12), a small amount of flint — split-off pieces and individual tools; some objects made of horn (fragments of soil-softening and digging tools); about 200 bones of wild and domestic animals. Moreover, along the whole depth of the pit there were fragments of burnt clay — plaster without any admixture of chaff in the mass. The plaster did not form any constructions. The latter fact and the section of the pit do not allow regarding pit 1 as a remainder of a dug-in-earth hut, notwithstanding its relatively large size — up to 10 sq.m. The pit had been filled gradually. Possibly, the Tripolye people used a natural cavity, made by the rains in the soil at the side of the ravine, as a garbage pit.

The vessels can be divided into two groups — vessels for the kitchen and vessels to be used at the table (Fig. 6 and 7). Specific features of the vessels allow attributing the site to the Kolomiyshchina-I type.

The kitchen vessels were of two kinds — with an admixture of shells in the dough of the vessels and with a combined admixture of shells and sand. The quality of baking was medium, the colour of ceramics ranged from terracotta to dark brown. The pots were of different sizes with turned-out high rims. The surface was covered with "strip-like smoothing". The vessels were decorated with various cuts, pinches, impression of cliché and a cord. Less frequently, the patterns included plastered-on shapes and handles. On some of the fragments the scratches formed some ornamental compositions.

The tableware vessels were of three types. The first type was decorated with an impressed ornament. Several dozens of fragments were found — the fragments of craters and major vessels. The most numerous were fragments of the second type — without any ornament but with slightly polished surface, brown or black, sometimes with a thicker layer of finish. Those were conical bowls with wavy rims, cups, cups with handles and small bi-conical vessels.

The third type consisted of painted vessels, with the surface covered with orange angobe and painted with dark-brown paint. The finds included fragments of conical and semi-spherical bowls, a zoomorphic bowl, cups and bi-conical vessels of different sizes. The group of painted vessels could be initially divided into two subtypes, according to distinct manufacturing techniques and painting patterns, related to different groups of the Tripolye monuments of the area between the Southern Bug and the Dniester rivers — the Kaniv and the Tomashivka groups. The first group included fragments with reddish, slightly polished surface, rounded shapes, a fresh break-up of a fragment would be of rosy or reddish colour. The Tomashivka imports were made of white clay, covered with reddish angobe; the dough contained more admixtures of sand; the shapes were bi-conical, the paint used for making the ornaments was lighter, and the surface was not finished.

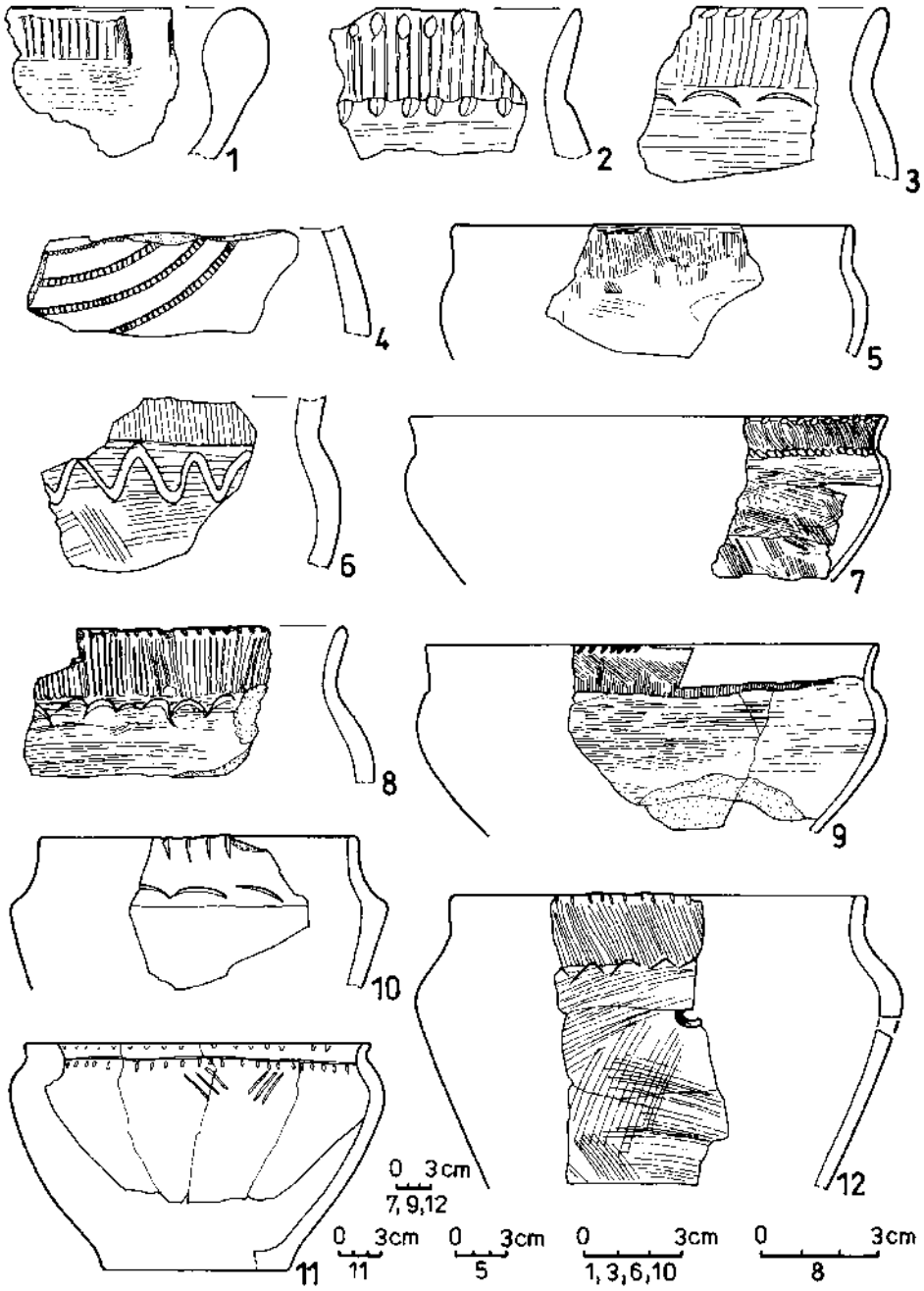

Fig. 6. Khomyne, Kiev Region. Settlement of the Tripolye culture, stage CI. Ceramics from pit no 1 (kitchen vessels and vessels with pressed-in ornament)

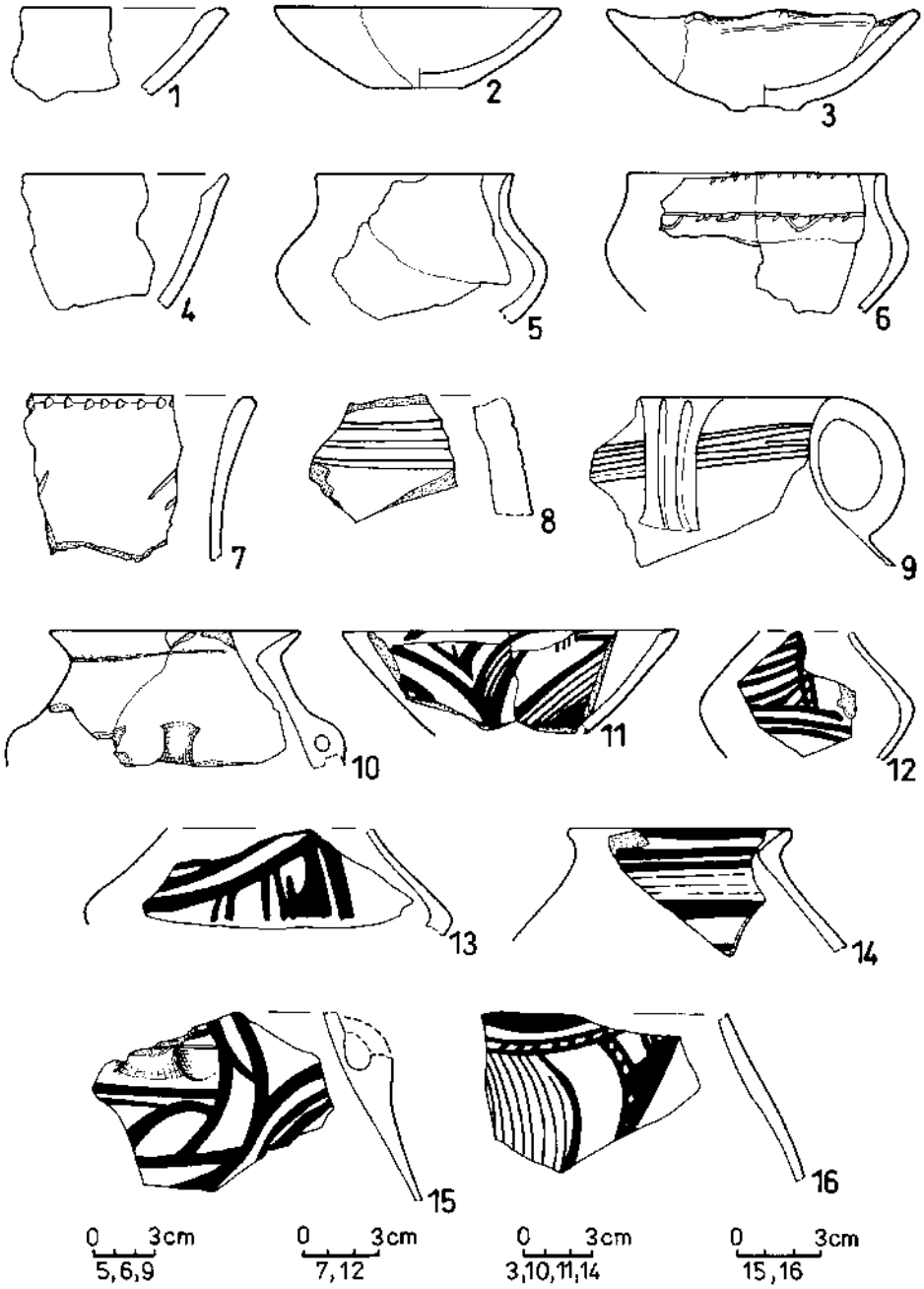

Fig. 7. Khomyne, Kiev Region. Settlement of the Tripolye culture, stage CI. Ceramics from pit no 1 (table vessels: with pressed-in ornament, without ornament, painted)

The imported painted vessels allow including the monument to stage CI of the Tripolye and synchronising it with the third phase of the Tomashivka group (according to S.M. Ryzhov) [Kruts, Ryzhov 1985:45-56; Ryzhov 2000:459-471].

2. ABSOLUTE DATES FOR SETTLEMENTS OF BII AND CI STAGES AT THE MIDDLE DNIEPER

The beginning of stage BII at the Dnieper is determined by dates for the Hrebeni settlement (Vasylyshyn Yar) and Chapaevka that point to the period between 4000 and 3700 BC. The lower limit of stage BII in that region may be determined by the dates of a settlement of the Kaniv group, Khatyshche (village Hryhorivka) — i.e., between 3600 and 3400 BC (Table 1).

Monuments of the Middle Dnieper area of stage CI have dates between 3600/3550 and 3200/3100 BC. It is noteworthy that the complexes of the Lukashi type (which includes Evminka-I) may not be referred, according to their materials, to stage CII but have to be dated as CI, which confirms the earlier obtained data for Evminka-I [Videiko 1998:12-15]. The complexes can be divided into earlier ones (e.g., Ihnatenkova Hora), and later ones e.g., Khomyne (Tables 2-3). Interestingly, according to the finds of ceramics the complexes can be synchronised with settlements of the Tomashivka type in the area between the rivers of the Southern Bug and Dnieper, in particular, Talyanki and Maydanetske. There are six definitions for those settlements (Table 5), including four for Talyanki [Klochko, Kruts 1999:79] and two for Maydanetske [Telegin 1985:12; Mantu 1998:252; Wechler 1994:18].

Table 5

Isotope dates for settlements of the Tomashivka type (stage CI)

Settlement	Material	Lab.No.	Date BP	Date BC
Talyanki	bone	Ki-6865	4755±50	3565±81
Talyanki	bone	Ki-6866	4720±60	3475±96
Talyanki	bone	Ki-6867	4810±55	3586±66
Talyanki	bone	Ki-6868	4780±60	3575±76
Maydanetske	coal	Ki-1212	4600±80	3226±163
Maydanetske	coal	Bln-2087	4890±50	3679±43

Among other things, these dates suggest that settlements of the Tomashivka type most probably are in fact synchronous with the Dnieper settlements of the end

of stage BII (the Kolomiyshchina-II type and early settlements of the Kaniv group) — and the beginning of stage CI (the Kolomiyshchina-I type and late settlements of the Kaniv group). Given the presence of painted vessels of the Tomashivka type at the Khomyne settlement as well (the Kolomiyshchina-I type), which according to absolute dates, is substantially later than the Tomashivka settlements, one may assume that similar finds document migration of a certain part of dwellers of Tripolye proto-cities to the north.

The end of stage CI may be set at about 3300-3200 BC by the dates from the Khomyne settlement. This conclusion, to a certain extent, is also supported with a set of dates for the CII phase — i.e., the earlier dated complexes of the Sofievka type, referred to the period between 2950–2750 BC [Kovalyukh, Videiko, Skripkin 1996:140-146].

Table 6

Absolute dating for settlements of the Tripolye culture

Stage	Regions			
	Middle Dnieper area	Southern Bug area	Dniester area	Volhynia
BII	4000-3600/3400	?	?	?
CI	3600-3300/3200	3700-3400(?)	?	?
CII	3300/3200-2750	?-2870(?)	3400-2710	3350-2500(?)

The dates, received for stages BII and CI at the Middle Dnieper substantially change earlier views on their connection exclusively with the second half of 4000 BC. They have been proved to have moved to the second half of 4000 BC, having covered the gap between them and complexes of stage CII. It is worth noting that nowadays the settlements for which the fewest dates have been taken are the settlements of the middle stage of the Tripolye culture (BI, BI-II, BII).

The obtained isotope dates confirm, to a certain extent, the conclusions about the uneven development of the Tripolye complexes in different regions that have been formally referred to the same stage of periodisation (Tripolye BII and CI), for instance, at the Middle Dnieper and the area between the rivers of the Southern Bug and Dnieper (Table 6). The latter, in our opinion, should be taken into account when setting dates for monuments of other archaeological cultures based on finds of imports of the Tripolye ceramics, particularly painted samples.

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 22-66
PL ISSN 1231-0344

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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; Kośko, 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).

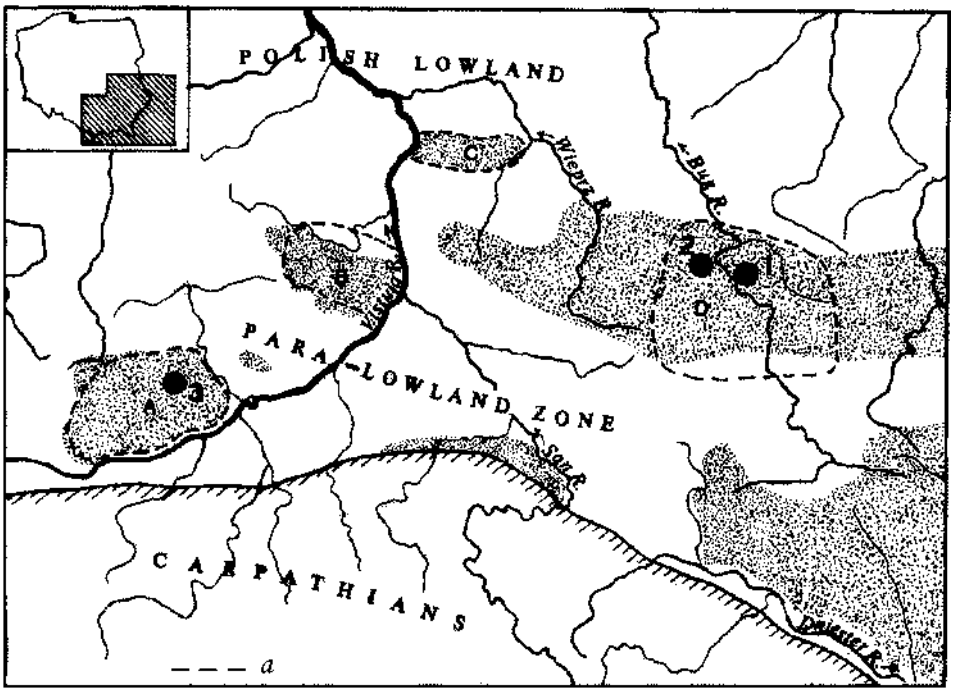

Fig. 1. South-Eastern Group of the Funnel Beaker culture (a) A - the Kraków area, B - the Sandomierz area, C - the Lublin area, D - the Volhynia area (according to Burchard, Jastrzębski, Kruk 1991); 1 - Zimne, 2 - Gródek Nadbużny, 3 - Bronocice; the dotted area — loess soils

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, Milisuaskas 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, Milisauskas 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, Kośko, 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 Bodrogkerestur 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-Lasinja 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 form the LVC cemetery (Table 1) received

Table 2

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

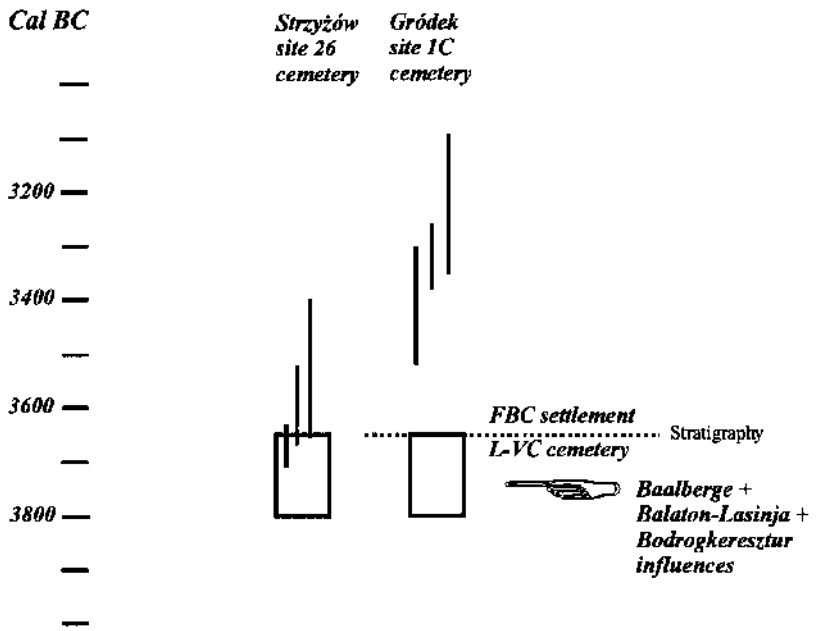

Fig. 2. A graph showing discrepancies between the radiocarbon dating of the cemeteries of the late phase of the Lublin-Volhynia culture and the outcomes of stratigraphic and stylistic-typological analysis. LVC - Lublin-Volhynia culture, FBC - Funnel Beaker culture

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 Bodrogkerestur, 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, Milisuaskas 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; Kośko 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

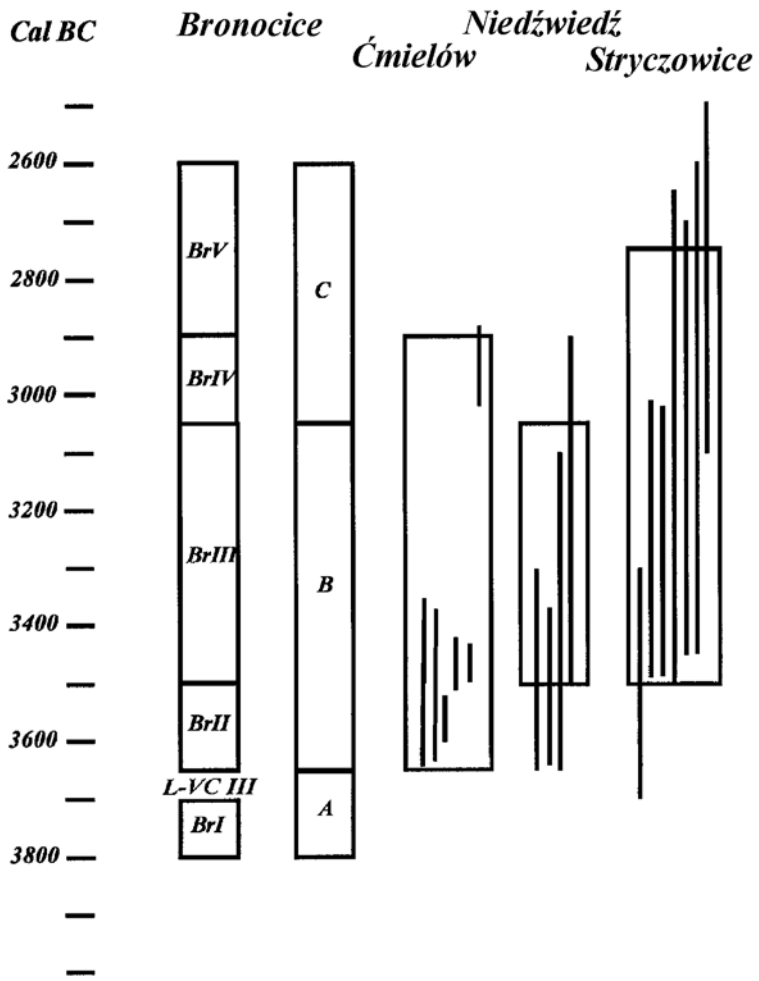

Fig. 3. A graph showing the absolute chronology of the Funnel Beaker culture settlement in the Kraków and Sandomierz areas, based on radiocarbon dating. The vertical lines show the probable distribution of particular ^{14}C dates within sigma 1 range. A - medium settlements stage, B - central places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

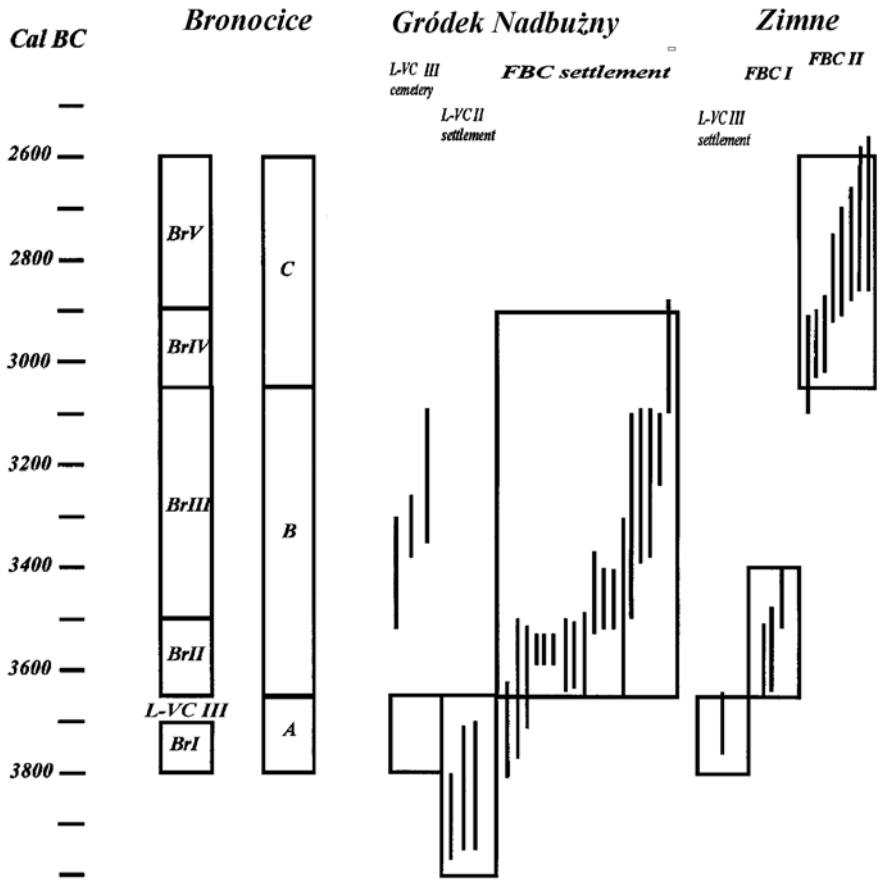

Fig. 4. A graph showing the absolute chronology of the Funnel Beaker culture settlement in the Kraków and Volhynia areas, based on radiocarbon dating. The vertical lines show the probable distribution of particular ^{14}C dates within sigma 1 range. A - medium settlements stage, B - central places stage, 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. Łańcut, site 10; Kadrow, Kłosińska 1989], the Baalberge/Michelsberg culture [e.g. Gródek Nadbużny, site 1C; Kokowski, Zakościelna 1988:Fig. 6d] and the Balaton-Lasinja 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 Folteşti 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 "tripolyesation". 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 Niedźwiedź [Burchard 1991:185] existing, according to the ^{14}C 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 ^{14}C 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

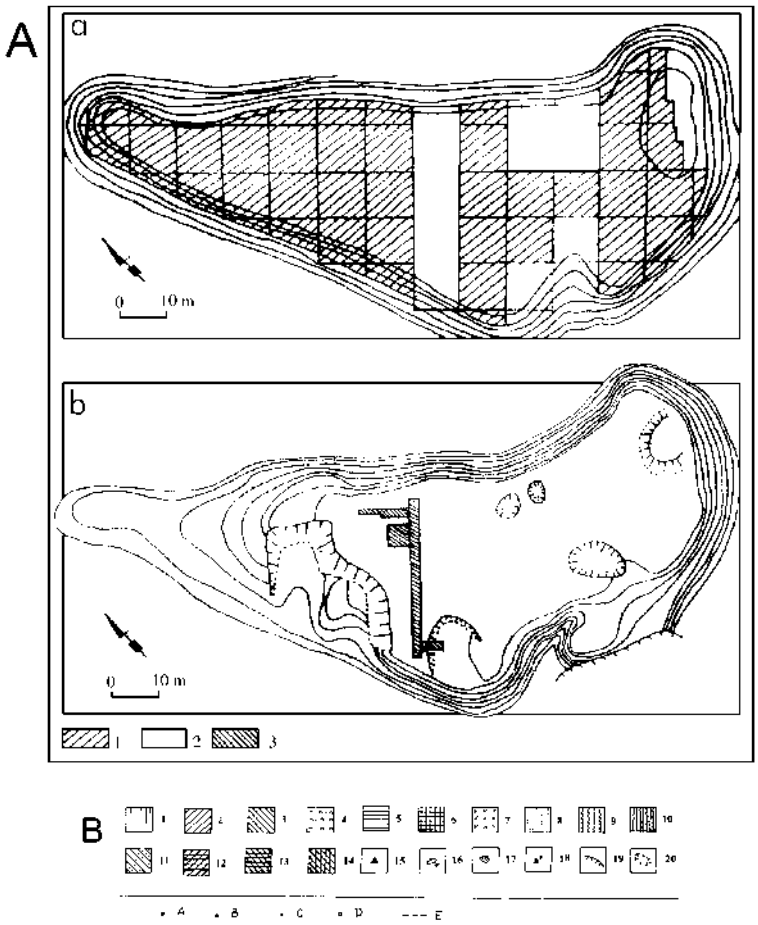

Fig. 5. A. Defenced settlement in Zimne. Location of archaeological excavations: a - area excavated before 1997 (1) and not excavated area (2), according to Aulich 1972; b - area excavated in 1997 (3), according to the location and altitude map drawn up in 1997 (according to Bronicki, Ochrimenko, Zakościelna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

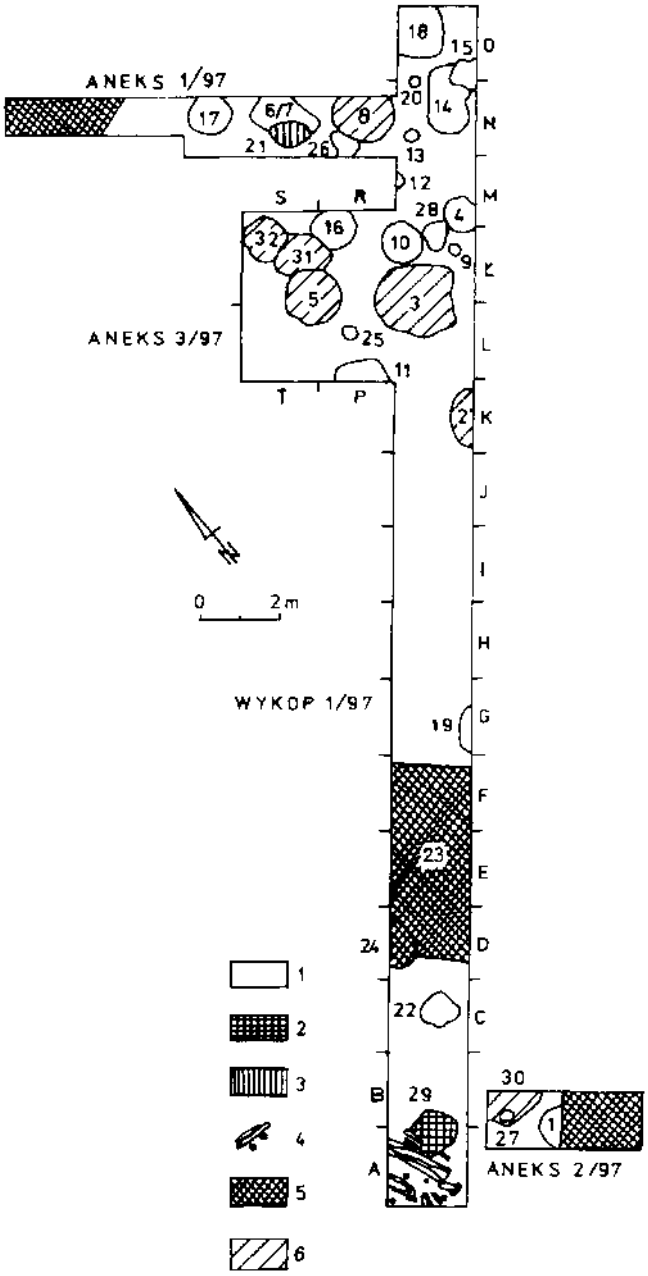

Fig. 6. Defenced settlement in Zimne. A collective map of features excavated in 1997. 1 - feature of the Funnel Beaker culture, 2 - feature of the Pomorze culture, 3 - early medieval feature, 4 - relics of timber defensive structures of an early medieval stronghold, 5 - area analysed before 1997 (old 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-

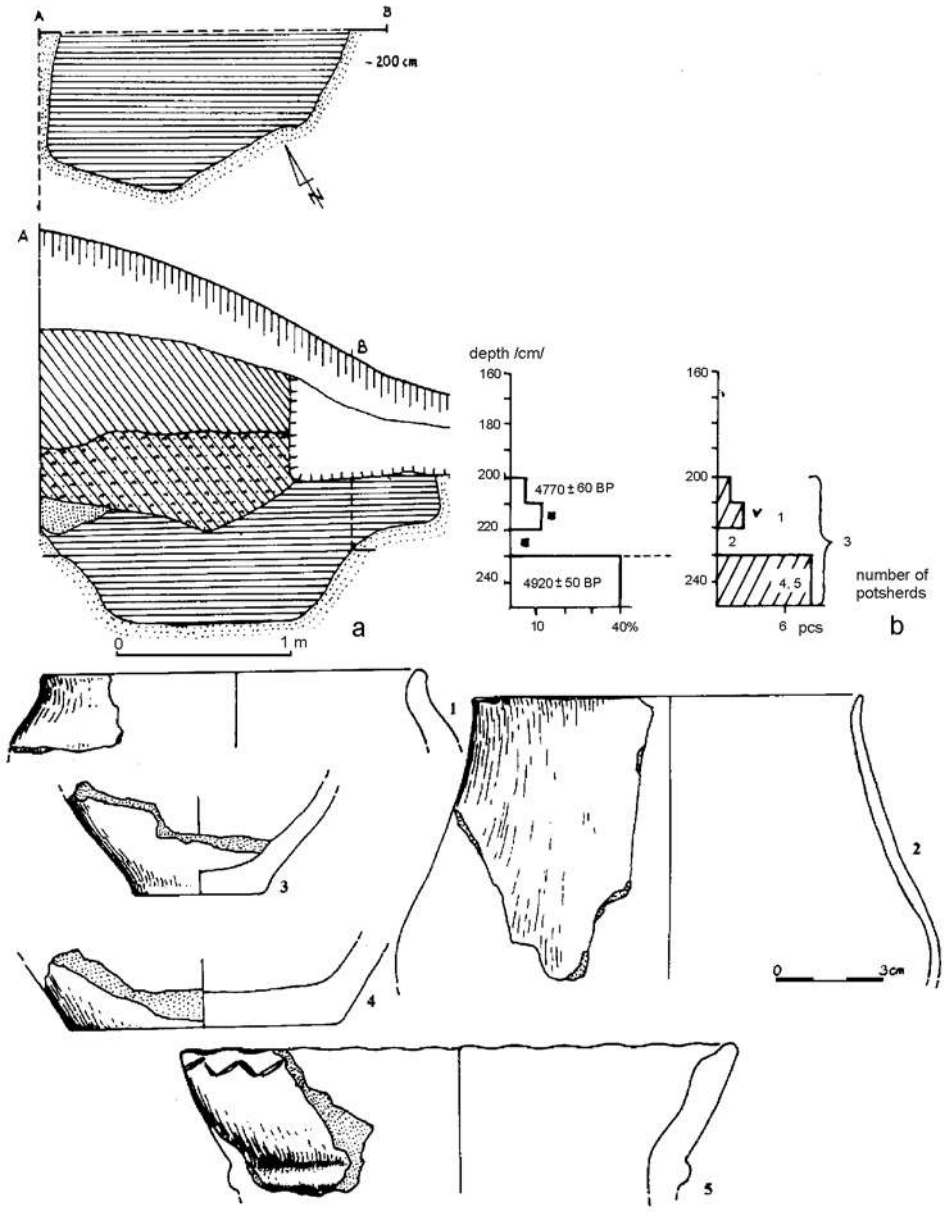

Fig. 7. Defenced settlement in Zimne. Feature No. 30/97. Layout at the depth of 2.00 metres and a vertical cross-section along the A-B cut; 1-3 - potsherds of the Lublin-Volhynia culture; 4, 5 - potsherds of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

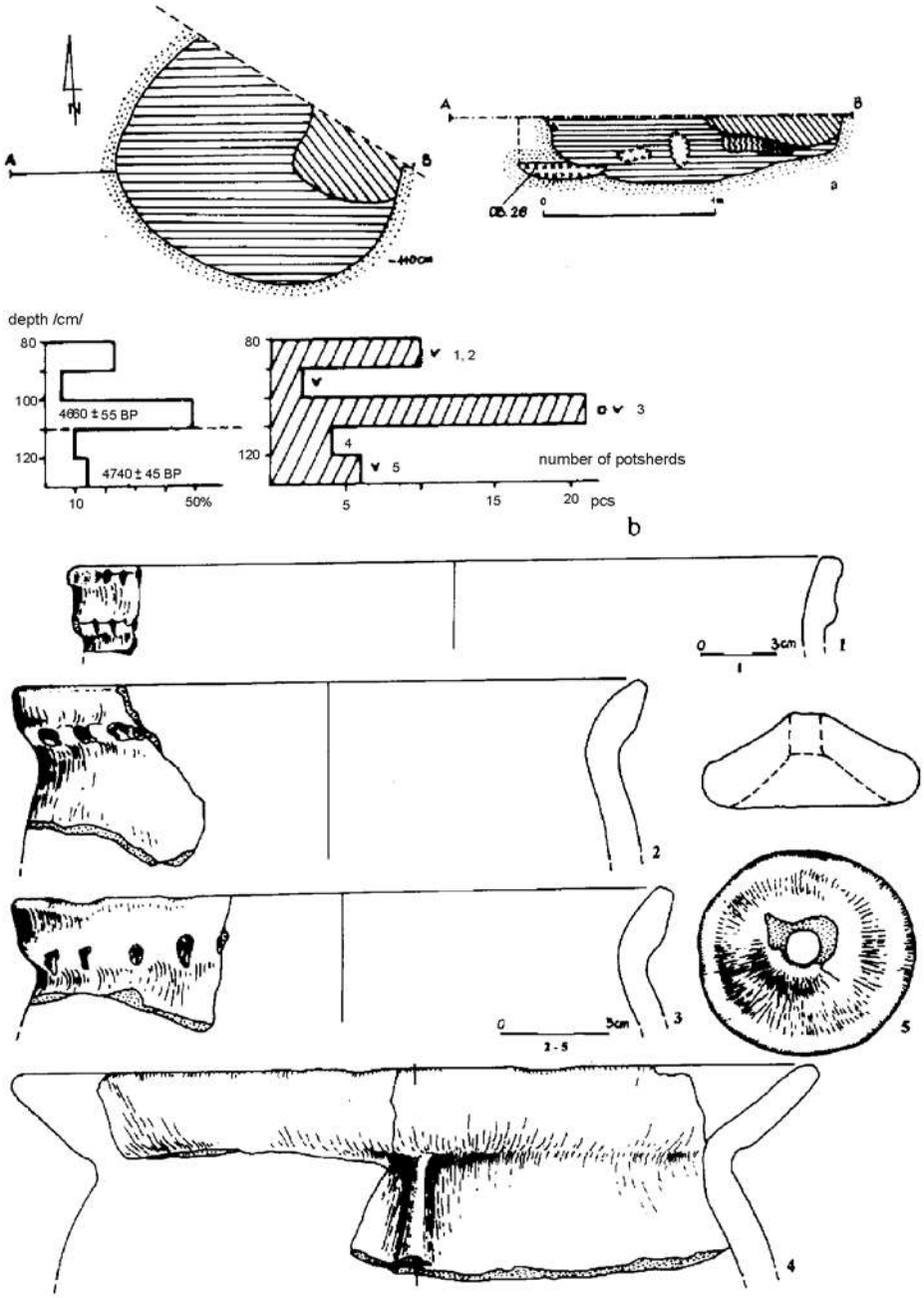

Fig. 8. Defenced settlement in Zimne. Feature No. 8/97. Layout at the depth of 1.40 metres and a vertical cross-section along the A-B cut; 1-5 - potsherds and a spindle whorl of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

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].

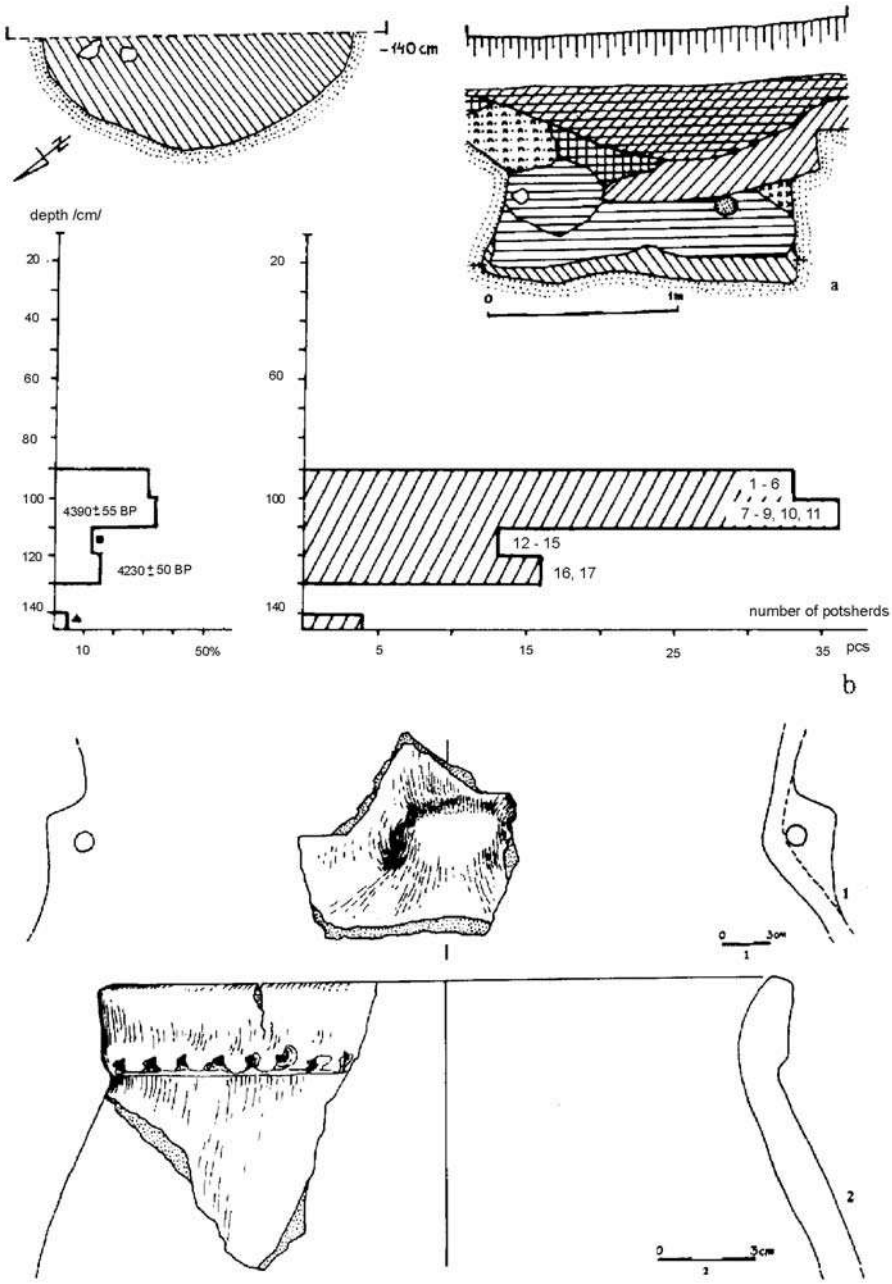

Fig. 9. Defenced settlement in Zimne. Feature No. 2/97. Layout at the depth of 1.10 metres and a vertical cross-section along the profile cut; 1-2 - potsherds of the Funnel Beaker culture. Key - see Fig. 5. Drawings by A. Bronicka

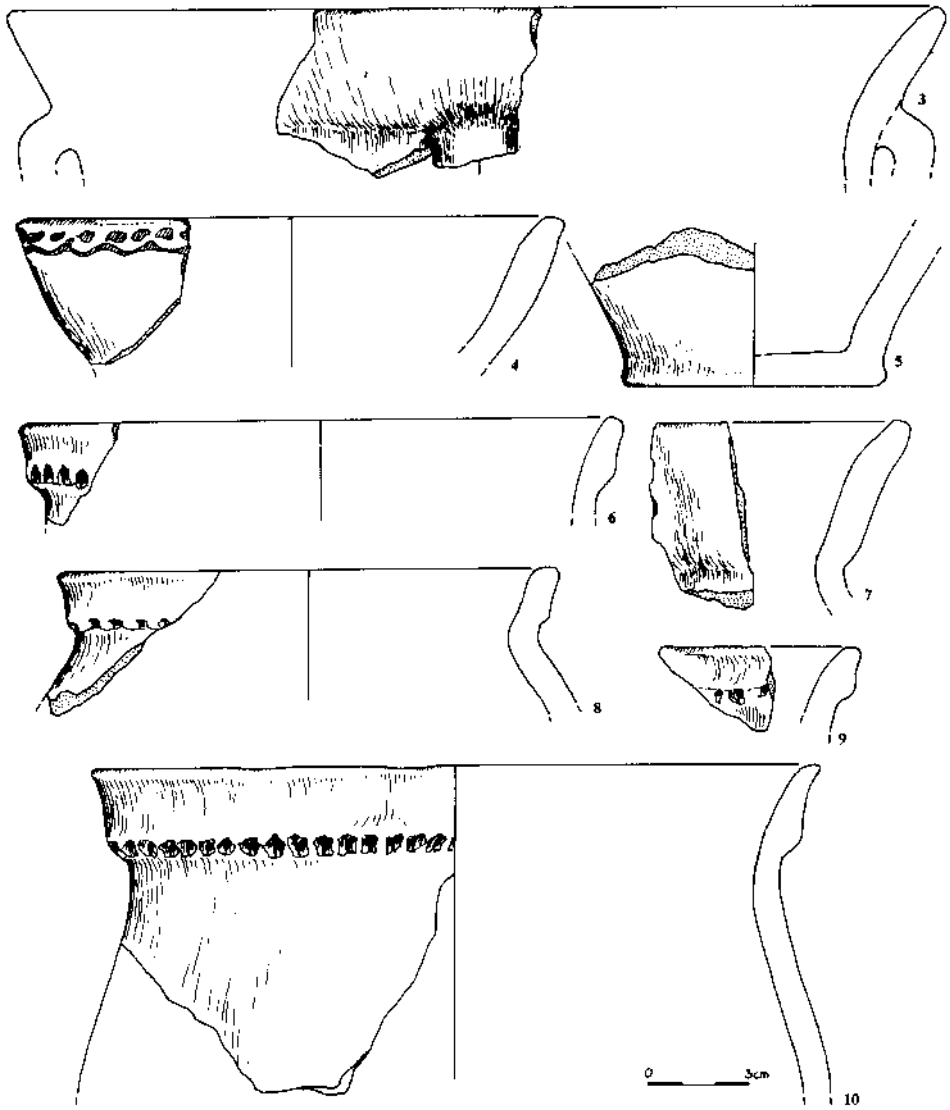

Fig. 10. Defenced settlement in Zimne. Feature No. 2/97, continued. 3-10 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

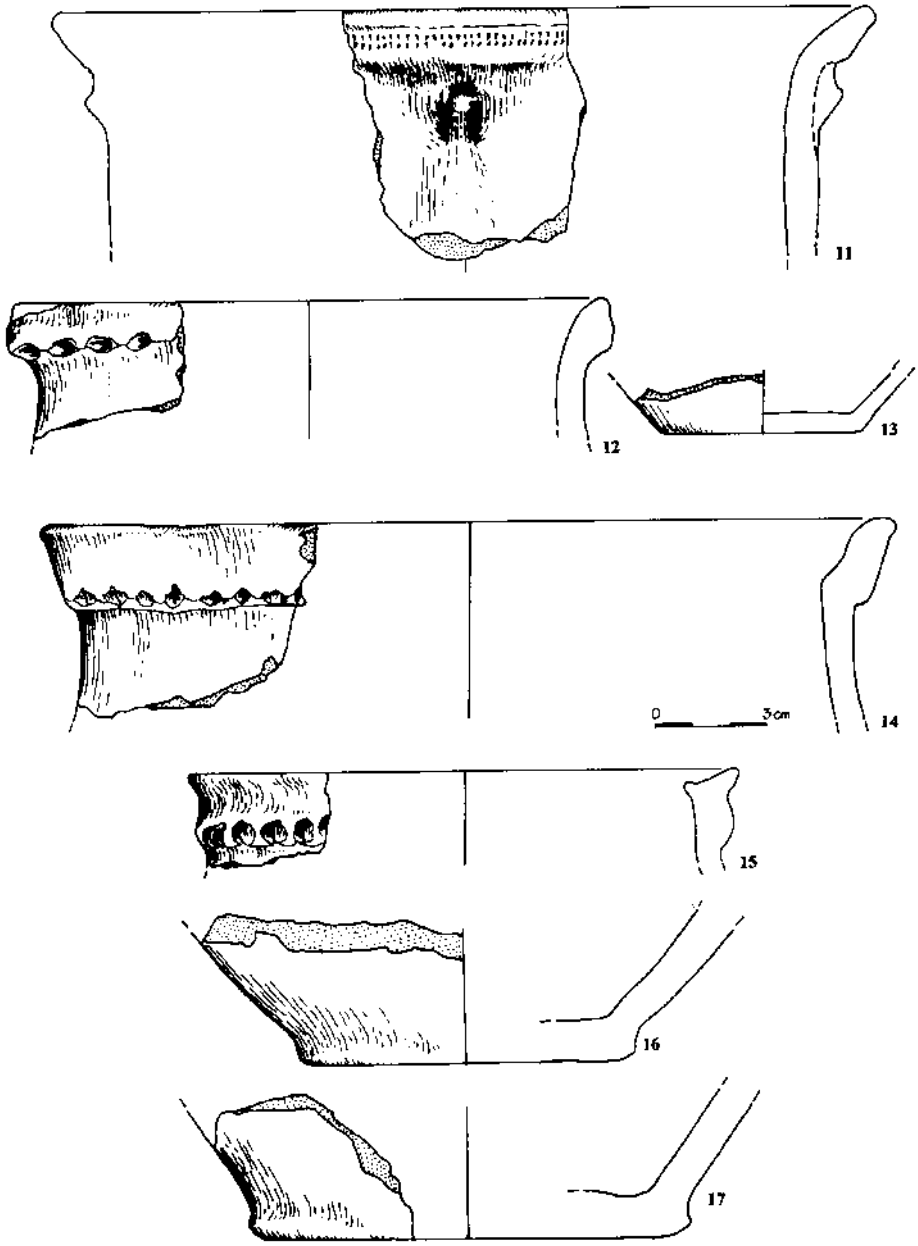

Fig. 11. Defenced settlement in Zimne. Feature No. 2/97, continued. 11-17 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

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 meters (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.

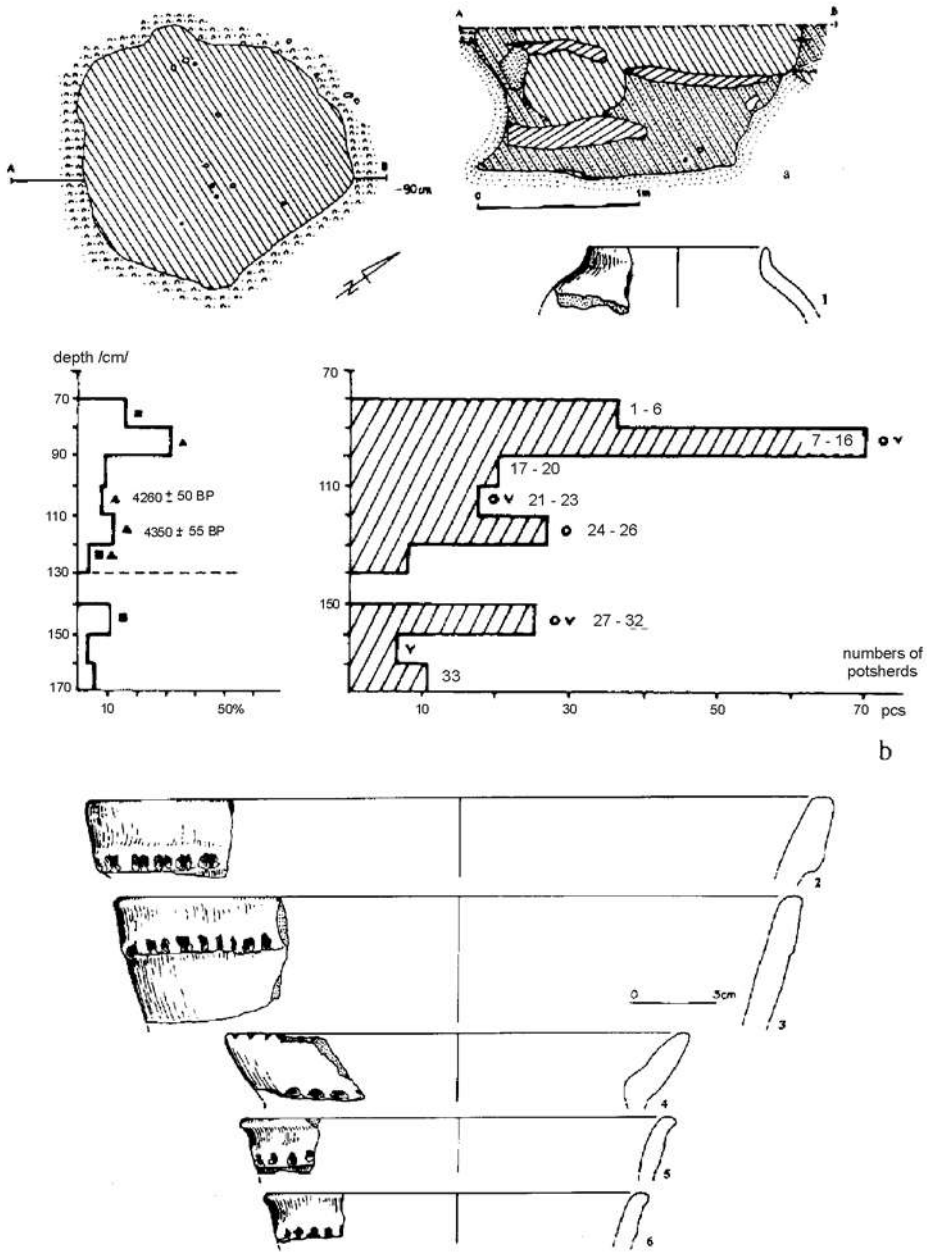

Fig. 12. Defenced settlement in Zimne. Feature No. 5/97. Layout at the depth of 0.90 metre and a vertical cross-section along the A-B cut; 1 - potsherd of the Lublin-Volhynia culture; 2-6 - potsherds of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

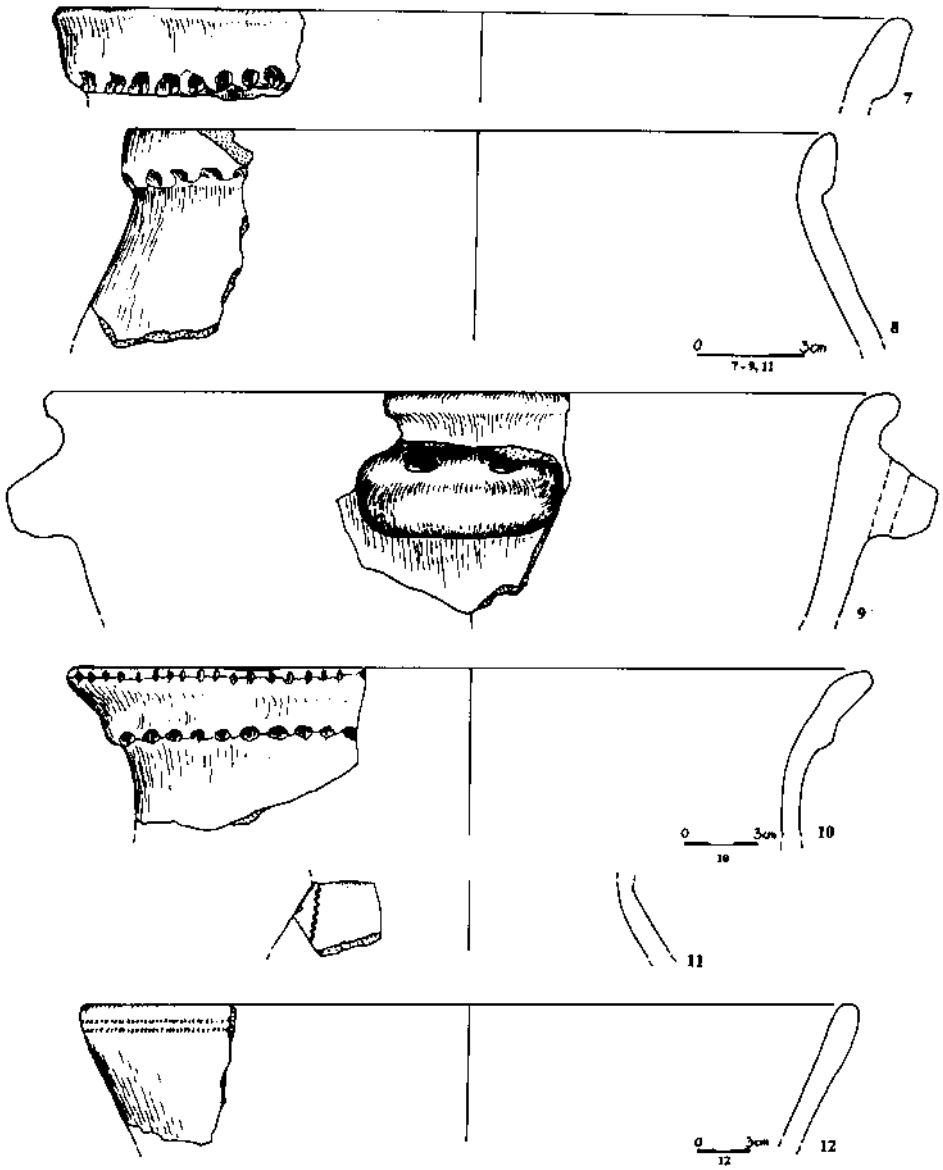

Fig. 13. Defenced settlement in Zimne. Feature No. 5/97, continued. 7-12 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

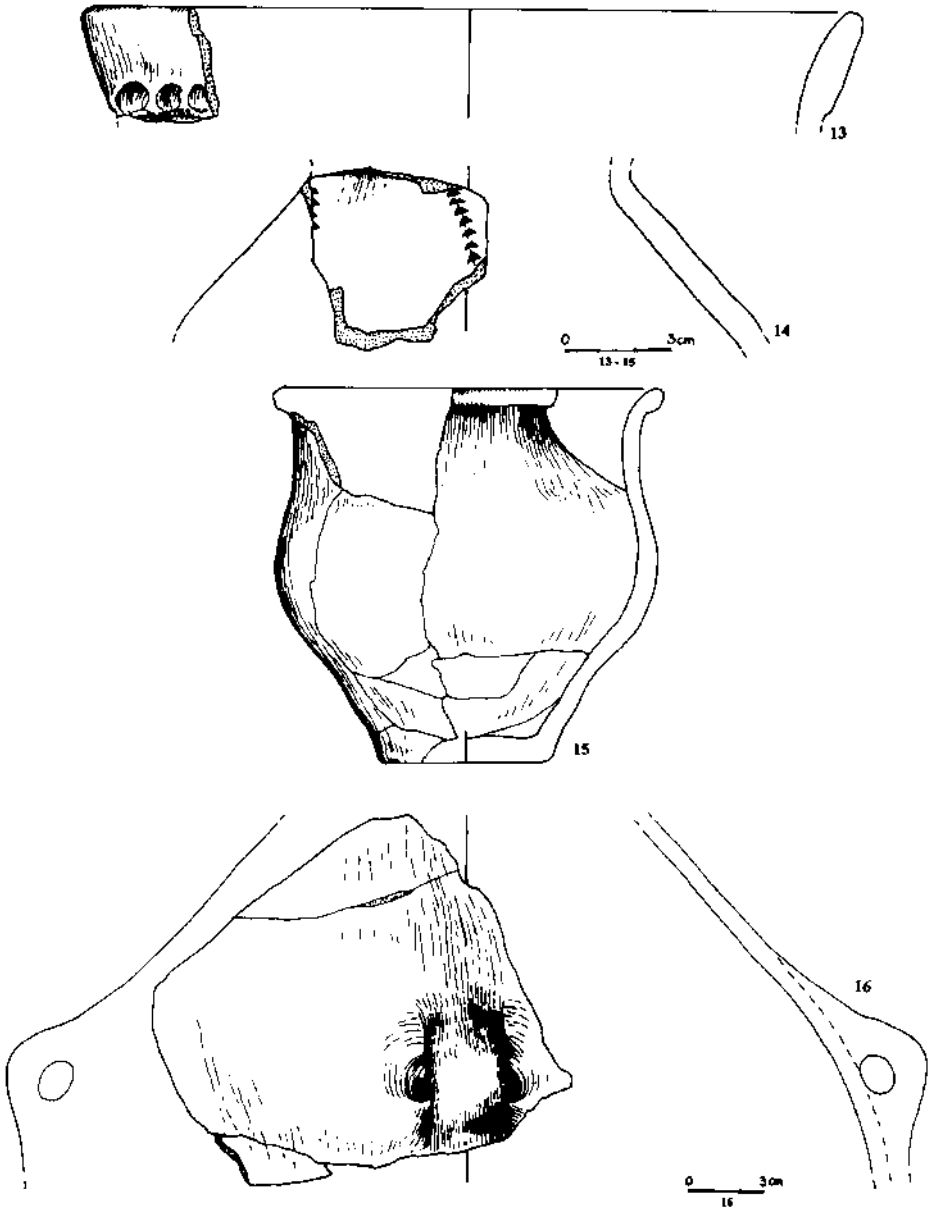

Fig. 14. Defenced settlement in Zimne. Feature No. 5/97, continued. 13-16 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

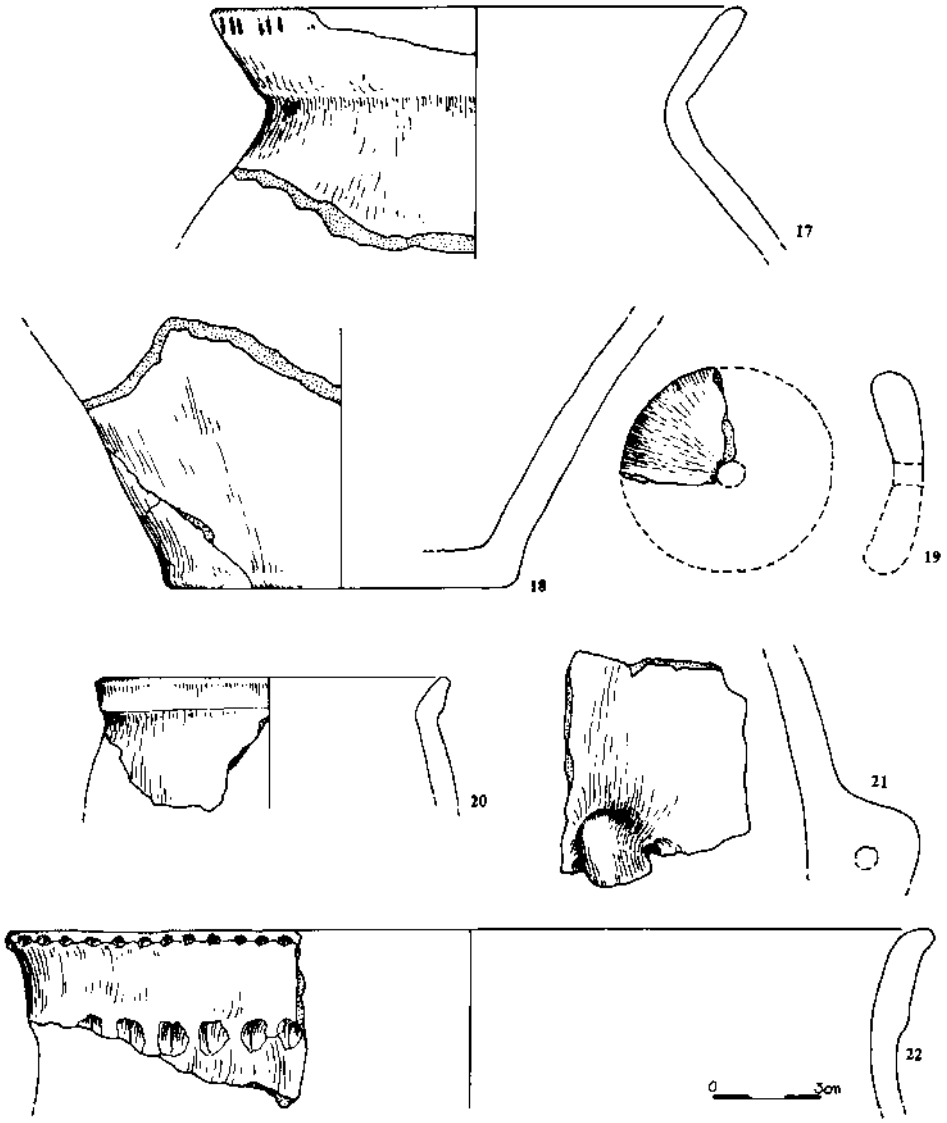

Fig. 15. Defenced settlement in Zimne. Feature No. 5/97, continued. 17-22 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

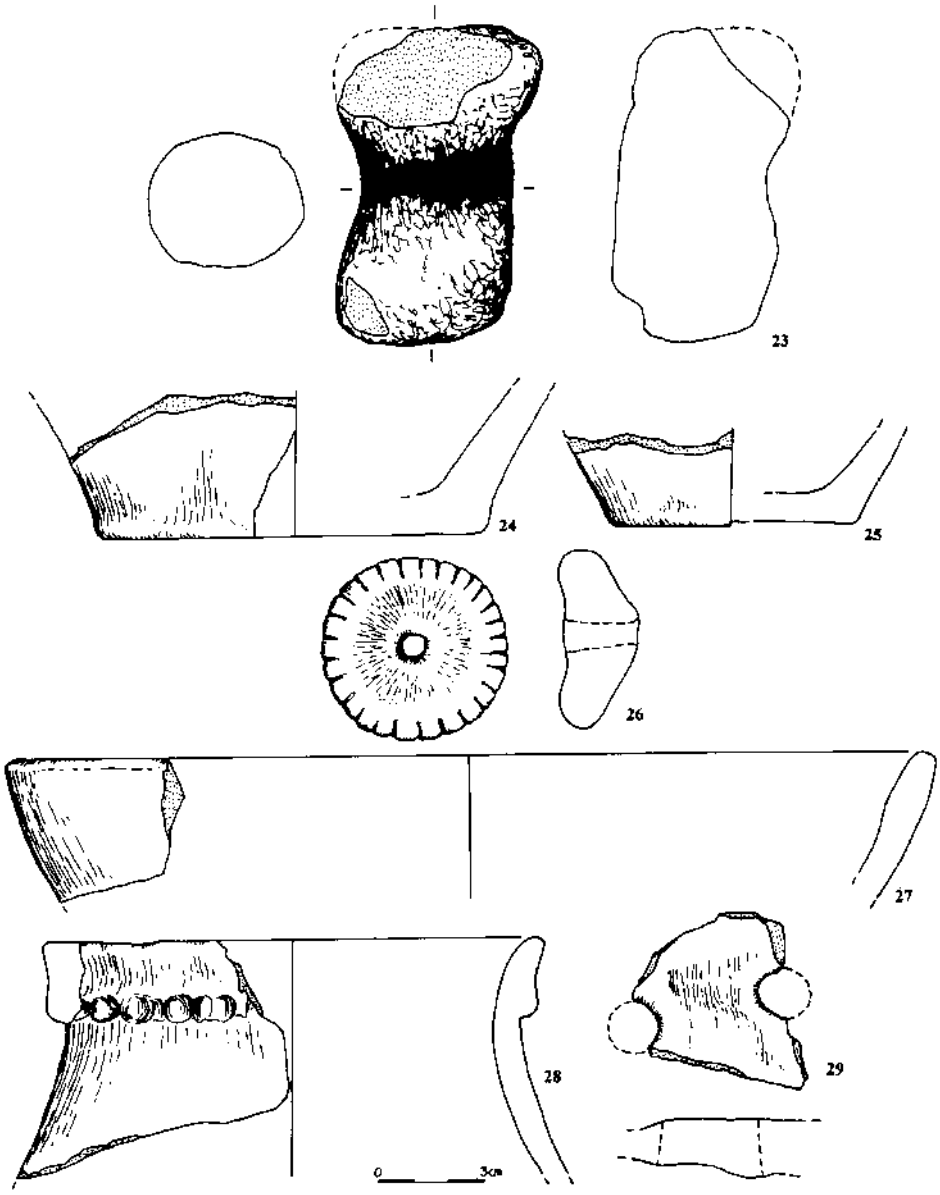

Fig. 16. Defenced settlement in Zimne. Feature No. 5/97, continued. 23 - figure-of-eight-shaped weaving weight; 24-29 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

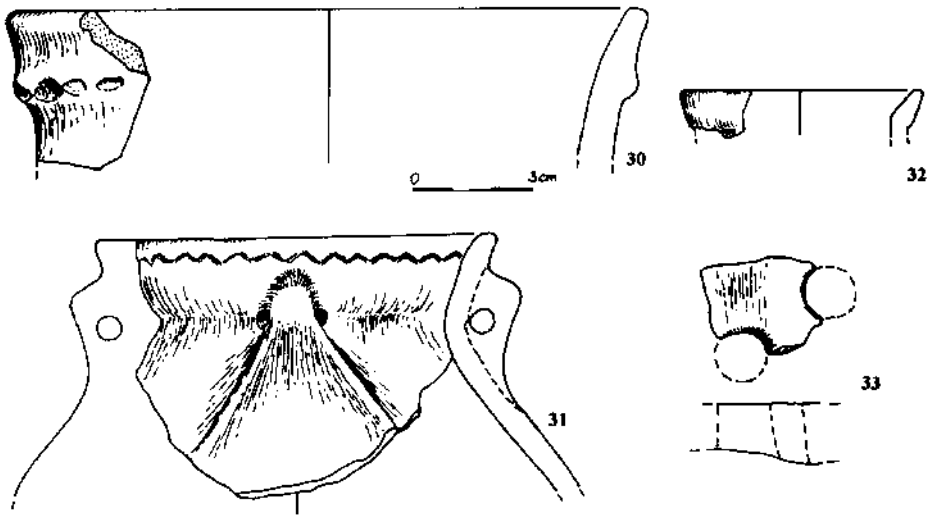

Fig. 17. Defenced settlement in Zimne. Feature No. 5/97, continued. 30-33 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

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

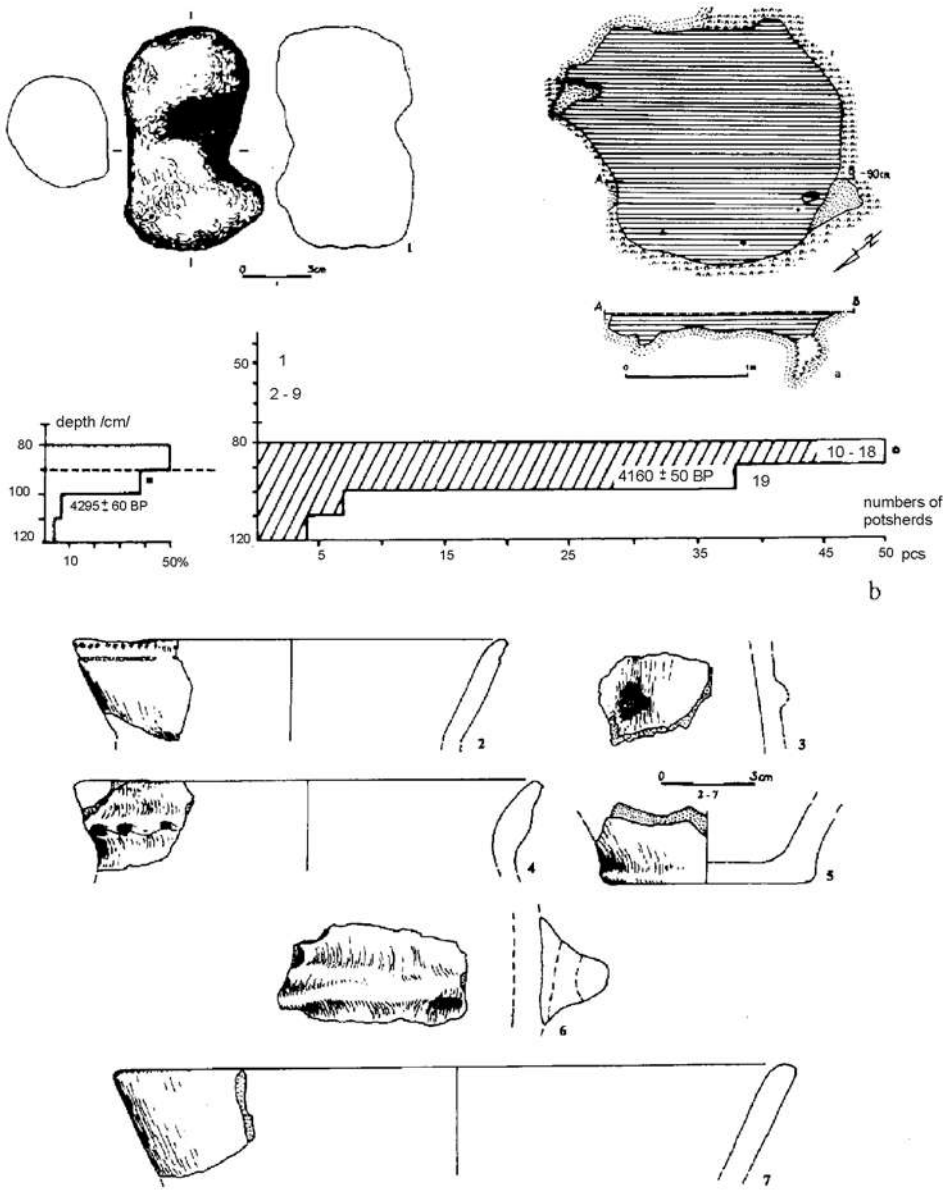

Fig. 18. Defenced settlement in Zimne. Feature No. 3/97. Layout at the depth of 0.90 metre and a vertical cross-section along the A-B cut; 1 - figure-of-eight-shaped weaving weight; 2-7 - potsherds of the Funnel Beaker culture. Key — see Fig. 5. Drawings by A. Bronicka

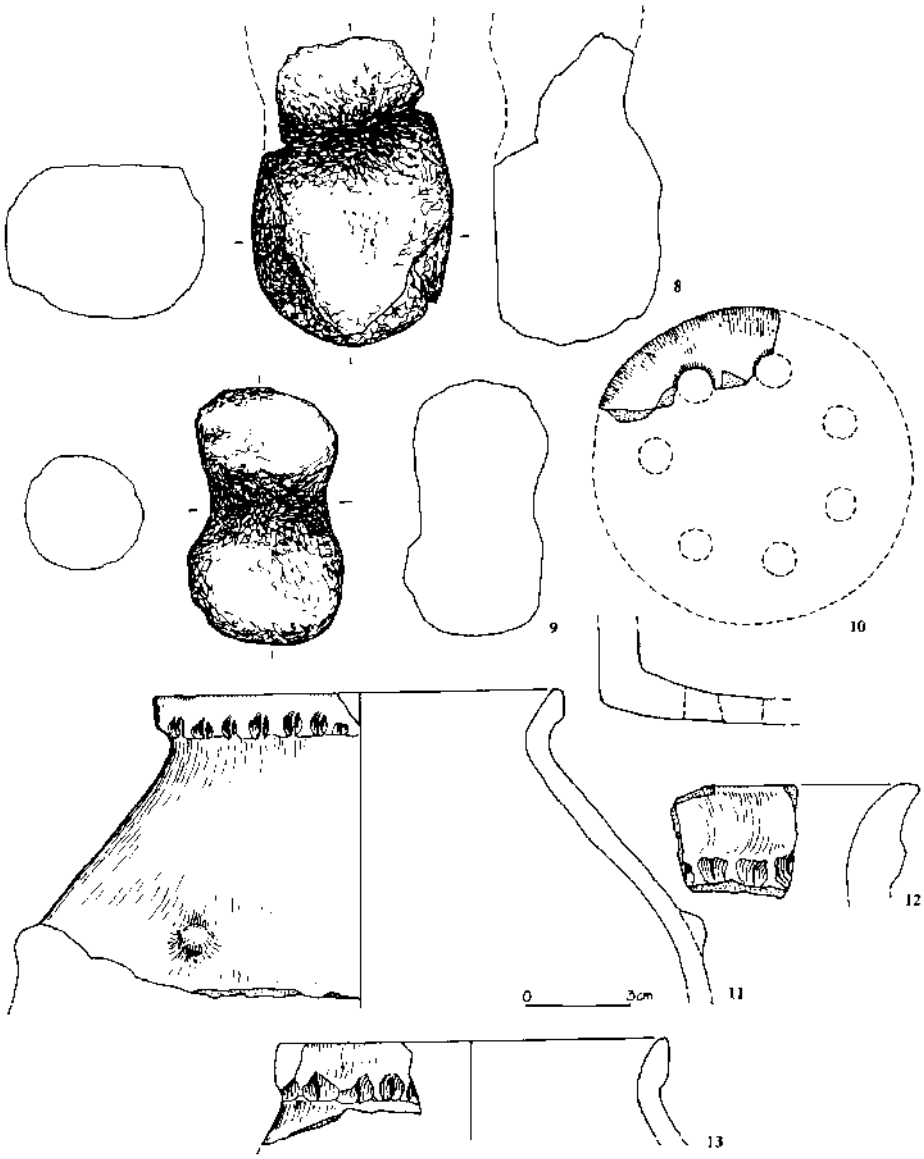

Fig. 19. Defenced settlement in Zimne. Feature No. 3/97, continued. 8, 9 - weaving weights; 10-13 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

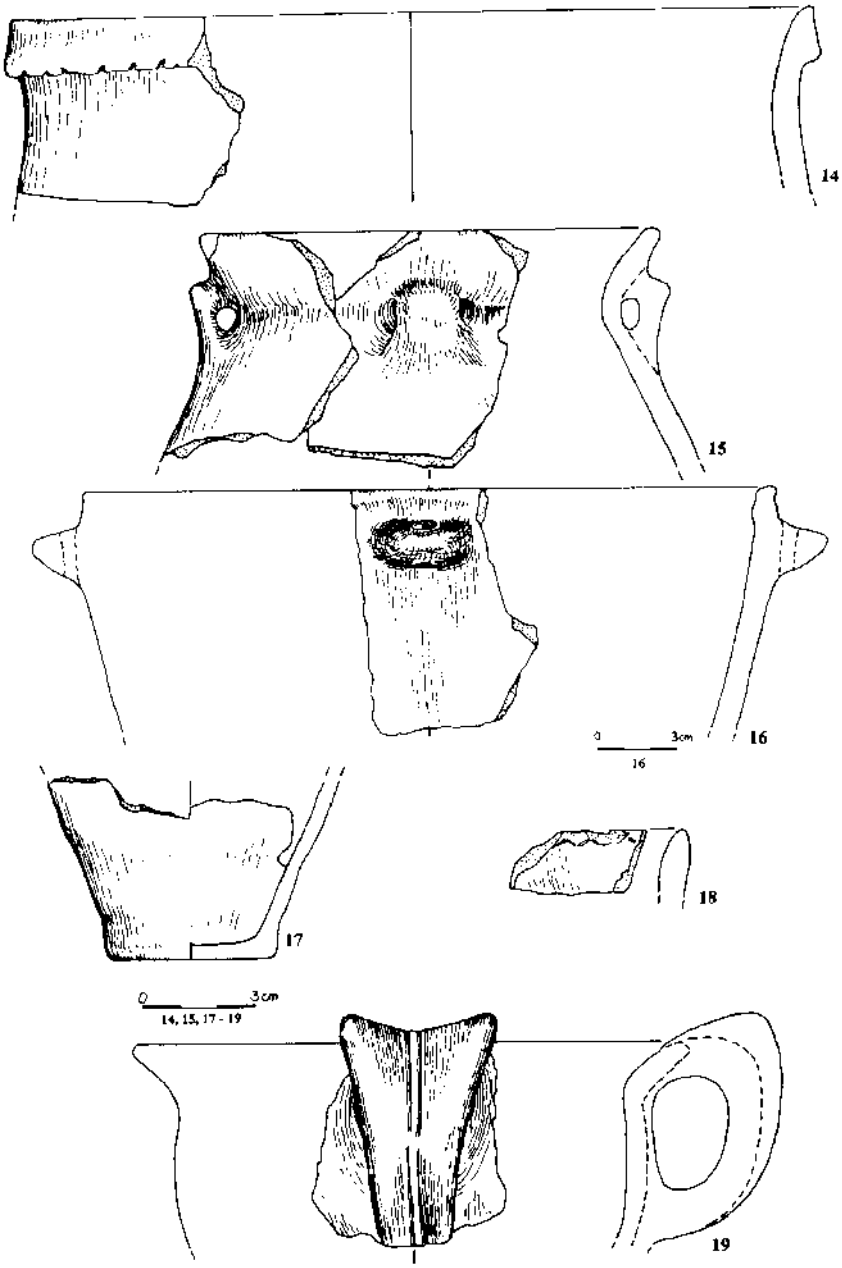

Fig. 20. Defenced settlement in Zimne. Feature No. 3/97, continued. 14-19 - potsherds of the Funnel Beaker culture. Drawings by A. Bronicka

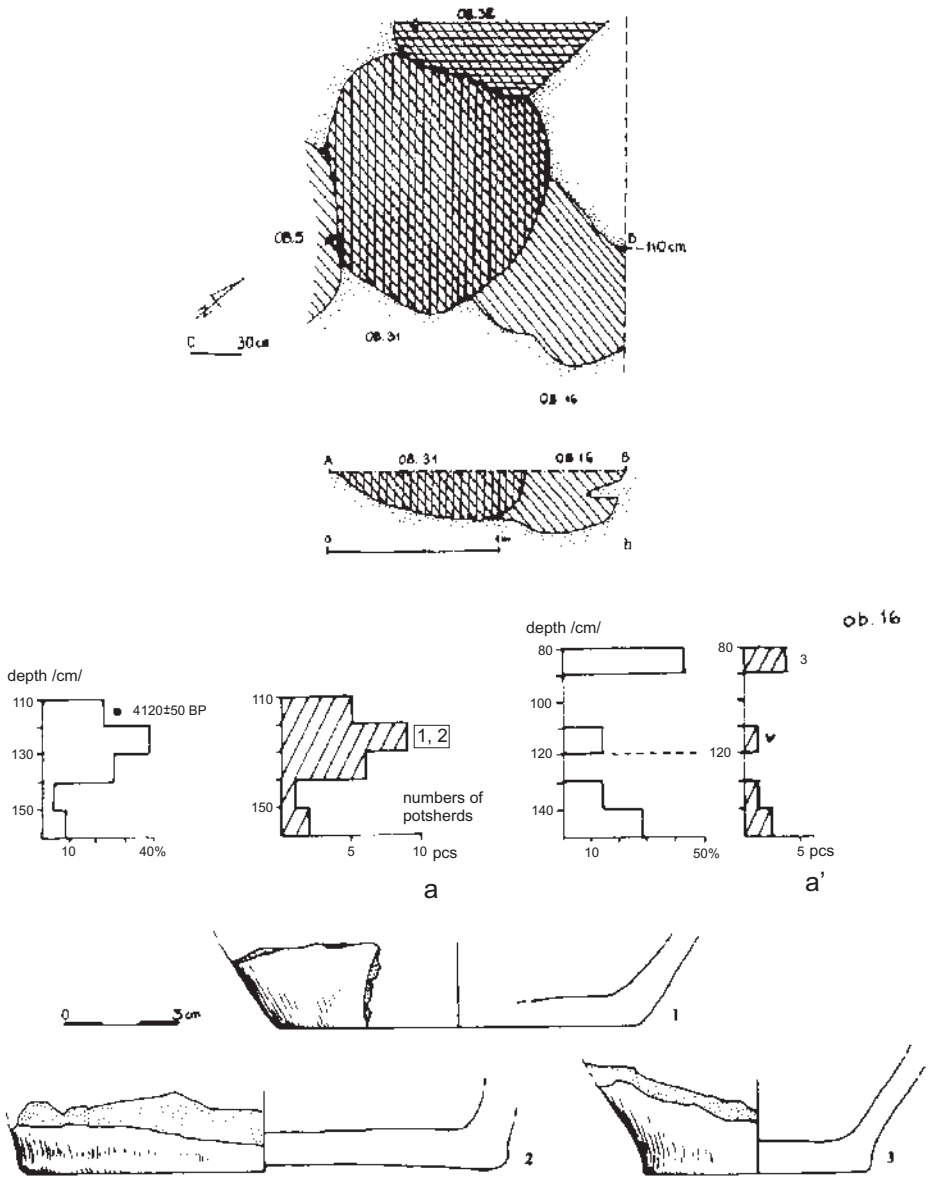

Fig. 21. Defenced settlement in Zimne. Features No. 16/97 and 31/97. Layout at the depth of 1.10 metre and a vertical cross-section along the A-B cut; 1-3 - potsherds of the Funnel Beaker culture (1, 2 - potsherds from pit 31/97; 3 - potsherds from pit 16). Key — see Fig. 5. Drawings by A. Bronicka

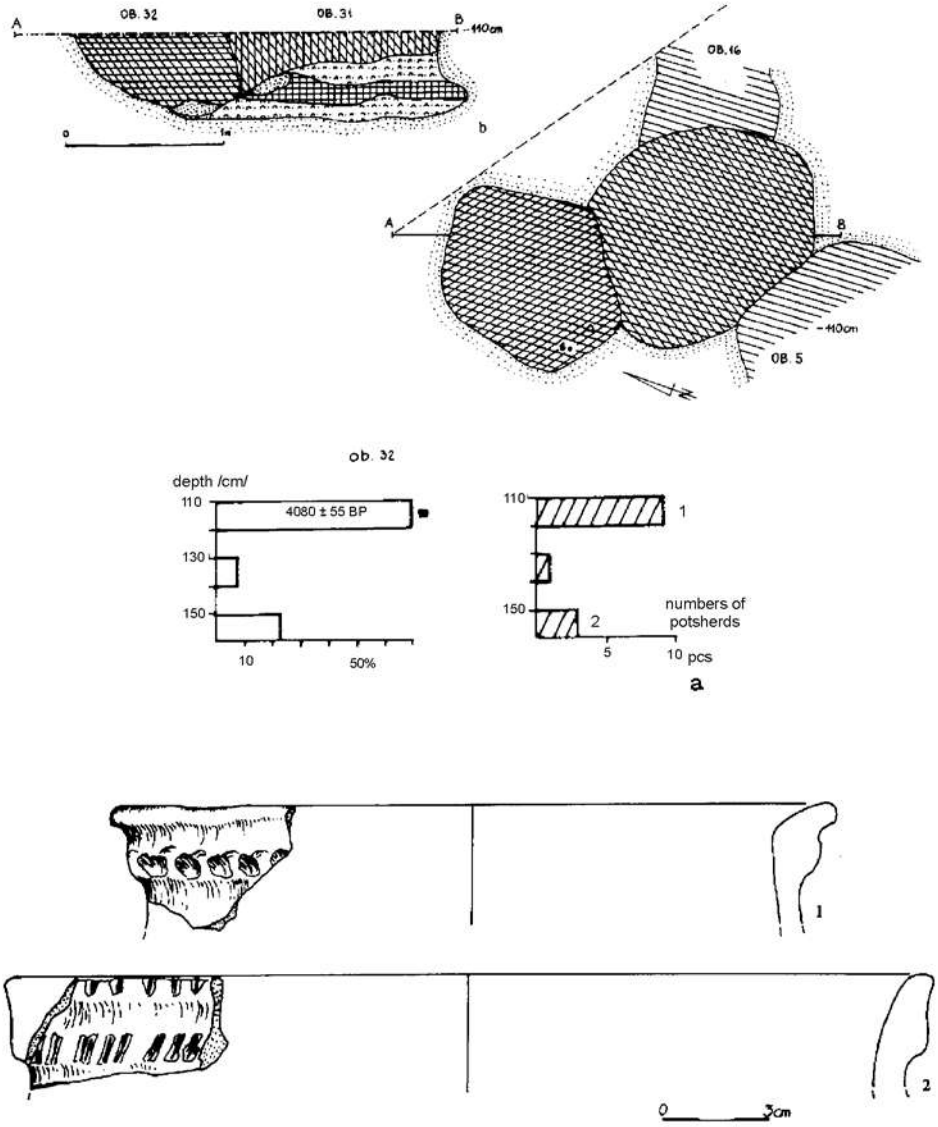

Fig. 22. Defenced settlement in Zimne. Features No. 31/97 and 32/97. Layout at the depth of 1.10 metre and a vertical cross-section along the A-B cut; 1, 2 - potsherds of the Funnel Beaker culture from pit 32/97. Key — see Fig. 5. Drawings by A. Bronicka

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

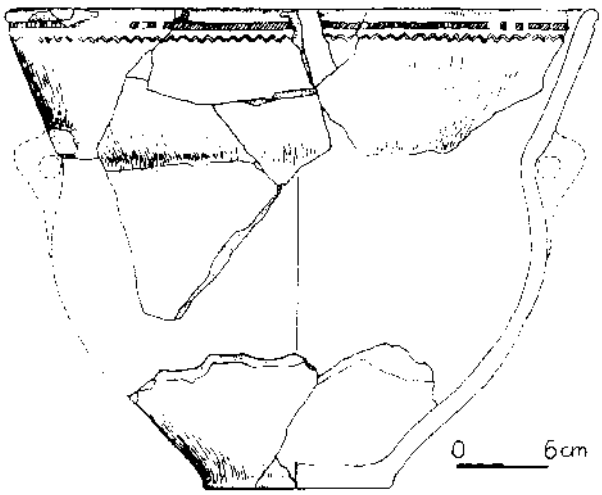

Fig. 23. Defenced settlement in Zimne. Potsherds of one vessel that appeared in the debris filing three pits: 5/97 (at the depth of: 0.7-0.8; 0.8-0.9; 1.1-1.2; 1.2-1.3; 1.4-1.5; 1.5-1.6 meters), 16/97 (at the depth of: 1.0-1.1 meters) and 31/97 (at the depth of: 1.1-1.2; 1.2-1.3; 1.4-1.5). Drawings by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

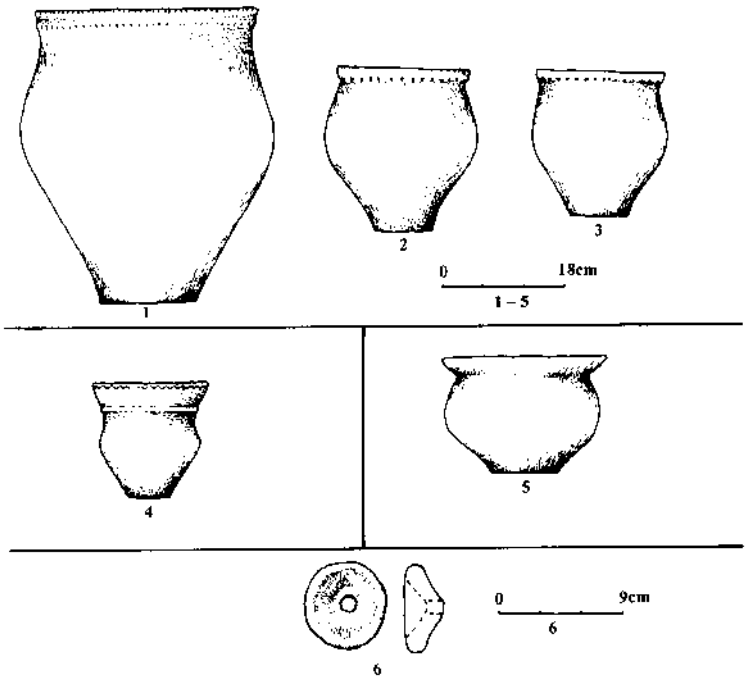

Fig. 24. Defenced settlement in Zimne. Reconstructed vessel forms and a plano-convex spindle whorl of the Zimne I phase. 1-3 - bag-shaped vessels; 4 - funnel beaker; 5 - vase; 6 - spindle whorl. Drawings by E. Hander

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).

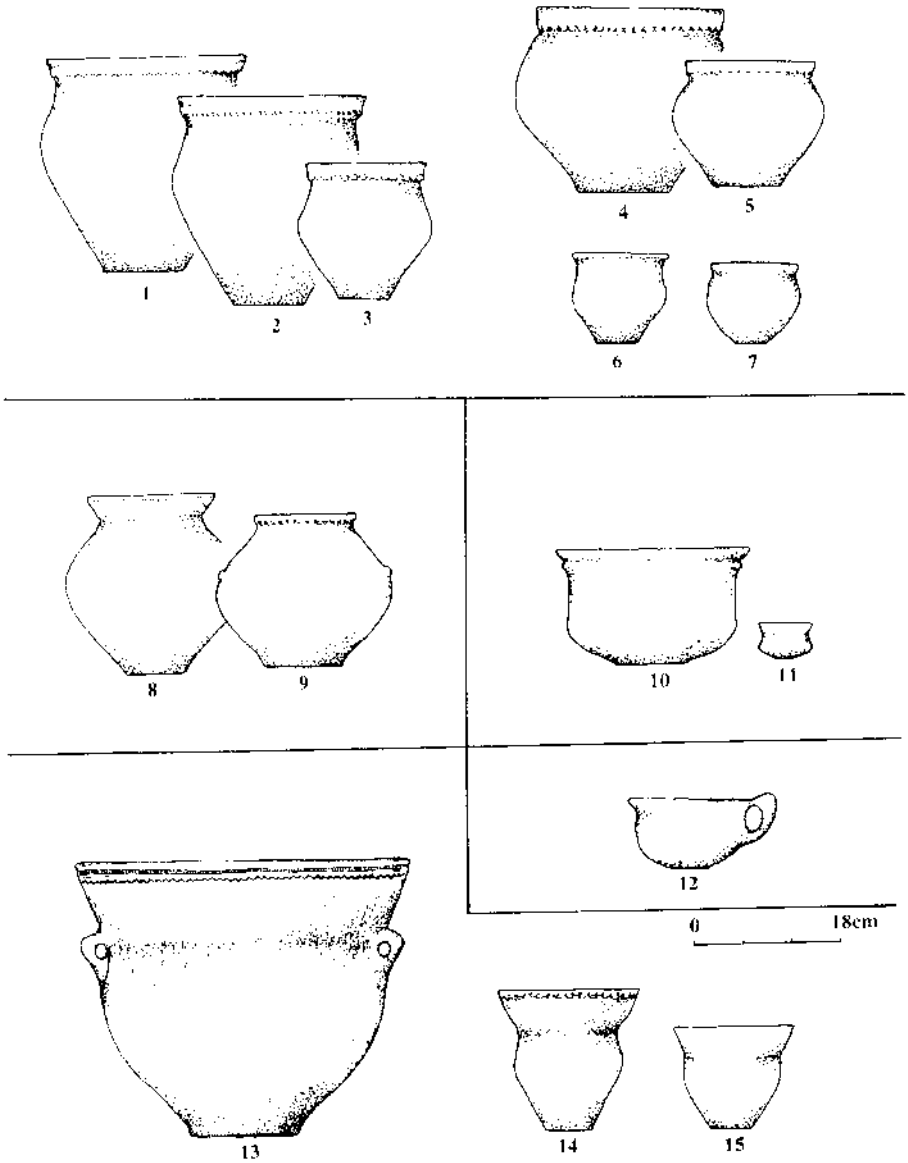

Fig. 25. Defenced settlement in Zimne. Reconstructed vessel forms, spindle whorls and weaving weights of the Zimne II phase. 1-7 - bag-shaped vessels; 8, 9 - bulging pots; 10, 11 - vases; 12 - cup with *ansa lunata* handle; 13-15 - funnel beakers. Drawings by E. Hander

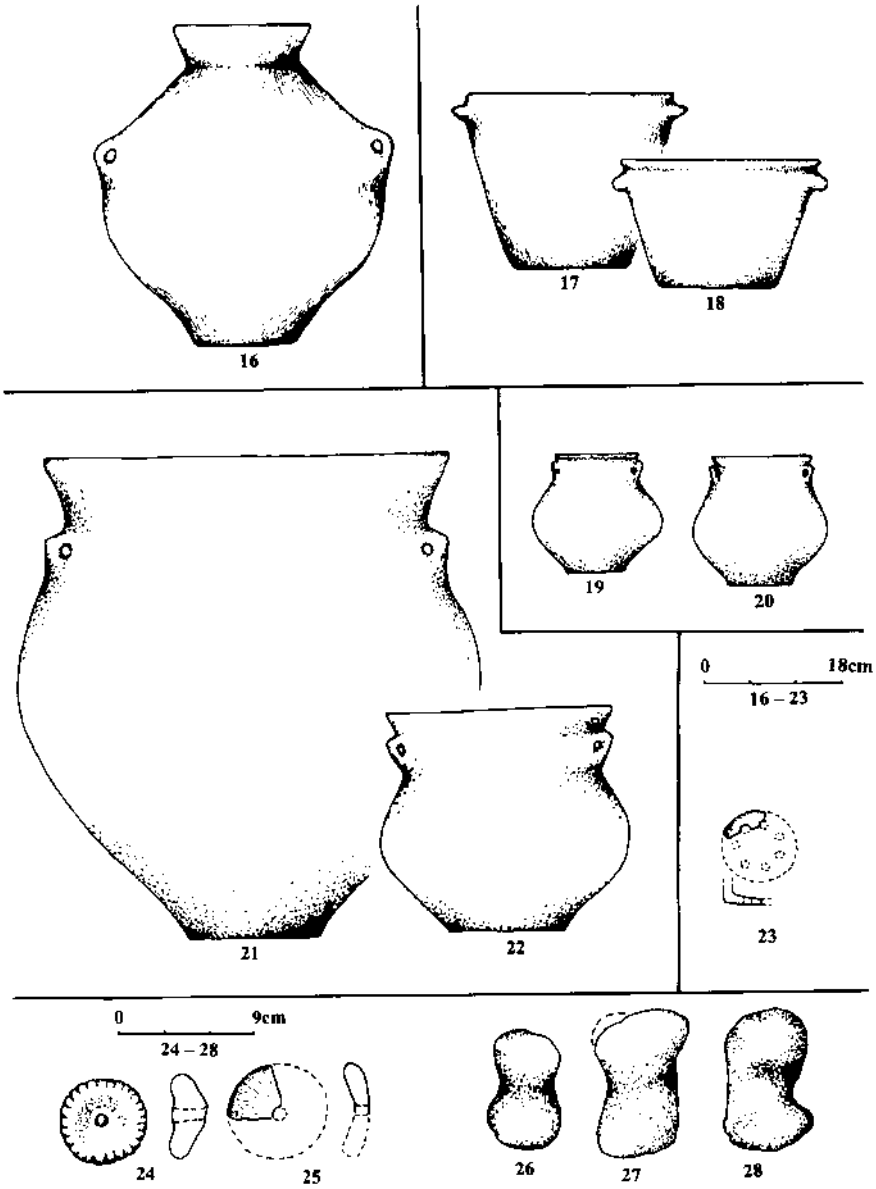

Fig. 26. Defenced settlement in Zimne. Reconstructed vessel forms, spindle whorls and weaving weights of the Zimne II phase, continued. 16 - amphora with handles affixed at the point of the greatest protrusion of the belly, 17, 18 - mortar-shaped vessels; 19, 20 - small-sized amphorae (19 - amphorae 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 ^{14}C 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. Peleshchyshyn, 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 Horodiştea group and both

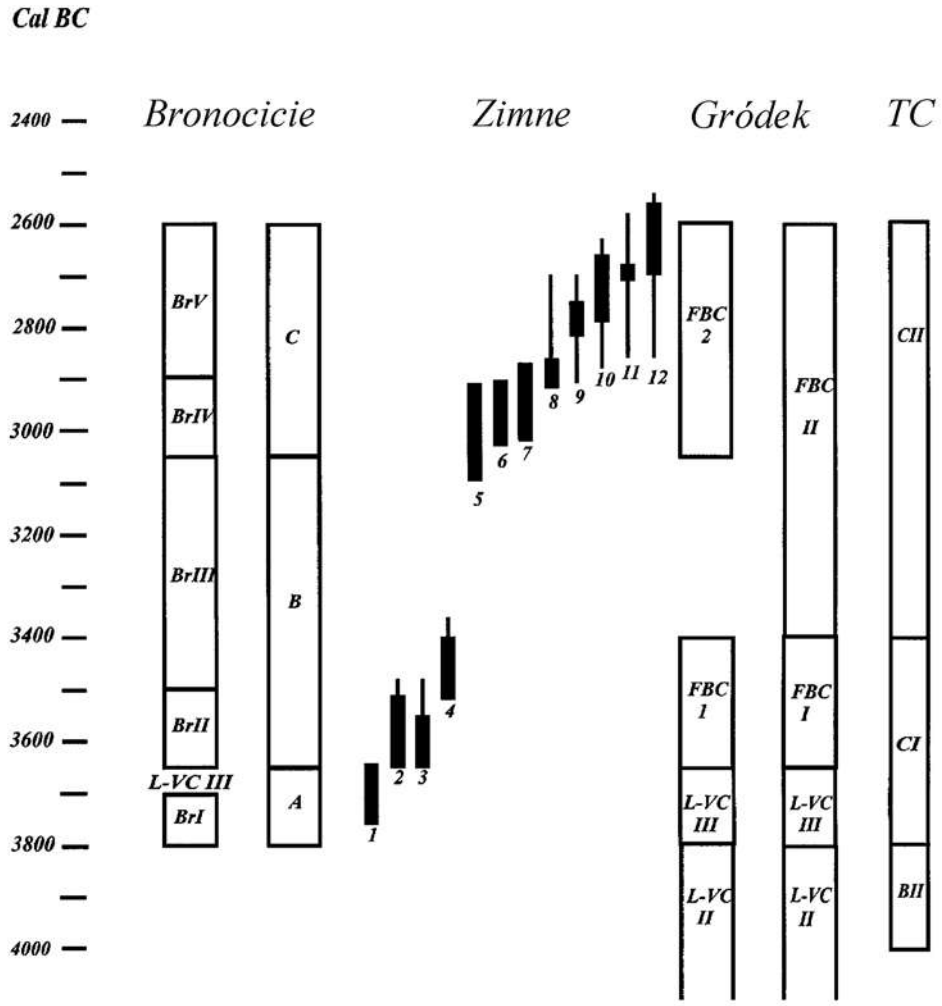

Fig. 27. Chronology of settlement phases in Zimne in light of contemporary cultural phenomena in Małopolska and west Ukraine. Partly on the basis of Jastrzębski 1991; Kadrow, Zakościelna 2000. Br - Bronocice, LVC - Lublin-Volhynia culture, FBC - Funnel Beaker culture, TC - Tripolye culture, A - medium 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

Baltic-Pontic Studies
vol. 12: 2003, 67-81
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE MĄTWY GROUP OF THE FUNNEL BEAKER CULTURE. THE QUESTION OF CHRONOLOGICAL AND CULTURAL POSITION OF "LINEAR-COMB POTTERY"

The Mątwy Group (MG) was distinguished within the Eastern Group (EG) of the Funnel Beaker culture (FBC) on the basis of the presence of exogenous elements — generally of eastern European origin (from the area where forest-steppe and forest zones met), identified as the so-called Mątwy Cultural Component (MCC) — in the upper Noteć River part of the FBC range in 1981 [Kośko 1981; 1988b:94ff]. The MCC takes its name from eponymous sites 1 and 5 at Inowrocław-Mątwy, Kujawy-Pomerania Province, Inowrocław District (Kujawy Upland; Fig. 1).

The MCC is made up of (a) technological and stylistic traits of pottery and (b) traits not related to ceramic vessels, namely, technologies and product forms [cf. Kośko 1988b:94ff]. In (a) one can distinguish seven trait complexes of pottery: (aa) painted, (ab) corded, (ac) linear-comb ("skein comb"), (ad) "carpet-furrow", (ae) "carpet-incised/impressed", (af) incidental ornamentation (e.g. zoomorphic motifs).

In the MCC's development, three phases were distinguished (states of co-occurrence of the above-named traits "a" and "b"). These are: an early phase (phases IIIA/IIIB — IIIB of the FBC), a classical phase (phases IIIB/IIIC — III-IVA of the FBC) and a late phase (IIIC-IVA/IVB - IVB/VA of the FBC). The MG was mainly associated with the classical phase, i.e. with the domination of the complex of "ac" traits in the MCC (in terms of chronology and space as well) [Kośko 1988b:106ff].

In the conception of the development of the MG, a special role is played by chronology, specifically by the comparative chronology — on the scale of borderland cultures developing between the west and east of Europe — of "the linear-comb pottery" that serves as a diagnostic segment for the MG.

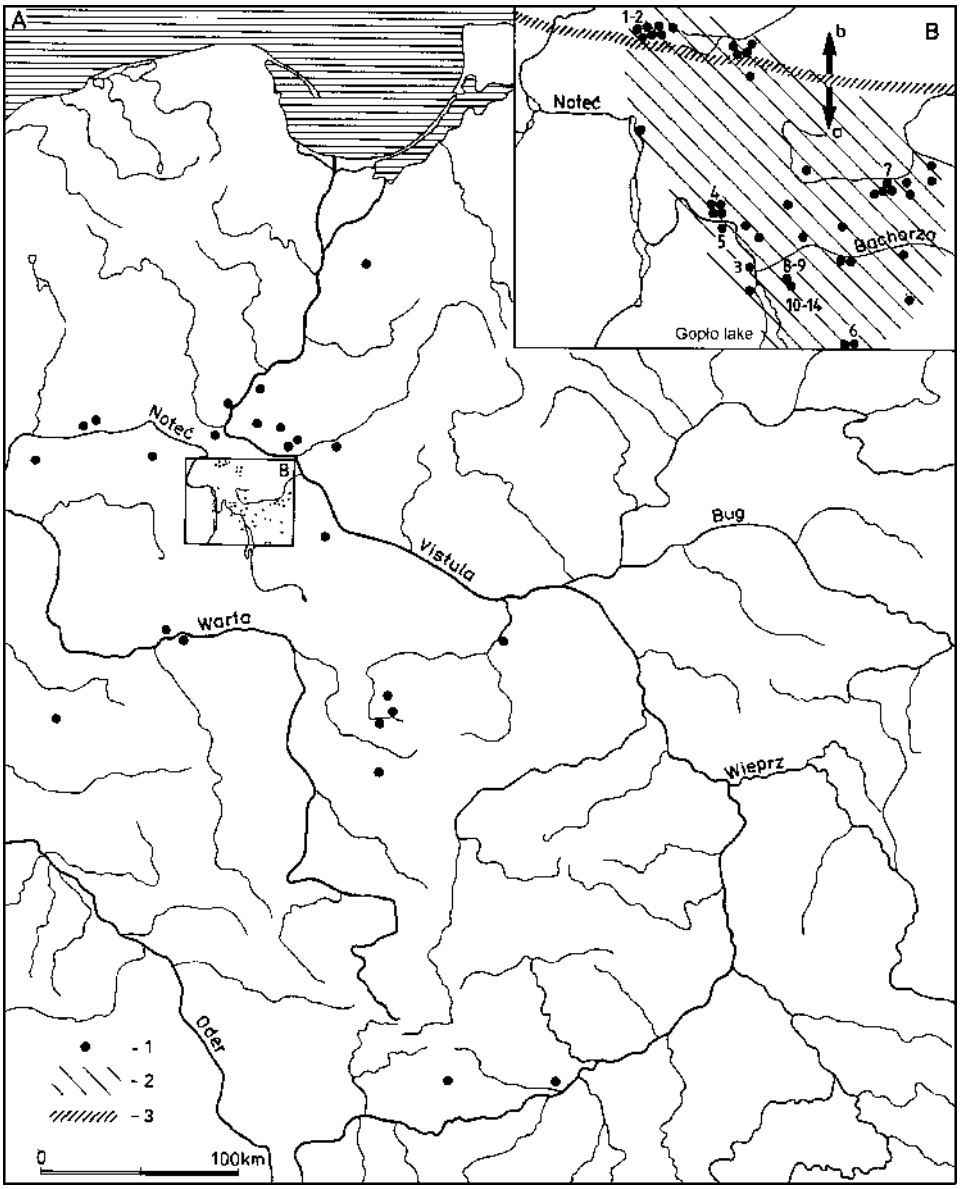

Fig. 1. "Linear-comb pottery" ranges (A) and the Mątwy Group of the Funnel Beaker culture (B). 1. FBC sites with a share of "Linear-comb pottery" (No 1-14: see Tab. 1-2); 2. Mątwy group range; 3. physiographic border between the Kujawy Uplands (a) and the Toruń-Bydgoszcz Basin (b). Following Kośko 1981

1. "LINEAR-COMB POTTERY"

A key diagnostic position in the MCC is occupied by the "ac" complex of "linear-comb pottery" [cf. Jażdżewski 1936:247 — "vessels with linear-comb ornamentation"] (Fig. 2). Part of the pottery of this type ("subset A" — having the greatest diagnostic value) shows the presence of:

- ornamentation (and not a smoothing-out of the surface! — which has to be stressed) made using a comb as a burin or incision tool;
- temper of large pieces of shells ("crushed");
- high smoothing-out or shining of the outer surface (frequent damages or pits are an effect of the destruction of the temper of crushed shells-washing-out of the carbonate-occurring after a vessel was deposited);
- signs of excellent firing mainly in a reducing atmosphere.

These technological traits were described in detail in a series of specialist physical, chemical and mineralogical studies conducted by M. Daszkiewicz and D. Prinke [Daszkiewicz, Prinke 2001]. What they show is a significant difference in raw materials between "typical" FBC pottery and "linear-comb pottery" (within the MG). Concluding, the two cited authors see a need for testing the following two hypotheses:

- both groups of FBC vessels differed as to their function [Kośko 1981:92-95], or
- "linear-comb pottery" belonged to another culture (which?) than FBC pottery [Daszkiewicz, Prinke 2001:128].

The technological and genetic distinctness of the "linear-comb pottery" — within the FBC — inspired serious discussions concerning, for instance, the provenance of the said phenomenon within broadly outlined limits of Eastern Europe [Kośko 1981; 1985; 1988a; 1988b; 1991; Jastrzębski 1984; Kukawka 1987; 1989; 1991; 2001; Rybicka 1995; 2001; Daszkiewicz, Prinke 2001]. The discussions concerned both a narrower issue of the provenance of the indicated complex of technological and stylistic traits as well as a broader one of the development of cultural interactions — encompassing all or a very significant part of the diagnostic traits of the MCC — in the borderland between the east and west of Europe in the 4th millennium BC.

2. RADIOCARBON CHRONOLOGY OF KUJAWY "LINEAR-COMB POTTERY"

At present, we have a set of fourteen ^{14}C dates associated with pottery displaying technological and stylistic traits (temper of crushed shells + linear-comb ornaments) and only technological ones (temper of crushed shells) characteristic of

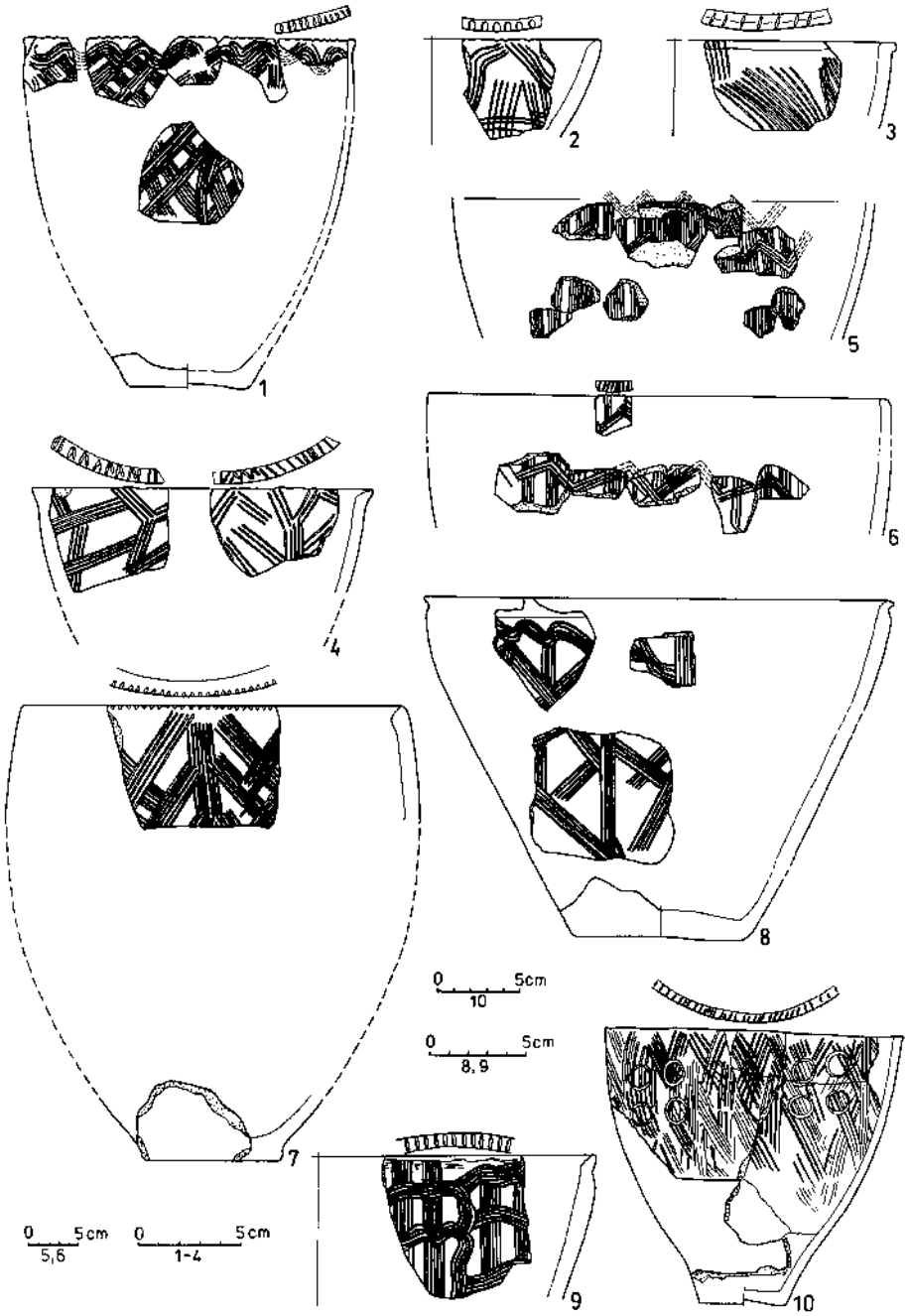

Fig. 2. "Linear-comb pottery". 1-6 - Tarkowo Dolne, site 23; 7 - Piecki, site 1; 8-9 - Inowrocław-Mątwy site 1; 10 Inowrocław-Mątwy site 5. Following Kośko 1981; Daszkiewicz, Prinke 2001; Kośko, Przybył 2003

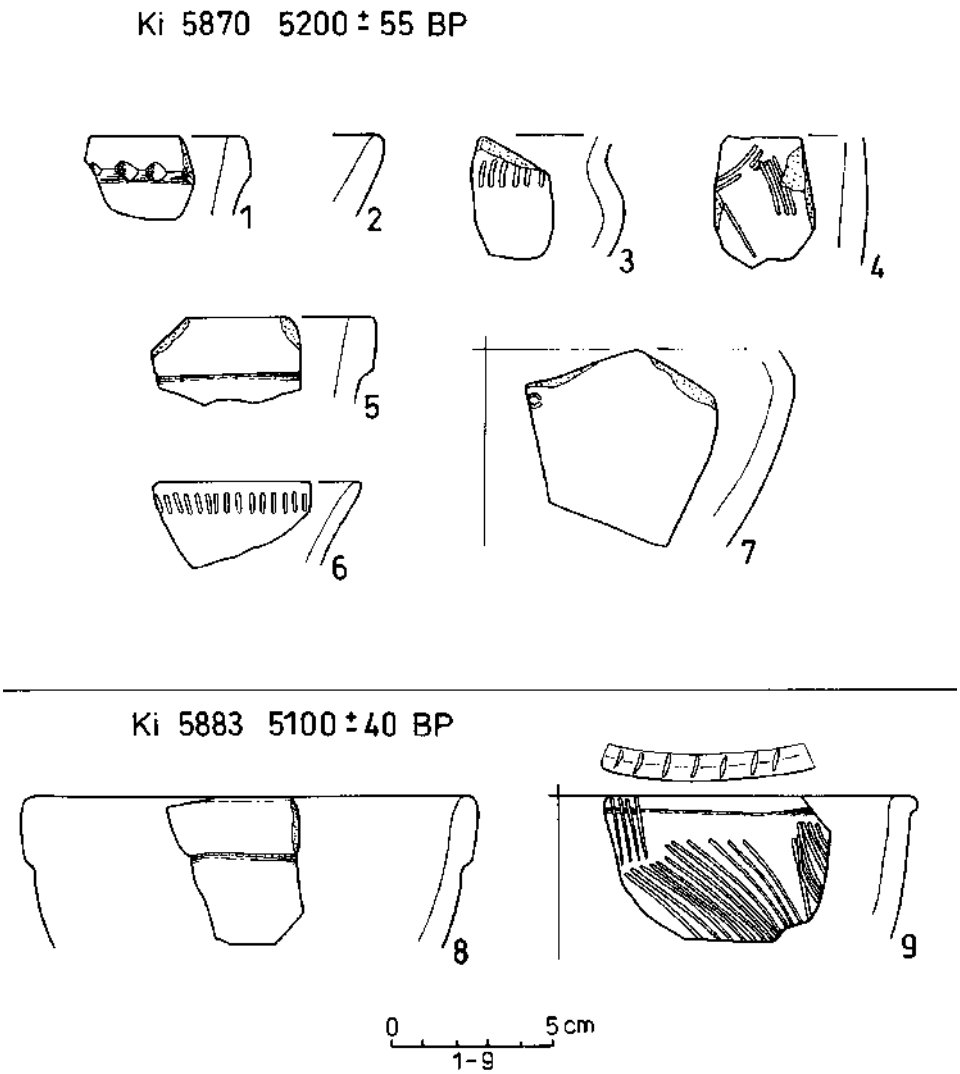

Fig. 3. Tarkowo Dolne, Kujawy-Pomerania Province, site 23. Pottery from features XXX III/1 (1-7) and IVA/5A (8-9) with "linear-comb" ornaments, ^{14}C dated. Following Daszkiewicz, Prinke 2001

the "ac" complex of the MCC. The set comprises (a) seven dates that have been published earlier (Table 1) and (b) seven new ones presented here for the first time (Table 2) [calibration: Weninger *et al.* 2002].

Table 1

Previous dates of Kujawy FBC pottery identified with the "ac" complex of the MCC

No.*	Sites	Features	Samples: Signature / Material	Identifiers of MCC - "ac"complex: Technology-shell admixture	Stylistics-"linear-comb"	BP	BC	References (Fig. 3)
1.	Tarkowo Dolne - 23	XXXIII/1	Ki-5870 / bone	–	+	5200±55	4050±90	Daszkiewicz, Prinke 2001
2.	Tarkowo Dolne - 23	IVA/SA	Ki-5883 / bone	+	+	5100±40	3880±60	Daszkiewicz, Prinke 2001
3.	Rożniaty -2	F1	Ki-6506 / bone	+	–	5080±40	3867±59	Kośko 2000
4.	Inowrocław-Mątwy - 1	11	Bln-1314 / charcoal	+	+	4580±60	3300±150	Kośko 1981; 1988
5.	Inowrocław-Mątwy - 5		Bln-2186 / charcoal	+	+	4470±60	3170±130	Kośko 1981
6.	Opatowice - 42		Gd-2764 / charcoal	–	+	4460±80	3150±150	Kośko 1988
7.	Dąbrowa Biskupia - 21	92a	Gd-2287 / charcoal	+	+	4400±140	3100±190	Kośko 1988

* See Fig. 1

Table 2

Series of new dates of FBC pottery identified with the "ac" complex of the MCC

No.*	Sites	Features	Samples: Signature / Material	Identifiers of MCC - "ac"complex: Technology-shell admixture	Stylistics-"linear-comb"	BP	BC	References (Fig. 4-7)
8.	Bachorce - 4	62	Ki-9936 / bone	+	+	4710±60	3500±100	Kośko, Przybył 2003
9.	Bachorce - 4	69	Ki-9937 / bone	+	±	4680±60	3490±90	Kośko, Przybył 2003
10.	Piecki - 1	32	Ki-9938 / bone	+	+	4480±55	3180±120	Kośko, Przybył 2003
11.	Piecki - 1	37	Ki-6230 / bone	+	+	4470±40	3180±120	Kośko, Przybył 2003
12.	Piecki - 1	105	Ki-9941 / bone	+	+	4450±55	3150±140	Kośko, Przybył 2003
13.	Piecki - 1	104	Ki-9940 / bone	+	–	4420±55	3110±150	Kośko, Przybył 2003
14.	Piecki - 1	19	Ki-5683 / bone	+	+	4380±30	2990±50	Kośko, Przybył 2003

* See Fig. 1

a. In the original approach, "linear-comb pottery" was associated with phases IIIB--IIIC of the Kujawy FBC thus dating it to ca. 3500-3250 BC [Kośko 1981:Fig. 18]. The basis for the dating was observations of co-occurrence of sources in settlement features and few direct ^{14}C datings (Table 1:4, 5). The growth of data in the 1980s and 1990s did not bring any significant changes (Table 1:6, 7) reinforcing the "classical" approach to the chronological limits of "linear-comb pottery" or rather the MCC. In this approach the limits are 3500-3150 BC [Kośko 1988b:98; 1988a:174]. The process of introducing corrections that is under way now has been initiated in recent years by a publication of three noticeably older radiocarbon dates. The dates link the pottery in question to as early phases as IIB/IIIA-IIIA of the FBC, i.e. to the period of 4050-3850 BC (Table 1:1, 2, 3). Two older dates come from the mezzoregion of the Toruń-Bydgoszcz Basin (Tarkowo), while the third and the youngest comes from the mezzoregion of Kujawy Upland (Rożniaty).

(b) The situation outlined above made it necessary to expand the list of ^{14}C dates concerning the MCC or, more precisely, pottery with a temper of crushed shells and bearing linear-comb ornaments or displaying one of these two traits recorded separately. For this purpose, a number of features recorded at settlement sites along the course of the "KMPG gas pipeline Mogilno-Wydartowo" were used [Kośko, Przybył 2003] (Table 2). Both sites from which samples come from (Bachorce 4 and Piecki 1) are located in the black soil (chernozem-like) center of the Kujawy Upland. In terms of physiography, this location is very similar to that of the two eponymous sites. Seven newly obtained dates support "classical" ("Upland") approach to the chronology of "linear-comb pottery" by specifying/ correcting (expanding) — in an expected manner — the dates given as its prologue and decline, namely 3500 and 3000 BC. It may be expected that possible future corrections of the "Upland" development trend of the said phenomenon will concern chiefly the commencing date, which is suggested by the earlier date from Rożniaty 2, i.e. 3867±59 BC.

Summing up, the outlined corrections suggest the following version of the chronology of the "Kujawy variety" of "linear-comb pottery":

early phase = 4050-3850? BC (Toruń-Bydgoszcz Basin + ?);

classical phase = 3500-3150 BC (Kujawy Upland + ?);

late phase = 3150-3000 BC (Kujawy Upland + ?);

This division corresponds to the periodization of the MCC introduced earlier (phases: early, classical, late — see introduction).

If ^{14}C dates from Tarkowo are accepted (Table 1:1, 2), then the process of reception of "linear-comb pottery" (temper of shells plus ornamentation) is moved to the early phase of the MCC, which is of vital importance for the study of its Lowland provenance (see chapter 3).

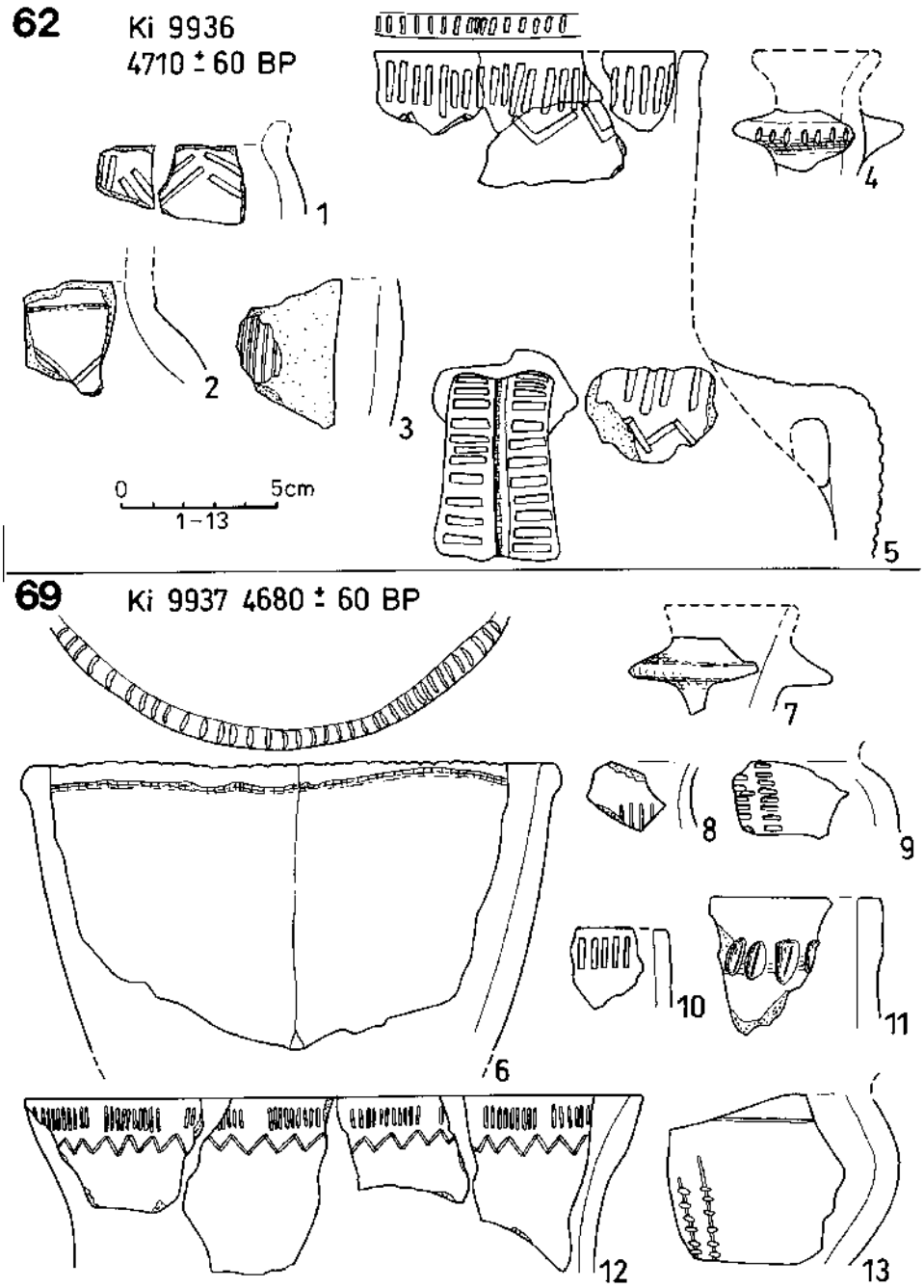

Fig. 4. Bachorce, Kujawy-Pomerania Province, site 4. Pottery from features 62 (1-5) and 69 (6-13) with "linear-comb" ornaments, ^{14}C dated. Following Kośko, Przybył 2003

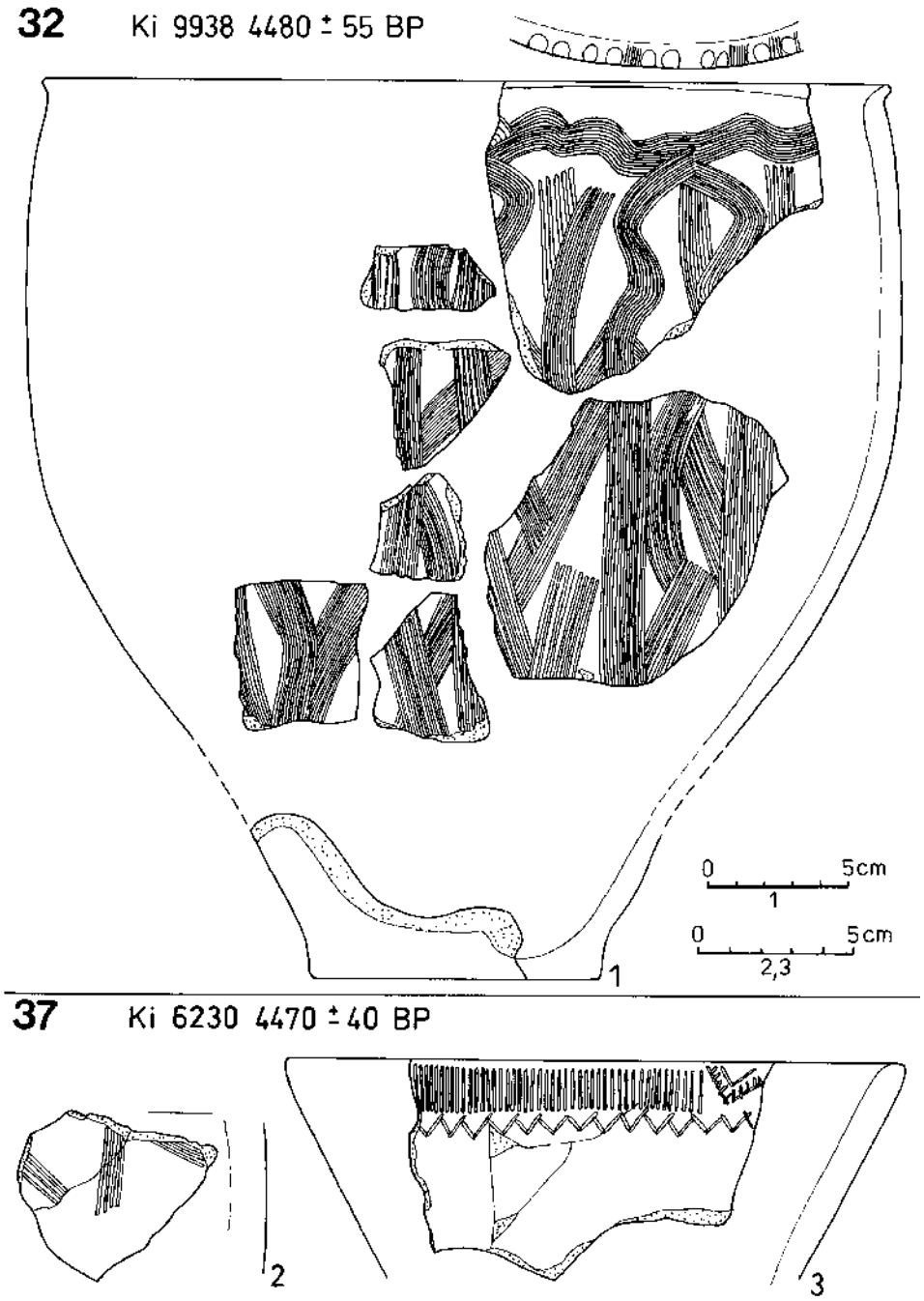

Fig. 5. Piecki, Kujawy-Pomerania Province, site 1. Pottery from features 32 (1) and 37 (2-3) with "linear-comb" ornaments, ^{14}C dated. Following Kośko, Przybył 2003

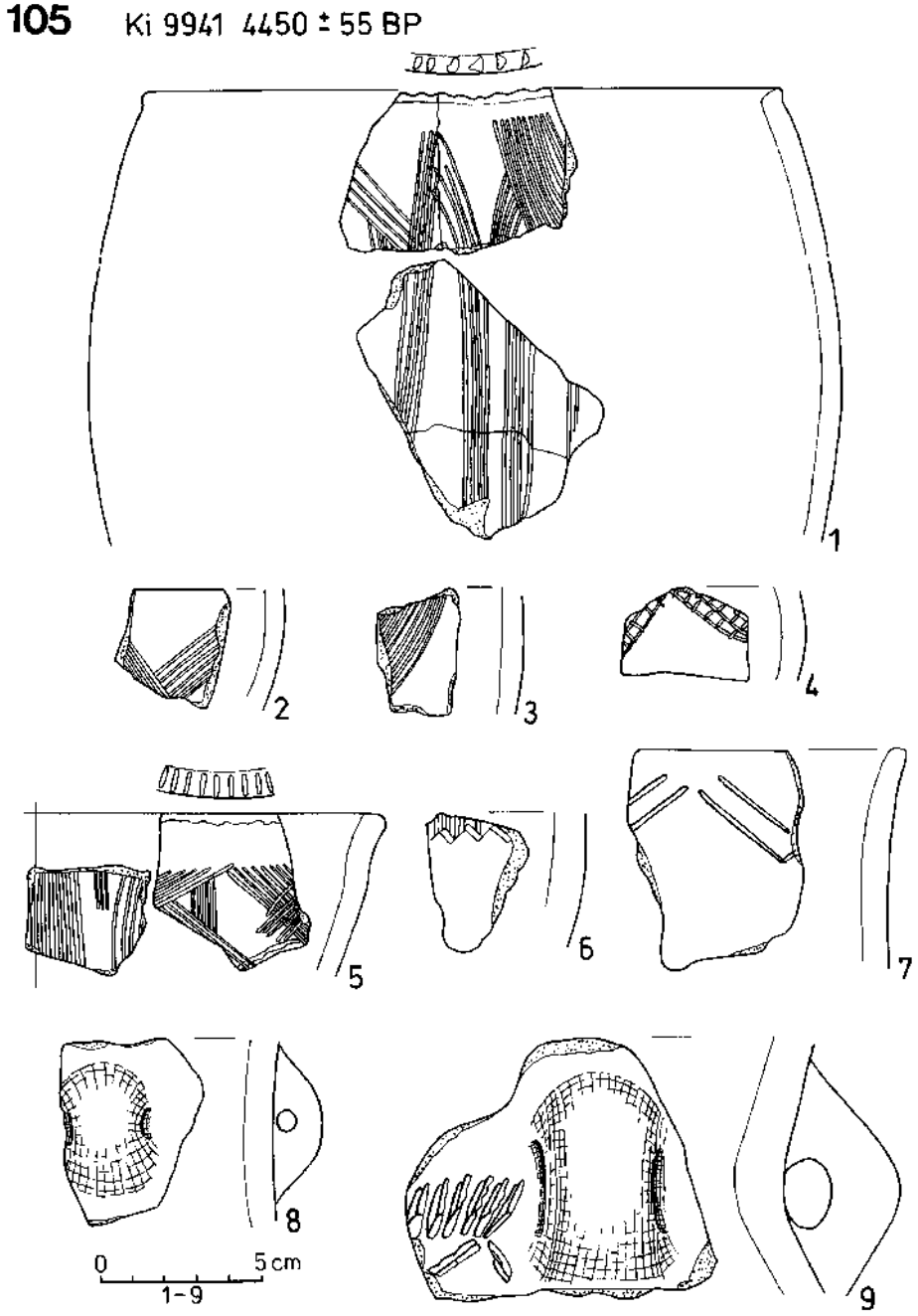

Fig. 6. Piecki, Kujawy-Pomerania Province, site 1. Pottery from feature 105 with "linear-comb" ornaments, ^{14}C dated. Following Kośko, Przybył 2003

3. RADIOCARBON CHRONOLOGY OF KUJAWY "LINEAR-COMB POTTERY" AND THE PROBLEM OF ITS PROVENANCE

The problem of provenance of "linear-comb pottery" has been discussed so far from three different territorial and source-data perspectives: (a) Kujawy Upland, (b) Vistula-Noteć Valley (Toruń-Bydgoszcz Basin) and, indirectly, (c) the Chełmno Land.

a. "Upland" observations borne out the MCC conception, i.e. development integrity of all Kujawy complexes of eneolithic (clearly dominant) and subneolithic traits of generally southeastern European provenance, specifically from the area where forest-steppes and forests (taiga) met [Kośko 1988b:94ff]. Linear-comb pottery — a classical example of the synthesis of the trait complexes named above — was a diagnostic element for "classical" (2) and "late" (3) phases in the development of the MCC. These opinions were grounded in the investigations of FBC sites located on the chernozem plains of the Kujawy Upland, i.e. in the main center of neolithization and eneolithization of the eastern part of Central European Lowlands. In these explorations, the MCC (distinguished from about 4050/4000 BC) is deemed to be an outcome of a long process of transmission of cultural patterns between the circumpontic and circumbaltic zones and evidence of the initial stage of their circulation along a permanent trail from the Crimea via Kujawy to Jutland/Sambia [Kośko 1991; 2001; 2002]. A key role in the conception of the beginnings of this stage was played by occidental migrations initiated by the movements of pre-Yamnaya culture (PYC) populations towards the northwest (on the Dnieper River). Next, the course of events followed the "movement of billiard balls": PYC→Tripolye (TC)→FBC-"Bug Group" →FBC-Mątwy Group →.... Now, in the "classical" approach to the MCC, the discussed phenomena should be related to the period after 4050/4000 BC, while their "linear-comb" phases should be bracketed together with the period between 3500 and 3150 BC (see Ch. 1) or, in the light of adjustments suggested by the latest series of ^{14}C dates (Table 2), with the period of 3500 and 3000 BC (see Ch. 2).

b. The conception of the MCC, however, is not the only explanation of the provenance of "linear-comb pottery". The germs of revision are sown by — quoted earlier — early ^{14}C dates (4050-3900/3850 BC) for "linear-comb pottery" from outside of the Kujawy Upland, specifically from the dune-podzol Toruń-Bydgoszcz Basin. The Basin is deemed to be a typical example of a refuge oecumene of marginal importance for the development of early agrarian settlement in Kujawy [Prinke, Szmyt 1990; Daszkiewicz, Prinke 2001]. A comprehensive assessment of the cognitive import of the quoted observations calls for their verification including — in the first place — a corroboration by increasing the number of radiocarbon

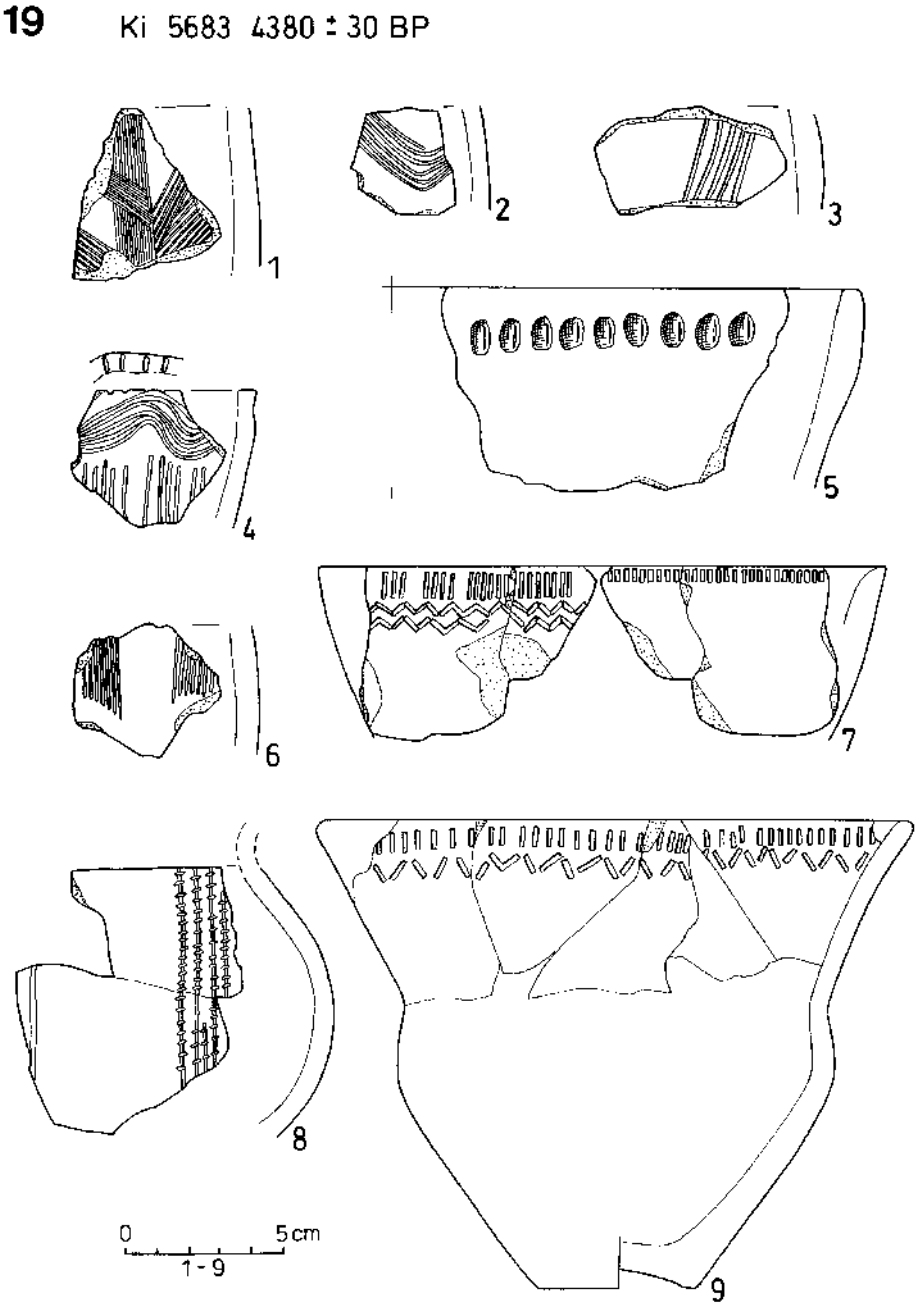

Fig. 7. Piecki, Kujawy-Pomerania Province, site 1. Pottery from feature 19 with "linear-comb" ornaments, ^{14}C dated. Following Kośko, Przybył 2003

dates. However, one can discern already now reasons for making adjustments to the chronological-spatial description of "linear-comb pottery". This, in particular, applies to the view of its relationship to the MCC. An extreme opinion on this matter is a hypothesis, mentioned already earlier, under which "linear-comb pottery" is taken out from the development circle of the MCC [Prinke, Daszkiewicz 2001:128].

It must be stressed, however, that the expanding of the chronological brackets of "linear-comb pottery" — to 4050-3000 BC — does not exclude a "classical" identification of the "departure point" of technological and stylistic traits of interest to us here. It is taken to lie in the borderland area between the forest-steppe and forest zones in the Black Sea drainage (Dnieper drainage). Of vital importance for upholding such an opinion is also the development of research into TC "kitchen" pottery, including Dnieper applications of a comb as a burin for making ornaments on vessel surfaces. The prologue of such ornaments is associated with phases BII-CI of the TC [Videiko 2001:218ff], i.e. with the period of 4100-3500 BC [Videiko 2001:217, Tab. 2]. It must be remembered that in the hitherto adopted approach the prologue of such technological and stylistic manipulations was associated — at the earliest — with the Dereivka phase (i.e. II — "corded") of the Sredny Stog II culture (SSC) [Telegin 1973:50; cf. Kośko 1988b:100ff], i.e. the period of ca. 4350-4050 BC [Telegin, Nechytailo, Potekhina, Panchenko 2001:128 — eight dates for the eponymous site]. M. Videiko stresses that considering the thickness of the cultural layer at the settlement of Dereivka, it is difficult to establish a more detailed chronology of their application (kind verbal communication). Thus, it can be assumed that, generally speaking, in the late 5th and early 4th millennia BC, in the period when the discussed patterns appeared among the traits characteristic of the Vistula FBC, they had a stable intercultural tradition of use on the middle Dnieper.

c. Attempts to discredit the Dnieper, or rather Eneolithic, view of the provenance consist in:

- exclusion of "linear-comb pottery" (specifically, the "ac" complex) from the MCC framework accompanied by a marginalization of "Eneolithic traditions" (from the TC/SCC — "Upland" FBC cycle) and
- promotion, in the studies of the origins of the said complex, of vague "forest" analogies, in particular from the area of subneolithic settlements in the Daugava drainage, taken to be unquestionable "pre-forms" [Kukawka 2001, see there for older literature].

Both the "discrediting" of the MCC and "forest reorientation" stem from analytical experiences gathered in the Chełmno Land neighboring on Kujawy. According to S. Kukawka [2001:76ff], in materials of the local FBC "elements of clear northeastern analogies" are observable "not later than ca. 3900 BC." About 3800/3700 BC, there occurred a short-lived synthesis of in-coming cultural environ-

ments, namely, of the Małopolska FBC and the Narva culture (NC), more precisely its Piestinia group; the influence of the latter became stronger after 3650/3550 BC when the Chełmno group (ChG) of the FBC (exhibiting "linear-comb pottery") arose. In the discussed approach, the ChG is presented as an earlier link in the development of the MG — an intermediary in the transmission of "patterns from the NC circle to FBC groups living west of the Vistula River" [Kukawka 2001:81].

The major arguments — presented in brief in 1988 — against the conception outlined above have lost nothing of their validity [Kośko 1988:110ff]. A new element, however, is an adjustment of the chronology of cultural systems exhibiting "linear-comb pottery". In the light of dates quoted here — as well as the general knowledge of cultural exchange trails-it is admissible to adopt the following filiation cycle:

Stage I

SSC↔TC (Dnieper area: borderland between forest-steppe and forest areas) 4350/3500 BC

→ Dnieper area — forest zone = Vishinki-Mnevo-Taustyki [Kośko 1985:67ff; 1988b: 101; Yazepenka 1994] (upper Dnieper trail) from ca. 4100-3700 BC (?-typochronology);

→ area located between the Vistula and Noteć rivers = FBC (Volhynia trail...?) from ca. 4050 BC.

Stage II

FBC, EG→MG (area located between the Vistula and Noteć rivers) from ca. 4050 BC

→ area located between the Vistula and Drwęca rivers = FBC, ChG (neighbor transmission) from ca 3650/3550 BC;

→ middle and upper Warta = FBC, EG (Warta trail) from ca. 3500/3300 BC.

In the approach outlined above, the Chełmno Land (located between the Vistula and Drwęca rivers) integrates "elements of clear northeastern analogies," mentioned by S. Kukawka, with those of the MCC, chiefly of southwestern origin, i.e. coming from Kujawy (Vistula-Noteć area). What is still doubtful, however, is whether the former, which have here a relatively early chronology [comparing to the areas on the Vistula's left bank: Gaździk, Józwiak 2001; Józwiak 2003], are directly related to the NC. The reception of the MCC in the Neolithic/Subneolithic settlement environments east of the Vistula means significant changes in their forms and functions. One of the clear manifestations of such changes is a downplaying of the ornament role of linear-comb motifs. In the Chełmno Land, they take on a new role of technological manipulations — forming ("smoothing out") vessel surfaces.

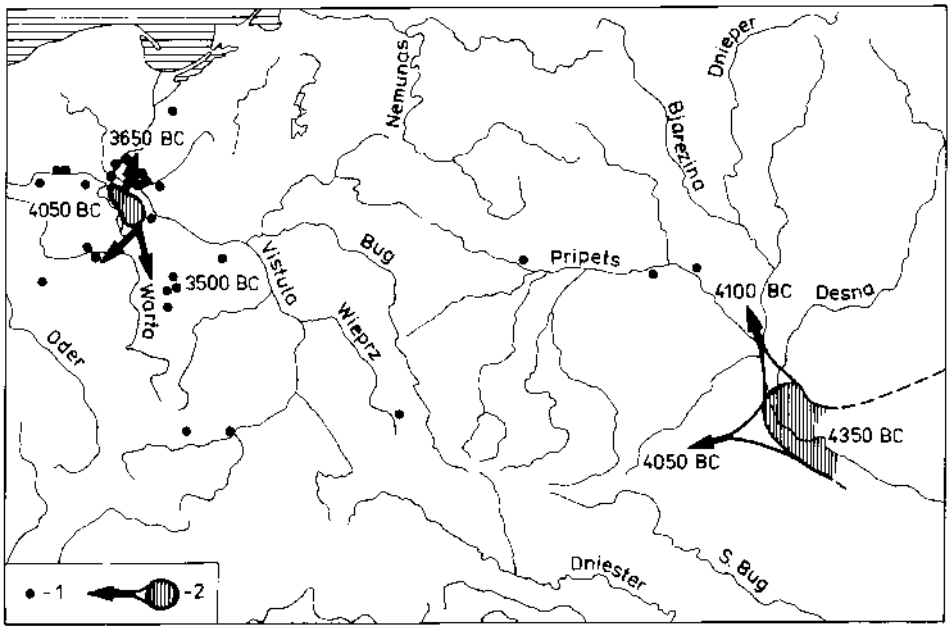

Fig. 8. Topogenesis of "linear-comb" pottery. 1 - sites with "band-comb" pottery; 2 - development centres and filiation directions of stylistics of "linear-comb" pottery

CONCLUSIONS

About 4050 BC, in Kujawy, there appeared a package of eastern European patterns — which is temporarily difficult to assess functionally — identified in this paper as "linear-comb pottery" (or more broadly as the MCC), whose origins can be traced to the intercultural environments of the forest-steppe zone (in the borderland with the forest zone) along the Dnieper River, chiefly to the SCC-TC. The environment that received the package in Kujawy was the EG of the FBC, which, owing to the broadening of the MCC reception — mainly in the Kujawy Upland — evolved into the MC of the FBC.

Around the same time, in the neighboring region — the right-bank drainage of the Vistula — a complex of forest eastern European patterns was taken over whose occidental transmission had a clear western limit in the Chełmno Land and the Vistula. Approx. in 3650/3550 BC, Kujawy linear comb-pottery, or rather a reduced set of MCC patterns, was diffused here and began since then to form part of the local ChG of the FBC.

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 82-112
PL ISSN 1231-0344

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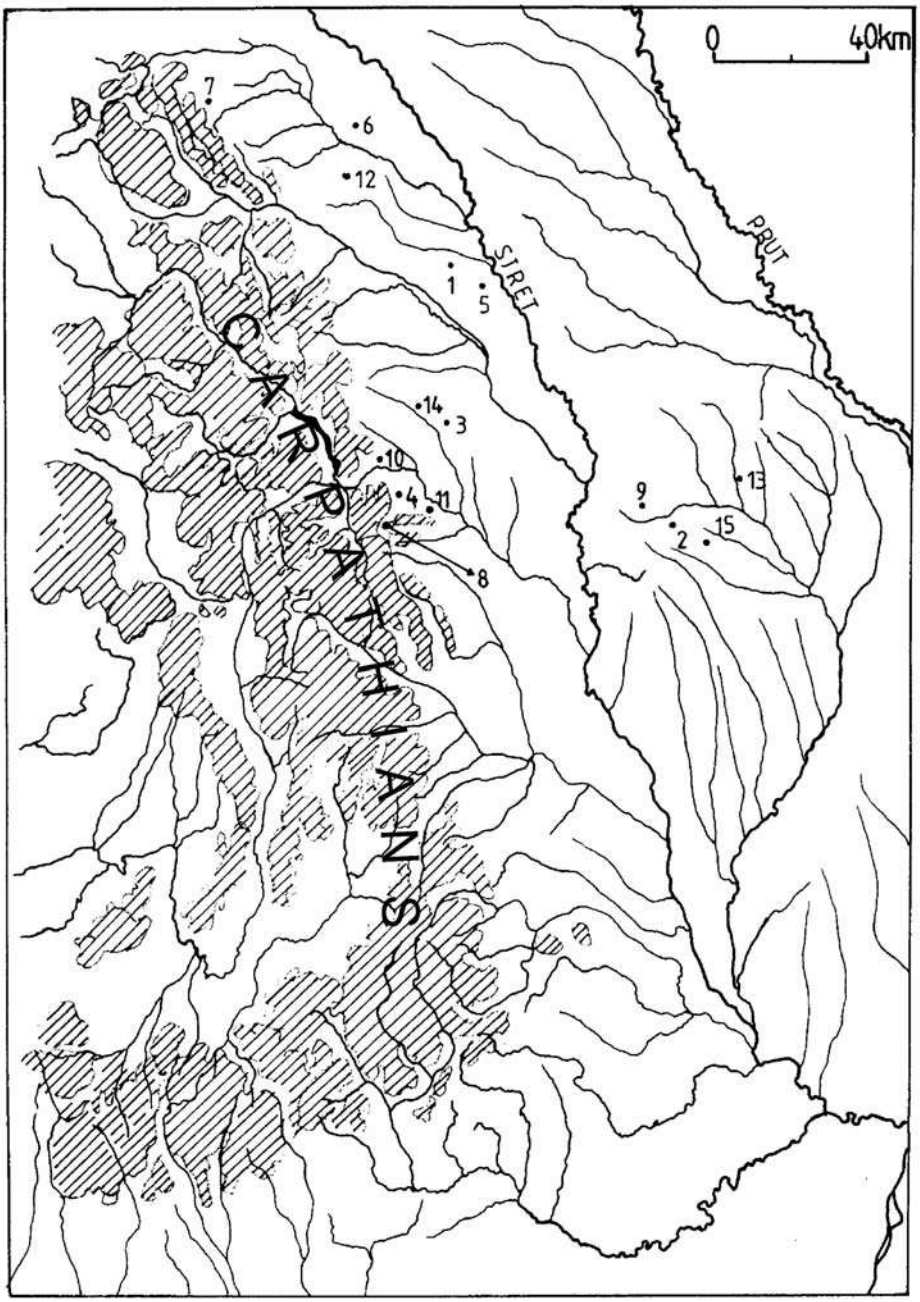
RADIOCARBON CHRONOLOGY OF THE MOLDAVIAN (SIRET) SUBGROUP OF THE GLOBULAR AMPHORA CULTURE

The first monuments of the Globular Amphora culture (GAC) have been recorded in the Moldavian Upland in Romania since the end of the 19th century (Grăniceşti, Suceava county). In the first half of the 20th century such discoveries became more numerous (Horodnicul de Jos, Suceava county; Brăşăuţi, Neamţ county) and, as such, they attracted ever more interest of investigators [Nestor 1932:70; Matasă 1940a:37f.; 1940b:42]. But only in the 1950s, after the investigations of Piatra Neamţ [Matasă 1959:723-729] and Dolheştii Mari [Dinu 1959; 1960; 1961a; 1961b] such discoveries were assigned to the GAC. In the last decades, new GAC monuments have surfaced (Basarabi, Suceava, Mastacăn etc.), a fact that made Romanian archaeologists resume their investigations (Fig. 1).

Almost all the GAC monuments, which have been found until now in Romania, are of funerary type. The discovery of some artefacts belonging to the GAC (especially pottery) has just been signalled in some contemporary settlements without any other explanations [see e.g. a list of data in: Szmyt 1999]. Moreover, it has to be specified that all the discoveries were in the eastern part of Romania (in Moldavia), which led to their classification as a separate subgroup ("Moldavian subgroup"or "Moldavian - Siret subgroup") of the eastern group of the GAC [Wiślański 1966:87; Sulimirski 1968:47f.; Sveshnikov 1990; Szmyt 1999:42].

The most numerous, the oldest and the most evident monuments of the GAC in Moldavia are concentrated in its north-western region, between the Siret River and the Carpathians Mountains (Suceava and Neamţ counties). It is a less favourable zone for agriculture, having poor brown soils, a dense hydrographical net and salt deposits, and being covered with deciduous forests supporting a rich and varied fauna [Mihăilescu-Bîrliba 2001:204].



F i g . 1. Distribution of the graves of Globular Amphorae culture in Moldavia (eastern part of Romania). Key: 1 - Basarabi; 2 - Băceşti; 3 - Bârgăuani; 4 - Brăşăuţi (or Cut); 5 - Dolheştii Mari; 6 - Grăniceşti; 7 - Horodnicul de Jos; 8 - Mastacăn; 9 - Oniceni; 10 - Piatra Neamţ; 11 - Deleni (former Calu); 12 - Suceava; 13 - Şcheia; 14 - Şerbeşti; 15 - Gârceni

Until now the absolute chronology of the Moldavian GAC has been established only on the basis of comparative data (typological and radiocarbon). The latest relevant literature describes two distinct approaches, one by (a) Gheorghe Dumitroaia [2000] and the other by (b) Marzena Szmyt [1999].

a. According to Gheorghe Dumitroaia [2000:81], GAC populations existed on the territory in question between 2700/2600 bc and 2300/2200 bc (non-calibrated dates). This chronology is based on the assumption that GAC populations functioned in the Siret drainage synchronously with the Horodiştea-Erbiceni culture[1] and that the estimated duration of the GAC settlement in the Moldavian Uplands was approximately 300 years. The time brackets mentioned above were determined by comparing the radiocarbon chronology of the late stage of the Cucuteni-Tripolye culture with the chronology of the GAC on the territory of Poland [Dumitroaia 2000: 81].

b. Marzena Szmyt [1999:195-201], who used *inter alia* the first ^{14}C assays for the Volhynia and Podolia complexes, claims that GAC populations penetrated the Moldavian territory between 2700 and 2450 BC. This opinion arose from several assumptions. Firstly, it was believed that GAC populations flowed here from the north, which could occur only after they had appeared in Podolia (i.e. after about 2900-2850 BC). Secondly, some of the Moldavian graves were similar to complexes from phase A in Podolia (= PA). This similarity indicates that the beginnings of the Siret subgroup date back to this very phase in Podolia, i.e. between 2900 and 2700 BC. Thirdly, the presence of mixed complexes that bore traits of the Globular Amphora and Yamnaya cultures implies that the two units were at least partially correlated. Bearing in mind the late chronology of the Dniester group of the Yamnaya culture (probably after 2500 BC), the decline of the Siret subgroup of the GAC may be dated at about 2500-2450 BC.

Thanks to the joint initiative of the present authors, it was possible to change the situation outlined above. Old anthropological materials had been found and bone samples had been taken and sent to a radiocarbon laboratory[2]. As a result of that, the first dates for the graves of the Moldavian (Siret) subgroup were obtained, which shed new light on the chronology of both the given unit and the whole eastern GAC. However, the new data are not easily interpretable. On the contrary: they raise numerous questions that should stimulate further study of the chronology. While analysing the already known series of dates, the following issues will be taken into consideration: (1) archaeological context of each dated sample, (2) the results of laboratory tests, and (3) calibration of ^{14}C assays. Finally, (4) a suggestion will be made as to the interpretation of the analysed series on the basis of the results of *archaeological wiggle matching*.

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[1] G. Dumitroaia also erroneously assumed [inspired by Sulimirski 1968:5] that the GAC and the phase B2 of the Cucuteni culture functioned contemporaneously.

[2] This project was effected thanks to funds from a grant managed by Professor Aleksander Kośko, awarded by the Polish State Committee for Scientific Research (research project no. 5 H01H 02121). We would like to express our gratitude to Professor Kośko.

1. RADIOCARBON-DATED GRAVES OF THE MOLDAVIAN SUBGROUP OF THE GLOBULAR AMPHORA CULTURE

The series consists of five dates of samples taken from four GAC graves: one for each feature from the following localities: Basarabi, Bârgauani and Piatra Neamț, as well as two others for a sample obtained from grave 2 in Dolheştii Mari. Only human bones from burials were dated, following an assessment made by an anthropologist (R. Szimalcsik). All of the samples contained bones excavated between 1955 and 1967 and stored in the Anthropological Research Centre of the Romanian Academy in Iaşi. Nothing is known about the bone storage conditions or any preservation treatment.

1.1. BASARABI, PREUȚEŞTI COMMUNE, SUCEAVA COUNTY

A stone grave was accidentally uncovered in 1967 on the hill "Lan"during forest works. Rescue excavations have been carried out by professor Victor Spinei (Archaeological Institute in laşi) and Mihai Nistor (Museum of Fălticeni).

A. Grave structure. The grave was partially destroyed by the workers. It was found about 0.5 m below today's ground surface and consisted of a cist of local slabs. The grave, trapezoidal in shape, was oriented E-W and had the following dimensions: length 1.40 m; width 1.0 m (W) X 0.85 m (E); depth 0.50 m. The lid was made of three flat slabs. Each of the long sides (N and S) was made up of three slabs (a smaller one in the middle). The west and the east walls were made of one slab each. All the vertical slabs on the four sides were tilted outwards, so that the top of the cist was larger than its bottom (Fig. 2). It was also noticed that the vertical slabs of the lateral walls were situated outside the three unequal slabs that made up the bottom of the grave [Spinei, Nistor 1968:621f.].

B. Inventory. A crouched skeleton of a man (35-40 years old) was found in the grave. The deceased lay on its right side, its skull faced east and its legs pointed west. The man was about 165-167 cm tall and belonged to a northern type with alpine influences (mezocran just at the limit with dolicocran). In front of the skull there was a vessel (no. 1) of which only some fragments survived. There was also another pot next to the skeleton's lower limbs (no. 2). Behind its pelvis, a flint chisel was found and in front of its knees there was a flint chip [Spinei, Nistor 1968:623; Necrasov, Antoniu, Fedorovici 1972; Necrasov, Cristescu, Botezatu, Miu 1990:198ff.].

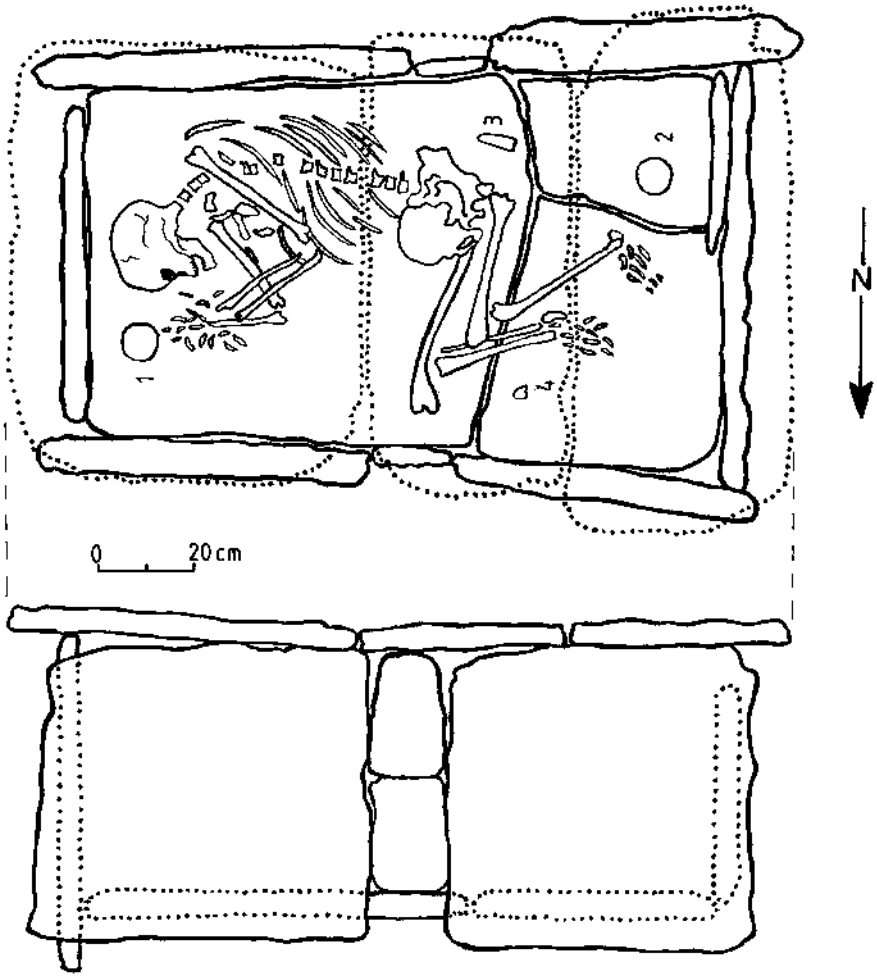

Fig. 2. Basarabi. Plan and cross-section of the cist grave. Key: 1 - vessel no. 1; 2 - vessel no. 2; 3 - chisel; 4 - chip. Source: Victor Spinei

Vessel no. 1. Only some fragments made of rough clay survived of this undecorated pot [Spinei, Nistor 1968:Fig. 2].

Vessel no. 2, found in the southwest corner of the grave, was a goblet made of clay mixed with small-grained gravel and burnished unevenly. The clay was brittle and had a reddish-brown colour. The walls of the pot were smeared with light-brown slip. The vessel was rounded and had a wide, slightly flared opening and a thin lip. There are two small, horizontally perforated lugs on its shoulder. The bottom of the vessel is slightly curved outwards. On the shoulder and belly one could notice a "fish

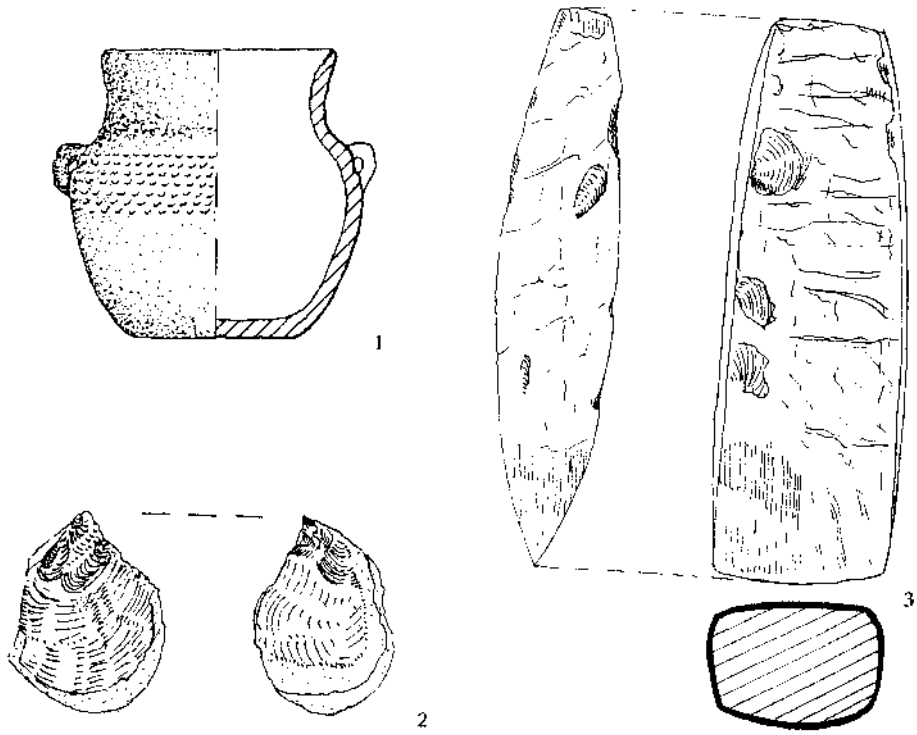

Fig. 3. Basarabi. Grave goods: 1 - goblet; 2 - flint chip; 3 - flint chisel. Source: Victor Spinei

scales"ornament arranged in three horizontal rows out of which other vertical lines radiated (Fig. 3:1). Dimensions: height 10.9 cm; opening diameter 8.7 cm; bottom diameter 6.8 cm [Spinei, Nistor 1968:625].

The chisel was made of opaque whitish flint with bluish-grey pigments. It had a trapezoidal shape, thickened at one end and sharpened at the other. The surface of the chisel was polished. Both ends were damaged (Fig. 3:3). Dimensions: length 9.2 cm; width 3.0 cm; thickness of butt 2.0 cm [Spinei, Nistor 1968:623].

The chip comes from a nucleus of black flint split into two parts. On its surface there is a white-yellowish cortex (Fig. 3:2). Dimensions: length 3.2 cm; width 2.4 cm; thickness 0.9 cm [Spinei, Nistor 1968:624].

The materials presented above had been given to Moldavia's History Museum in Iaşi but they could not be found any more.

Human bones - carpals, phalanx, heel (calcaneous) and shin (tibia) - were submitted to the ^{14}C analysis.

On 14 July 1963, west of Bârgăuani village, on "Osoi"hill, during field works two peasants uncovered a cist grave. Most of the grave and part of its inventory were damaged. The rescue excavation work was carried out by Aurel Buzilă (District Museum in Piatra Neamț).

A. Grave structure. It is known that the grave was at 0.25 m below today's ground surface and that it was built of shell limestone, brought from the adjacent area. The cist was rectangular (1.40 m x 0.60 m), oriented SSE-NNW. Its north and west walls were made of one slab each; the east and south walls were made of two slabs each (Fig. 4:1). The grave floor was 0.80 m below today's ground surface; it was built of fourteen small slabs, cemented with clay and gravel. It is not known if the tomb had a lid [Cucoş 1985:141f., Figs. 1:2; 2:1-2; Dumitroaia 2000:71; Fig. 56:5].

B. Inventory. Three male and two female skeletons were found in the cist grave. Although most of inventory was lost, it is known that at least six vessels were in the cist. There was also a bone dagger (in the southern part; Fig. 5:1), a flint axe and a flint chisel, two wild boar fangs and pig bones. The pottery was made of clay, with an admixture of coarse-grained sand and pebbles. Its colour was brown-greyish and the outer walls of the pots were polished. Two vessels were reconstructed; the rest of fragments belonged to amphorae and small bowls (Fig. 5:2-10) [Cucoş 1985:142; Figs. 1:4; 4; Dumitroaia 2000:71f.; Necrasov, Antoniu, Fedorovici 1972; Necrasov, Cristescu, Botezatu, Miu 1990:198ff.].

An amphora (no. 1) with a large rim, thin lip, short neck and globular belly; the bottom is flat; four small horizontally perforated handles are placed on the pot shoulder. There is a stamp ornament on the neck and on the shoulder. It consists of short vertical, parallel lines each of them bordered (under the rim and on the shoulder) by a zigzag line (Fig. 4:5). Dimensions: height 27.1 cm; opening diameter: 15.1 cm; maximum diameter: 29.3 cm; bottom diameter: 12.4 cm [Cucoş 1985:142; Fig. 2:3; Dumitroaia 2000:72; Fig. 53:4].

An amphora (no. 2) similar to the previous one, not fully reconstructed (the pot rim did not survive), with a globular belly, a raised foot and a flat bottom; four small horizontally perforated lugs are placed on the shoulder. A stamp ornament with three rows of short vertical, parallel lines bordered (on the neck and shoulder) by rows of chevrons oriented upright (Fig. 4:4). Dimensions: preserved height: 20.8 cm; maximum diameter: 26.6 cm; bottom diameter: 12 cm [Cucoş 1985:142; Fig. 2:4; Dumitroaia 2000:72; Fig. 53:3].

An opaque, whitish flint axe, trapezoidal in shape, with the cutting-edge slightly arched outwards. All its sides are smoothed and its both ends are damaged (Fig. 4:3). Dimensions: length 18.8 cm; width 5 cm; thickness 3 cm [Cucoş 1985: 142; Fig. 1:4; Dumitroaia 2000:72; Fig. 56:1].

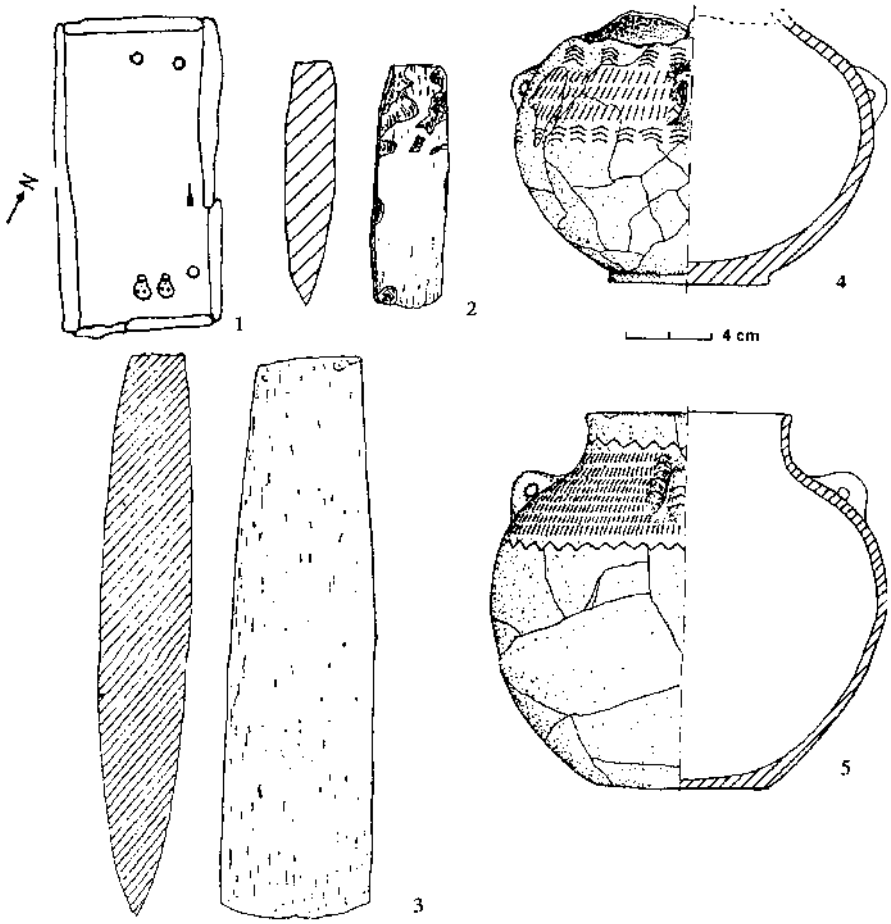

Fig. 4. Bârgăuani. Key: 1 - plan of the cist grave; 2 - flint chisel; 3 - flint axe; 4 and 5 - vessels from the grave. Source: Dumitroaia 2000

An opaque, whitish flint chisel, trapezoidal in shape with the cutting-edge slightly arched outwards. It is polished and damaged on all its sides (Fig. 4:2). Dimensions: length 8.2 cm; width 2.4 cm; thickness 1.6 cm [Cucoş 1985:142; Fig. 4:10; Dumitroaia 2000:72; Fig. 56:2].

The materials are kept at the Museum in Piatra Neamţ.

Bones (*coxae*) of skeleton no. 3 were submitted to the ^{14}C analysis.

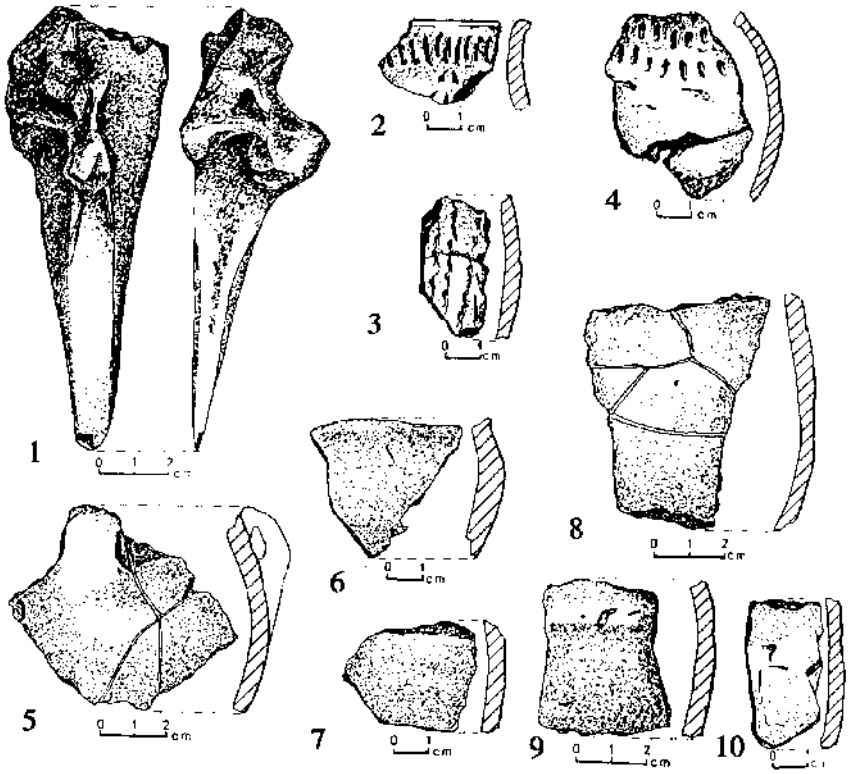

Fig. 5. Bârgăuani. Grave goods: 1 - bone dagger; 2-10 - potsherds

1.3. DOLHEŞTII MARI, DOLHEŞTI COMMUNE, SUCEAVA COUNTY

In the spring of 1956, a cist grave (no. 1) was uncovered by a local inhabitant working in his garden. It is situated northwest of Dolheştii Mari village, on a slope of "Dealul Vântului", on the left lower terrace of the Şomuzul Mare rivulet. The grave and most of its inventory were destroyed and, therefore, lost.

Later, in the autumn of 1957, rescue works carried out by Professor Marin Dinu (Alexandru I. Cuza University in Iaşi) started in that place. Three parallel trenches oriented N-S (length: SI: 112 m; SII: 94.5 m; SIII: 44 m), and two rectangular surfaces were excavated. On this occasion, a discovery was made of another cist grave (no. 2), an animal burial and a layer of a posterior settlement (Fig. 6:1).

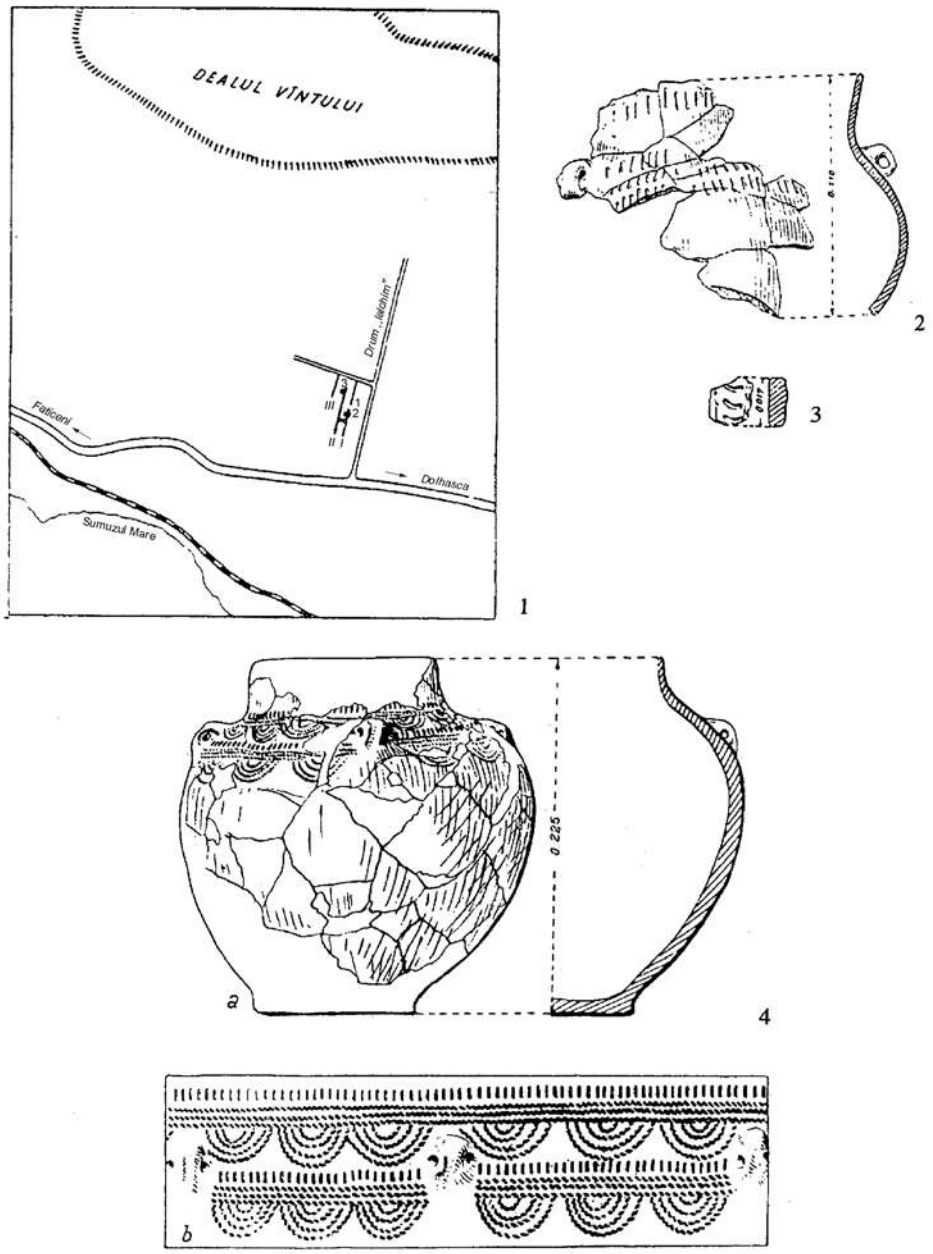

Fig. 6. Dolheştii Mari. Key: 1 - location map (I-III - trenches; 1 - pit of Horodiştea II - Erbiceni I-II culture; 2 - animal burial; 3 - cist grave no. 2; X - cist grave no. 1); 2 - potsherds from the grave no. 3; 3 - potsherd from the grave no. 4; 4 - vessel from the animal burial. Source: Dinu 1959; 1960; 1961a; 1961b

1.3.1. GRAVE NO. 1

As the owner of the land said, four human skeletons lying on their backs were found (two of them having their heads towards the east, and the other two towards the west). There were also more fired clay vessels, two flint axes, a flint chisel, a flint blade and two engraved and perforated fragments of a bone belt-buckle. Only the skeletons, fragments of bone buckles and the flint artefacts were saved [Dinu 1959:213; Fig. 1; 1960:93; 1961a:47].

Inventory. As it has been mentioned above, the inventory was mostly lost. The two axes, the chisel and the blade are made of white-greyish flint with shades of bluish-grey colour; they are trapezoidal in shape, their cutting-edges arched; one of the axes has a rectangular butt while the other end is pointed. The chisel has its cutting-edge less arched. All the three flint objects were carefully polished and damaged at their both ends [Dinu 1960:93f.; Fig. 4:7-10; 1961a:47, 49; Fig. 4:7-10].

Two fragments of a bone belt-buckle were also found. Their shape could not be reconstructed. On one of their sides they had an ornament consisting of rows of dots, zigzag lines and bands with suspended triangles, filled with horizontal, parallel lines; the whole ornament was incised (Fig. 8:3-4) [Dinu 1960:93, 98; Fig. 5:1-2; 1961a:47, 53; Fig. 5:1-2; Dumitroaia 2000:Fig. 51:3-4].

1.3.2. GRAVE NO. 2

It was uncovered in the north end of trench II (SII), 0.35 m below today's ground surface.

A. Grave structure. The pit of the grave was dug in the yellow-clayey ground under the layer of a Horodiştea II - Erbiceni I-II settlement. The four walls of the cist, its bottom and its lid were built of many local sandstone slabs, having different dimensions. Inside the grave, which was 0.65 m deep, two crouched human skeletons (a man and a woman) lying on their backs were found. Their skulls faced ESE and the lower limbs pointed WNW [Dinu 1959:216f.; Figs. 1, 3-4; 1960:92f.; 1961a:46f.; 1978:19; Necrasov, Cristescu 1965:149, 153; Necrasov, Cristescu, Botezatu, Miu 1990:198ff.].

B. Inventory of the grave consisted of five intact vessels and a fragmented one, two flint chisels and other five bone artefacts (two buckles, two appliques and a bracelet) having the same ornaments as those found in grave no. 1. Three of the vessels were found next to skeleton no. 1 (at the northwest wall of the cist), two

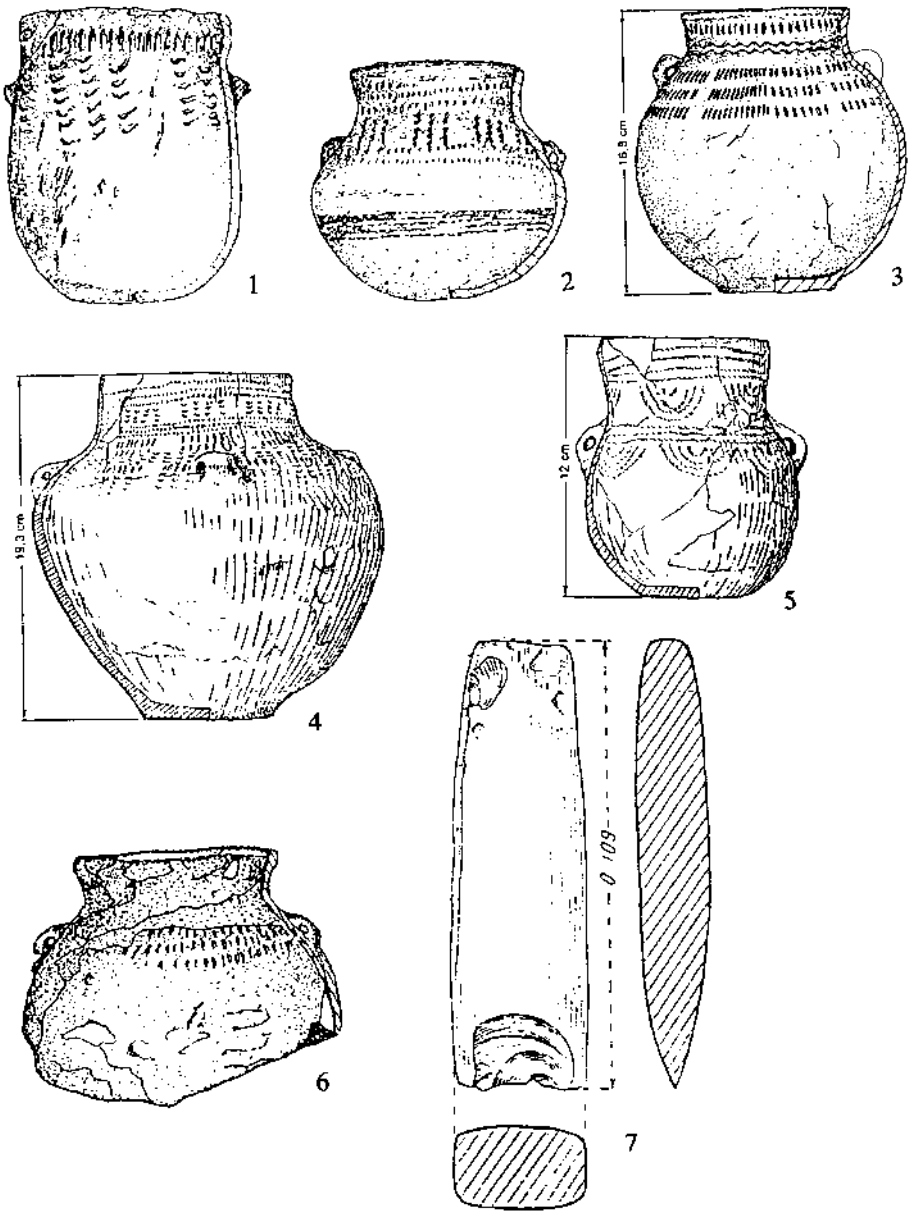

Fig. 7. Dolheştii Mari. Goods from the grave no. 2: 1-6 - vessels, 7 - flint chisel. Sources: Dinu 1959; Dumitroaia 2000

of them at the legs of skeleton no. 2 and one at the skull of the same skeleton (at the southeast wall of the grave). The pottery was brittle, made of greyish clay, and smeared with brown slip or brick-red clay [Dinu 1959:217; Fig. 5; 1960:93; 1961a:47].

A *goblet* of brick-red clay had its rim slightly curved inwards, a long neck, globular belly and flat bottom. There are two small, horizontally perforated lugs on the vessel shoulder. The ornament on the neck consists of cord impressions with four horizontal, parallel rows made of short vertical parallel lines. Below this ornament there is another one consisting of the same kind of impressions made of cord festoons. Between the shoulder and belly, there are three rows of similar impressions (parallel and horizontal). Finally, other cord festoons run out of the last row (Fig. 7:5). Dimensions (approximate): height: 12 cm; opening diameter: 7.7 cm; maximum diameter: 9.9 cm; bottom diameter: 5 cm [Dinu 1959:217; Fig. 5:4; 1960:93, 95; Fig. 3:3; 1961a:49, 51: Fig. 3:3; Dumitroaia 2000:Fig. 50:4].

A *globular amphora* of the corrupt Kujawian type, with a straight rim, short cylindrical neck, flat bottom and four small, horizontally perforated lugs on the shoulder. The neck has an ornament with three short, parallel, horizontal rows of cord impressions. Below this ornament there is a row of vertical bands, each of them made up of four rows of "fish scale"impressions. These bands are followed by other three parallel, horizontal rows of cord impressions. On the shoulder, next to the four handles, the vessel is decorated with two vertical bands, made up of three rows of impressions each; these ornamental bands alternate with equal blank spaces similar to a chessboard (Fig. 7:4). The brittle clay has a brick-red colour. Dimensions (approximate): height: 19.3 cm; opening diameter: 10.7 cm; maximum diameter: 19.85 cm; bottom diameter: 7.17 cm [Dinu 1959:217; Fig. 5:5; 1960:93, 95; Fig. 3:6; 1961a:49, 51; Fig. 3:6; Dumitroaia 2000:Fig. 50:3].

A *high goblet*, almost cylindrically shaped, with a straight rim, slightly rounded belly and flat bottom; it is provided with two small, vertically perforated lugs on the shoulder. The ornament on the neck consists of a horizontal row made up of short, parallel lines. The shoulder is ornamented with "fish scale"bands, arranged in three parallel lines. The decorative bands alternate with blank spaces (Fig. 7:1). Dimensions: height: 9.8 cm; opening diameter: 6.8 cm; maximum diameter: 7.6 cm; bottom diameter: 3.4 cm [Dinu 1960:93, 95; Fig. 3:2; 1961a:49, 51; Fig. 3:2; Dumitroaia 2000:Fig. 50:1].

A *globular cup* with a flared rim, short neck, globular belly and almost round bottom; it has two small, horizontally perforated lugs. On the neck and shoulder there is a cord ornament made up of two rows of short, parallel, horizontal lines; between these rows there are bands of vertical lines alternating with blank spaces (Fig. 7:2). Dimensions: height: 8.3 cm; opening diameter: 6.7 cm; maximum diameter: 8.5 cm [Dinu 1960:93, 95; Fig. 3:1; 1961a:49, 51; Fig. 3:1; Dumitroaia 2000:Fig. 50:2].

An *amphora*, only partially preserved (upper part). It has a flared rim, short neck and globular belly; on the shoulder there are four small, horizontally perforated lugs. On the neck and shoulder there is a stamp ornament of horizontal, parallel rows consisting of short, vertical and parallel lines (Fig. 7:6) [Dinu 1960:93, 95; Fig. 3:4; 1961a:49, 51; Fig. 3:4; Dumitroaia 2000:Fig. 51:8].

A *globular amphora* made of greyish clay and covered with brown slip, polished on the outside. The rim is slightly flared, the neck short; it has a globular belly and flat bottom; there are two small, horizontally perforated lugs on the shoulder. On the neck, below the rim, there is a stamp ornament with a row of short, vertical and parallel lines; below them there are two parallel, zigzag lines. On the shoulder there is an ornament of three short, vertical and parallel lines (Fig. 7:3). Dimensions: height: 16.8 cm; opening diameter: 10.8 cm; maximum diameter: 17.6 cm; bottom diameter: 7.6 cm [Dinu 1960:93, 95; Fig. 3:5; 1961a:49, 51; Fig. 3:5; Dumitroaia 2000:Fig. 50:5].

A *flint chisel* of white-greyish colour with bluish-grey shades. It has an almost rectangular shape, arched cutting-edge, and a rectangular butt. All sides are well polished and both ends are damaged [Dinu 1960:93f.; Fig. 4:6; 1961a:47, 49; Fig. 4:6].

A *flint chisel* of white-greyish colour with bluish-grey shades. It has an almost rectangular shape, arched cutting-edge, and a rectangular butt. All sides are well polished and both ends are damaged (Fig. 7:7). Dimensions: length: 10.9 cm; width: 3,25 cm; thickness: 2 cm [Dinu 1959:217; Fig. 5:1; 1960:93f.; Fig. 4:4; 1961a:47, 49; Fig. 4:4; Dumitroaia 2000:Fig. 52:1].

The chisels were found over the bones in the grave, in opposite positions (at the lower limbs and the skulls of skeletons), but the place of each object could not be specified [Dinu 1960:95; 1961a:49].

Bone buckles. They were found next to the hipbones of the female skeleton (no. 2). They are oval polished bone plates. In order to be used, they have perforations and fretted-patterns (Fig. 8:1-2) - an incision ornament of notched and zigzag lines [Dinu 1959:217; Fig. 5:2-3; 1960:93, 98; Fig. 5:3-4; 1961a:47, 53; Fig. 5:3-4; Dumitroaia 2000:Fig. 51:1-2].

A *bone appliqué* was found next to the hands of the male skeleton (no. 1). It was made in the same way as the one previously presented. The ornament is incised and its patterns consist of notched lines, zigzag lines and bands of angles with parallel sides ("herringbone") (Fig. 8:5) [Dinu 1960:93, 98; Fig. 5:5; 1961a:47, 53; Fig. 5:5; Dumitroaia 2000:Fig. 51:5].

A *bone appliqué* similar to the one described above (Fig. 8:6) was found next to the female skeleton (no. 2) [Dinu 1960:93, 98; Fig. 5:6; 1961a:47, 53; Fig. 5:6].

Bone bracelet. A fragment of a bracelet was found next to the hands of the male skeleton (no. 1). It is incised with notched parallel, longitudinal lines. At both ends of the bracelet there are two circular perforations; in the same place, the spaces

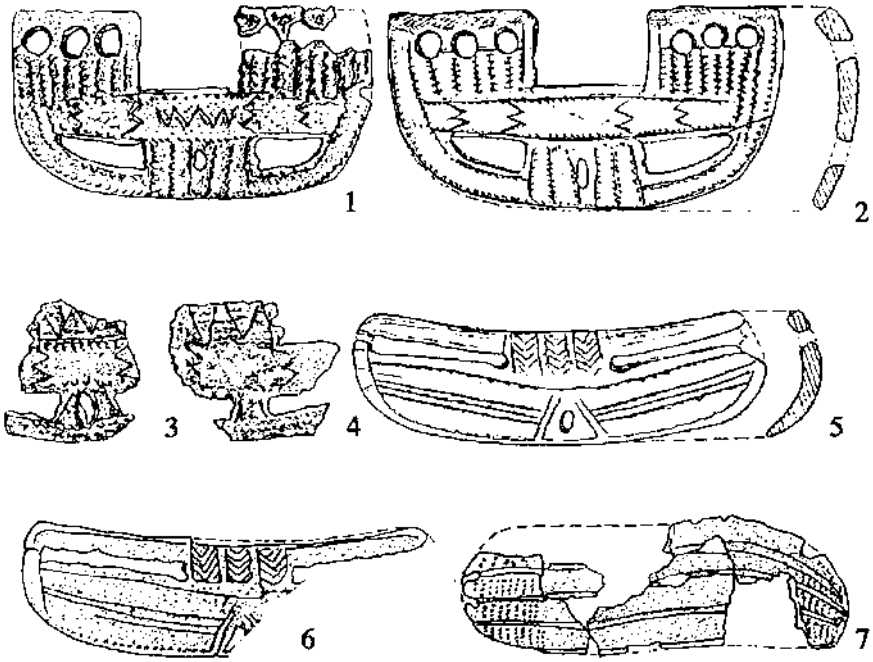

Fig. 8. Dolheştii Mari. Grave goods: 1-2 - bone buckles, 3-4 - fragments of a bone buckle, 5-6 bone appliques, 7 - bone bracelet. 1-2, 5-6 and 7 from the grave no. 2; 3-4 from the grave no. 1. Sources: Dinu 1959; Dumitroaia 2000

between the notched lines are filled with parallel and cross dotted lines (Fig. 8:7) [Dinu 1960:93, 98; Fig. 5:7; 1961a:47, 53; Fig. 5:7; Dumitroaia 2000:Fig. 51:7].

1.3.3. ANIMAL BURIAL

The skeleton of a young cervidae or bovidae not very well preserved was found under the Horodiştea II - Erbiceni I-II layer, in trench I, at the depth of 0.50 - 0.60 m. It lay on its right side, head pointing SSE. Near the head of the animal stood a globular vessel.

Inventory. A globular amphora of brown-greyish clay, containing ground flint and having black polished walls was recovered. It has a thin lip, short neck, high shoulder, globular belly and flat bottom. On the shoulder, there are four small

horizontally perforated lugs. The neck, partially preserved, is decorated with three rows of small parallel, vertical lines. A more complex ornament can be noticed on the shoulder consisting of five patterns: the first one is made up of three rows of parallel, horizontal dotted impressions; then comes a row of arched festoons; the third pattern has a row of short vertical, parallel lines and the fourth one has three rows of small parallel, horizontal dotted impressions like the first pattern; the last one consists of the same type of festoons (Fig. 6:4a-b). Dimensions (approximate): height: 22.5 cm; opening diameter: 11.4 cm; maximum diameter: 22.5 cm; bottom diameter: 10.2 cm [Dinu 1959:216; 1960:92; Fig. 1; 1961a:46; Fig.1].

In the autumn of 1958, Professor Marin Dinu continued his excavations in Dolheştii Mari. The field between the three trenches dug in 1957 was investigated. This time other four trenches were dug east of SI (1957) oriented NS, each of them being 68 m long (SIV - SVII). Another two inhumation graves were found on this occasion (no. 3 and no. 4) [Dinu 1960:93; 1961a:47; 1961b:121f.].

1.3.4. GRAVE NO. 3

It was found in the north end of trench IV (SIV). The skeleton belonged to an adult laying in a crouched position, on the left side, with the head pointing to the ESE and legs to the WNW. The bones of the skeleton were found on a pedestal of local sandstone slabs, 0.60 m below today's ground surface [Dinu 1961a:47; Fig. 6; 1961b:125].

Inventory. Only some fragments of a globular vessel have been preserved. It has a flared rim, very strongly re-curved shoulder, spherical belly, profiled leg and flat bottom. On the shoulder, there are four small horizontally perforated lugs. Just below the rim, there is a stamp ornament, consisting of a row of short vertical, parallel lines going around the neck. On the shoulder, there is another decoration of three rows of similar parallel stamped lines (Fig. 6:2) [Dinu 1960:93; Figs. 6; 7:5; 1961a:47; Figs. 6; 7:5; 1961b:125; Fig. 5:1].

1.3.5. GRAVE NO. 4

The grave was uncovered in the north part of the investigated area, between SV and SVI. The tomb is oriented W-E. Two poorly preserved skeletons were found at the bottom of a shaft 0.55 m below today's ground surface. The first of them

was crouched and lay on the left side (N-S). The other was poorly preserved and it seems that it was buried in a normal position, head to the W and legs to the E; there were two fragmented vessels near its legs (one of them was small). The vessels were globular in shape and had a flat bottom. Only one fragment of these pots has been preserved. It is decorated with "fish scales"forming rows of festoons (Fig. 6:3) [Dinu 1960:93; 1961a:47; 1961b:125; Fig. 5:2].

The inventory is stored in the History Museum of Moldavia in Iaşi.

Human bones from grave no. 2 (vertebrae and a scapula from skeleton no. 1) were submitted to the ^{14}C analysis.

1.4. PIATRA NEAMȚ

A cist grave was uncovered here in the spring of 1955, on the middle terrace of the Bistrița river, during some geological works near the town station. Part of the grave slabs and the inventory were destroyed. The investigation was carried out by Constantin Matasă (Director of the Museum of Piatra Neamț).

A. Grave structure. The cist was found at the depth of 0.60 m. It was oriented E-W, trapezoidal shaped, with the wider side facing east. Built of local whitish sandstone (Kliwa) slabs, the cist, besides the four walls, had a floor and lid. The lid slabs were completely damaged. The floor was made of two big slabs and a smaller one, with the gaps between them filled with pieces of stone, pebbles and trodden earth. On each of the long sides, northern and southern one, there was only one big slab more than 2 m long. It seems that on eastern and western sides there was also one slab each (Fig. 9). Coal and burned pebbles were found at the eastern end of the grave [Matasă 1959:723-726; Figs. 2-3].

B. Inventory. According to the information collected from the discoverers, there were two skulls, fragments of a pot and two flint axes at the western end of the grave; at the eastern end there was another skull, a flint axe and a flint blade; in the middle of the cist there was a "millstone". The researcher believed that the skeletons had been crouched. According to the anthropological investigations, 3-4 adults and 2-3 children lay in the grave [Necrasov, Cristescu 1965:144, 153; Necrasov, Antoniu, Fedorovici 1972:9-23]. The bones of the skeletons, the sherds of "8-9 small and medium-size pots", three flint axes and a flint blade were delivered to the Museum in Piatra Neamț. Further investigations revealed numerous potsherds, two flint tools and a stone one [Matasă 1959:723].

Pottery. The ceramic fragments belonged to nine pots (Fig. 10: 1-13). Their clay contains pebbles and big stone chips (11 mm long); there are more pieces of stone at

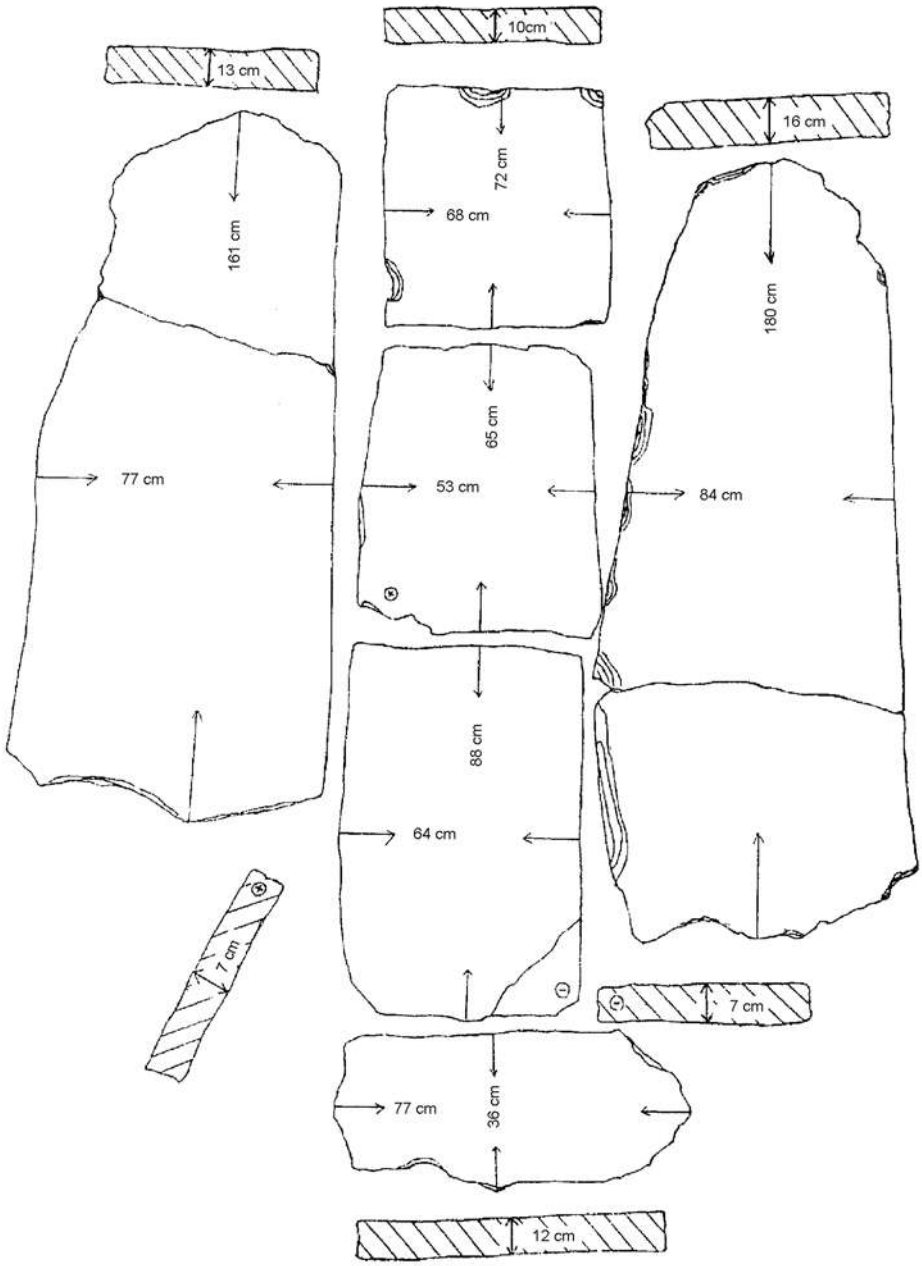

Fig. 9. Piatra Neamț. Slabs of the cist grave. Source: Matasă 1959

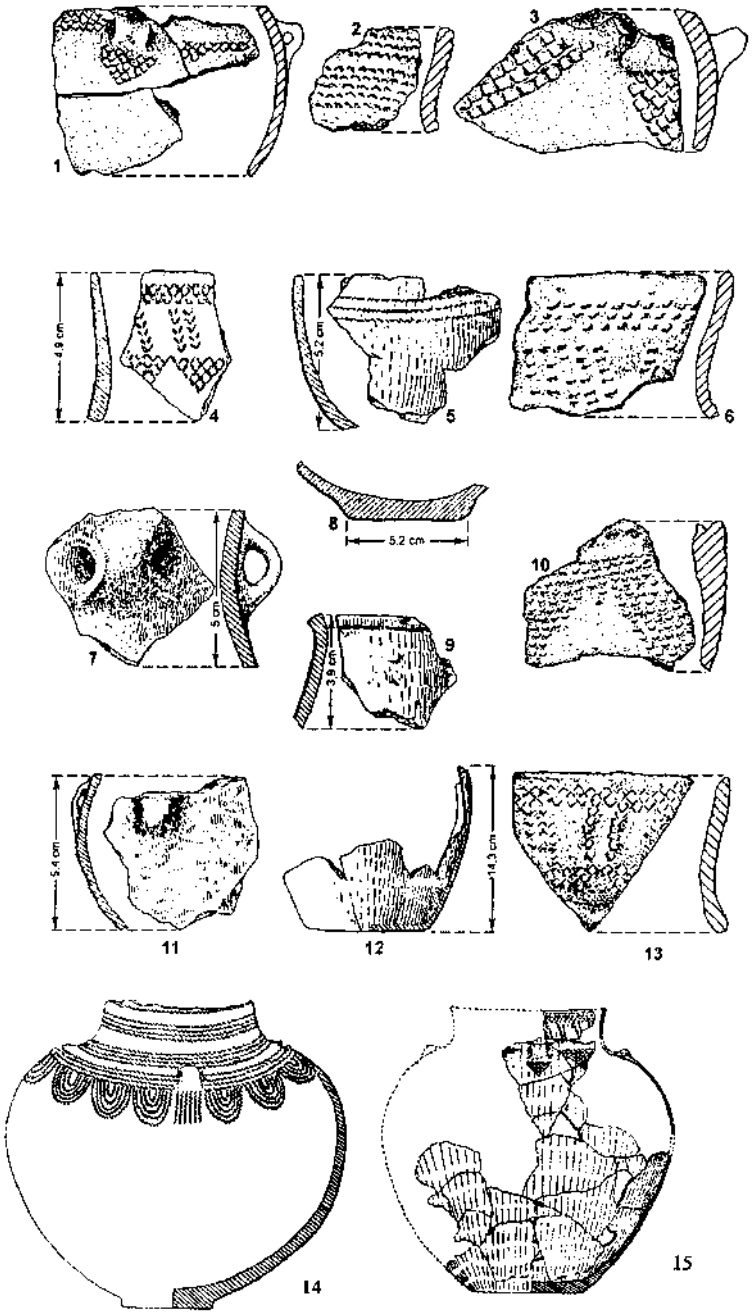

Fig. 10. Piatra Neamț. Pottery from the grave. Source: Matasă 1959; Dumitroaia 2000

the bottom of the vessels. The clay is cleaner in the small vessels. Its colour is brick red or dark brown. The vessels are mainly globular in shape; they have a slightly flared rim, short cylindrical neck and flat bottom. More fragments belonged to some smaller pots with thin walls. The ceramic fragments found in the grave bore also other decorative elements like vertical bands, consisting of angles with parallel sides ("herringbone"). The ornament of the two reconstructed pots is described below. Some of the undecorated vessels are also mentioned [Matasă 1959:726f.; Fig. 6:1-7; Dumitroaia 2000:74; Fig. 55].

Globular amphora (partially restored). It has a damaged rim, short neck, spherical belly, profiled leg and flat bottom. There are four small horizontally perforated lugs on the shoulder. On the neck and shoulder there are three horizontal bands each of them having four parallel, short stamped rows, imitating a cord. Below the last horizontal row, on the shoulder, there are impressed arched festoons, interrupted at the lugs by a vertical band made up of six stamped rows similar to those described above (Fig. 10:14). Dimensions: presumed height: 23-24 cm; presumed rim diameter: 15 cm; maximum diameter: 23.4 cm; bottom diameter: 8 cm [Matasă 1959:726f.; Figs. 4; 5:1].

Globular amphora (partially restored). It has a flared rim, short neck, spherical belly and flat bottom. Four small horizontally perforated lugs are on the shoulder. The ornament has three impressed patterns: a horizontal band below the rim with three impressed rows; then, vertical bands with "fish scale"impressions on the neck; on the shoulder there are suspended triangles with stamped rhombi (Fig. 10:15) [Matasă 1959:727; Fig. 5:2].

Flint artefacts. Three axes, a chisel, a scraper and a blade were uncovered (Fig. 11:1-6). Well-polished axes are trapezoid in shape, having their cutting-edge slightly curved and a rectangular butt. Two of them were made of translucent greenish flint (length: 10.3 cm and 14.5 cm; width: 3.3 cm and 5 cm; thickness: 1.5 cm and 2.5 cm). The third axe was made of translucent bluish flint (length: 9.3 cm; width: 3.2 cm; thickness: 1.3 cm). The chisel is almost rectangular in shape, the cutting-edge is slightly curved, while the butt is quadrangular. The flint is translucent and greenish. It seems it was broken in olden times (preserved length: 7.4 cm; width: 1.8 cm; thickness: 1.6 cm). The axes and the chisel have all their sides well polished. They are, however, all damaged. A greyish flint scraper (length: 8.9 cm) and a light grey flint blade (length: 5.4 cm) were also found [Matasă 1959:728f.; Fig. 8:1-6].

Stone artefacts. A flat piece of yellowish shale, rectangular-oval in shape and slightly curved inwards on both sides was recovered. Both its ends bear the signs of perforations (Fig. 11:7). Another flat sandstone plate is rectangular in shape (Fig. 11:8). It is thought to have been used as a "millstone", although both its sides are smooth and do not show any signs of wear [Matasă 1959:729; Fig. 8:7-8].

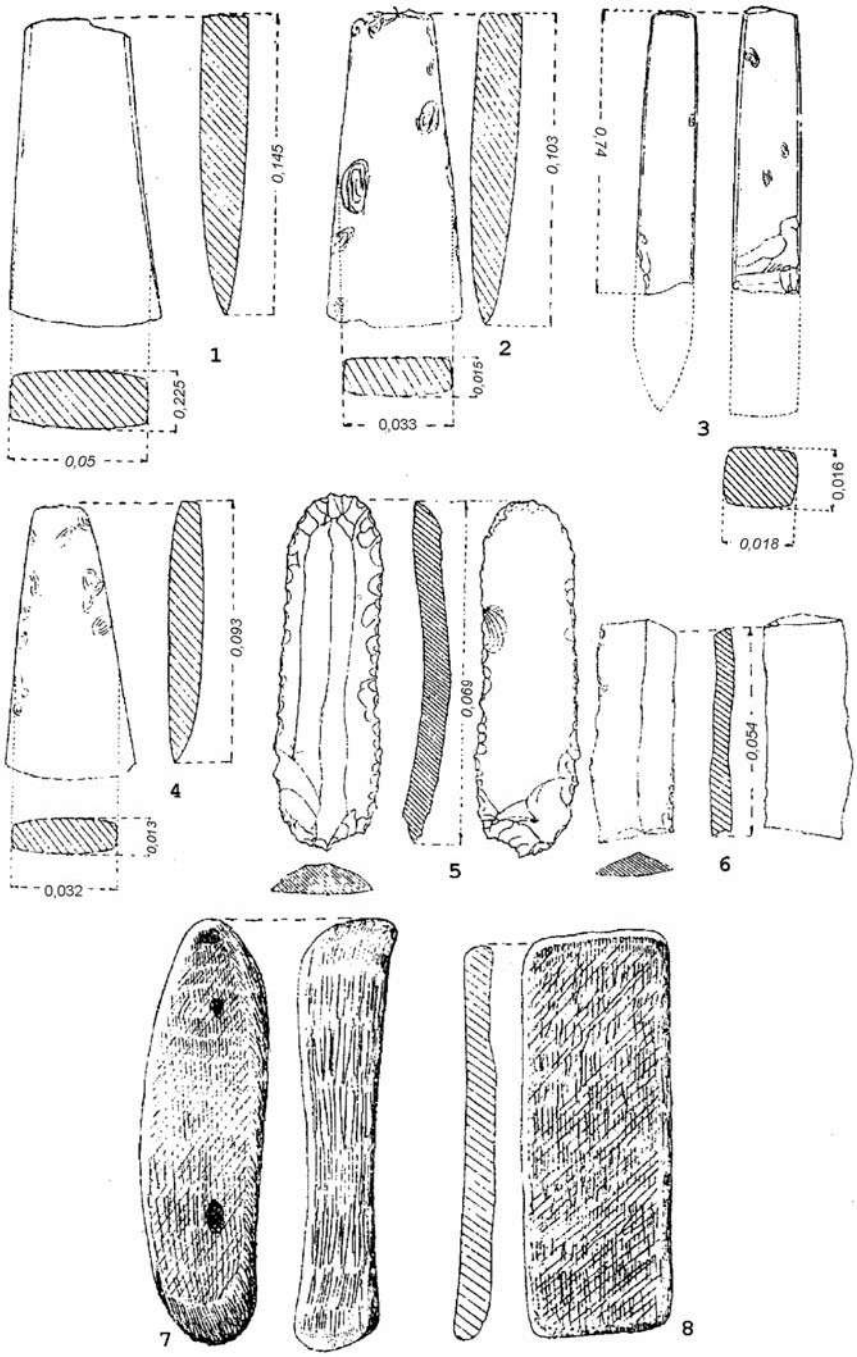

Fig. 11. Piatra Neamț. Goods: flint (1-6) and stone (7-8) artefacts from the grave. Source: Matasă 1959

The documentation, slabs and inventory are stored in the District Museum of Piatra Neamț.

Human bones (leg bones of an adult) from the grave were submitted to the ^{14}C analysis.

1.5. CONCLUSION

Basarabi. Both the context in which the sample was deposited and its relation to the GAC are clear (see part 1.1). Unfortunately, the grave was partially destroyed and then some elements of the grave inventory (particularly one of the two vessels found in the grave) disappeared making its taxonomic assessment rather difficult. The only published vessel suggests that the grave has an early chronology, correspondent with phase PA (2900-2700 BC) in Podolia, yet this suggestion is uncertain.

Bârgăuani. In this grave five bodies were laid: three male and two female (see part 1.2). Nothing is known about their arrangement. Since the grave was small, it may be assumed that the bones of at least some of the skeletons were not arranged anatomically. The bones of one of the dead (no. 3) were taken for dating. The burials and the inventory were partially destroyed before the archaeological excavation. Out of at least six vessels found in the grave, only about two we have relevant information. The ornaments of these vessels are similar to decorations typical of phase PB (2700-2350 BC) in Podolia. However, the time brackets of the other, destroyed grave goods are unknown. Thus, it cannot be determined whether the above chronology refers to the whole period in which the grave functioned or only to one possible phase of its use. Moreover, it is impossible to establish what relation there was between the dated sample and the inventory.

Dolheştii Mari, grave 2. The grave featured the remains of two persons: a man and a woman (see part 1.3.2). The arrangement of bodies [Dinu 1960:Fig. 4] suggests that they were both laid in the grave at the same time. The grave inventory, particularly pottery, is abundant and fully published. It seems to be related to phase VB in Volhynia (2750-2500 BC) but it also contains less chronologically clear elements from Podolia. Several bones from the male skeleton were taken for dating. Consequently, the relation between the dated sample and the grave inventory that makes it possible to assess the grave taxonomically is clear.

Piatra Neamț. The grave and its inventory were partially destroyed before the archaeologists started excavation works. There were found the remains of 5-7 per-

sons (see part 1.4). The leg bones of one of the adults were taken for dating. The dead (all of them?) were laid crouched. However, nothing is known about the arrangement of the bodies in relation to one another. Only a small part of the inventory, consisting of inter alia nine vessels, was described. Not more than a few of these vessels were published. This information serves as the only basis for a cautious conclusion that the vessels bear traits analogous to the ones known from phase PB (more probably PB1) in Podolia and phase VB in Volhynia (i.e. 2700-2500 BC). Similarly to the grave from Bârgăuani, it is impossible to determine whether the above time brackets correspond to the whole period in which the grave was used. Besides, it is not possible to determine the relation between the grave goods and the dated sample.

To sum up, in the case of two examined bone samples (Basarabi and Dolheştii Mari grave 2) the depositional context (i.e. the context in which the samples were deposited) is clear enough to assess the features taxonomically. However, due to the loss of part of the grave inventory, in the case of Basarabi such evaluation is more difficult. In the two other cases (Bârgăuani and Piatra Neamț), it is apparent that the bone materials are related to the GAC. Yet, the fact that the graves featured many burials, were partially destroyed or that some elements of their inventories are missing raises many doubts as far as the taxonomic evaluation of the graves is concerned.

2. RADIOCARBON DATINGS OF THE MOLDAVIAN (SIRET) SUBGROUP OF THE GLOBULAR AMPHORA CULTURE

Five human bone samples from four graves were analysed (Table 1). The measurements were performed at the Radiocarbon Laboratory of the National Academy of Sciences of Ukraine in Kiev[3]. The levels of both ^{14}C isotope and $\sigma^{13}C$ were determined. The laboratory error of the ^{14}C measurement is 60 years, which means that the assay was moderately precise. The results of tests on two samples from the same skeleton (Dolheştii Mari grave 2, skeleton 1) are consistent. The $\sigma^{13}C$ values range between -18.90±0.2 and -19.90±0.2, which is consistent with the results of analyses of human bones from other territories settled by the GAC [Piontek, Sobczyk, Szmyt 2004], as well as bones related to the other Neolithic cultural units that appeared in the east European forest-steppe and steppe [Lillie, Richards 2000:Table 1].

[3] We would like to thank Nikolay Kovalyukh, PhD, head of the Radiocarbon Laboratory of NASU in Kiev for his help.

Table 1

^{14}C dating of samples from graves of the Moldavian (Siret) subgroup of the Globular Amphora culture

No.	Site	Grave/ skeleton	Lab. No.	Sample	$\sigma^{13}C$ (‰)	BP	BC 1 sigma (68,2%)	BC 2 sigma (95,4%
1	Bârgauani	skeleton 3	Ki-10654	human bones	-19.90±0.2	4320±60	3020-2880 (68,2%)	3100-2700 (95,4%)
2	Basarabi		Ki-10651	human bones	-19.30±0.2	4370±60	3090-3060 (8,4%) 3040-2900 (59,8%)	3330-3220 (9,4%) 3180-3150 (1,3%) 3120-2880 (84,6%)
3	Dolheştii Mari	Grave 2/ skeleton 1	Ki-10652	human bones	-19.00±0.2	4560±60	3490-3470 (4,0%) 3380-3300 (21,9%) 3240-3100 (42,3%)	3510-3420 (10,6%) 3380-3080 (82,8%) 3070-3030 (2,0%)
4	Dolheştii Mari	Grave 2/ skeleton 1	Ki-10658	human bones	-19.20±0.2	4590±60	3510-3430 (22,6%) 3380-3320 (21,1%) 3220-3170 (12,9%) 3160-3110 (11,6%)	3520-3090 (95,4%)
5	Dolheştii Mari	Grave 2/ skeleton 1	Combine (Ki-10652 + Ki-10658)	human bones		4575±42	3500-3460 (9,5%) 3380-3330 (27,8%) 3220-3180 (14,5%) 3160-3120 16,3%)	3500-3430 (13,6%) 3380-3260 (37,5%) 3240-3090 (44,3%)
6	Piatra Neamț		Ki-10653	human bones	-18.90±0.2	4140±60	2870-2800 (20,4%) 2790-2620 (46,7%) 2610-2600 (1,1%)	2890-2570 (94,0%) 2520-2500 (1,4%)

3. CALIBRATION OF DATES

The calibration of dates was carried out by means of the computer program OxCal v.3.5 [Bronk Ramsey 2000]. All results are listed in Table 1. In the further analysis mainly the 1 sigma (68.2%) probability range is used.

The series (Fig. 12) is clearly divided into two groups. The older one contains the dates for Dolheştii Mari grave 2 and they all fall at approximately 3510-3100 BC (Fig. 13). The younger one contains the other three dates, ranging between 3090 BC and 2600 BC. The dates from Dolheştii Mari fall at three segments of the calibration curve [references according to Raetzel-Fabian 2000:Fig. 50]: two segments form large plateaux (3520-3360 BC and 3350-3090 BC) and one forms a wiggle of the curve (3370-3350 BC). Both these dates and the combined date fit, with the highest probability, in the younger plateau. The dates from Basarabi and Bârgăuani are situated within two segments of the calibration curve (Fig. 13): one plateau (3100-2920 BC) and one wiggle (2920-2880 BC), but, with the highest

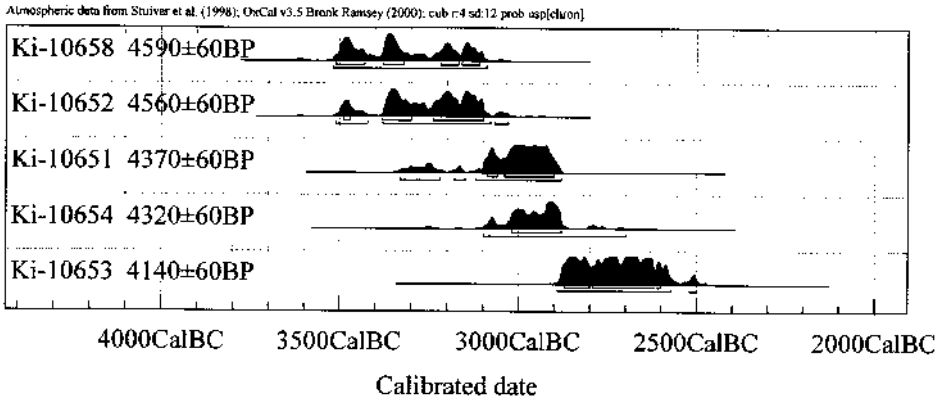

Fig. 12. Calibration of radiocarbon datings for four graves of the Moldavian (Siret) subgroup

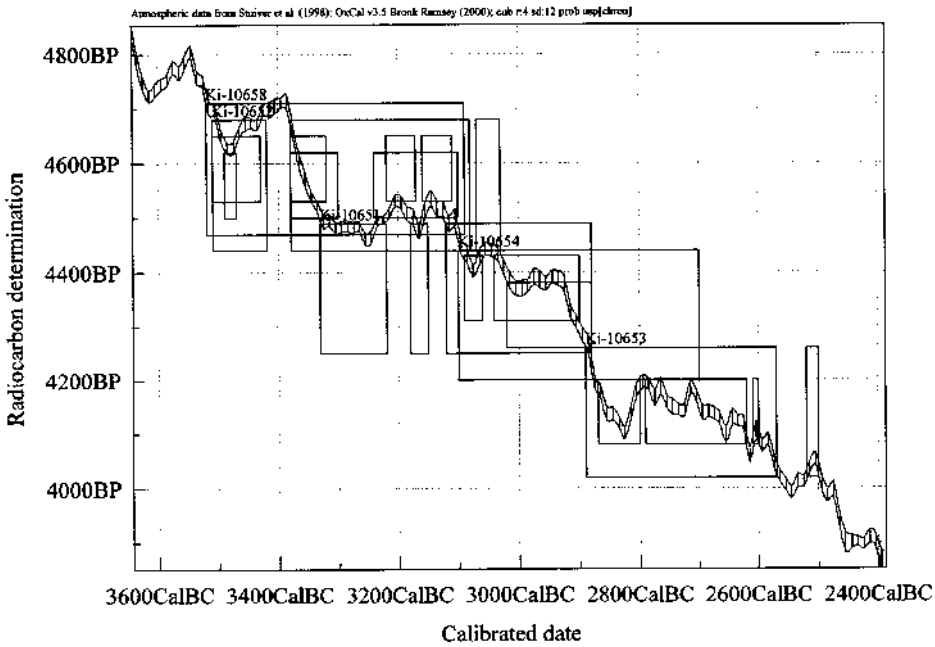

Fig. 13. Calibration of radiocarbon datings for the Moldavian (Siret) subgroup. Time brackets against the calibration curve

probability, they fall at the border point between them. The date from Piatra Neamț is fully included in a large plateau (2880-2580 BC).

To conclude, all the considered dates fall at a complicated segment of the calibration curve, characterised by large, even 300-calendar-year-long plateaux and short 20- to 40-year-long wiggles (Fig. 13). In view of that, mean measurement precision and the laboratory errors of 60 radiocarbon years yield broad confidence intervals, obtained as a result of calibration. A way to narrow them down is to carry out *archaeological wiggle matching*.

Furthermore, in the case of Basarabi and Piatra Neamț the calibration results correspond to the taxonomic assessment. The date for the Bârgăuani feature is older than the taxonomic time brackets, yet their accuracy is doubtful. In contrast to the above, the dates for well-investigated Dolheştii Mari grave 2 are absolutely incompatible with taxonomic assessment. Both dates for this grave, as well as the combined date, are considerably earlier than other assays carried out for features from the eastern group. With the current state of knowledge, it is difficult to explain this asynchronism in archaeological terms. We believe that the assays could be erroneous, due to such reasons as unknown conditions of storing the Dolheştii Mari bone materials, a mistake made during inventory control, packaging, laboratory handling or an error committed while measuring the ^{14}C content. Because it is possible to date the bone samples from Dolheştii Mari grave 2 again, for the time being this issue has to remain unresolved.

4. ARCHAEOLOGICAL WIGGLE MATCHING AND A SUGGESTED INTERPRETATION OF DATES

Archaeological wiggle matching (see article by S. Kadrow in this volume) involves confronting the results of probability calibration of radiocarbon dates with additional information about the calendar age of the dated sequence of events [Weninger 1997:165-170]. In this case the additional information comes form taxonomic analysis, thanks to which it is possible to determine the most probable time relations between the examined graves (more precisely: between the samples taken from these graves). For the purpose of this analysis two assumptions were made. First, the origins of the Moldavian subgroup are connected with the influx of GAC populations from Podolia (partially from Volhynia, too), which means that the beginnings of the subgroup in question cannot be dated earlier than the oldest GAC phase in Podolia (and, of course, Volhynia). Second, the changing of characteristics of grave inventories in the Moldavian (Siret) subgroup replicates the series of changes traced in the other two branches of the eastern group of the GAC, i.e. in Volhynia and

Table 2

^{14}C dating of samples from sites of the Volhynian and Podolian subgroups of the Globular Amphora culture. Calibration after OxCal v.3.5.

Site	Feature	Lab. No.	Sample	BP	BC 1 sigma (68,2%)	BC 2 sigma (95,4%)	References
VOLHYNIA							
Tovpyzhyn	Grave	Ki-5011	human bones	4310±45	3020-2980 (17,4%) 2960-2950 (1,6%) 2930-2880 (49,2%)	3090-3060 (2,5%) 3040-2870 (92,9%)	Maleyev, Pryshchepa 1996; Szmyt 1999
Tovpyzhyn	Grave	Ki-5010	human bones	4270±50	2930-2860 (50,6%) 2810-2780 (10,9%) 2770-2760 (3,3%) 2720-2700 (3,4%)	3030-2850 (66,6%) 2820-2670 (28,8%)	Maleyev, Pryshchepa 1996; Szmyt 1999
Tovpyzhyn	Grave	Combine	human bones	4292±33	2914-2884 (68,2%)	3020-2870 (95,4%)	Maleyev, Pryshchepa 1996; Szmyt 1999
Ozdiv	Grave	Ki-5919	human bones	4150±50	2880-2830 (13,6%) 2820-2800 (5,4%) 2790-2660 (40,5%)	2880-2580 (95,4%)	Mazurik, Panyshko 1998; Szmyt 1999 Szmyt 1999
Ivanye	Grave	Le-5021	human bones	4090±70	2860-2810 (14,4%) 2750-2720 (6,7%) 2700-2560 (41,2%) 2520-2490 (5,9%)	2880-2470 (95,4%)	Sveshnikov 1983; Maleyev 1996; Szmyt 1999
Ivanye	Grave	Ki-5141	human bones	4030±50	2620-2470 (68,2%)	2860-2810 (5,7%) 2750-2720 (1,1%) 2700-2450 (88,6%)	Sveshnikov 1983; Maleyev 1996; Szmyt 1999
Ivanye	Grave	Combine (Le-5021 + Ki-5141)	human bones	4050±41	2660-2650 (1,6%) 2630-2490 (66,6%)	2860-2810 (7,6%) 2700-2460 (87,8%)	Sveshnikov 1983; Maleyev 1996; Szmyt 1999
Suyemtsy 2	Grave	Ki-6930	human bones	3935±45	2550-2540 (2,1%) 2490-2340 (66,1%)	2570-2510 (10,2%) 2500-2290 (85,2%)	Sveshnikov 1983; Szmyt 1999

Site	Feature	Lab. no.	Sample	BP	BC 1 sigma (68,2%)	BC 2 sigma (95,4%)	References
Peresopnitsa 3	Pit	Ki-5075	animal bones	3910±50	2470-2300 (68,2%)	2560-2520 (3,2%) 2500-2270 (86,8%) 2260-2200 (5,5%)	Shelomentsev-Terskiy 1996; Szmyt 1999
PODOLIA							
Vorvulintsy	Grave	Ki-5008	human bones	4220±70	2910-2850 (18,4%) 2820-2670 (49,8%)	3010-2980 (1,2%) 2930-2570 (94,2%)	Sveshnikov 1983; Maleyev 1996; Szmyt 1999
Loshniv	Grave	Ki-5006	human bones	4150±55	2880-2830 (13,7%) 2820-2800 (5,6%) 2790-2660 (40,2%) 2650-2620 (8,8%)	2890-2570 (95,4%)	Sveshnikov 1983; Maleyev 1996; Szmyt 1999
Khartonivtsy 2	Grave	Ki-5586	human bones	4130±70	2870-2800 (18,5%) 2780-2770 (2,6%) 2760-2580 (47,1%)	2890-2550 (90,8%) 2540-2490 (4,6%)	Sveshnikov 1983; Szmyt 1999
Khartonivtsy 2	Grave	Ki-5587	human bones	4060±60	2840-2810 (6,6%) 2670-2470 (61,6%)	2870-2800 (13,3%) 2790-2460 (82,1%)	Sveshnikov 1983; Szmyt 1999
Khartonivtsy 2	Grave	Combine (Ki-5586 + Ki-5587)	human bones	4090±46	2860-2810 (16,0%) 2700-2570 (47,3%) 2520-2500 (4,9%)	2870-2800 (19,2%) 2790-2490 (76,2%)	Sveshnikov 1983; Szmyt 1999
Dovge	Grave	Ki-5009	human bones	4040±60	2830-2820 (2,4%) 2660-2650 (2,7%) 2630-2460 (63,1%)	2900-2350 (95,4%)	Sveshnikov 1983; Maleyev 1996; Szmyt 1999

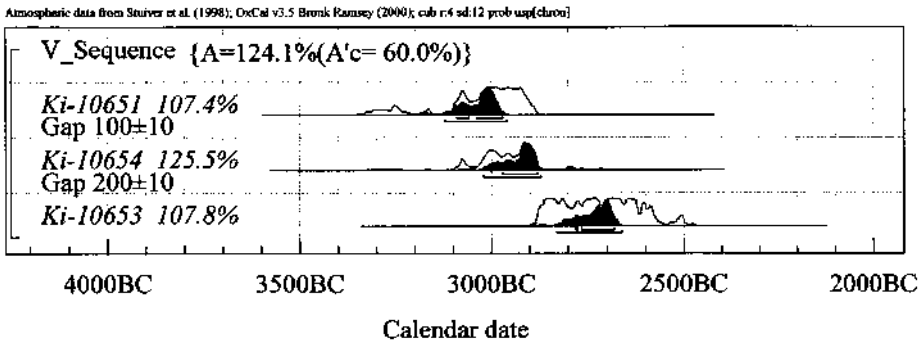

Fig. 14. Archaeological wiggle matching analysis for selected ^{14}C datings: Basarabi (Ki-10651), Bârgauani (Ki-10654) and Piatra Neamț (Ki-10653)

Podolia [Szmyt 1999]. However, one has to bear in mind that due to problems with identifying the context in which the sample was deposited (see point 1.5 above), the dates from Bârgăuani (because of too large taxonomic brackets) cannot be reliably placed in the examined sequence. Already at the beginning, it turned out that the Dolheştii Mari dates disrupted the sequence because in their case the taxonomic assessment and the radiocarbon dates were absolutely at odds with one another, so they had to be eliminated from further procedures. Consequently, the following sequence of features was analysed: 1. Basarabi (Ki-10651); 2. Bârgăuani (Ki-10654); 3. Piatra Neamț (Ki-10653).

The results merit the following comment. The Basarabi feature has characteristics typical of the early graves, thus its chronology should be set at the period between 2900 and 2700 BC. According to the ^{14}C dating, the older time limit is more accurate, but the most probable confidence interval is 3040-2900 BC (Table 1). This time bracket is older than any other dates from Podolia known so far (Table 2). Thus, the chronology of GAC beginnings in Podolia should be corrected. In the case of the Piatra Neamț multi-burial grave, the ^{14}C date is clear. In the light of the taxonomic assessment, the date should not be earlier than 2700 BC. There are two potential confidence intervals (Table 1), but the one falling between 2790 BC and 2620 BC, and more precisely its younger part, i.e. 2700-2620 BC, is more probable. The Bârgăuani multi-burial grave should be at least to a certain degree younger than the Basarabi feature, but also considerably older than the Piatra Neamț grave. These assessments correspond to the 1 sigma range: 3020-2880 BC. However, this is a definitely earlier bracket than the one obtained as a result of taxonomic assessment of the available grave goods (2700-2350 BC). It is possible to date the feature at about 2700 BC when the 2 sigma range of probability for the discussed dates, i.e. 3100-2700 BC is taken into consideration.

Using the OxCal program the information was tested by simulating different versions of time intervals separating the examined ^{14}C assays. The optimum statistical and logical variant is illustrated in Fig. 14. The dated GAC grave assemblages form the following sequence: 2995±25 BC (Basarabi); 2925±45 BC (Bârgăuani); 2717±43 BC (Piatra Neamț). It was this variant that was adopted as a summary of the above discussions.

5. CONCLUSIONS

This article presents the first radiocarbon dates for the southern part of the eastern group of the GAC, i.e. for the so-called Moldavian (Siret) subgroup. Their chief significance lies in the fact that they encourage researchers to formulate a program of further chronological studies. The data are not easy to interpret because the archaeological context of the dates from Bârgăuani and Piatra Neamț is not straightforward and the dates from Dolheştii Mari grave 2 need a confirmation (they could be erroneous). That is why efforts should be intensified to obtain more precise data concerning the existence of settlement structures of GAC populations in the Moldavian Uplands.

According to current information, the beginning of the presence of GAC populations on the Siret River falls approximately at 3000 BC. If this date is confirmed by subsequent sources, it will mean that it is necessary to correct the date marking the emergence of the GAC settlement in Podolia and Volhynia. In both these regions, GAC populations must have appeared either somewhat earlier or at least at the same time as in the south, considering that the only possible way of transmitting the GAC patterns was from the Vistula drainage area towards the southeast [Szmyt 1999]. The youngest date, i.e. about 2700 BC still does not mark the youngest stage of the Moldavian subgroup development, which could fall at about 2500 BC at the latest, as confirmed by Yamnaya culture grave assemblages containing GAC elements [Szmyt 2000].

While preparing the next stage of research into the radiocarbon chronology of the Moldavian (Siret) subgroup of the GAC, and more broadly the whole eastern group, it is necessary to take into consideration the experience in this field gained so far. The first issue is the selection of samples for dating. In all assays for the eastern group it was impossible to take the optimum samples but only those which were available. In most cases (in the Siret subgroup always) the dated material came from previous investigations, carried out several decades earlier and employing not very precise exploration methods of GAC graves. In view of this, and because of

the fact that the assemblages and documents were incomplete, in most cases it was impossible to obtain in-depth information that would provide the means to relate closely the examined bones to the context in which they were found (e.g. to determine which skeleton in a multi-burial grave a given bone belongs to). In this respect, so far, the samples were selected randomly. What is more, since there are no investigations of the relevant GAC graves using modern methods, it is unlikely that the situation described above will ever change for the better.

As concerns the Moldavian subgroup, undisputedly, new radiocarbon dates are necessary. The best solution would be to continue the already started program [Klochko, Kośko, Szmyt 1999a; 1996b] involving the analysis and dating of short-life material, mainly bones. However, working on grave materials requires co-operation with anthropologists in order to identify precisely the sequence of burials and select the optimum samples to be sent to a radiocarbon laboratory. Finally, it would be particularly important to have an opportunity to radiocarbon date samples from graves containing elements of the Globular Amphora and Yamnaya cultures [Szmyt 2000].

Acknowledgements. We would like to express our special thanks to Professors Victor Spinei and Marin Dinu (Alexandru I. Cuza University in Iaşi) and to Dr Gheorghe Dumitroaia (Director of the District Museum in Piatra Neamţ) for providing unpublished documentation and illustrations. We would also like to thank the young researcher Robert Szimalcsik (Anthropological Research Centre of Romanian Academy in Iaşi) for collecting samples of human bones for the ^{14}C analysis.

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 113-120
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF COMPLEXES OF THE ENEOLITHIC — EARLY BRONZE AGE IN THE NORTHERN PONTIC REGION, A PRELIMINARY REPORT

Although as many as about twenty radiocarbon dates have been already received for complexes of the Usatovo type in the Northern Pontic region [Videiko 1999:56-59; Szmyt, Chernyakov 1999:196-202], the issue of their absolute chronology remains firm on the agenda. For older, so-called Eneolithic graves of the region (predominantly containing no objects) until recently there were no radiocarbon dates at all, and their dates were based on stratigraphical data and finds of the Tripolye pottery.

1. LIST OF DATINGS

This article published five dates for the Koshary Eneolithic cemetery [calibration after Kovalyukh, Nazarov 1999], one for the Mayaki settlement (of the Usatovo type), and six for the sub-barrow burial sites (cemeteries near the villages of Katarzhyno, Oleksandrivka, Khadzhider-1, Sadove, also identified as the Usatovo ones), Fig. 1.

1.1. THE KOSHARY SITE 1

The cemetery was found during the exploration of remainders of an ancient town near the Koshary village in the Odesa Region, situated in the mouth of the Tiligul river. The research has continued for a rather long period of time.

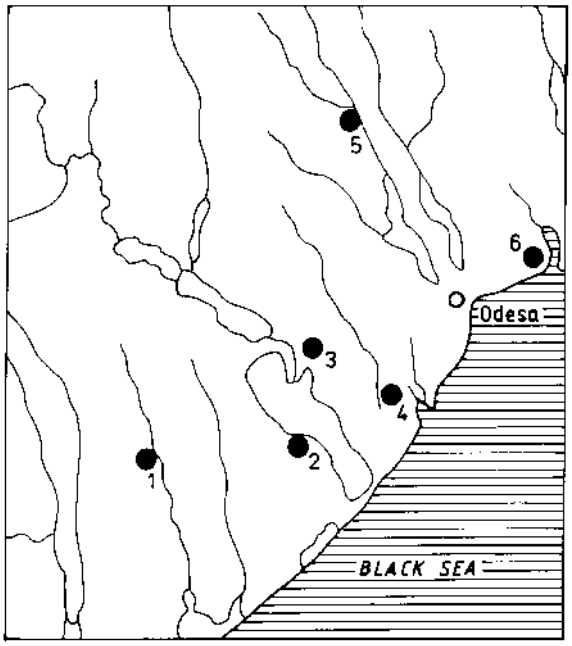

Fig. 1. Map of location of the dated complexes – Odesa District: 1- Khadzhider-1; 2 - Sadove; 3 - Mayaki; 4 - Oleksandrivka; 5 - Katarzhyno; 6 - Koshary

Grave 20, studies by E.Y. Dyamant, contained a smallish Tripolye vessel with traces of decorative painting [Patokova *et al.* 1989:124]. The vessel can be dated back to stages BII or CI of the Tripolye period. No remainders of burial mounds were found over the graves in Koshary; therefore, it may be assumed that the find was a soil cemetery.

Table 1

Koshary 1 — the dated complexes

Copmlex	Material	Lab. No.	Date BP	Date BC
Grave 1	bone	Ki-9784	4920±70	3705±66
Grave 3/2	bone	Ki-9785	4950±70	3720±74
Grave 3	bone	Ki-9786	5035±70	3844±84
Grave 4	bone	Ki-9787	5150±70	3946±110
Grave 5/1	bone	Ki-9788	5180±70	4023±105

Excavation of five Eneolithic graves that provided samples for dating was done in 2001 by an expedition led by Y. Redina.

The obtained dates (Table 1) helped identify the Koshary cemetery as belonging to stage BII of the Tripolye culture — which fully corresponds with the dating of a vessel that was found in the grave before.

1.2. KATARZHYNO

Table 2

Katarzhyno — the dated complex

Complex	Material	Lab. No.	Date BP	Date BC
Barrow 1, grave 10	bone	Ki-9523	4950 ±70	3720±74

The barrow cemetery of five mounds near the village of Katarzhyno, Ivanivka District of the Odesa Region, was studied in 1991 by an expedition led by S.V. Ivanova. The cemetery was located on a plateau on the right bank of the Maliy Kuyalnik river.

The samples (bones) selected for date-setting, were taken from grave 10 of barrow 1 (Table 2). That was the main grave of the cemetery, referred by the authors of this article to the Usatovo type.

The diameter of the barrow at the moment of the beginning of the excavation was 80-85 m; the general height was 6.45 m.

There were two mounds made over grave 10. The first one was oval in section, 13 x 16.5 m, up to 1.4 m high; it was made of black soil and lay on a 0.35-0.4 m thick layer of buried black soil. The second one, 24 meters in diameter, was up to 2 meters high and consisted of black soil with some elements of loam. The mound was circled with an oval ditch (22 x 26 m), 0.9 m wide at the top, 0.3 m wide at the bottom, buried by 0.4 m to the main soil. The ditch was filled with black soil, in which a few animal bones were found. The other 'dropped-in' graves belonged to the Yamnaya culture [Ivanova 2000:200], the Catacomb culture and the Mnogovalikovoi Pottery culture.

Grave 10 (the main one, Usatovo) was found in 5.5 m to the south from the center of the barrow. Above the grave, there were remainders of a dome-shaped cover made or fragments of flat stones (lime-stone). The cover was about 4 m. in diameter and up to 0.6 m high. Between the stones there were occasional fragments of large tubular animal bones; some of the stones bore traces of fire. The stones lay on a 0.2-0.3. m layer of loam and charcoal. After the cover and a layer of loam were removed, another cover was found below (3.4 m x 2.05 m, 0.1-0.15 m thick,

on the remainders of a reed mat). The middle part of the cover moved down to the grave. At the southern side of the cover, there was a half of a broken pot.

The pot was a typical vessel of the Usatovo type. It was made of clay with an admixture of shells; at the neck there was an ornament made of four rows of imprints of a cord and some "sickle-shaped imprints".

Under the remainders of the mat and around the grave there was a 0.04-0.05 m layer of ach and charcoal; there were also traces of three fires. The burial chamber was oval in projection, 1.40 x 1.08 m at the bottom, 0.6 m deep. The buried body had been placed on a mat (only brown ashes of it were preserved) in a curved position on the back, knees to the right, arms straight, palms down. There was red ochre on the bones. On the chest there were traces of a piece of ochre and some coals. Under the skull there was a splinter of flint. On the left arm there was another piece of ochre; a pot (0.08-0.09 m high with a broken handle was placed on the ochre) [Ivanova, Vetchinnikova 1991:1; 8-10; 16-17].

The date, obtained for grave 10 (3720±74 BC) is too early for the Usatovo complexes, for it corresponds to stage BII of the Tripolye. The ceramics, same as the one found at the cover of grave 10, belongs to stage CII of the Tripolye culture and, therefore, may not be dated back to earlier than 3200-3100 BC.

1.3. OLEKSANDRIVKA

Table 3

Oleksandrivka — the dated complexes

Complex	Material	Lab. No.	Date BP	Date BC
Grave 35	bone	Ki-9524	4720±70	3476±99
Grave 22	bone	Ki-9525	4760±70	3538±97
Grave 17	bone	Ki-9526	4010±60	2552±83

Barrow 1 near the village of Oleksandrivka of the Odesa Region was studied by an expedition led by V. S. Beilekchi in 1993. The barrow contained graves that were interpreted by these authors as those of the Usatovo type (17, 22, 35). Later graves in the barrow belonged to the Yamnaya culture [Ivanova 2000:198].

Dates for graves 35 and 22 (3476±99 BC and 3538±97 BC) may be synchronized with early complexes of the Usatovo type; grave 17 should rather be dated back to the Yamnaya culture (Table 3). However, the fact that it was not referred to the Yamnaya culture (it is not present in the catalogue of the Yamnaya graves

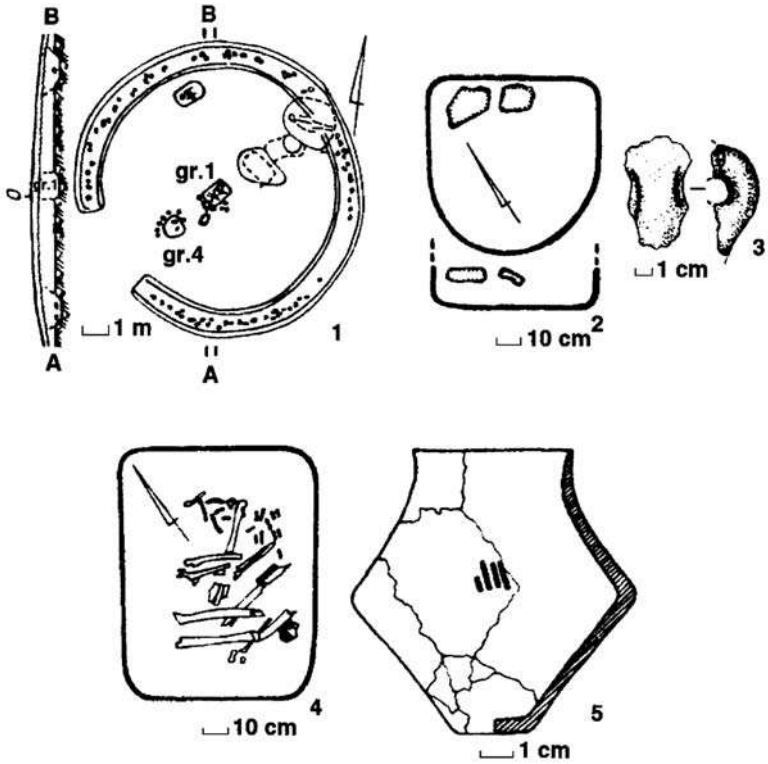

Fig. 2. Khadzhider site 1: 1 - plan and section of the barrow; 2 - plan and section of grave 4; 3 - fragment of a vessel from grave 4; 4 - plan and section of grave 1; 5 - vessel from grave 1 (after V.H. Petrenko)

issued by S.V. Ivanova) allows for the assumption that is was a late complex of the Usatovo type — possibly, similar to the latest ones of the Akkembetskiy kurgan [Szmyt, Chernyakov 1999:196-202].

1.4. KHADZHIDER SITE 1

Table 4

Khadzhider — the dated complex

Complex	Material	Lab. No.	Date BP	Date BC
Grave 4	bone	Ki-9528	4640±70	3429±116

The Khadzhider cemetery of the Sarata Region, Odesa District, was studied under the leadership of O.S. Ostroverkhov in 1988. Barrow 6 contained two Eneolithic graves the main one (no 1) and grave 4 (possibly, a cenotaph?). The barrow also contained dropped-in graves of the Yamnaya and the Catacomb cultures [Ivanova 2000:203], Fig. 2.

Grave 4 was a pit with rounded corners, about 1 m x 1 m in dimensions, traced to 0.2 m deep. At the bottom of the pit there were fragments of a vessel with two handles. The vessel was made of clay with an admixture of ground shells.

The other Eneolithic grave (no 1) contained a skeleton that lay curved on the left side, with traces of ochre on the bones. Next to it there was a smallish bi-conical vessel with traces of an ornament; the vessel may be dated back to stage CI of the Tripolye culture [Patokova *et al.* 1989:124, Fig. 40].

The date of grave 4 (Table 4) corresponds with stage CI of the Tripolye culture; therefore, it could be approximately synchronous with grave 1. However that chronological interval also includes early Usatovo complexes.

V.H. Petrenko identified complexes of the Khadzhider type that, in his opinion, were involved in the genesis of the Usatovo layer of historic objects [Patokova *et al.* 1989:124].

1.5. SADOVE

Table 5

Sadove — the dated complex

Complex	Material	Lab. No.	Date BP	Date BC
Grave 35	bone	Ki-9529	4900±70	3700±66

The barrow near the village of Sadove of the Bilgorod-Dnistrovskiy Region, Odesa District, was studied by an expedition led by E.A. Malyukevich in 1990. Seven Yamnaya graves were found in the barrow.

The date of grave 35 (Table 5) corresponds to stage BII of the Tripolye culture.

Table 6

Mayaki — dates for wood samples from the studies by V.H.Petrenko

Complex	Material	Lab. No.	Date BP	Date BC
Feature 1/1990	wood	Ki-9527	4380±70	2993±91

The complex near the village of Mayaki of the Bilyaivka Region, Odesa District, was studied by V.G. Zbenovich and V.H. Petrenko [Zbenovich 1974:22-33; Patokova *et al.* 1989: 89-91].

The Mayaki settlement was located at the edge of a high (12 m) terrace at the left bank of the Dniester. The remainders of two ditches possibly, of defense purpose were traced. The ditches were linear in section. The first of them was from 4-5 m to 6-8 m wide in the upper part, 3.2-3.4 m deep from the ancient surface (Table 6). The filling contained traces of fires, concentration of ash and coal. The filling of the ditch contained plenty of fragments of pottery, moulded shapes, flint and bone tools, animal bones and fish-scale [Zbenovich 1974:22-25, Fig. 8-10].

Based on the samples from the excavations led by V.G. Zbenovich, three dates were obtained for the Mayaki settlement [Zbenovich 1974:143].

V.H. Petrenko studied the ditch that was the closest to the precipice, in 1986. He dug the 15 m segment of the ditch and found up to 30 layers in the filling. The finds included fragments of clay plaster with imprints of wood — the remainders of a ruined hut. According to the researcher, the ditches themselves were made due to the excavation of clay for construction of the huts [Patokova *et al.* 1989:89-91, Fig. 32]. Dates for two samples taken from the layer of coal of the filling were as follows (Table 7) [see Videiko 1999:56-57].

Table 7

Mayaki — dates for wood samples from the old studies by V.H. Petrenko

Complex	Material	Lab. No.	Date BP	Date BC
Trench	wood	KIGN-281	4475±130	3154±180
Trench	wood	KIGN-282	4580±120	3292±189

The obtained dates show that the Mayaki settlement had existed for a substantial period of time.

2. ABSOLUTE DATING OF COMPLEXES OF THE ENEOLITHIC EARLY BRONZE AGE IN THE NORTHERN PONTIC REGION

The dates obtained allow — for the first time — identification in absolute dates of the period of existence of Eneolithic complexes of the so-called **Khadzhider type**, represented by the graves from Koshary and an eponymic monument. That period (4000-3400 BC) corresponds with stage BII and the beginning of stage CI of the Tripolye culture.

Of the dates obtained for the Usatovo complexes, only some correspond with their real age. The dates for graves from the barrows near Katarzhyno and Sadove, as well as Oleksandrivka — no 35, 22 — are too old and in fact correspond with the age of pre-Usatovo monuments.

Complexes of the **Usatovo type — Mayaki** (settlement) and grave 17 from Oleksandrivka date between 3000-2500 BC, which in general corresponds with the ideas about dates for those monuments [Klochko, Kośko, Szmyt 1999:269].

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 121-131
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE "MIDDLE LAYER" OF THE MIKHAILIVKA SETTLEMENT

The multi-layer settlement at the village of Mikhailivka of the Kherson region was excavated in 1953-1961 [Lagodovska, Shaposhnikova, Makarevich 1962] (Fig. 1). It includes layers of developed Eneolithic (lower layer), late Eneolithic — Early Bronze (middle layer) and the Early Bronze Age (upper layer). Materials of the middle layer of that settlement rise interest among a broad circle of researchers. Let us briefly outline the key views.

Authors of the excavations identified the middle layer of the settlement as belonging to the early stage of the Yamnaya culture, and synchronized it with monuments of Tripolye CII, based on fragments of imported vessels from a house in the lower horizon, as well as on bi-conical ornamented distaffs [Lagodovska, Shaposhnikova, Makarevich 1962:187].

D.Y. Telegin included the middle layer of the Mikhailivka with the early Yamnaya layer of Aleksandria and the Repin Khutor, referring then to the middle or early part of the second half of 3000 bc [Telegin 1973:128]. Later on, he reconsidered the dates and included the early Yamnaya monuments together with Tripolye culture and the Funnel Beaker Culture within the second quarter to middle 3000 bc [Telegin 1992b:5; 1993:19-20].

V.N. Danilenko singled out the Mikhailivka period of development of the Old Yamnaya Culture and referred it to the end of 3000 bc [Danilenko 1974:86].

A.V. Nikolova, studying burial monuments of the Yamnaya culture, synchronized the Repin Khutor and the middle layer of Mikhailivka with the earliest of them (like Bykove 2, 2/3), having set their date as 27-25 (24) centuries bc [Nikolova 1992].

A.T. Sinyuk viewed the middle layer of Mikhailivka within the Repin Eneolithicic culture and set its dates to the range from the middle of 3000 bc to the edge of 3000 and 2000 bc [Sinyuk 1981].

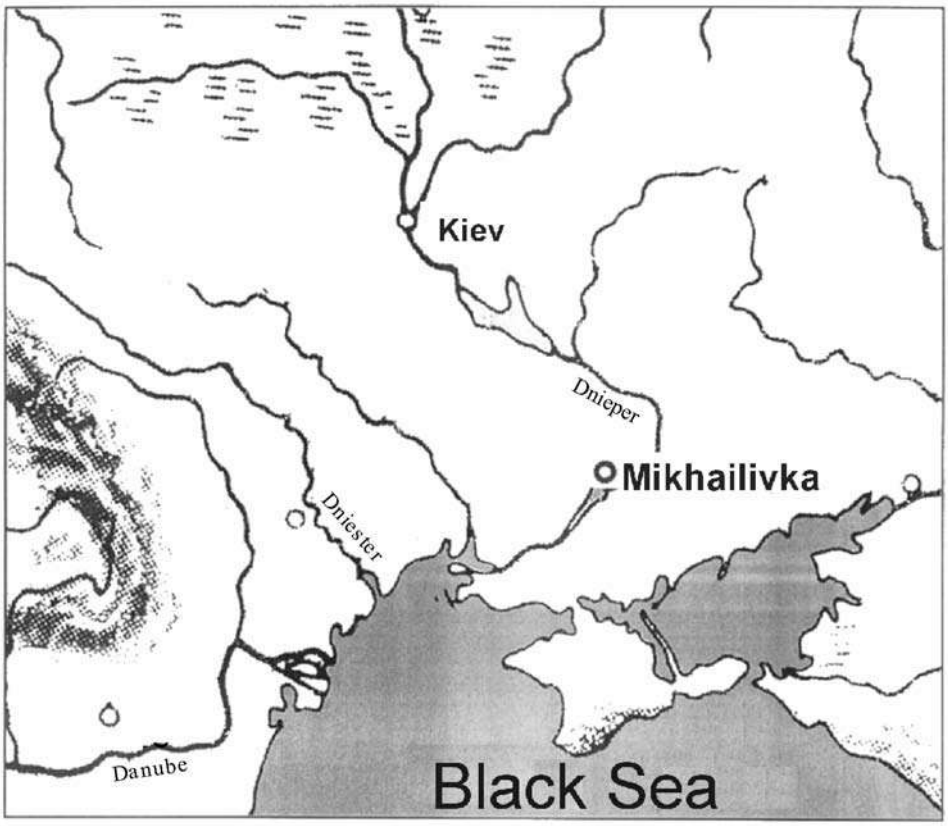

Fig. 1. The Mikhailivka, Kherson Region, settlement 1. Location of the site.

V.A. Trifonov, using calibrated dates, synchronized the middle layer of the Mikhailivka settlement with the emergence of the Repin culture in the Lower Don, and set its dates to 3350-3000 BC [Trifonov 1996]. In his opinion, the middle layer of Mikhailivka ius somewhat younger the Tripolye CII monuments, the Konstantinovka culture and settlements of the Maykop culture (Galiugai 1 and 3, Bolsheteginske etc.), as well as graves of the kind of Maykop and monuments like Novosvobodna.

According to the brief historical outline, researchers do not have a common view on relative and absolute chronology of the middle layer of Mikhailivka. We have processed numerous materials of the collection, notebooks and fieldwork reports, and took new radiocarbon data for that monument. Comparison of its materials with materials of surrounding cultures and radiocarbon chronology of monuments of Eneolithic — Bronze Age of Eastern Europe allows more precise synchronization and chronology of the middle layer of Mikhailivka.

1. STRATYGRAPHY OF THE MIKHAILIVKA SITE AND LIST OF C14 DATINGS

Let us briefly address the stratigraphy of the monument. In general, the geological section of the settlement was as follows:

– black earth, 0.2-0.5 m thick;
– grey loamy soil with inclusion of humus, about 1 m thick;
– light-grey loam;
– line-stone below it.

Archaeological materials lay in the black earth and the loamy soil with humus. Pits that served as foundations of the huts could be traced in the layer of light-grey loam. The excavations of the monument were done within 100-meter square boxes that were numbered with Latin figures. Each of the 100-meter square was divided into 25 4-meter squares that were numbered with Arabic figures. The bones for radiocarbon chronology were takes from squares (a) XXXII and (b) LII (Table 1). The research allowed assuming the following stratigraphical observations for those squares [see Lagodovska, Shaposhnikova, Makarevich 1962].

a. In the 100-meter square XXXII the black earth layer was up to 1 m thick. It contained two horizons: the proper black earth horizon that lay from 0.05 m to 0.7 m deep, and black earth with ashes at the depth from 0.5-0.7 m to 0.9-1.3 m. Materials of the upper layer of the settlement were found in both horizons.

Under the black earth with ashes there was a layer of light-grey loam with ashes. At the point where the two layers met, at the depth of 1.05-1.13 m from the surface — and in the southern part of 100-meter square XXXII at the depth of about 1.5 m — there was a layer of baked clay. It is believed to be connected to the remainders of hut no.1 on the surface of the upper horizon of the middle layer.

The lower strata, according to drawings and materials in that square, was located in the middle part of the layer of loam with ashes. The lower part of the loam became light-brown as a result of an ancient fire. In that burnt layer the researchers traced a trough-like cavity of hut no. 2, linked to the lower horizon of the middle layer. In general, the materials of the lower horizon were found 1.85-2.06 m deep.

Below there was dark burnt loam-soil. Below it, from the depth of 2.2 m, the researchers studied the lower horizon that had been caught by fire and the hut of the lower layer.

The radiocarbon date was taken from a bone tool no. 3752 from the lower horizon of the middle layer in square 14 at 2.06 m deep – 4710±80 BP. Nearby there were ceramic objects as shown in Fig. 2.

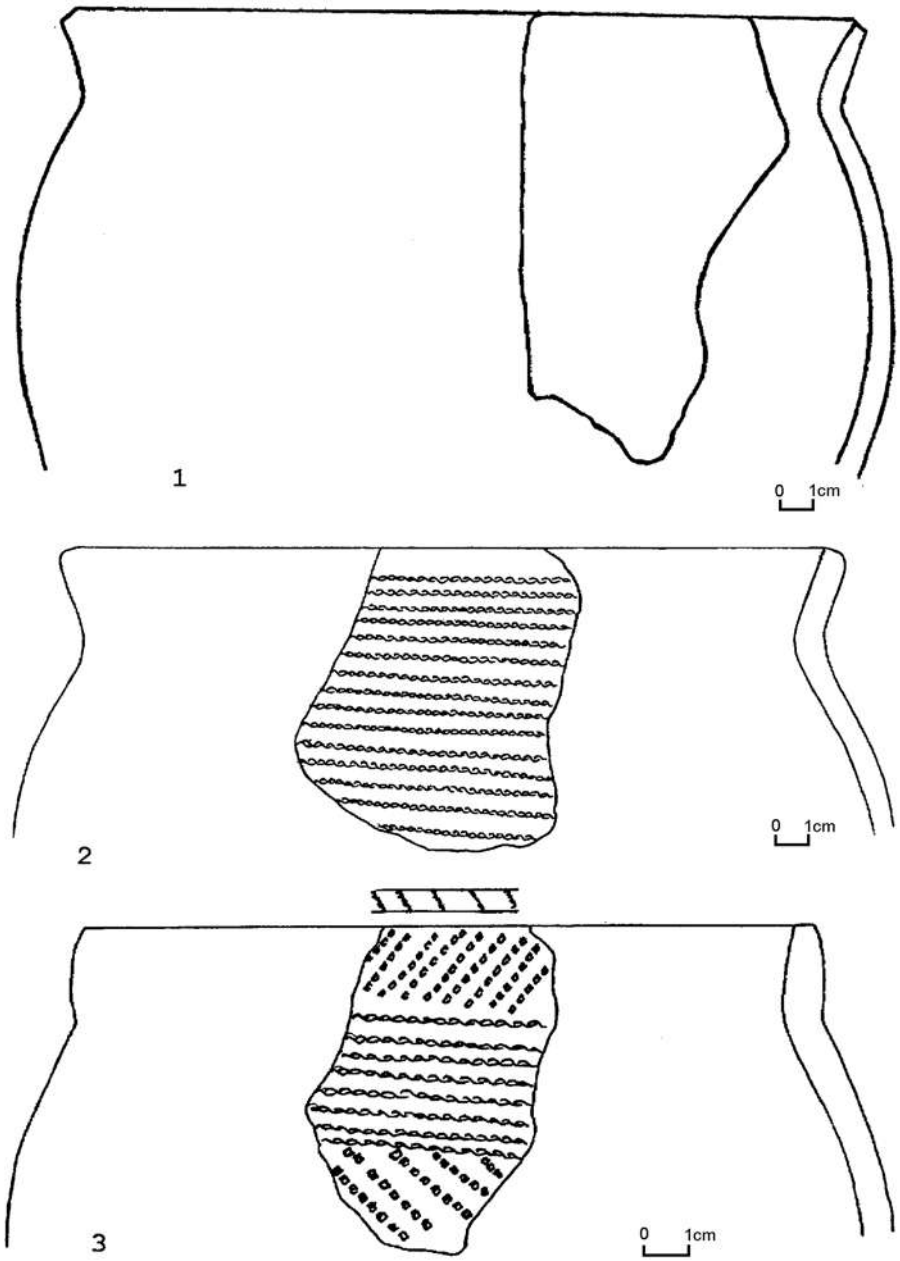

Fig. 2. Ceramics of the middle layer of Mikhailivka

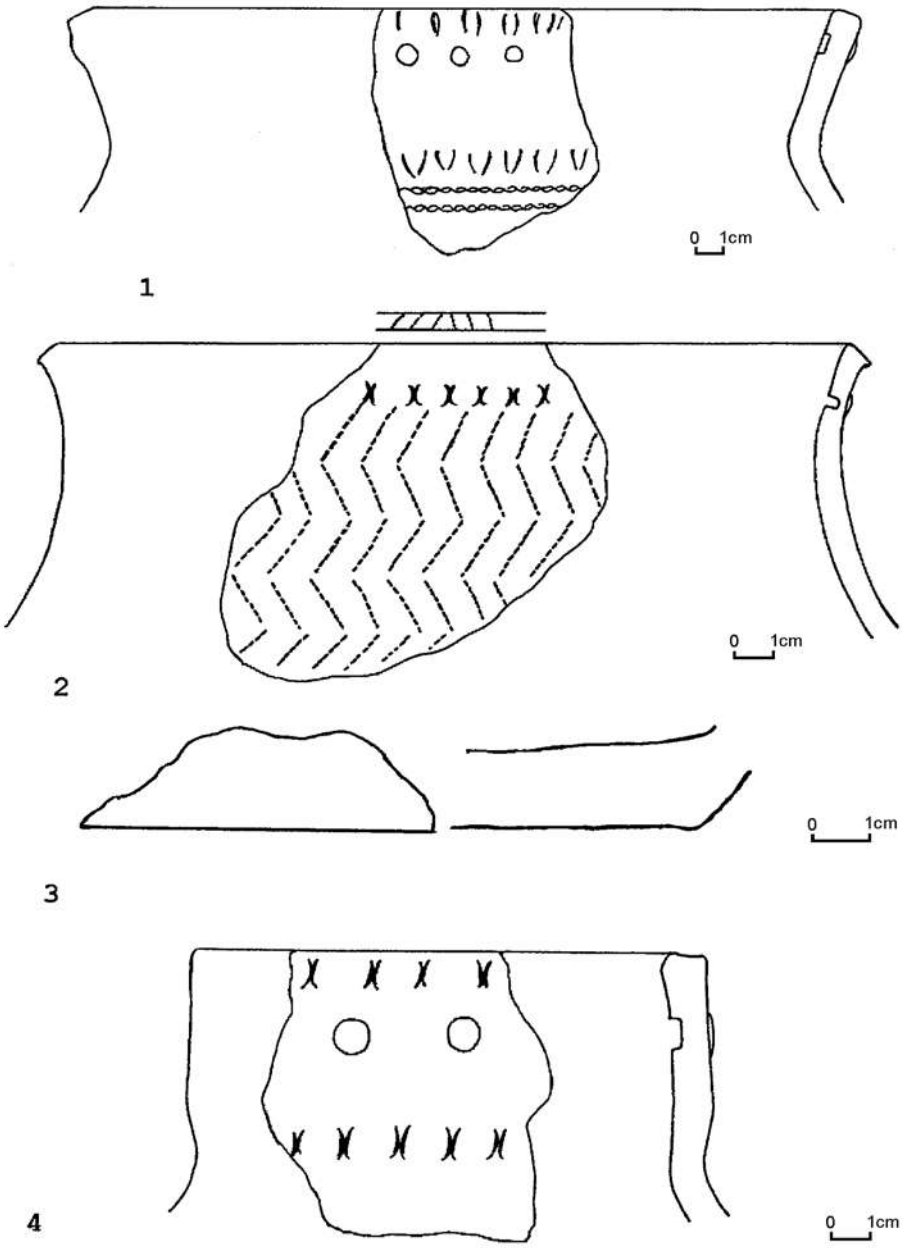

Fig. 3. Ceramics of the middle layer of Mikhailivka

Table 1

Radiocarbon Dates of Monuments of the Late Eneolithic Early Bronze (by bone)

Cultures, sites, samples	Lab. No.	BP	BC*	References
Mikhailivka				
Mikhailivka, square XXXII, 14, depth 2.06 m	Ki-8012	4710±80	3483±103	
Mikhailivka, square LII, 17, depth 1.08-1.26 m	Ki-8186	4480±70	3180±128	
Mikhailivka, square LII, 17, depth 1.08-1.26 m	Ki-8010	4570±80	3236±137	
Repin culture				
Podgorovka, third layer	Ki-7843	4560±50	3234±106	Manko, Telizhenko 2002
Podgorovka, third layer	Ki-7841	4370±55	2972±67	Manko, Telizhenko 2002
Podgorovka, third layer	Ki-7842	4330±50	2984±58	Manko, Telizhenko 2002
Maykop Culture				
Galiugai 3	OxA-3779	4980±120	3787±126	Korenevskiy 1993
Galiugai 1	OxA-3778	4650±80	3463±128	Korenevskiy 1993
Galiugai 1	OxA-3777	4530±70	3220±114	Korenevskiy 1993
Zamankul 1/70	GIN-8034	4820±70	3599±83	
Zamankul 2/60	GIN-8424	4670±35	3430±58	
Novosvobodnaya type				
Novosvobodnaya 11/50	OxA-5059	4835±60	3605±75	Rezepkin 1996
Novosvobodnaya 11/55	OxA-5061	4765±60	3566±85	Rezepkin 1996
Novosvobodnaya 11/43	OxA-5058	4675±70	3447±96	Rezepkin 1996
Novosvobodnaya 11/48	OxA-5060	4665±60	3434±81	Rezepkin 1996

* Weninger 1993

b. Precise stratigraphy, according to the authors of the excavations, can be clearly traced in square LII. In its north-western part, in the black soil — an ash layer under an ask-like smear there was a pile of *Unio* shells (about 8 sq. m. in size), in which animal bones were found.

Below, in light-yellow loam at the depth of 0.9-1.1 m there were materials of the upper horizon of the middle layer. At 1.08-1.26 m there was a floor of hut no. 7 of the upper horizon of the middle layer. A bone from that horizon was dated back to — 4480±70 BP (Ki-8186), 4570±80 BP (Ki-8010). A vessel was found nearby (Fig. 3:1-3).

The lower horizon includes materials that lay at 1.6-2.24 m from the bench-mark. The floor of hut no. 8 that belonged to the lower horizon of the middle layer of the settlement was found at 1.8 m below the bench-mark.

2. RADIOCARBON CHRONOLOGY AND CULTURAL CONTEXT

Investigation of materials of the lower and upper horizons of the middle layer of the Mikhailivka settlement showed typological uniformity of their ceramics. The vessels of those horizons represent the same kinds of technological process, shapes and ornamentation. Notwithstanding the stratigraphic differentiation between the two horizons within the middle layer, it is impossible to divide the ceramics typologically into distinct types. Materials of the middle layer of the Mikhailivka settlement demonstrate the development of the same culture group of an ancient population within a long period of time, within which a 60-70 cm strong culture layer emerged. That group of population, probably, populated the central hill of the monument twice. Interestingly, the second settlement showed a change in housing constructions: slightly dug-in huts are substituted with huts that stood entirely on the surface. However, pottery traditions remained unchanged. It should be noted that the period between the first and the second population of the site was not long, for the upper horizon lies immediately on the lower one. Another argument in favour of a short break between the settlements on the site is the location of the huts in the same part of the site. The huts had been built in the same ancient narrow gully almost one after the other. Nowadays, judging from the radiocarbon dates, the middle layer of Mikhailivka can be referred to about 4750- 4350 BP (3500-3100 BC). It is possible, however, that it had existed fro a longer period of time, which is suggested by a thicker cultural layer.

Traditionally, materials from the middle layer of Mikhailivka are referred to the early period of the Yamnaya culture and are classed in the same group as monuments of the Khutor Repin type [Lagodovska, Shaposhnikova, Makarevich 1962; Telegin 1973]. Less often they have been regarded — together with the Khutor Repin — as part of the Repin culture [Sinyuk 1981]. The investigation of the materials showed a difference between the middle layer of Mikhailivka and its analogues in the Dnieper region from monuments of the Khutor Repin type that had occupied the basin of the Don and the Siversky Donets rivers [Spitsyna 2000; Sanzharov 2000]. The population that left the middle layer Mikhailivka had built dug-in huts that have not been found so far in the area of the Repin culture. Their ceramics are also different. For the Repin culture, a typical kind of vessels would be with a spherical bottom; in the middle layer of Mikhailivka there are both spherical-bottomed and flat-bottomed vessels (Fig. 3:3). Apart from ceramics with flute-shaped neck, typical for the Repin culture, dwellers of the steppe Dnieper Region made smoothly-shaped pots (Fig. 3:2) and vessels with inward- lowered necks (Fig. 3:4) that have not been found in the Repin monuments.

Certain differences can be traced in ornamentation as well. The most typical for vessels from the middle layer of Mikhailivka is ornamentation with a cord (Fig.

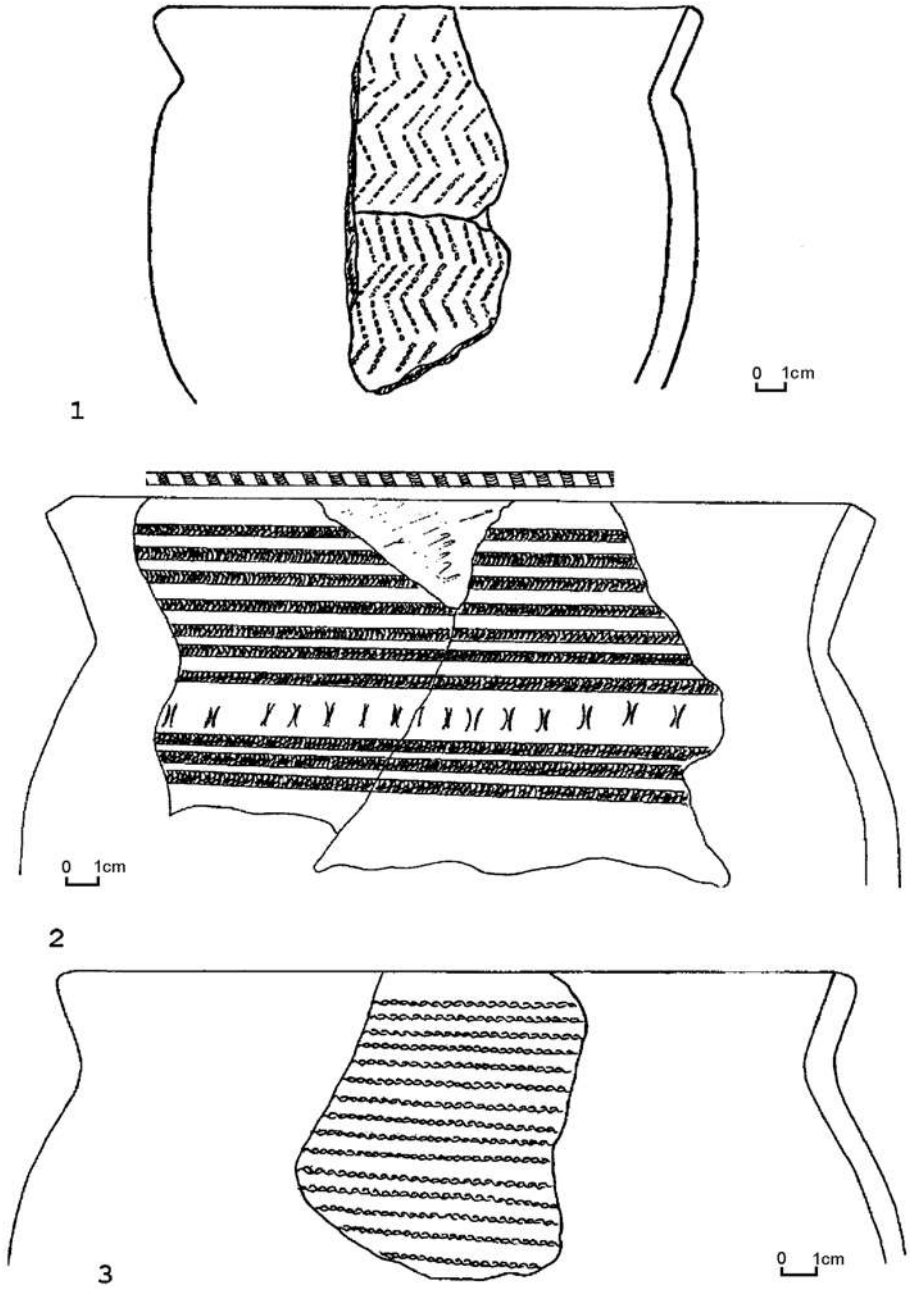

Fig. 4. Ceramics of the middle layer of Mikhailivka

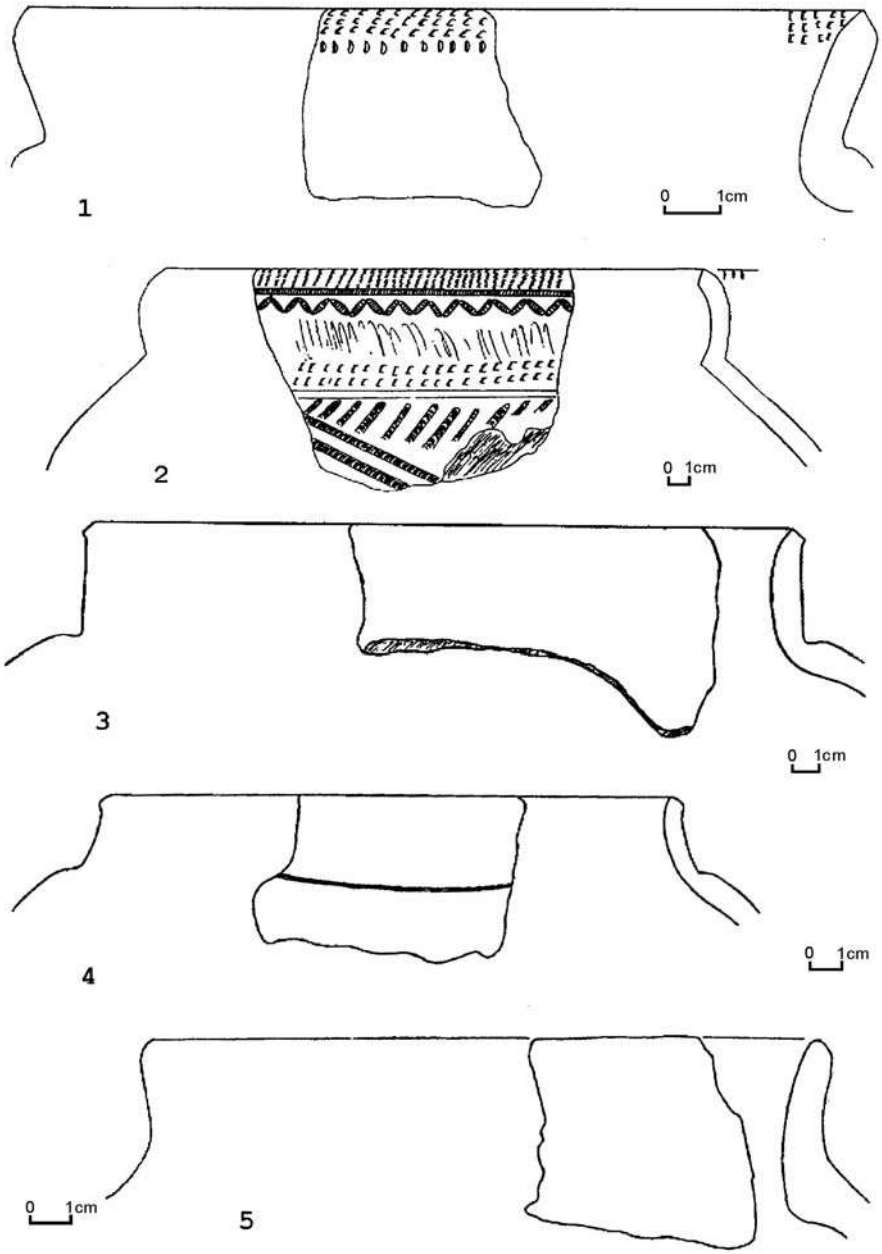

Fig. 5. Ceramics of the middle layer of Mikhailivka

2:2; 4:3); the second most typical pattern is comb-shaped impressions (Fig. 3:2; 4:1). There are also pearls with holes plastered with clay from the inside. From the outside their shaped was often changed with the help of nips (Fig. 3:2). Smooth shaping of a major proportion of vessels from the middle layer of Mikhailivka determined location of ornamentation as one "belt" of repeated elements (fish-bone and horizontal lines). In the Repin vessel the most frequent patterns are comb impressions; the pearls were not plastered with clay from the inside; and from the outside, in most of the cases, there shape was not changed with nips. The ornament compositions of the pots that had a sharp turn from the neck to the body consistent, predominantly, of three zones — ornament of a groovy neck, ornament of a sharp turn to a shoulder, and ornament of a shoulder).

However, notwithstanding the traced specifics of the ceramics, it is possible to synchronize the middle layer of Mikhailivka and monuments of the Repin culture. The proof of that is the finds of ceramics in the middle layer of Mikhailivka. The ceramics were identical to the Repin vessels in terms of shape (groove-shaped neck), admixtures (shell) and ornamentation (complex compositions, pearls with unchanged shapes) (Fig. 5:1, 2). Probably, they were imports. Synchronization can be supported with a few radiocarbon dates from settlements of the late Eneolithic — Bronze from the basin of the Siverskiy Donets [Manko, Telizhenko 2002a]. For instance, the Podgorovka settlement in the basin of the Aidar river produced dates for the layer of the Repin culture: 4560±50 BP (Ki-7843), 4370±55 BP (Ki-7841), 4330±50 BP (Ki-7842).

Materials from the middle layer of Mikhailivka may be also partly synchronized with monuments of the type of Maykop and Novosvobodnaya in the Northern Caucasus [Korenevsky 1993; Rezepkin 1996]. For them a series of dates was produced (Table 1), that referred their existence to about 4950-4500 BC. A number of vessels from the middle layer of Mikhailivka have shapes that resemble Maykop ceramics (Fig. 5:3-5). Probably, such shapes of pots emerged in the steppe Dnieper region under the influence of traditions of the Northern Caucasus population.

For a long period of time the middle layer of Mikhailivka was synchronized with the Tripolye CII based on finds of fragments of Tripolye painted ceramics in a hut of the lower horizon of the middle layer [Lagodovska, Shaposhnikova, Makarevich 1960]. However, to date there has been a major series of dates obtained for the Tripolye CII, suggesting that they belong to the period about 4100-4500 BP [Videiko 1999; Radiocarbon... in this volume]. Those dates require that the lower horizon of the middle layer Mikhailivka be synchronized with Tripolye CI. The study of Tripolye imported vessels from the hut in the middle layer of Mikhailivka showed that analogy to it can be found in monuments of the Koshylivtsy group of the Tripolye culture (period CI). Probably, the upper horizon of the middle layer is synchronous with the beginning of Tripolye culture.

Further study of materials of the multi-layer settlement of Mikhailivka and its analogies in the steppe Ukraine will allow more precise identification of the time of existence of its cultural layers.

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 132-184
PL ISSN 1231-0344

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RELATIVE AND ABSOLUTE CHRONOLOGY OF YAMNAYA AND CATACOMB MONUMENTS THE ISSUE OF CO-EXISTENCE

INTRODUCTION

The creation of periodisations is the primary task of history studies in the course of systematization of any archaeological material. Periodisation completes a typological study of individual categories of newly discovered materials and, after all, serves as the basis for further historical reconstructions. The arrangement of some objects in time allows the creation of structural-genetic schemes and interpretations based on particular archaeological material. Building a periodisation is a rather difficult work. Newly received archaeological materials demand constant correlation with the existing periodisation and, if necessary, its correction. Periodisation of the steppe bronze epoch of Eastern Europe is not an exception.

This article summarizes more than a century of efforts aiming at this and a chronological division between barrow burial sites of the early and middle bronze epoch. The emergence of a substantial number of radiocarbon identifications for graves of the Yamnaya and Catacomb communities allows a more confident interpretation of data of burial rites and inventories, a more critical perspective on the relative chronology of Yamnaya and Catacomb graves and, finally, the creation of a non-contradictory chronological scheme of development of these two major ethno-cultural formations.

Each of the authors was responsible for a specific chapter of the article. D.Y. Telegin wrote a chapter on analysis of the Yamnaya materials; S.Z. Pustovalov wrote a chapter on the analysis of Catacomb materials and their relation with Yamnaya monuments, and N.N. Kovalyukh contributed a chapter on the methodology of radiocarbon analysis as well as supervising the research on bone and wood samples.

1. RADIOCARBON DATING OF SAMPLES OF WOOD AND FOSSIL BONES

Radiocarbon dating is a multi-stage complex process.

The purpose of the initial chemical processing of samples to be dated is, first, to remove accidental inclusions of particles that contain carbon and may distort the true age of a sample. Practically all of the samples are unique in terms of their condition in their natural environments, and the most suitable way of processing them is required in every individual case. The generally accepted standard acid-alkali processing of carbon-containing substrates of vegetable origin very often leads to unjustifiable losses of matter containing the fraction of carbon that is used for dating. This is caused by dissolution of semi-ruined cellulose in the process of the removal of humic acids with alkali. The technique of selective removal of outside organics, developed at the laboratory of the National Environment and Radio-geochemistry Research Centre of the National Academy of Science of Ukraine, makes this stage far more secure and simple. The essence of the method is the processing of samples of vegetable origin with a 1%-3% solution of hydrofluoric acid. In that process, the first element to be dissolved is the silicate layer that coats organic fibres. That layer is formed due to the presence of excessive amounts of silicic acid in the soil which has immense absorption capacity. By dissolving that layer we automatically transform all humic acid and fulvo-acids that it absorbed into a mobile gel-like condition.

The development of a new method of obtaining lithium carbide — the so-called "vacuum pyrolysis" allowed substantial simplification and acceleration of two such important uses of the radiocarbon method as dating of wood and bones [Skripkin, Kovalyukh 1998].

Samples of wood are initially ground to the size of 3-10 mm and, after the removal of roots of contemporary plants, are processed in diluted hydrofluoric acid (1%-3%). An important advantage of this process is the maximum safety of the organic matter even of severely damaged wood. After rinsing and drying, the wood sample is placed in a reactor in a special container over melted lithium at 800°C in vacuum. Intensive thermal destruction of the wood occurs whereby the products of pyrolysis are fully absorbed by lithium.

After complete destruction of the organic substance, the hard residue (charcoal) is also added to the lithium alloy. Therefore, the whole carbon of the wood sample goes to the lithium carbide with minimum losses. The synthesis takes one stage and lasts for only 20 to 30 minutes instead of 3-5 hours required by the traditional technique.

The method of vacuum pyrolysis offers even more advantages for dating bone samples. The technique we developed allows us to obtain lithium carbide from collagen or bone coal without initially extracting them to a pure condition [Skripkin, Kovalyukh 1999]. For that purpose, bones are ground and, after being rinsed in a

solution of tri-sodium-phosphate, processed with 1-3% hydrofluoric acid. That acid transforms carbonate and partially calcium phosphate into fluoride. A substantial advantage of hydrofluoric acid is its capacity to dissolve silicates and humic acids and products of life activity of bacteria absorbed in them. That factor allows the removal of alien organics and carbonate carbon, as well as an easy and thorough washing and drying of processed samples. At further stages the sample is ground and mixed with manganese bi-oxide for obtaining lithium carbide through the "vacuum pyrolysis" technique.

The technique in question is based on a combination of two processes: thermal destruction or an organic sample and chemical absorption of gas-like products with lithium. The synthesis is done in a stainless steel reactor; metal lithium is placed inside the reactor and the sample is placed in a titanium cup. Such a location of lithium and the processed sample allows regulation of temperature in the thermal destruction zone (and, therefore, the speed of extraction of gas) without changing the temperature in the melted lithium zone. The reactor is placed in an electric furnace at the optimum depth and fixed in that position. The pressure in the reactor is set at the level of 0.1-0.2 atmospheres. That contributes to intensifying the extraction of volatile products of thermal destruction and prevents condensation of those products of the walls of the reactor. As a result of the processes, collagen is transformed into volatile organic compounds and bone coal. When heated to more than 550°C, manganese bi-oxide splits up with educing active oxygen from the whole volume of the mixture. The educing of oxygen occurs smoothly in a broad range of temperatures (550-940°C). In that process fine-dispersed bone coal oxidizes to carbon oxide and carbon bi-oxide and is absorbed by melted metallic lithium in that condition. A very important property of manganese oxides is their ability to link phosphorus and sulphur into thermo-stable compounds. That allows obtaining high-quality lithium carbide of practically all carbon of bone organics. The formation of lithium carbide occurs without complications with high return.

A chemical system for obtaining, purification and polymerization of acetylene is made of materials that do not absorb acetylene at all. The inner capacity of the vacuum line was reduced to a minimum due to the optimum composition of elements of the system and the use of a cryogenic pressure stabilizer. Due to these measures the "memory effect" is excluded completely from the process of the synthesis of benzol.

To ensure full standardization of quantitative features of obtained benzols, our laboratory has introduced additional chemical processing. For that purpose, a calculated amount of sulphur acid is added to freshly obtained benzol; after 24 hours the sulphur acid is removed with a micro-pipette. Benzol is separated through a low-temperature sublimation method with simultaneous removal of admixtures of radon. Such distillation excludes the drop-based transfer of harmful admixtures and even the slightest losses of benzol.

Following the addition of a scintillator, the benzols are placed in high-efficacy teflon optimum-sized vials. The optimization of working capacity of the vials allows minimization of space radiation on fidelity and stability of determination of b-activity. The measurements are performed in a low-phone spectrometer "Quantulys 1220 T". To take into account the influence of isotope fractioning, correction by correlation of stable isotopes of carbon is performed. A micro-sample of benzol (1-5 mg) is oxidized to carbon bi-oxide and tested with the help of a mass-spectrometer MI-2001.

2. ABSOLUTE AGE AND PERIODISATION OF MONUMENTS OF THE YAMNAYA CULTURE BY RADIOCARBON DATA

2.1. HISTORY OF THE CREATION OF YAMNAYA CULTURE PERIODISATION

Among the increasingly important issues in the study of the Yamnaya culture of the early Copper — Bronze Age of Eastern Europe, discovered more than a century ago, are those of its chronology and periodisation. These issues are equally of interest to historians, archaeologists, anthropologists, linguists and other specialists. As we know, the author of the identification of the Yamnaya culture, V.A. Gorodtsov, referred it back to 3000 bc. Other opinions, however, were expressed on that issue at the same time, either moving its age strongly back to 6000 bc [Rykov 1923] or, on the contrary, making it much "younger", up to 2000 bc [Sinitsyn 1948]. The issue of the absolute age of the Yamnaya culture was approached from a somewhat different perspective by N.Y. Merpert [1968], who identified its individual groups that were dated differently within the time range of 3000-1700 bc. V.A. Fisenko [1970] dated that culture of Kalmykia within the time range of 3000-1900/1980 BC. According to O.G. Shaposhnikova [1971], the Yamnaya culture could be referred to the beginning of the second half of 3000 bc.

The above data about defining the absolute age of the Yamnaya culture were based mainly on stratigraphical observations of graves in barrows as well as on the study of materials in complexes and on comparing them with finds of other cultures. A new stage in addressing that issue began from the 1970s, when authors started to apply radiocarbon dating for that purpose. One of the first works on this issue was an article by D.Y. Telegin [1977] that included references to about 40 first identifications done with the use of the ^{14}C method. The analyses were performed in Kiev as well as in Leningrad and Novosibirsk laboratories based on wood and charcoal relics in late Yamnaya graves of Ukraine. Most of these were graves made

in ordinary rectangular pits with or without a shelf. The predominant majority of the buried were placed on their backs with their legs bent up in the knees, while some of the buried were placed in a curved position on the side. In some cases there were ceramic vessels of the late "Gorodtsov" type placed near the buried bodies. The date count showed that most of the graves belonged to the period between 2500 and 1900/1870 bc by non-calibrated identifications. Only some of the graves dropped out of that chronological segment, one being later and two earlier than the rest. Basing on this data it was concluded that the Yamnaya culture could be referred to the period from the second half of 3000 to early 2000 bc. Moreover, that case involved monuments of the late stage of that culture, for early Yamnaya monuments were not subject to dating with the help of the ^{14}C method at that time [Telegin 1977].

Later on, other researchers followed approximately the same chronological framework for the Yamnaya culture of Ukraine. For instance, according to Z.P. Marina [1982], the Yamnaya culture developed within the time period from late 4000 to early 2000 bc. A.V. Nikolova [1992] referred it to 2400-1900 bc, and D.L. Teslenko [1999] referred it to 2400-1900 bc.

Some time ago, A.V. Nikolova [1999b; 2001] published a summary of her report on the chronology of the Yamnaya and the Catacomb cultures of the Middle Dnieper Region suggesting that graves of that culture with the buried bodies placed on their backs in a curved position should be referred to the period within 2800-2300 BC, and the graves with the remains curved on the side should be referred to 2580-2130 BC. A similar opinion is shared by authors of a report on the chronology of the Yamnaya culture of the North-Western Caspian Region — N.I. Shishlina [2001], referring it to 2700-2100 BC.

Unlike the dates for the Yamnaya culture of the Caspian Region, the age of Yamnaya graves of the Samara-Volga Region, based on the radiocarbon method, has been defined by experts as belonging to the period between the last quarter of 4000 — the first quarter of 3000 BC [Turetskiy 2001]. The graves of the so-called Novotitorovskaya culture, a relative of the Yamnaya culture, are referred to the second half of 3000 BC, based on the radiocarbon method [Gei 2000].

To complete the discussion of the issue on dates of the Yamnaya culture, let us consider interpretation of this issue by V.Y. Trifonov [2001], who quotes relevant data for individual regions of Eastern Europe from pre-Carpathians to the Steppe Volga. According to that author, there are six individual territorial groups of the Yamnaya monuments on that territory that differ in terms of period of their existence: from 3-6 centuries (the pre-Kuban Region, Kalmykia, the Lower Don) to 9-13 centuries (the Prut-Dniester, the Middle Don, the Lower Volga).

As we may see below, that dating of the Yamnaya culture needs to be clarified.

The issue of defining the absolute age of the Yamnaya culture is closely connected to the issue of its periodisation that is addressed by various authors in different

ways. For instance, according to E.F. Lagodovska, O.G. Shaposhnikova, M.L. Makarevich [1962], there were two main stages in the development of that culture — the early and the late ones. The first included monuments of the kind represented by the second layer of the Mikhailivka settlement, the Repin Khutor, etc. The late stage is represented by materials of the third layer of the Mikhailivka settlement. N.Y. Merpert [1974] suggested that the Yamnaya culture should consist of three stages. The first of the stages, in his view, included early graves with ovoid vessels like the Bykovo II,2/3, and of the Berezhnovka 5/22 type. For the second stage there were two kinds of typical vessels: (a) primitive neck-less vessels with a semi-round bottom; (b) vessels of a generally similar shape with a small rim. Z.P. Marina [1982] and I.F. Kovaleva [1984] see four stages in the development of the Yamnaya culture based on materials of the area between the Orel and the Samara rivers. They relate the early stage to the period of proliferation of pots of the Bykovo and Berezhnovka types, second layer of the Mikhailivka settlement and the Repin Khutor, etc. The second stage, in their opinion, corresponds with materials of the lower horizon of the Mikhailivka-3, while attributing the third and the fourth stages in development of that culture to the upper horizon of the third layer of that settlement.

A.V. Nikolova [1992] also identifies four periods in the development of the Yamnaya culture. Opinions of the above authors are shared by D.L. Teslenko [1999], who introduced a far more complex system of proof. In his view, monuments of the Yamnaya culture can be initially divided into three territorial groups. Within each of them, after having identified the "chronological weight" of each of the monuments, he identified 8-9 "interval groups" which he then unites into four chronological periods. The whole approach is based on statistical evaluation of the "weight" of individual features of the burial rites. In fact, the author deals with materials only at a later stage. Apparently, it is difficult to build historical assumptions on such a periodisation. Finally, some words need to be said about the periodisation suggested about 30 years ago by V.N. Danilenko [1974] that has been ignored by all researchers — and, perhaps, there is a reason. The point is that according to Danilenko, the Yamnaya culture should include not only Yamnaya monuments but also materials of other cultures of the Copper Age — for instance, the Sredniy Stog culture that was, in his opinion, "artificially removed from the Yamnaya culture". After such a "revision" of the Yamnaya culture, the author raises the issue of identifying within it about ten different periods and phases, the identification of which is basically not supported with any justification — that is why they remain unaccepted among archeologists.

It should be emphasized that there are different degrees of justification for the separation of individual periods in the development of the Yamnaya culture. For instance, while the first and second periods are rather substantially identified both stratigraphically and typologically, the third, fourth and other periods are marked,

at best, by statistical processing of data in burial rites and are poorly correlated with analysis of factual materials.

Given the above, we believe — based on stratigraphical observations and data of radiocarbon analysis — that there were two periods in the development of the Yamnaya culture — the early and late ones. In general, this perspective is in agreement with the stratigraphy of the Mikhailivka settlement and other monuments. The early period of the Yamnaya culture corresponds with early Yamnaya graves and the second level of Mikhailivka, while the late period corresponds with the upper level of Mikhailivka and late Yamnaya graves. The issue of identification of the third and fourth periods in the Yamnaya culture demands, in our opinion, further research.

2.2. STAGES IN THE DEVELOPMENT OF THE YAMNAYA CULTURE — BASED ON DATA OF TYPOLOGICAL ANALYSIS OF MATERIALS AND STRATIGRAPHY

As set out below, let us briefly focus on the characteristics of the two identified periods of the Yamnaya culture and their absolute age. The periods differ primarily in terms of their types of ceramics and, as mentioned above, stratigraphy in settlements and, in some cases, in barrows as well.

The monuments of the first (early) period of the Yamnaya culture are relatively well represented in almost the entire territory of the proliferation of that culture from the Dnieper to the territory beyond the Volga. They have been known for a long time in settlements and barrows. The buried remains in those graves were usually placed curved on their backs and sprinkled with red ochre. In some cases the skeletons are accompanied with broken vessels of the Repin or Mikhailivka-2 types that belong to the early Yamnaya time. Those include graves of the Verkhna Maevka, Sokolove in the Dnieper Region [Shaposhnikova 1985; Kovaleva 1984; Marina 1982], Kremnivka, Volonterivka in the Azov Region [Constantinescu 1984], Repin Khutor on the Don, Bykovo-II 2/3, Berezhnovka 5/22, Kumyska on the Volga and others [Merpert 1974; Dremov, Yudin 1992] (Fig. 1:3-9).

A common feature of the early Yamnaya vessels of the territory between the rivers Dnieper and Volga is their rounded shape, fine or rounded bottoms, and the admixture of ground shells in the dough. Elements of the ornament include impressions of a comb or cord cuts; rather often there are rows of holes — "pearls"; the ornaments consist of horizontal rows and zigzags. The ornament usually covers only the upper part of a vessel, but sometimes goes down to the very bottom.

The early Yamnaya age of those vessels is proven by stratigraphy at the Mikhailivka settlement, in a number of barrows (Sokolove 9/19).

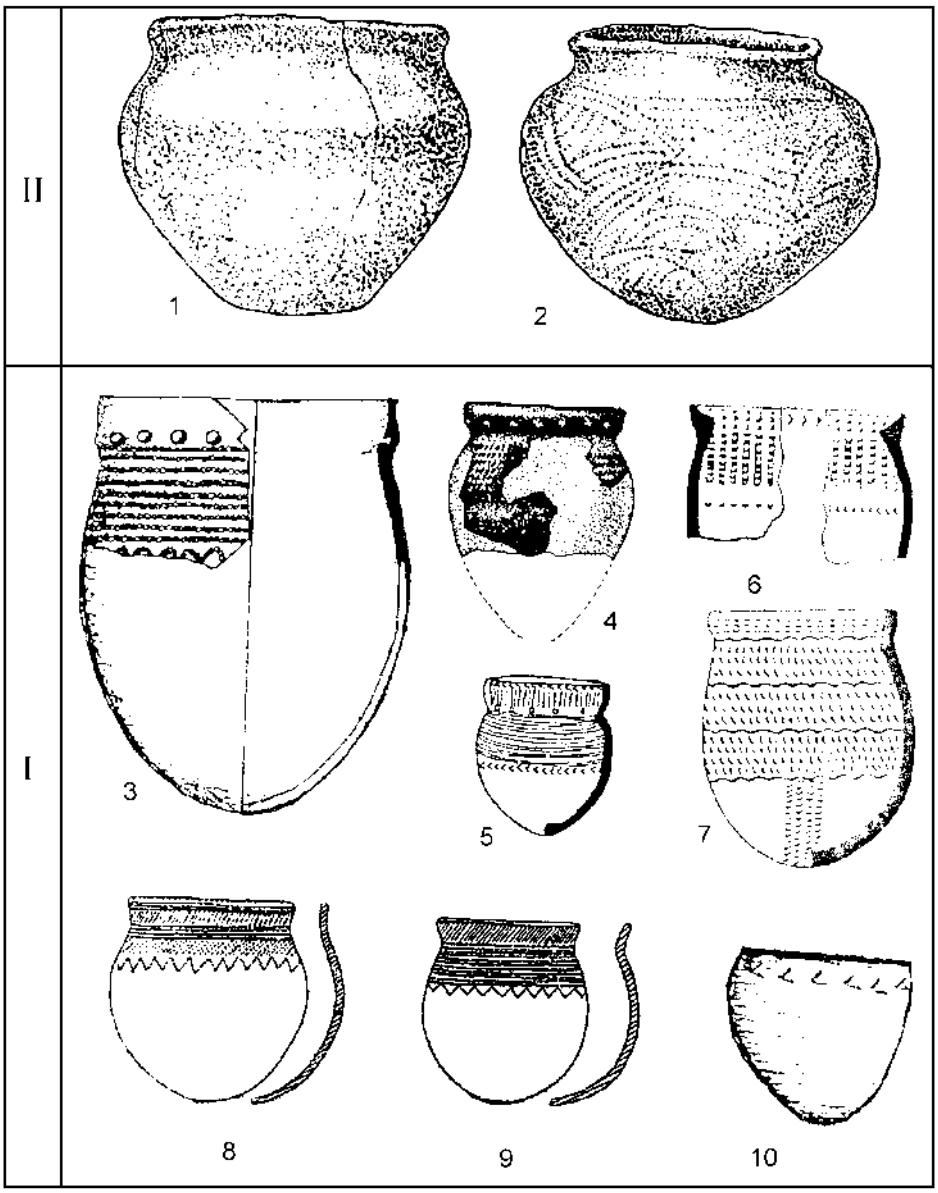

Fig. 1. Ceramics of the Yamnaya culture — early (3-10) and late (1-2) stages. 1. Mogilev, Brilyuvata Mohyla; 2. Otradnoe 36; 3. Repin Khutor; 4. Mikhailivka 2; 5. Bykovo II 2/3; 6. Rivne; 7. Berezhnovka I 5/22; 8-9. Kremnivka 6; 10. Berezhnovka I 22/4

While discussing the vessels in general, it is impossible to ignore noticeable differences among them, primarily in details of shapes, decoration of the rims and bottoms, — which allows identifying three types: ovoid vessels (type A), globular vessels (type B) and semi-ovoid vessels (type C).

Ovoid vessels (type A) differ from others by the elongated shape, sharp bottom, more often high, usually slightly grooved rim (in rare cases, the rim is short but carefully modelled). By this feature the ovoid vessels are classed into two versions: subtype A1 (Repin Khutor, Mikhailivka-2, Bykovo II 2/1 etc.; Fig. 1:3-5) and subtype A2 (Berezhnovka 1, 32/2, Kumyska etc.; Fig. 1:6-7), that also differ by the location of the ornament. In vessels of sub-type A1 it usually covers the upper part only, while in vessels of subtype A2 it covers the entire surface. These two types of ovoid vessels have different genetic sources.

Vessels of globular shape (type B) have a well-pronounced globular shape, round bottom and slightly-pronounced outward-bent short rim (Fig. 1:8-9).

Semi-ovoid vessels (type C) differ substantially from all other types by the general primitivism of their form and ornament. They are sub-conical, broadly opened without a pronounced rim, with a sharp bottom. They are decorated very poorly with cuts or do not have any ornament at all (Fig. 1:10).

Vessels of the three described types and sub-types occur in the whole territory of the Steppe between the rivers Dnieper and Volga, though not in the same numbers. For instance, ovoid vessels of subtype A1 are well represented in the Dnieper Region (Mikhailivka-2, Sokolove, Ignatevka etc.) and the Don Region (Repin Khutor, Universitetskaya Stoyanka etc.), while only a few of them occurred in the Volga Region (Bykovo II 2/1). On the contrary, vessels of subtype A2 are more common in the Volga Region (Berezhnovka 1, 32/2, Kumyska etc.). As for the globular vessels of type B and semi-ovoid vessels of type C, the former were found in the Left-bank Dnieper (Maevka, Kremnivka, Volonterivka), while the latter dominate among the Yamnaya funds in the Volga area. They were also found there at a later period [Merpert 1958].

Tools of the early Yamnaya culture period were made mainly of flint, stone and bone. Metal tools (awls) are poorly represented.

The monuments of the second period of the Yamnaya culture differ substantially from earlier ones by a number of features, primarily their ceramics. Vessels of the second period practically do not have admixtures of ground shells in their dough but have thicker walls and admixtures of sand in the clay. Their surface is usually covered with comb-like scratches. Among the shapes of ceramics, vessels of ovoid shape with short rims, flat or sharp bottoms dominate. However, some of the vessels have a different shape — and have handles or "ears". Alongside with them, in the Volga Region in particular, semi-ovoid vessels continue to occur for a long time, but they are rare in the Don Region and further to the west. The main elements of ornament in those vessels are imprints of a cord, a comb, or cuts.

The ornament usually covers the upper part of a vessel, but sometimes goes down to the very bottom (Fig. 1:1-2). Other shapes include bowls, including bowls on "legs".

Graves of the late period of the Yamnaya culture are divided by researchers into two or three "burial rite" groups. Vessels of that time include different shapes that are similar to those of the Catacomb culture. In addition to graves that contained skeletons placed curved on their backs, there were graves containing skeletons curved on the side, with their hands placed near the knees (the so-called "Catacomb" position).

Tools of the second period of the Yamnaya culture were made, as before, from flint, stone, bone and horns. The wide-spread tools include battle stone hammers, double-sided finished arrow-heads etc. At the same time, bronze tools become widespread.

The division of materials of the Yamnaya culture by periods casts light on a number of sides of its genesis. For instance, the presence of a substantial number of ceramic forms, particularly in the early period, points to the process of its formation in which earlier cultures took part, including the Sredniy Stog and the Khvalynsk cultures, as some researchers wrote before [Vasilev, Sinyuk 1985; Telegin 2000].

2.3. NEW MATERIALS IN RADIOCARBON DATING OF THE YAMNAYA CULTURE

As discussed above, the powerful Yamnaya culture that occupied huge territories of Europe and Asia, according to many authors, dates back to the period between middle 3000 and early 2000 BC. Nowadays, however, due to the availability of a number of new data, those dates need to be set more accurately. Within the past two or three decades, the number of radiocarbon identifications of the age of monuments of the Yamnaya culture has increased more than five-fold, particularly in Ukraine (Table 1). The methodology of treatment of samples with the ^{14}C method has also improved substantially. New schemes of radiocarbon dating with the use of calibration have been developed — for instance, the B. Weninger [1993] method of determining the age of a monument in a point-based mode.

The use of a major number of radioactive analyses of materials of the cemeteries of the Yamnaya culture for addressing the issues of chronology raises a number of separate tasks that need to be addressed. It should be noted that different dates may be obtained in the process of the definition of the age of a monument depending on the kind of material being analyzed (wood, bone, shells etc.).

Because the process of accumulation of radiocarbon definitions of the Yamnaya culture has occurred for several decades, and has been processed in different

Table 1

Radiocarbon Chronology of the Yamnaya Culture*

No.	Locality (site, barrow/grave)	Material**	Author of research/publications	Lab. No.	Date 14C	
					BP	BC
1	2	3	4	5	6	7
Northern Pontic Area						
1.	Zaporizhzhia Reg., v. Avgustynivka 5/2	W	Otroshchenko	Ki-7110	4130±55	2712±115
2.	— << >> — 4/2	W		Ki-7111	4190±60	2773±94
3.	— << >> — 4/1	W		Ki-1446	4100±80	2618±137
4.	— << >> — 4/1	W		Ki-7116	4120±60	2702±121
5.	— << >> — 1/2	W		Ki-2118	4800±55	3579±66
6.	Odesa Reg., v. Zatoka, Akkembek barrow 1/33	W	Chernyakov	Ki-6816	3865±50	2309±89
7.	— << >> — 1/14	W		Ki-6817	3920±95	2345±136
8.	— << >> — 1/17	W		Ki-6816	3920±95	2345±136
9.	— << >> — 1/17	B		Ki-6819	3865±60	2314±97
10.	— << >> — 1/21	W		Ki-6820	3760±45	2126±79
11.	— << >> — 1/22			Ki-6820	3775±60	2160±105
12.	— << >> — 1/22	B		Ki-6822	3810±50	2224±88
13.	Mykolaiv Reg., v. Antonovka 1/30	W	Shaposhnikova	Ki-7117	3990±65	2483±99
14.	Luhansk Reg., v. Astakhovo 22/3	W	Evdokimov	Ki-2809	4880±90	3651±108
15.	— << >> — 3/15	W		Ki-7075	3950±65	2428±103
16.	Zaporizhzhia Reg., v. Balki 1/40	W	Otroshchenko	Le-1168	4080±90	2609±142
17.	— << >> — 1/57	W		Ki-606	4370±120	2979±34
18.	Cherkasy Reg., v. Bashtechki 4/2	W	Artemenko	Ki-1720	4405±70	3006±113
19.	Odesa Reg., v. Borisovka	W	Subbotin	Le-856	3920±50	2386±72
20.	Kherson Reg., v. Brilevka 16/29	W	Evdokimov	Ki-2762	4415±70	3025±129
21.	Mykolaiv Reg., Bugskiy 1/15	W	Pustovalov	Ki-9404	3900±70	2367±98
22.	Dnipropetrovsk Reg., v. Verkhnetarasovka 70/13	W	Cherednichenko	Ki-957	4090±95	2615±148
23.	— << >> — 9/18	W		Ki-602	4070±120	2555±58
24.	— << >> — 9/18	W		Le-1180	3980±70	2457±107
25.	— << >> — 17/3	W		Ki-581	3820±190	2242±38
26.	— << >> — 21/11	W		Ki-582	3740±150	2123±64
27.	— << >> — 21/11	W		Ki-7074	3860±70	2313±106
28.	Zaporizhzhia Reg., v. Vinogradne 2/18	W	Otroshchenko	Ki-9388	4245±70	2801±102
29.	— << >> — 2/11	W		Ki-987	3950±80	2432±119
30.	— << >> — 20/18	W		Ki-9395	4140±80	2725±123

1	2	3	4	5	6	7
31.	— << >> — 3/25	W		Ki-9399	3765±70	2152±114
32.	— << >> — 24/37	W		Ki-9402	3930±70	2380±101
33.	— << >> — 3/25	W		Ki-9413	3970±70	2451±107
34.	— << >> — 3/25	B		Ki-9395	3970±70	2451±107
35.	— << >> — 3/10	B		Ki-9414	4340±70	2965±82
36.	Odesa Reg., v. Vishnevoe 17/4	W	Subbotin	Ki-1270	3950±90	2434±132
37.	— << >> — 17/38	W		Ki-1711	4250±65	2808±98
38.	— << >> — 17/36	W		Ki-9927	3920±70	2373±99
39.	— << >> — 17/38	W		Ki-1726	4105±65	2697±129
40.	— << >> — 17/37	W		Ki-9926	3880±70	2342±102
41.	— << >> — 17/38	W		Ki-7078	4180±70	2762±104
42.	— << >> — 17/38	W		Ki-7079	4105±65	2697±129
43.	Luhansk Reg., v. Voykovo 4/8	W	Bratchenko	Ki-1718	4000±60	2501±86
44.	Zaporizhzhia Reg., v. Volchansk 1/18	W	Dorofeev	Ki-2119	3860±50	2303±89
45.	Donetsk Reg., v. Volonterivka 1/3	W	Bratchenko	Ki-9917	4570±80	3236±137
46.	— << >> — 1/4	W		Ki-9918	4535±80	3221±125
47.	— << >> — 1/5	W		Ki-9919	4490±80	3191±132
48.	— << >> — 1/6	W		Ki-9920	4305±70	2950±103
49.	— << >> — 1/9	W		Ki-9921	4320±70	2954±87
50.	— << >> — 1/1	W		Ki-9922	4380±80	2995±109
51.	Rostov Reg., Gireeva Mohyla	W		Le-136	3870±130	2318±50
52.	Kirovograd Reg., v. Golovkovka 3/1	B	Nikolova	Ki-6718	3020±60	1256±101
53.	— << >> — 5/3	B		Ki-6730	3960±60	2446±97
54.	— << >> — 5/5	B		Ki-6730	4005±55	2516±72
55.	— << >> — 6/8	B		Ki-6719	3970±55	2472±90
56.	— << >> — 6/9	B		Ki-6720	3880±55	2356±89
57.	— << >> — 6/11	B		Ki-6721	3850±55	2296±94
58.	— << >> — 7/4	B		Ki-6722	3980±60	2480±93
59.	— << >> — 11/5	B		Ki-6723	4030±60	2539±81
60.	— << >> — 12/3	B		Ki-6724	3950±50	2403±81
61.	— << >> — 14/2	B		Ki-6727	3910±15	2385±69
62.	— << >> — 14/3	B		Ki-6725	3895±55	2371±83
63.	— << >> — 14/4	B		Ki-2726	3840±50	2285±90
64.	— << >> — 14/7	B		Ki-6728	3905±55	2374±80
65.	— << >> — 14/9	B		Ki-6729	3920±50	2386±72
66.	Dnipropetrovsk Reg., v. Dmitrovka 1/5	W	Shilov	Le-822	3850±60	2302±99
67.	— << >> — 1/16	W		Le-823	3680±60	2037±90

1	2	3	4	5	6	7
68.	— << >> — 10/12	W		Le-824	3920±50	2386±72
69.	Cherkasy Reg., v. Dobrovody 1/2	W	Artemenko	Ki-2124	4200±70	2779±100
70.	— << >> — 1/6	W		Ki-7090	3960±60	2446±97
71.	— << >> — 2/4	W		Ki-2129	4160±55	2750±102
72.	— << >> — 2/6	W		Ki-2107	3980±45	2496±71
73.	— << >> — 2/10	W		Ki-7091	3920±60	2379±85
74.	Odesa Reg., v. Zheltiy Yar 1/11	W	Chernyakov	Le-2323	4020±40	2518±48
75.	Zaporizhzhia Reg., v. Zarechnoe 1/9	W	Mikhaylov	Ki-4193	4060±90	2594±143
76.	— << >> — 1/9	W		Ki-4616	4135±45	2731±108
77.	Dnipropetrovsk Reg., v. Kamenka-Dniprovska 1/9	W	Otroshchenko	Ki-3368	3960±50	2405±89
78.	— << >> — 1/9	W		Ki-3592	4370±50	2974±62
79.	— << >> — 6/4	W		??-3135	4062±19	2547±59
80.	Luhansk Reg., Kleshniya 3	B	Manko	Ki-7847	4120±60	2702±121
81.	— << >> — 2	B		Ki-7848	4170±60	2759±101
82.	Donetsk Reg., v. Kremnivka 6/4	W	Bratchenko	Ki-1708	4260±50	2830±83
83.	— << >> — 6/6	W		Ki-7076	4330±70	2958±83
84.	— << >> — 6/7	W		Ki-7077	4170±60	2759±101
85.	— << >> — 6/9	W		Ki-7260	4465±60	3170±129
86.	— << >> — 6/8	W		Ki 9898	4410±70	3013±121
87.	Mykolaiv Reg., v. Kovalivka 6/13	W	Kovpanenko	Ki-9392	3745±70	2118±109
88.	Odesa Reg., v. Liman 2/2	W	Subbotin	Ki-2394	4490±90	3185±140
89.	Kherson Reg., v. Mayachka 2/27	W	Telegin	Le-1501	3840±60	2296±101
90.	Dnipropetrovsk Reg., v. Minovka 2/5	W	Telegin	Ki-8296	4030±70	2551±103
91.	— << >> — 1/3	W		Ki-421	3970±80	2445±120
92.	Odesa Reg., v. Mikhailovka 3/10	W	Chernyakov	Le-2327	4010±40	2519±47
93.	Dnipropetrovsk Reg., v. Mogilev 1/6	W	Telegin	Ki-497	4270±120	2886±17
94.	— << >> — 1/5	W		Ki-8295	4105±70	2695±132
95.	— << >> —, Brilyuvata Mohyla 5	W		Ki-493	4220±80	2783±109
96.	— << >> — 6	W		Le-1167	4000±100	2534±26
97.	— << >> — 12	W		Ki-494	4080±100	2557±61
98.	Kherson Reg., v. Obloy 1/8	W	Evdokimov	Le-1507	3860±60	2309±97
99.	— << >> — 1/7	W		Le-1508	4630±40	3427±68

1	2	3	4	5	6	7
100.	Odesa Reg., v. Ogorodnoe 1/11	W	Subbotin	Le-2323	4020±40	2518±48
101.	— << >> —, v. Novoseltsy 19/7	W		Ki-1219	4520±70	3217±114
102.	— << >> — 19/11	W		Ki-1220	3800±60	2222±105
103.	— << >> — 19/15	W		Ki-1712	4350±70	2967±83
104.	— << >> — 19/19	W		Ki-7127	4055±65	2566±99
105.	— << >> — 20/8	W		Ki-7128	4005±50	2515±62
106.	— << >> — 20/9	W		Ki-8294	4190±80	2771±110
107.	Cherkasy Reg., v. Nagornoe 15/10	W	Artemenko	Le-2322	3940±40	2402±61
108.	— << >> — 49/3	W		Ki-2119	4620±50	3418±87
109.	Luhansk Reg., v. Nikolaevka 5/12	W	Bratchenko	Ki-873	4280±100	2890±16
110.	Kherson Reg., v. Novokievka 9/1	W	Evdokimov	Le-1713	3820±40	2250±72
111.	— << >> — 1/5	W		Le-1716	4010±60	2522±83
112.	— << >> — 1/8	W		Le-1714	4180±60	2775±97
113.	Dnipropetrovsk reg, Ordzhonikidze 11/90	W	Nikolova	Ki-6570a	4035±50	2532±66
114.	— << >> — 11/11	W		Ki-6572a	4005±55	2516±72
115.	Mykolaiv Reg., v. Otradnoe 26/9	W	Shaposhnikova	Ki-478	3990±100	2533±28
116.	— << >> — 1/17	W		Ki-431	3890±105	2355±49
117.	— << >> — 1/2l	W		Ki-452	3830±120	2243±39
118.	— << >> — 1/22	W		Ki-454	3925±110	2402±42
119.	— << >> — 24/1	W		Ki-470	3860±105	2285±52
120.	— << >> — 36/4	W		Ki-483	3660±120	2006±29
121.	Cherkasy Reg., v. Palmira 3/2	W	Sivolap	Ki-4044	4060±60	2562±94
122.	— << >> — 3/2	B		Ki-7101	3990±55	2495±80
123.	Dnipropetrovsk Reg., v. Pereshchepyno 4/13	W	Telegin	Ki-9980	4150±70	2745±113
124.	— << >> — 1/6	W		Ki-9981	4080±70	2589±119
125.	— << >> — 1/7	W		Ki-9982	4105±70	2695±132
126.	— << >> — 1/7	W		Vs-?	4215±65	2790±94
127.	Kherson Reg., v. Pervomaevka 1/19	W	Evdokimov	Le-1712	4480±40	3209±106
128.	— << >> —, v. Pidkalynivka 5/5	W		Le-1377	4050±80	2573±125
129.	— << >> — 6/12	W		Ki-1715	4200±60	2781±92
130.	— << >> — 6/10	W		Le-1439	4220±50	2796±83
131.	Cherkasy Reg., v. Podolskoe 4/1	W	Sivolap	Bln-4602	4128±46	2777±87
132.	— << >> —, v. Pridneprovskoe 3/1	W		Ki-3139a	3970±80	2445±120

1	2	3	4	5	6	7
133.	— << >> — 4/1	W		Ki-3253	3600±90	1901±130
134.	Luhansk Reg., v. Pryvilya 8/1	W	Bratchenko	Ki-1214	3800±100	2241±33
135.	— << >> — 1/9	W		Ki-1707	4550±100	3166±68
136.	— << >> — 11/15	W		Ki-1437	4390±70	2995±97
137.	Kirovograd Reg., v. Protopopovka 1/2	W	Nikolova	Ki-6733	3945±50	2398±78
138.	— << >> — 1/3	W		Ki-6734	3925±55	2388±78
139.	— << >> — 1/4	W		Ki-6732	3890±55	2364±85
140.	Kiev Reg., v. Rosava 1/8	W	Klochko	Ki-3036	4570±90	3230±152
141.	Odesa Reg., v. Semenovka 11/6	W	Subbotin	Ki-1758	4400±50	2994±76
142.	— << >> — 14/52	W		Ki-2126	4600±90	3320±169
143.	Luhansk Reg., Svatove 1/1	W	Bratchenko	Ki-585	4000±190	2529±34
144.	— << >> — 1/1	W		COAH-1043	4150±30	2750±93
145.	— << >> — 2/1	W		Ki-7103	4060±55	2556±87
146.	— << >> — 2/1	W		Ki-586	4010±180	2565±263
147.	— << >> — 2/1			COAH-044	4070±50	2564±88
148.	Kherson Reg., Skadovsk 1/14	W	Evdokimov	Ki-2439	4100±90	2702±144
149.	— << >> —, v. Stryukovka 105/20	W		Ki-897	4035±60	2544±82
150.	Zaporizhzhia, v. Starobogdanovka 1/6	W	Otroshchenko	Ki-2120	4760±55	3570±82
151.	Cherkasy Reg., v. Talyanki 2/3	W	Kruts	Ki-2612	3760±70	2144±113
152.	— << >> — 1/1	B		Ki-6714	3990±50	2502±71
153.	— << >> — 1/2	B		Ki-6715	3945±50	2398±78
154.	— << >> — 1/3	B		Ki-6716	3950±50	2403±81
155.	— << >> — 1/4	B		Ki-6717	3865±50	2309±89
156.	Rostov Reg., v. Usman 1/13	W		UBLA-1271	4550±80	3225±128
157.	Kirovograd Reg., v. Uspenka 1/3	W	Nikolova	Kin-4599	4167±44	2770±92
158	— << >> — 1/14	W		Bin-4600	4125±40	2671±108
159.	— << >> — 1/7	W		Bin-4601	4140±48	2733±107
160.	Odesa Reg., v. Utkonosovka 1/3	W	Shmagliy	Ki-660	4770±120	3556±31
161.	Mykolaiv Reg., v. Khristoforivka 1/1	W	Shaposhnikova	Ki-578	4160±170	2758±81
162.	— << >> — 1/11	W		Ki-549a	4200±70	2779±100
163.	Volgograd Reg., v. Tsatsa 6/3			UBLA-1270	4210±80	2778±108

1	2	3	4	5	6	7
164.	Kherson Reg., v. Chervoniy Yar 1/10	W	Evdokimov	Ki-1436	4100±130	2619±65
165.	— << >> — 1/10			Le-1504	3640±40	1972±60
166.	Dnipropetrovsk Reg., v. Chkalovo 11/9	B	Nikolova	Ki-6570	3985±45	2507±66
167.	— << >> — 11/11	B		Ki-6829	3900±55	2373±81
168.	— << >> — 11/11	B		Ki-6829a	3990±50	2502±71
169.	— << >> — 11/11	B		Ki-6572a	4005±55	2516±72
170.	— << >> — 11/11	B		Ki-6572	4060±50	2554±80
171.	— << >> — 11/8	B		Ki-6827	3910±45	2385±69
172.	— << >> — 11/9	B		Ki-6828a	4010±50	2521±60
173.	— << >> — 11/9	B		Ki-6828	3960±50	2450±89
174.	— << >> — 11/9	B		Ki-6571a	4035±50	2532±66
175.	Dnipropetrovsk Reg., v. Chernyavshchina 3/2	W	Telegin	Ki-803	4180±120	2784±73
176.	— << >> — 3/2	W		Vs-?	3790±105	2182±160
177.	Dnipropetrovsk Reg., v. Shakhty 2/6	B	Nikolova	Ki-6833	3900±55	2373±81
178.	— << >> — 2/9	B		Ki-6834	3970±50	2478±84
179.	— << >> — 2/9	B		Ki-6834a	3930±50	2392±72
180.	Kherson Reg., v. Shyroka Balka 4/10	W	Evdokimov	Ki-1716a	4800±120	3552±40
181.	— << >> — 3/6	W		Ki-8293	4055±70	2570±107
182.	— << >> — 4/7	W		Le-1506	4250±60	2811±93
183.	— << >> — 3/6	W		Le-1778	3940±60	2389±90
184.	— << >> — 1/10	W		Le-1379	4010±60	2522±83
185.	Luhansk Reg., v. Pidgorivka, feature 3a		Gurin	Ki-7843	4560±50	3234±106
186.	— << >> —, feature 2			Ki-4841	4370±55	2972±67
187.	— << >> —			Ki-4842	4330±50	2948±58
188.	— << >> —			Ki-7839	4130±70	2713±121
189.	— << >> —			Ki-7840	4205±70	2779±99
Northern Caspian Area						
190.	Zunda Tolga 3/3	W	Shishlina	IGAN-16334	3955±40	2407±72
191.	Mandzhyky 1 3/2	W		IGAN-1981	3955±50	2406±86
192.	— << >> — 3/2	W		IGAN-1891	3950±50	2403±81
193.	— << >> — 2, 11/2	W		IGAN-2042	3920±20	2401±47
194.	— << >> — 2, 11/2	W		IGAN-2058	4070±40	2556±78
195.	— << >> — 2, ?1/3	W		GrA-12690	4060±50	2554±80
196.	— << >> — 2, 11/3	W		IGAN-2056	4050±51	2546±75

1	2	3	4	5	6	7
197.	— << >> — 2, 11/4	W		IGAH-2057	3760±40	2124±74
198.	Shupta 1, 1/2	W		IGAH-1890	3860±90	2322±127
199.	Mu-Sharet 4, 1/4	W		IGAH-1851	4770±120	3511±134
200.	Ostrov 3/33	W		IGAH-2106	3620±260	1965±342
201.	KVCh-56 8/7	W		IGAH-1005	3610±90	1910±134
202.	— << >> — 13/9	W		IGAH-1004	3500±150	1809±194
203.	— << >> — 17/3	W		IGAH-1006	3850±40	2277±79
204.	Tsatsa 6/4	W		Le-0002	3980±50	2488±78
Samara-Volga Area						
205.	Kutuluk 1, 4/1		Turetskiy	OxA-?	4400±70	3001±106
206.	— << >> —			AA-?	4370±75	2986±95
207.	Nizhnyaya Orlyanka 1, 1/5			?	4510±75	3218±120
208.	— << >> —, 4/1			?	4520±75	3217±119
209.	Nizhnepavlovsk 5, 2/3			?	4001±75	2496±118
210.	Pershin 1/4			?	4200±75	2775±104

* See also ^{14}C dates for Myronivka barrows [Klochko 1999] - Ed.
** W – wood; B – bone

laboratories, a number of contradictions have emerged in some individual cases. About ten samples in these cases received two or three (or even four) definitions each, stretched within several centuries. Obtaining a large number of ^{14}C definitions requires checks and mutual comparison of different monuments. This is even more relevant and necessary given the fact that the dates were often obtained through different methods, including typological-statistic or radiocarbon methods. In our case, for instance, the above related to the issue of the chronological co-ordination of early Yamnaya monuments like Kremnivka-Volonterivka and the same dates that were obtained for the monuments that were typologically defined as late Yamnaya.

Below we provide a list of the majority (about 200) radiocarbon definitions of the age of monuments from Ukraine and adjacent territories that were obtained in different laboratories (mainly in the Kiev Laboratory). The list is followed with a chart of the distribution of those definitions (Fig. 2). The list contains references to locations of these monuments, kinds of materials analyzed, index of the laboratory that performed the analysis and results of the identification of the age of the samples: a) before contemporary time (BP); and b) BC in the point-based expression. The definition results are grouped on the chart by monument (barrow) and placed

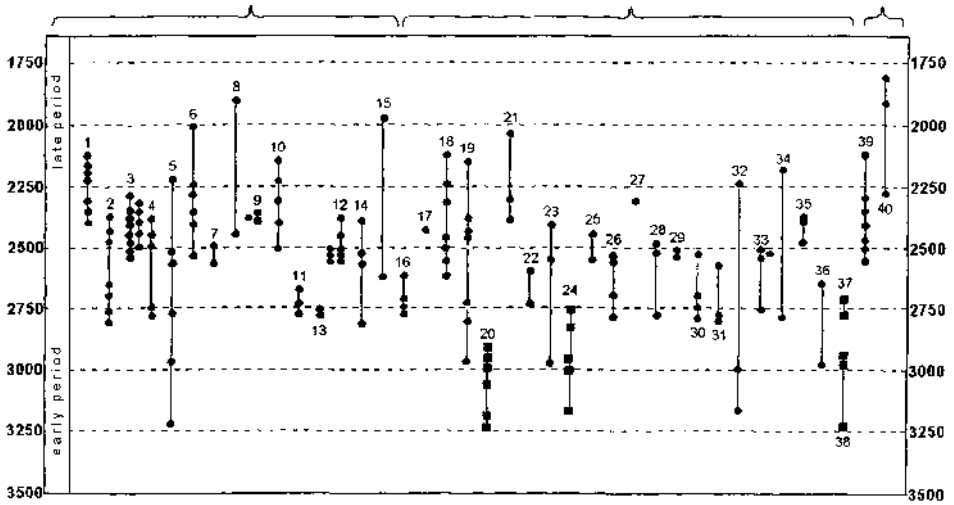

Fig. 2. Chronology and periodisation of the Yamnaya culture – early and late periods – based on radiocarbon data. 1. Zatoka (6-12); 2. Vishnevoe (36-42); 3. Golovkovka (53-64); 4. Dobrovody (69-73); 5. Novoseltsy (101-106); 6. Otradnoe (115-120); 7. Palmira (121-122); 8. Pridneprovskoe (132-133); 9. Protopopovka (137-139); 10. Talyanki (151-155); 11. Uspenka (157-159); 12. Chkalovo (166-174); 13. Khristoforivka (161-162); 14. Shyroka Balka (181-184); 15. Chervoniy Yar (164-165); 16. Avgustynivka (1, 4); 17. Astakhovo (15); 18. Verkhnetarasovka (22-27); 19. Vinogradne (28-35); 20. Volonterivka (45-50); 21. Dmitrovka (66-68); 22. Zarichnoe (75-76); 23. Kamenka-Dniprovska (77-79); 24. Kremnivka (82-86); 25. Minovka (90-91); 26. Brylyuvata Mohyla (94-97); 27. Obloy (98); 28. Novokievka (110-112); 29. Ordzhonikidze (113-114); 30. Pereshchepyno (123-126); 31. Pidkalynivka (128-130); 32. Pryvilya (134-136); 33. Svatove (142-143); 34. Chernyavshchina (175-176); 35. Shakhty (177-179); 36. Balky (16-17); 37. Kleshniya (80-81); 38. Pidgorivka (185-187); 39. Mandzhyky (191-197); 40. KVCh (201-203)

within a chronological scale within the period from 3300 to 1900 BC. Each symbol on the chart identifies one definition; the number next to it refers to the title of the sample in the general list of the monuments. In general, the chart reads from west to east and includes all major territorial groups of the Yamnaya culture from the Northern Pontic Region, the Right-bank Dnieper area, the Dnieper, the Left-bank Dnieper to the Azov Region, the Don, the Northern Caspian and the Samara-Volga area.

The chart contains a whole series of definitions (up to 8-10 per barrow) that form either a rather dense group or stretch from century to century in a peculiar "chain" with breaks of two, three or more centuries between individual symbols. As for the degree of fidelity of every individual definition, there is more confidence about groups of dates in that sense. Individual dates or definitions with major chronological gaps between them are seen as less reliable and were not included in the chart.

In general, the definitions presented in the chart and the table cover the period of time from the second half of 4000 to the end of 3000 BC. At the turn of 3000

and 2000 the Yamnaya culture ceased to exist almost along the entire territory of Eastern Europe.

However, the life time of the Yamnaya culture differed substantially in different Regions. For instance, judging from radiocarbon definitions for the North-Western Pontic Region, the oldest graves there were made in 3300-3100 BC. They occurred somewhat later in the Dnieper and the Azov Regions. The old Yamnaya graves in the Volga Region also belong to that time [Turetskiy 2001]. In the North-Western Caspian, however, they occur only in the second half of 3000 BC [Shishlina *et al.* 2001]. Late Yamnaya graves (Geshanovo, Plachidol) in Bulgaria also refer to a rather early period (2900-2500 BC) [Kaiser 2001:100].

One of the important results of the study of the issue of radiocarbon dating of Yamnaya culture monuments should be the recently obtained age definitions for graves of its early stage. We have in mind the dates for five samples of wood from barrow 6 near the village of Kremnivka of the Volodarske district, the Donetsk Region, six samples from barrow 1 near the village of Volonterivka near Mariupol, at the village of Pidgorivka in the Luhansk Region etc. These dates are located rather closely on the chart — within the period of 3200-2700 BC. With this stage the Kremnivka and Volonterivka monuments correspond with a number of other monuments of the early period of the Yamnaya culture, including the Repin, Mikhailivka-2 types etc. [Constantinescu 1984].

2.4. CONCLUSIONS

1. Therefore, based on the above, we may conclude that the Yamnaya culture in the steppe and forest-steppe zones of Eastern Europe was developed within the period of fifteen centuries, approximately from 3300-3200 to 2100-2000 BC.

2. In its genesis there were two distinct periods — the early one and the late one, divided with a conventional edge mark at the beginning of 3000 BC (3000-2700 BC), when the monuments of the first and the second periods developed practically in parallel (?!).

3. In conclusion, let us note that the analysis of the definitions of the isotope age of the Yamnaya culture, discussed above, needs further, deeper investigation — both in terms of selection of samples for analysis and the methodologies of their study through typo-statistic and radiocarbon methods. The solution of these issues, probably, requires their separate theoretical discussion.

3. THE ISSUE OF THE CO-EXISTENCE OF THE YAMNAYA AND CATACOMB MONUMENTS

3.1. THE ISSUE OF CO-EXISTENCE AS PRESENTED IN THE LITERATURE

The first efforts to divide materials of the bronze epoch, undertaken by D.Y. Samokvasov [1892; 1908], A.A. Bobrinskiy [1901], A.A. Spitsyn [1899], N.E. Brandenburg [1899; 1908], failed because the researchers took individual, occasional features (for instance, colouring with ochre) as the unit of systematization.

V.A. Gorodtsov was the first to bring a scientific foundation to the study of periodisation based on Steppe Bronze materials [Gorodtsov 1905; 1907]. In addition to the stratigraphic method, V.A. Gorodtsov used the typology of forms of burial rites and inventories [Gorodtsov 1916]. Mutual correlation of their results produced a scheme that remained almost without changes for several decades.

The long life of Gorodtsov's periodisation of the Bronze epoch was caused, first of all, by the fact that all of its three components (stratigraphy, burial rite and inventory) did not contradict each other. However, some contradictions emerged at a later stage. Let us consider the process in detail.

The first serious corrections in Gorodtsov's scheme had to be introduced after the excavation of Eneolithic-Bronze settlements in the ravines area of the Dnieper and particularly the excavation of the widest-known Mikhailivka settlement [Lagodovska, Shaposhnikova, Makarevich 1962]. The presence in the same layer of late Yamnaya, Inhul (separated in an individual culture much later by O.G. Shaposhnikova) and classical Catacomb relics, the occurrence of mixed Yamnaya-Catacomb graves formed the basis for a hypothesis about the long-time co-existence of the Yamnaya and the Catacomb cultures in the Lower Dnieper Region.

The hypothesis about long-time co-existence of the Yamnaya and the Catacomb monuments was supported by such prominent researchers as S.S. Berezanskaya and O.G. Shaposhnikova [1957] and some others.

O.G. Shaposhnikova, when studying materials of the Lower Dnieper cemeteries, concluded that Yamnaya tribes had lived in the Lower Dnieper Region for a very long period of time, when bearers of the Catacomb culture had also lived there. As O.G. Shaposhnikova wrote, "analysis of materials from settlements and graves leads us to conclusion that a specific culture of a mixed type with rather strong traditions of the Yamnaya culture was formed in the Lower Dnieper. However, the culture of those tribes that continued to live there for a substantial period of time, the influence of the Catacomb culture was also obvious" [Shaposhnikova 1969:98].

V.A. Fisenko, describing the Catacomb monuments of the Region between the Volga and the Don rivers, identified a group of Yamnaya-Catacomb graves in which

the catacomb-like burial construction was combined with the typically Yamnaya position of the buried and the Yamnaya inventory, or vice versa — the pit-like burial construction was combined with catacomb inventory, primarily ceramics. Summing up his analysis, he wrote: "At the end of 3000 and the beginning of 2000 bc the territory of the Kalmykia ASSR was populated by two groups of tribes that had different material and spiritual cultures. These groups correspond with two archaeological cultures — the Yamnaya and the Catacomb. Their chronological and territorial contacts resulted in the creation of graves of the Yamnaya-Catacomb type" [Fisenko 1970:65].

Addressing the issue of the co-existence of the Yamnaya and the Catacomb populations in the Lower Dnieper Region, V.N. Danilenko wrote in early 1970s: "The population that continued the old Yamnaya tradition of ethno-cultural development, even in the period of domination of the Catacomb culture in the Eastern European steppes, did not leave its main territory — the Dnieper basin" [Danilenko 1974:138]. Interestingly, V.N. Danilenko began developing these ideas in the 1940s in his university course of lectures (the author is deeply grateful to O.G. Shaposhnikova for her kind permission to use materials from her personal archive).

Within the second half of the 1970s and in 1980s, due to vast excavations of barrows in the areas designated for new housing construction, new works emerged, based on stratigraphical columns of barrows. The investigations focused on chronological and cultural definitions of the Catacomb graves of the steppe area of Eastern Europe.

At the beginning, the field research seemed to confirm the accuracy of Gorodtsov's scheme and allowed dividing in time the materials that were mixed in the same cultural layer. That is how the periodisations made by A.A. Shchepinskiy and E.N. Cherepanova [1969], V.A. Safronov [1974], S.N. Bratchenko [1976], G.L. Evdokimov [1979; 1980; 1987], S.Z. Pustovalov [1980; 1982], I.F. Kovaleva [1982; 1984], Z.P. Marina [1982b], S.N. Bratchenko and O.G. Shaposhnikova [1985] and some other researchers were done. According to works of that period, the late Yamnaya monuments co-existed with so-called early Catacomb graves. For the territory of Ukraine the second (and sometimes the third) stage was formed by the Inhul catacombs, while for the eastern territories those were the monuments of the Baturyn [Trifonov 1991], Donets and Bakhmut groups [Bratchenko 1976].

As a result of those studies a number of authors shared the opinion about the existence of two stages of development of the Catacomb entity [Bratchenko 1976; Otroshchenko 1990; Shaposhnikova, Bochkarev, Sharafutdinova 1977]. Works of other archaeologists proposed division into shorter units (three stages) [Shchepinskiy, Cherepanova 1969; Evdokimov 1979; Pustovalov 1980; 1982; Kovaleva 1982; 1983b]. The latter view was reflected in the "Archaeology of the Ukrainian SSR" [Bratchenko, Shaposhnikova 1985].

The three-stage periodisation included a separate early Catacomb layer of graves. This was described by the earliest (of all Catacomb monuments) stratigraphic position in the barrows. Its distinguishing features included: a catacomb with clearly visible corners, the position of the buried body (curved on the back or on the side) and the Yamnaya traditions in the inventory. The second stage was characterized by oval burial constructions, the position of the buried body (curved on the side) and predominantly the inventory that was typical for the Donets culture. The third stage corresponded with graves of the Inhul culture identified by O.G. Shaposhnikova [Shaposhnikova 1978].

Describing the first ritual-chronological group, I.F. Kovaleva wrote: "Comparing the first ritual-chronological group with early catacomb graves, we find a convincing match of a number of features that prove the long preservation of local, late Yamnaya traditions in the catacomb time" [Kovaleva 1982:39]. At the same time, Z.P. Marina identified a group of Yamnaya-Catacomb graves based on the materials of area between the Orel and the Samara rivers. Some of those graves were made in catacombs, while others were made in pits [Marina 1982a:46-50]. The author stressed the long duration of the co-existence of the late Yamnaya (III-IV stage, according to Z.P. Marina) and the early Catacomb [Marina 1990:46] cultures (Fig. 3:1-2). The noteworthy fact is that the first ritual-chronological group of Catacomb monuments of the area between the Orel and the Samara rivers already contains elements of the Inhul culture: rounded catacomb shafts and the presence of Inhul ceramics, including those made of osteoceramic mass [Kovaleva 1982:Fig. 4-36, 27] (Fig. 3:11-12).

Later on, the conclusions made by I.F. Kovaleva and Z.P. Marina were developed in the work by E.L. Feshchenko [1993], who believed that the bearers of the Inhul burial tradition entered the Pryporizhie* at the second stage of development of the Catacomb monuments [Feshchenko 1993:16-17]. He also notes that the Yamnaya position (curved on the back) had existed in that region until the end of the Catacomb time [Feshchenko 1993:19]. That factor points out to the long co-existence of the Yamnaya and the Inhul populations.

Describing the second stage of the Yamnaya culture, G.T. Kovpanenko and V.N. Fomenko, wrote that there were "... certain reasons for synchronizing the second stage with monuments of the Donets catacomb culture" [Kovpanenko, Fomenko 1986:20]. The evidence they referred to, ceramics (Fig. 3:3-4), had analogues among the Inhul amphorae.

According to S.N. Bratchenko, the Catacomb entity is dated in the following way: the oldest stage — 2200-2000 bc, the stage of the Donets culture and cultures synchronous with it, including the Inhul — 2000-1800 bc, the late stage, including the end of the Inhul — 1800-1700 bc [Bratchenko 1989]. In our view, due to the general deepening of dates, the lower date should be moved even further.

* A section of the lower Dnieper where steps from waterfalls – Ed.

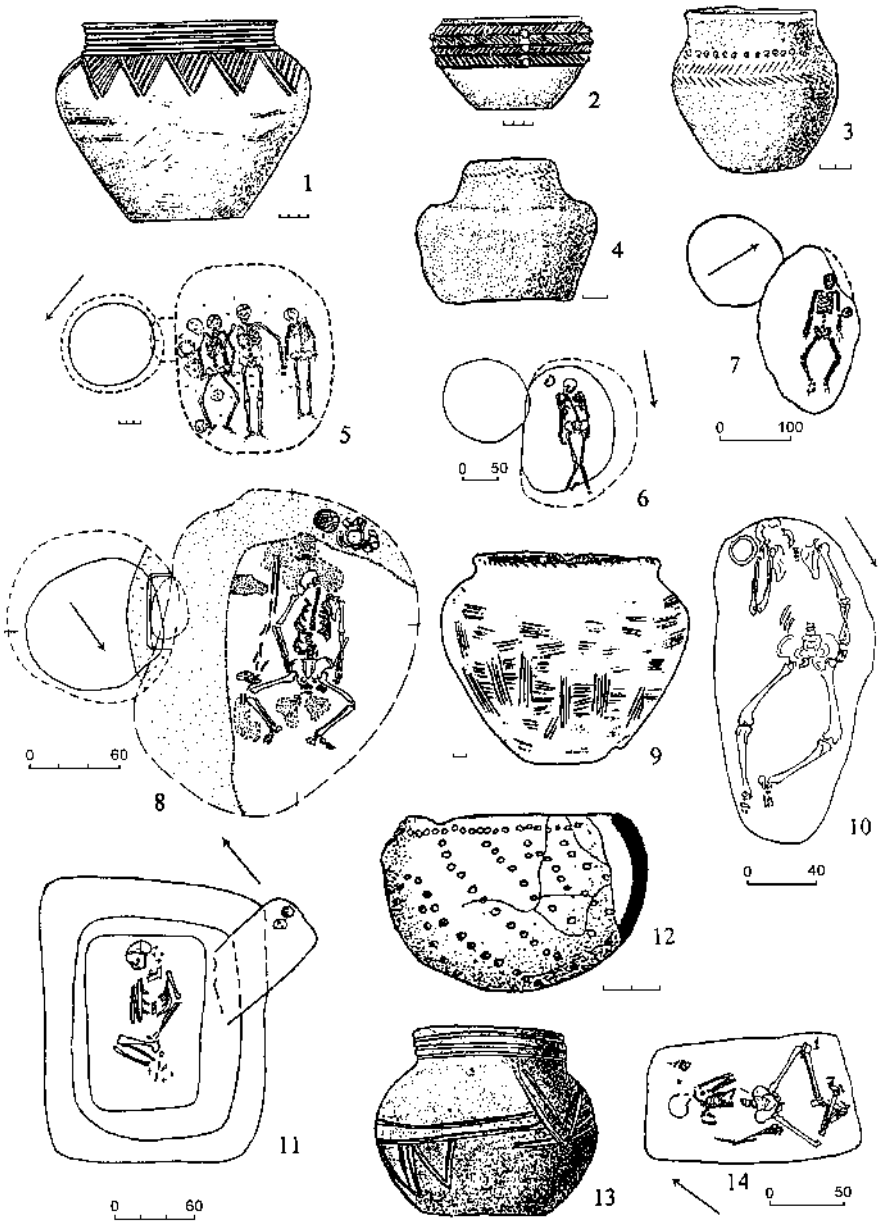

Fig. 3. Materials of the burial rite and inventory referring to the co-existence of the Yamnaya and Catacomb populations: 1. Verklina Maevka IV 2/5; 2. Pidgorodne V 7/2; 3. Kovalivka VII 4/22; 4. Kovalivka IV 1/9; 5. Bashmachka 3/4; 6. «Bobushka» 3/35; 7. Vilno-Grushivka 2/4; 8. Zamozhne 5/2; 9. «Bobushka» 3/34; 10. Velika Bilozerka 21/33; 11-12. Krasnoyarskoe 11/29; 13-14. Lymany 3/7

According to O.G. Shaposhnikova and other researchers, the upper date of the Yamnaya monuments appears to be 1900 bc [Shaposhnikova *et al.* 1986], while V.M. Fomenko refers to an even higher date — 1700 bc. In other words, according to the absolute chronology after S.N. Bratchenko, there was partial co-existence of the Yamnaya and Catacomb monuments, including the Inhul monuments, but according to the lower date of the Inhul monuments proposed by M.A. Chmykhov, the co-existence was practically complete. In any case, that co-existence was deemed a fact.

Co-existence of the Yamnaya and Catacomb monuments in the Steppe Volga Region was noted by I.I. Dremov [1997:61-69]. He wrote that the lack of the reliability of barrow stratigraphy illustrated the relative contemporaneousness of graves of the Yamnaya and Catacomb types.

One of the authors of this paper noted in 1987 and later [Pustovalov 1987; 1992b] that the Inhul monuments emerged very early and co-existed for a long period of time with the "early Catacomb" and late Yamnaya populations [Pustovalov 1990b; 1991a; 1995b; 1996c; 1997a; 1999d; 1999e; 2000d].

The long period of co-existence of the Yamnaya and Catacomb populations was mentioned by N.A. Chmykhov and I.T. Chernyakov [1988]. Of the four periods of the Yamnaya culture the two latter, in their opinion, co-existed with the Catacomb entity [Chmykhov, Chernyakov 1988:77]. They believed that the Yamnaya monuments had survived till the end of the Catacomb epoch and participated in the formation of the Srubnaya entity [Chmykhov, Chernyakov 1988:79]. However, the authors noted that among the Inhul pottery they identified, the objects were dated — according to the ornamentation system — to the early stage of the late Yamnaya period [Chmykhov, Chernyakov 1988:92].

Therefore, on the basis of the comparison of the periodisation schemes of the Yamnaya entity [Marina 1982; Shaposhnikova, Fomenko, Dovzhenko 1986; Kovpanenko, Fomenko 1986; Nikolova 1992] and the Catacomb entity [Bratchenko 1976; Bratchenko, Shaposhnikova 1985; Kovaleva 1982; 1983b; Bratchenko 1989; Chmykhov, Chernyakov 1988], developed on the basis of materials collected in the Ukrainian territory, it becomes obvious that the Yamnaya and Catacomb entities co-existed for a substantial, several centuries-long period of time.

It might appear that the issue of co-existence is clear enough. However, in the 1990s, some archaeologists took an opposite view. Their arguments were based on stratigraphical columns of barrows and cases of direct stratigraphy. They ignored the similarity of burial rites, including the similarity of ethnic features, of ceramics and other inventory [Nikolova, Chernykh 1997; Otroshchenko 2001]. They based their arguments on the presence of so-called "early Catacomb" graves between the Inhul and Yamnaya graves in stratigraphical columns of the barrows. Therefore, in their opinion, there could be no co-existence of the Yamnaya and Inhul monuments. They accept only short contacts between the Yamnaya and "early Catacomb" populations

[Nikolova 1992:20]. However, even the works of the above archeologists give data about such co-existence.

Analyzing the periodisation of the Yamnaya culture done by A.V. Nikolova, one may note that in the development of the Yamnaya culture, alongside with gradual changes in the burial rite and inventory, there was an obvious abrupt jump between the II and the III development stages. Of four sub-systems that were used for the analysis by A.V. Nikolova (shape of the burial construction, position of the buried body, orientation and ceramics) three undergo radical transformation from the beginning of stage III onwards. In the orientation subsystem, it is the circular orientation that substitutes the west-east orientation, but not the "unsteady", as A.V. Nikolova wrote [1992:16]. This change cannot be explained by internal processes in the Yamnaya culture alone. S.N. Bratchenko [1976] and, more specifically, S.Z. Pustovalov [1991d] demonstrated that the graves arranged in barrows in circular "bows" were the Catacomb graves.

At stage III, the position "curved on the side" emerges and gradually substitutes all other positions. The long co-existence of curved on the back and curved on the side positions of the buried bodies in the Yamnaya culture of the pre-Danube Region was recorded by S.V. Ivanova [1999]. The position of the buried body in the burial rite in the Yamnaya entity is one of the most important ethnic indicators [Rychkov 1990]. Its change is impossible without important reasons of an outside nature, for an ethnic group always seeks to support its own stability. The position "curved on the side" is the most typical feature of the eastern catacomb population (archaeo-ethnic types I, II, III) [Pustovalov 1992b:72-75].

Finally, from the beginning of the III period, flat-bottomed pots emerge among the ceramics. The fact itself could be caused by a variety of factors. However, some shapes of those pots are identical to the Catacomb forms [Kovpanenko, Fomenko 1986:Fig. 3:1, 2; 77, section II, group B, types 5-6; Teslenko 1999b:15; 1999a:90, table 3].

Therefore, following the classification done by A.V. Nikolova, in the process of development of the Yamnaya culture only the form of burial construction remains unchanged, i.e., a pit. All other sub-systems of the burial rite gradually change and become identical to catacomb sub-systems. Similarly, few differences occur in inventories of the Yamnaya and Catacomb entities. That is why this periodisation shows that two stages out of four were the stages of co-existence of the cultures.

The approach to creating periodisation, identical to that pursued by A.V. Nikolova, can be found in the work done by A.N. Gei [2000].

The uniqueness of pre-Kuban barrow graves of the early and middle Bronze epochs was noted long ago by many researchers. The monograph by A.N. Gei [2000] in a sense summarizes the study of that interesting phenomenon. The author consistently argues in favour of the existence of an independent Novotitarovskaya culture as distinct from the Yamnaya, the Northern Caucasus and the Catacomb cultures.

The Novotitorovskaya culture (NTC), in his opinion, was a predecessor of the Catacomb entity. A.N. Gei traces connections between the NTC and the Yamnaya monuments in the Lower Dnieper Region, the Budzhak culture, and the so-called level of the pre-Donets monuments. The foundation of the NTC was the stratigraphy of barrows. The work contains a large number of interesting observations and productive ideas, however, its main argument which, according to A.N. Gei, is that the NTC phenomenon is an archaeological culture that precedes the catacomb entity, is erroneous [Pustovalov 2000d].

Let us turn to the facts. In terms of the shape of a burial construction, most of the NTC graves are not different at all from Yamnaya graves. The so-called proto-catacombs are singular cases and serve as yet another proof of the co-existence of the NTC with the Catacomb entity (CE) [Pustovalov 1998; 2000c].

Some differences may be observed in the positions of the buried bodies in NTC graves. There are almost no early Yamnaya positions (curved on the back with legs bent in the knees). The predominant position is "curved on the side", typical for the second half of the Yamnaya entity, when features of its co-existence with the CE are found en masse. The same is proven by a substantial number of dismembered skeletons and partial burning of the dead bodies. All those are pieces of evidence of the influence of the Catacomb entity. The increasing number of buried bodies in the position "stretched on the back" by the late stage of the NTC may suggest not only the close ethnic contacts with the population of the northern Caucasian culture but able with the Inhul population. That is quite obvious, for NTC ceramics display not only influences of the Budzhak but (which was not noticed by A.N. Gei) the Inhul pottery (groups 1 and 6) [Gei 2000]. NTC amphorae and cups bear unquestionable resemblance to the Inhul analogues.

In general, the NTC material culture has both Yamnaya-Catacomb and Northern Caucasian nature. Ceramics, axes and knives demonstrate the long co-existence of the NTC with the Catacomb world. This point is confirmed by the radiocarbon dates quoted by A.N. Gei — which he, probably trapped by the barrow stratigraphy, dismisses as erroneous. According to the calibrated dates, the end of the NTC occurred in the first quarter of 2000 BC. This does not contradict the quoted parallels with the Inhul and Budzhak cultures.

It should be noted that the blind belief in the absolute priority of stratigraphy let A.V. Nikolova and A.N. Gei down. A.V. Nikolova failed to notice that three quarters of the features of the burial rite of the Yamnaya culture of Ukraine were substituted with Catacomb features. The Yamnaya ceramics, as A.V. Nikolova noted [1997:110], included some Bakhmut forms. However, those were already late Catacomb ceramics!

Mistakes of that kind were possible only because those authors broke the systemic approach to building periodisations that was presented in the works of V.A. Gorodtsov. In addition to stratigraphical observations, the analysis of burial rites

and inventory, the development of archaeology added data of exact sciences — archeo-magnetic and radiocarbon dating, that has developed to a great success. It is expected that these methods will provide new arguments in support of specific concepts.

3.2. RADIOCARBON DATING OF CATACOMB MONUMENTS AND THE ISSUE OF CO-EXISTENCE

Until recently, radiocarbon dating of Catacomb graves was practically never performed. Except for several published dates [Telegin 1992a; Telegin, Mallory 1994], Catacomb monuments, particularly those of the Inhul culture, were not studied with the use of that method. Meanwhile, such data became necessary for addressing the issue of the co-existence of the Yamnaya and Catacomb monuments (Inhul monuments in particular). The author of this paper already provided evidence of the co-existence of the Yamnaya and the Inhul populations, based on analysis of the burial rite [Pustovalov 1998; 2000d]. A new publication, in *BPS 7*, of a large series of materials on radiocarbon dating of the Yamnaya and Catacomb cultures prompts us to address this issue again.

Some of the articles of the above collection offer analysis of data that cannot be seen as satisfactory. Therefore, we will try to analyze the published data again.

The first series of radiocarbon dates for Yamnaya and Catacomb graves near Nikopol were published with major 'trickery' [Nikolova 1999a; 1999b]. In two articles, A.V. Nikolova published report data of excavations and data of radiocarbon analysis (53 definitions) of samples of bones from Yamnaya and Catacomb graves.

Such a significant series of dates should have assisted their deep and thoroughly weighted analysis. However, A.V. Nikolova did not use all of her advantages and omitted the most interesting instances.

Her final conclusion was radical: "The radiocarbon data obtained, supported by the published archaeological facts, absolutely contradict the theory of the synchronism of the Late YC and the Late CC monuments on the territory of Ukraine" [Nikolova 1999a:128]. Careful study of the published materials does not allow us to agree with that conclusion. A.V. Nikolova's interpretation of the results of radiocarbon study of the samples from the Yamnaya and Catacomb graves does not fully comply with the data she provided. A very different interpretation of the performed definitions demands consideration. Let us review the obtained materials.

It should be noted that the region of the Lower Dnieper was populated, as O.G. Shaposhnikova believes, by Catacomb tribes at a rather late stage [Shaposhnikova 1968], i.e., it was the periphery of the Inhul and other monuments of the Catacomb cultural and historic entity.

The modern methodology of radiocarbon dating provides an archaeologist with several scales for chronological analysis, including a scale on which the time is counted from the present day, calibrated dates from the edge of this era, two versions of calibrated dates with binary or singular mean-square deviation (1 sigma or 2 sigma). All of them offer relative dating.

As may be seen from the calibration tables [Nikolova 1999b:Fig. 9, 10], there were 29 dates for the Yamnaya graves and 24 dates for the Catacomb graves. By the way, it was not easy to find out the number of analyses performed. The number of dates in the calibration tables [Nikolova 1999b:Fig. 9, 10] does not match the number of dates in Fig.11 (53 and 49, respectively). Apparently, some of the dates were withdrawn by the author. The numeration of dates in Fig.11 is provided at random, and it is impossible to identify precisely the dates in the chart with the data in the table.

Now, let us perform our own analysis of the data presented in the article by A.V. Nikolova. First of all, the analysis should mention that the Yamnaya graves with the position of the buried body on the side have both earlier and later dates. Similarly, graves with skeletons curved on the back are present both in the earlier group and the later complexes.

It should be noted that in this case the testing was performed mainly on the Yamnaya graves that occupied earlier stratigraphical levels in the barrows. Hence, in barrow 11 at v. Chkalovo there were no definitions for the latest Yamnaya grave 13. In barrow 6 at v. Golovkovka the latest Yamnaya grave 13 did not have a definition of age, while the previous in age (grave 11) gives the date of 2296±94 BC. The same picture can be observed for other barrows used in the analysis. This allows an assumption that the Yamnaya graves from the published cemeteries were made later than the latest of the obtained dates. Radiocarbon dates confirm the point that notwithstanding a certain trend towards the increase of the number of skeletons in the "curved in the side" position with the time, the skeletons curved on the back also occur at the latest stage of existence of the Yamnaya entity [Pustovalov 1999b].

Now, let us see how the issue of the co-existence of the Yamnaya and Catacomb monuments is addressed. For that purpose it is necessary to identify the upper limit of the Yamnaya graves and the lower limit of the Catacomb graves. The fact that some of the Yamnaya and Catacomb graves were made during the same chronological period can be seen from the chart in Fig.11 [Nikolova 1999b:1-27] (dates Nos. 5, 6, 33, 45, 46, 48). Because the samples in the chart were numbered by Nikolova at random and the numeration is in no way related to specific definitions, let us put those data in good order. Having included the resulting chart in a joint chart where, in addition to data and articles by A.V. Nikolova we will introduce definitions from the late Yamnaya graves from barrows near the town of Myronivka [Klochko 1999], definitions from late Yamnaya (Budzhak) graves and graves of the Mnogovalikovoy

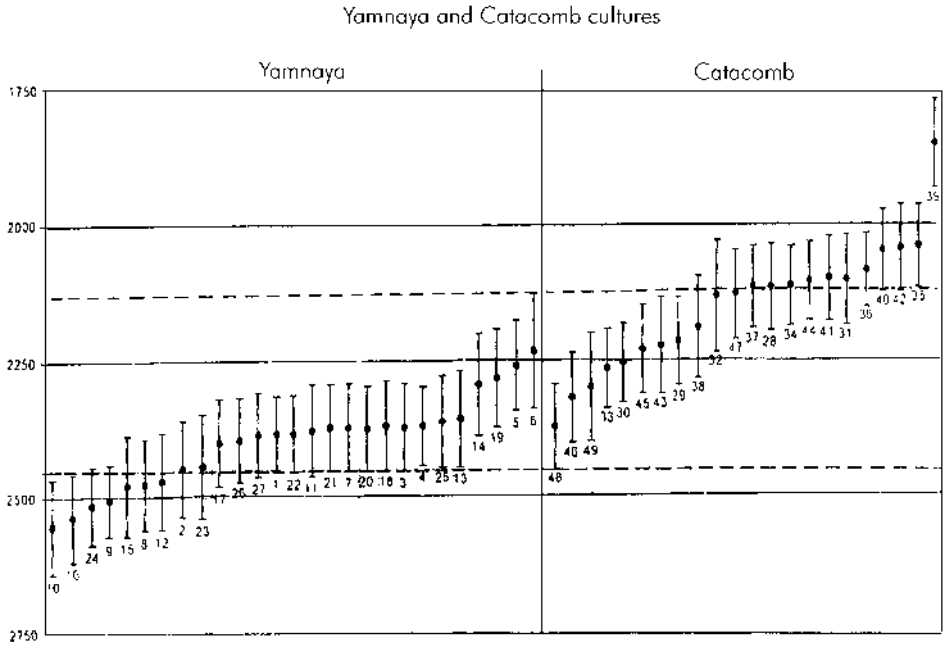

Fig. 4. The chart of distribution of dates of ^{14}C samples from graves of the Yamnaya and Catacomb cultures, based on the data presented by A. Nikolova

Pottery culture from the Akkembetskiy barrow of the Belgorod-Dnistrovski district [Szmyt, Chernyakov 1999] (Fig. 5). Let us analyze the resulting joint chart.

Two dates from the Yamnaya graves practically reach 2200 BC (Golovkovka, 6/11; Golovkovka 14/4). By the means of calibration, their age is 2296±94 and 2285±90 BC, respectively. The Inhul grave near v. Chkalovo, 11/12, has the age of 2320±83 BC. Taking into account the standard deviation, the Inhul grave reaches near 2400 BC.

The resulting corridor of 200 years (2400-2200 BC) may contain almost half of the dates from the Yamnaya graves and a substantial number of dates from the catacomb graves. It should be noted that the so-called "early Catacomb" graves were not the oldest ones according to the radiocarbon calibration scale. Of the oldest graves, middle dates for which reach 2300 BC, only two are "early Catacomb" (the Chorna Mohyla cemetery, barrow 3, grave 28 and the Kruhla Mohyla cemetery, barrow 11, grave 12; Fig.6). The other graves are the so-called "late Catacomb" or Inhul. This fact is admitted by E. Kaiser [1999:135-137]. The early date of the Inhul graves — even in such a limited territory — confirms earlier conclusions made by S.Z. Pustovalov [Pustovalov 1998; 1999d; 2000d] and indirectly suggests the caste nature of the Catacomb society of the Northern Pontic Region. The absolute dates

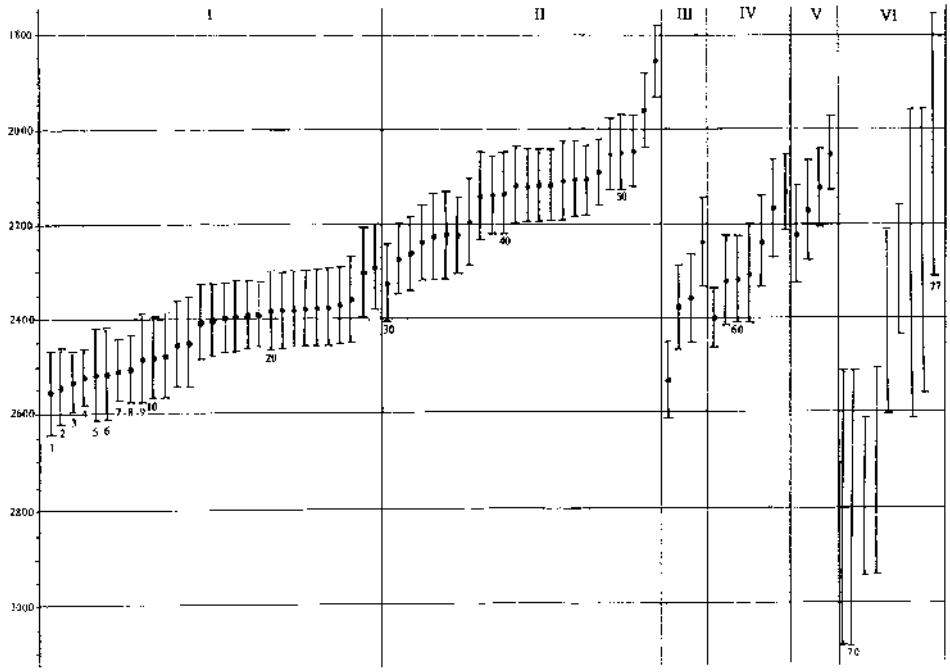

Fig. 5. Distribution of definitions of ^{14}C samples from Yamnaya and Catacomb graves of the Northern Pontic Region: I. Samples from Yamnaya graves near Ordzhonikidze and upper areas of the Inhulets river; II. Samples of Catacomb graves near Ordzhonikidze; III. Yamnaya graves near Myronivka; IV. Yamnaya graves from Budzhak; V. Graves of the Mnogovalikovoy Pottery culture from Budzhak; VI. Catacomb graves of Eastern Ukraine

of "early Catacomb" graves reach rather high, far younger than the co-existence corridor (e.g., Kruhla Mohyla cemetery, barrow 8, grave 13 — 2101±78 BC). Practically that is 177 years later than the co-existence corridor. Meanwhile, these graves contain, as a rule, the inventory of the Yamnaya types, including ceramics. It is estimated that up to 86% of ceramics from those graves are of the Yamnaya type [Pustovalov 1982]. The issue is how the Yamnaya ceramics found their way to the graves that go beyond the co-existence corridor. The conclusion that suggests itself it that the co-existence period was longer than presented in the chart (Fig. 5). True, dates of the Yamnaya graves from the Akkembetskiy barrow fall within 2380-2130 BC [Szmyt, Chernyakov 1999:199]. The same is suggested by the dates from the Yamnaya graves near Myronivka (Ki-5826 — barrow 2/3) [Klochko 1999:174].

Therefore, the time of co-existence of the Yamnaya and Catacomb entities is increased by almost 100 years.

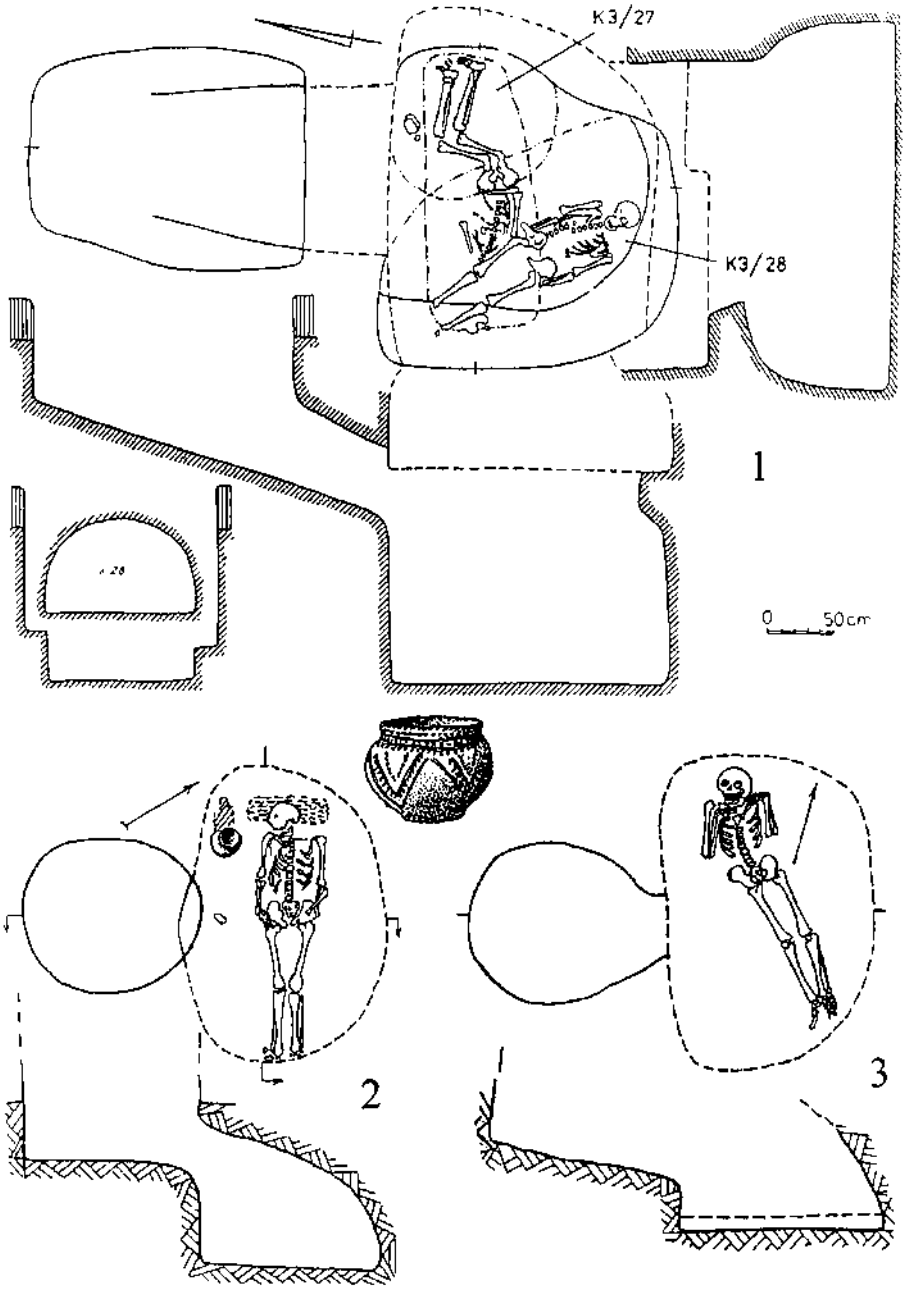

Fig. 6. Plans of catacombs near the village of Chkalovo at Ordzhonikidze (after Nikolova 1999 a,b; Kaiser 1999): 1. Chorna Mohyla 3/27,28; 2. Chkalovo 11/12; 3. Chkalovo 11/6

Now, let us see if the lower limit of co-existence grows older due to the published data from the Akkembetskiy barrow (the Odesa Region). In all the chronological schemes, the Mnogovalikovoy Pottery culture follows the Catacomb entity. The dates for Mnogovalikovoy graves from the Akkembetskiy barrow practically coincide with dates of the Catacomb graves from near the town of Ordzhonikidze (2220-2000 BC) [Szmyt, Chernyakov 1999:199]. There are no Catacomb graves in the Akkembetskiy barrow. However, given the dates of the Mnogovalikovoy graves of that barrow, the Catacomb graves on that territory should have earlier dates. It is difficult to say now for how many years the "aging" will be, but it is more than probable that such dates will be obtained.

Let us turn to the Eastern Catacomb monuments. Calibrated dates for Catacomb graves at Svatove, quoted by E. Kaiser [1999], refer to the beginning of the second quarter of 3000 BC (Fig. 5). Notwithstanding the broad chronological framework of some definitions, the radiocarbon dates are rather explicit. Therefore, the co-existence of Yamnaya and Catacomb tribes on the territory of Ukraine is a fact confirmed by radiocarbon dating. The lower line of the Catacomb monuments is on the edge of the first and second quarters of 3000 BC by the calibrated scale.

Based on the age difference between the Catacomb graves in the territories of Eastern Ukraine and the Dnieper Region, E. Kaiser believes that the centre of the Catacomb culture was located in the Done and Donets area [Kaiser 1999:147]. To this one can agree only for Eastern Catacomb monuments but not the Inhul monuments that had an absolutely different origin. The presence of two major ethno-social centres (the Eastern Catacomb and the Western Catacomb or the Inhul) was already described by the author [Pustovalov 1994; 1999e]. Therefore, rather early dates could be expected for the Inhul graves too. Such data have been obtained recently (Table 2).

Based on materials of definitions of samples of bones from the Yamnaya and Catacomb graves, excavated at the Molochna river, it is possible to argue confidently that the Inhul culture is synchronous — at least in that region — with the late Yamnaya culture. Both of the cultures cease to exist practically at the same time (Table 1, 2; Fig. 15, 16). The latest date for the late Yamnaya grave is 3765±70 BP; for the Inhul grave it is 3605±70 BP. Interestingly, one of the samples (Ki-9546) that produced the oldest date for graves of the Inhul culture was taken from a grave in the open steppe.

A.V. Nikolova does not publish radiocarbon dates from the Inhul Catacomb graves of the Golovkovka cemetery. However, such definitions were made. They are quoted by M. Szmyt [Szmyt 1999:279]. Judging from the numeration in the Kiev laboratory, where the analyses were performed, the definitions from the Inhul graves were performed together with definitions from the Yamnaya graves of the Golovkovka cemetery (Ki-6734 is from the Yamnaya grave; Ki-6735 and Ki-6736 are from the Inhul graves). Two definitions (from grave 10 of barrow 14 and from grave 1

Table 2

List of Radiocarbon Dates for Samples from Graves of the Catacomb Entity

No.	Locality (site, barrow/grave)	Material*	Culture**	Author of research/publications	Lab. No.	Date 14C	
						BP	BC
1	2	3	4	5	6	7	8
Western Azov Reg.							
1.	Zaporizhzhia Reg., v. Vinogradne 24/19	B	ECC	Otroshchenko	Ki-9401	4280±70	2825±123
2.	— << >> — 2/20	B	ECC		Ki-9389	4145±70	2736±115
3.	— << >> — 2/6	B	ECC		Ki-9394	4230±70	2794±99
4.	— << >> — 2/6	B	ECC		Ki-9544	4060±70	2572±109
5.	— << >> — 15/5	W	ECC		Ki-7095	4200±60	2781±92
6.	— << >> — 15/5	W	ECC		Ki-7096	4055±60	2557±91
7.	Zaporizhzhia Reg., v. Zhovtnevoe 12/2	W	ECC	Lyashko	Ki-9409	4120±60	2702±121
8.	Zaporizhzhia Reg., v. Vinogradne 3/39.	B	ECC?	Pustovalov	Ki-9412	3720±70	2088±104
9.	Zaporizhzhia Reg., v. Beloretskoe 1/12	B	IC		Ki-9546	4420±60	3018±118
10.	— << >> — 1/12	B	IC		Ki-9398	4360±60	2965±70
12.	Zaporizhzhia Reg., v. Zamozhne 5/2.	B	IC	Otroshchenko, Pustovalov	Ki-9418	4370±60	2976±73
13.	Zaporizhzhia Reg., v. Vinogradne 3/36	B	IC	Pustovalov	Ki-9390	4020±70	2533±105
14.	— << >> — 3/30	B	IC	Pustovalov	Ki-9417	3980±70	2457±107
15.	— << >> — 8/1	B	IC		Ki-9543	3950±60	2402±97
16.	— << >> — 23/5	B	IC	Otroshchenko	Ki-9393	3920±70	2373±99
17.	Zaporizhzhia Reg., v. Zamozhne 6/2	B	IC	Otroshchenko, Pustovalov	Ki-9416	3920±60	2360±114
18.	Zaporizhzhia Reg., v. Vinogradne 33/4.	B	IC	Pustovalov	Ki-9408	3910±80	2358±112
19.	Zaporizhzhia Reg., v. Zhovtnevoe 3/3.	B	IC	Pustovalov	Ki-9405	3910±60	2377±85
20.	Zaporizhzhia Reg., v. Vinogradne 23/5	B	IC	Otroshchenko	Ki-9407	3860±70	2313±106
21.	— << >> — 8/1	B	IC	Pustovalov	Ki-9397	3780±70	2164±118
22.	Zaporizhzhia Reg., v. Zamozhne 8/1	B	IC		Ki-9403	3780±60	2166±107
23.	— << >> —	B	IC		Ki-9522	3780±70	2164±118
24.	Zaporizhzhia Reg., v. Vinogradne 33/3	B	IC		Ki-9400	3710±60	2088±91
25.	— << >> — 34/9	B	IC		Ki-9410	3640±60	1977±93
26.	Zaporizhzhia Reg., v. Zamozhnoe 15/4	B	IC		Ki-9391	3605±70	1923±106
Dnieper Left bank's Reg.							
27.	Kamenka-Dniprovska 11/9	W	ECC	Chernykh	Ki-3368	3960±70	2445±107

1	2)	3	4	5	6	7	8
28.	— << >> —	W	ECC		Ki-7098	4015±60	2527±81
29.	Crimea, Bolotnoe 14/28	W	ECC	Korpusova, Lyashko	Ki-1200	4020±90	2536±147
Dnieper Law bank's Reg.							
30.	Dnipropetrovsk Reg., Ordzhonikidze Chorna Mohyla 3/28	B	ECC	Nikolova	Ki-6555	3825±45	2253±82
31.	— << >> — Kruhla Mohyla 11/12	B	ECC		Ki-6568	3810±50	2224±88
32.	— << >> — 8/13	B	ECC		Ki-6566a	3760±50	2127±85
33.	— << >> — 1/15	B	ECC		Ki-6562	3750±50	2117±75
34.	— << >> — 8/13	B	ECC		Ki-6566	3720±50	2101±78
35.	Zaporozhia 1/19	W	ECC	Mozolevski	Ki-521a	4080±70	2589±119
36.	Dnipropetrovsk Reg., Vyvodovo 93/10	B	IC	Cherednichenko	Ki-9415	3950±60	2433±108
37.	Kirovograd Reg., v. Golovkovka 14/10	B	IC	Kaiser	Ki-6735	3905±55	2460-2300
38.	Dnipropetrovsk Reg., v. Chkalovo 11/12	B	IC	Nikolova	Ki-6609	3870±40	2320±83
39.	Kirovograd Reg., v. Golovkovka 23/1	B	IC	Kaiser	Ki-6736	3845±40	2390-2220
40.	Dnipropetrovsk Reg., v. Chkalovo 7/8	B	IC	Nikolova	Ki-6558	3835±40	2266±72
41.	— << >> — 11/12	B	IC		Ki-6609a	3800±50	2217±87
42.	— << >> — Chorna Mohyla 3/27	B	IC		Ki 6554	3805±45	2217±80
43.	— << >> — Kruhla Mohyla 1/18	B	IC		Ki-6563	3775±50	2191±93
44.	— << >> — 11/6	B	IC		Ki-6608a	3770±50	2135±92
45.	— << >> — 11/7	B	IC		Ki-6610	3765±45	2131±82
46.	— << >> — Chorna Mohyla 3/17	B	IC		Ki-6553	3745±50	2118±79
47.	— << >> — 11/7	B	IC		Ki-6610a	3750±45	2117±75
48.	— << >> — 2 1/20	B	IC		Ki-6559	3740±45	2115±73
49.	— << >> — Gurska Mohyla 2/30	B	IC		Ki-6556	3720±55	2103±83
50.	— << >> — Kruhla Mohyla 11/17	B	IC		Ki-6569	3730±45	2106±72
51.	— << >> — 1/14	B	IC		Ki-6561	3710±40	2085±68
52.	— << >> — 8/12	B	IC		Ki-6565	3690±45	2048±75
53.	— << >> — 11/7	B	IC		Ki-6567	3680±50	2044±80
54.	— << >> — 1/7	B	IC		Ki-6560	3680±45	2041±76
55.	— << >> — 8/5	B	IC		Ki-6564a	3620±55	1953±80
56.	— << >> — 8/5	B	IC		Ki-6564	3560±55	1851±82
Inhul Region							
57.	Mykolaiv Reg., v. Privolnoe 2/27	B	IC?	Shaposhnikova	Ki-9411	3805±70	2224±122

1	2)	3	4	5	6	7	8
East-Ukrainian Reg.							
58.	Luhansk Reg., Svatove 12/4	W	ECC	Bratchenko	Ki-1564	4200±80	2773±109
59.	— << >> — 18/3	W	ECC		Ki-1584	4200±80	2773±109
60.	— << >> — 12/9	W	ECC		Ki-1560	4200±65	2779±96
61.	— << >> — 16/1	W	ECC		Ki-1562	4100±80	2618±137
62.	— << >> — 20/3	W	ECC		Ki-1567	3900±50	2374±77
63.	— << >> — 4/5	W	ECC		Ki-892	3820±35	2252±62
64.	— << >> — 12/2	W	ECC		Ki-1558	3800±90	2190±145
65.	— << >> — 5/1	W	ECC		Ki-906	3710±60	2088±91
66.	— << >> — 18/4	W	ECC		Ki-1564	3600±75	1917±112
67.	— << >> — 13/2	W	ECC		Ki-1561a	4070±80	2590±129
68.	— << >> — 18/1	W	ECC		Ki-1229	3990±80	2464±123
69.	Luhansk, 2/1	W	ECC		Ki-583a	3930±60	2384±86
70.	Luhansk, Nikolaevka 5/5	W	ECC	Cherednichenko	Ki-616	3910±70	2371±89
71.	— << >> — 5/10	W	ECC		Ki-618a	3950±70	2433±108
72.	Luhansk, Astakhovo 22/3	W	ECC	Evdokimov	Ki-2600	4100±80	2618±137
73.	Luhansk, Privolnoe 1/3	W	ECC	Bratchenko	Ki-1706a	4030±90	2546±146
74.	Luhansk, Voykovo 4/4	W	ECC		Ki-2093a	3960±70	2445±107

* W – wood; B – bone
** ECC – Eastern Catacomb culture; IC – Inhul culture

of barrow 23 at Golovkovka) give the date 3905±55 and 3845±60 BP, respectively (2460-2300 and 2410-2210 BC by the calibrated scale). Obviously, those are the two definitions of the four that were withdrawn by A.V. Nikolova. As we can see, the co-existence of the late Yamnaya and the Inhul population, even based on the data of the Golovkovka cemetery alone, lasted for more than 100 years. Therefore, A.V. Nikolova consciously concealed the fact of the co-existence of the Yamnaya and Catacomb populations.

It should be noted that notwithstanding the proven fact of co-existence there are very many other issues that need to be addressed. It is not clear how the co-existence really occurred: were there separate territories where the Yamnaya population continued to live until the end of the Catacomb era, or the Yamnaya enclaves did not exist and the Yamnaya and Catacomb populations lived in different segments of the same territory? In order to solve the issue of complex radiocarbon dating of monuments of the Yamnaya and Catacomb entities with a new, more precise radiocarbon method it is necessary to have not randomly captured individual materials but follow a consistent, specially designed programme. The materials, published in *BPS 7*, were taken from the periphery of the area occupied by the Inhul culture, where the Inhul culture emerged relatively late.

In order to identify the true period of the existence of the Inhul culture and the pace of its proliferation in different directions, first, it is necessary to obtain a series of dates from the graves in the area between the Southern Bug and Inhulets rivers where, according to O.G. Shaposhnikova, the oldest monuments of the Inhul culture lie. Then it is necessary to obtain a series of dates from burial monuments along the imaginary radial lines in that district. One of the radial lines should be aimed to the south-east, to the Steppe Crimea. Another one should run to the north-east, to the Left bank of the Dnieper, to the Molochna river and beyond, to Taganrog. The third radial line should aim northwards through the area between the Orel and Samara rivers, further to Cherkasy and to the southern districts of the Kiev Region. The fourth radial line should include monuments to the west from the centre of the Inhul culture — Budzhak, Southern Moldova and Eastern Romania. At each of the radial lines it is necessary not only to take samples form major barrows that contain Yamnaya, Eastern Catacomb and Inhul graves but also the barrows that do not have Catacomb graves but only have Yamnaya graves, as well as the barrows in which Inhul graves directly follow Yamnaya graves. It is very important to study samples from the barrows located in the valley and on the high bank of the same river. If performed in full, this programme will clarify completely the real picture of co-existence of the Yamnaya and Catacomb populations in its whole diversity.

Therefore, the analysis of published definitions of the age of graves through the radiocarbon dating method, strengthened with the analysis of stratigraphy of the graves that produced the samples as well as that of the graves from which the samples were not taken and by the analysis of archaeological materials from the graves, explicitly proves the presence of a long period of co-existence of the Yamnaya and Catacomb populations, the Inhul population included.

3.3. CO-EXISTENCE OF THE YAMNAYA AND CATACOMB POPULATIONS BASED ON DATA OF THE BURIAL RITE AND INTENTORY

The co-existence of the late Yamnaya and Inhul populations is also proven by the analysis of the burial rite and inventory [Pustovalov 2000d]. Let us consider some of the clearest pieces of evidence of that co-existence.

The Catacomb graves classed among the early ones occasionally contain skeletons that are stretched on their backs. Those include graves Novopilipivka 9/4-6 [Vyazmitina, Illinskaya 1960], Stryukovka 105/21 [Cherednichenko *et al.* 1975], Vysoka Mohyla 3/3, Kovalivka-VI 25/2, Krasne 5/8 [Krylova, Kubyshev, Yakovenko 1967]. The position of the skeletons alone allows suggestions about co-existence of the Inhul and the "early Catacomb" populations.

In turn, some of the Inhul graves contain skeletons places in the Yamnaya position (curved on the back). For the area between the Orel and Samara rivers such catacombs comprise 20% (91 graves) [Kovaleva 1987]. Such graves also occur at the Molochna river (Zamozhne 5/2, Akkermen-1 17/1) [Pustovalov 1999b; Vyazmitina, Illinskaya 1960] and the Left-bank Dnieper (Velika Bilozerka 21/33; Vilno-Grushivka 2/4; Zlatopol 7/28) [Bidzilya, Otroshchenko 1974; Telegin, Bratchenko, Smirnov 1977], and in the Mykolaiv Region (Otradnoe 28/8) [Shaposhnikova 1971b], and in the Crimea (Bolotnoe 15/15; Kropotkino 1/6) [Koltukhov, Toshchev 1998, Fig. 48] (Fig. 3:5-8, 10).

Another evidence of the co-existence of the so-called "early Catacomb" and the Inhul populations is the presence of multi-chamber catacombs in which the buried bodies had been placed in different chambers and in different positions: stretched on the back in one of them and curved on the back in the other. The chambers also differ accordingly (Minovka XVII 1/6-6a; Bogachovka 10/2, 8; Chkalovo 3/33-34) [Pustovalov 1999e]. In the latter case, the early date of the skeleton buried stretched on the back in an oval chamber is supported with a pot of the Yamnaya type (Fig. 3:9). A similar picture can be observed in some multi-chamber graves in the Samara Region (Bohdanovka 5/8) [Marina, Romashko, Severin 1995:40-41].

Late Yamnaya graves sometimes contain Inhul ceramics — for instance, a pot and a cup from the area between the Orel and Samara rivers [Marina 1982a:46-50]. One of the late Yamnaya graves in the Northern Crimea contained a cup that — judging by its shape — belonged to the Inhul type [Koltukhov, Toshchev 1998, Fig. 84] (Fig. 3:11-12). A late Yamnaya grave, Vysshetarasovka (Verkhnetarasovka) 78/5, contained a fragment of a cup with a typical Inhul handle with vertical holes in it [Cherednichenko, Evdokimov 1975] (Fig. 7:1-2). A Yamnaya grave, Lymany 3/7 in the Mykolaiv Region, contained a vessels of the Inhul type (amphora-like) with fine-drawn ornament [Elagina, Petrenko 1969] (Fig. 3:13, 14). The materials of Yamnaya graves at the Molochna river included a vessel of the Catacomb type, decorated with an ornament in the form of a thin rolled cord (Vinogradne 15/10) [Otroshchenko, Rassamakin 1983]. This ornament was typical for late Catacomb monuments of the Bakhmut type (Fig. 7:3-4). The materials gathered from the excavations conducted by A.A. Melnik included a number of graves of the late Yamnaya time that contained pots of the Catacomb type (Kriviy Rih, Shevchenko 4/29 group — Fig. 7:6-7, 9), Lukyanovka 19 (Fig. 7:8, 10) [Melnik 1984; 1986].

Samples of the Yamnaya, Budzhak and Catacomb ceramics were found in the grave Vladimirovka 13/10 in the Dnipropetrovsk Region [Cherednichenko, Evdokimov 1975]. There the burial construction displayed typical features of the Inhul culture: a rounded shaft and an oval chamber. Three buried bodies were placed curved on the side. There were six vessels in the chamber: one typically Lower Dnieper, the second one late Yamnaya, the third one was a shallow cup, and three others had strong resemblance with the Budzhak ceramics (Fig. 8:1-8).

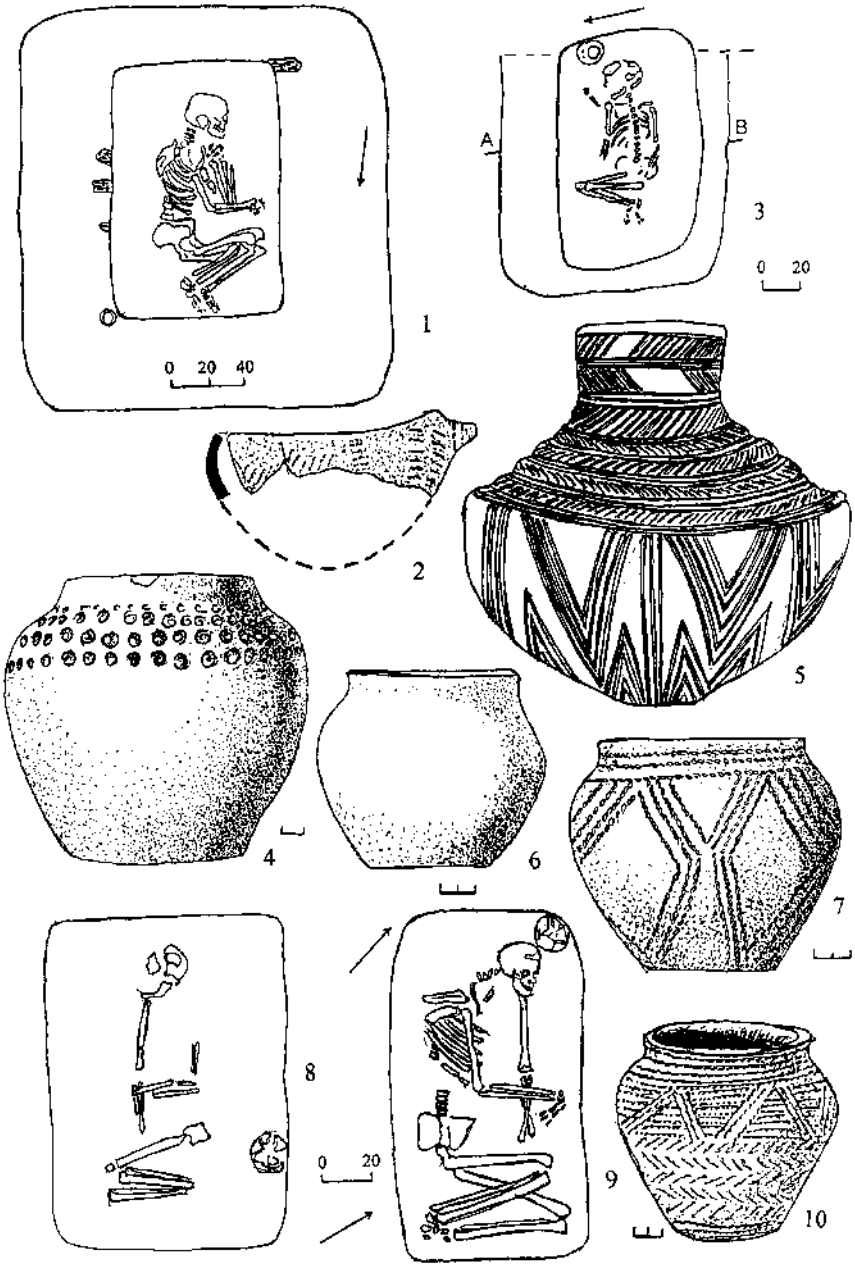

Fig. 7. Materials of the burial rite and inventory indicating the co-existence of Yamnaya and Catacomb populations: 1-2. Vysshetarasovka78/5; 3-4. Vinogradne 15/10; 5. Sokolovka 2/6; 6,7,9. Shevchenko 4/29; 8,10. "Lukyanovka" barrow 19

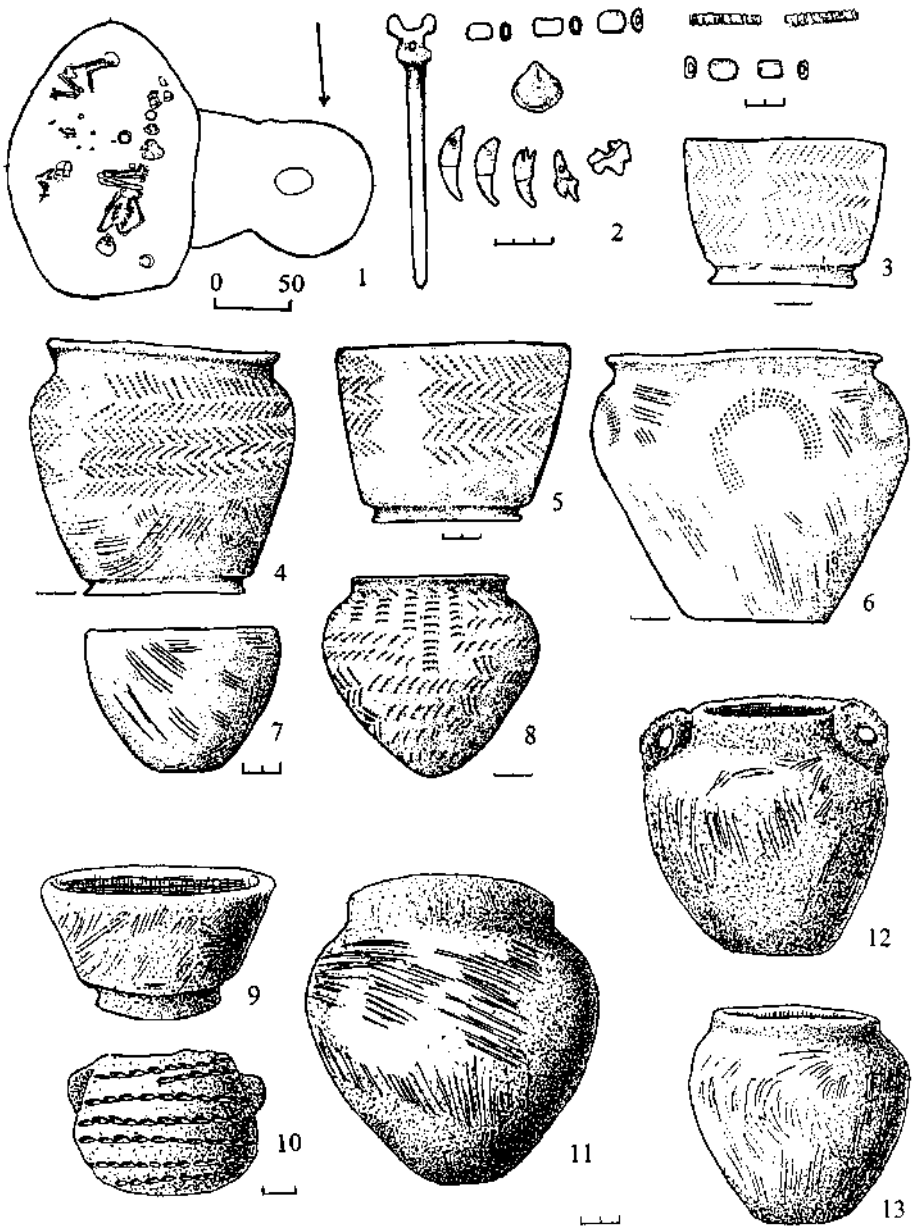

Fig. 8. Materials of the burial rite and inventory indicating the co-existence of Yamnaya and Catacomb populations: 1-8 - Volodymyrivka 13/10; 9-13 - Vinogradne 24/14

This co-existence can be traced in another round of analogues as well. Both, the late Yamnaya, the Inhul and the so-called "early Catacomb" graves contained analogues to ceramics of the Globular Amphora culture. Those include grave Lymany 9/1. There, in a bean-shaped chamber with two buried bodies placed on the side there was an amphora with typical ornament (Fig. 9:2). Volchansk 1/7 contained a similar amphora (Fig. 9:3) but in the late Yamnaya grave. The face of the buried body had been modelled [Pustovalov 1999b:222-255]. An amphora with a globular body was found in grave Antonovka 7/8 (Fig. 9:1). The ornament on it was made in e fine drawn technique with elements typical for the Inhul culture. A globular amphora was found in grave Akkermen-I 8/6 (Fig. 9:4). In the latter case the ornament on the amphora was made both by the cord and by drawn lines, i.e., in a typically Inhul techniques. The radiocarbon analysis data allow M. Szmyt to conclude that the Globular Amphorae population had survived until the Catacomb era [Szmyt 1999:117]. However, judging by their shape, the amphorae found in the Northern Pontic steppes do not appear to be the latest ones (Fig. 9:5-10).

The monograph by S.N. Bratchenko on the early stage of the Donets culture [Bratchenko 2001] proposes there are more than enough data pointing to the co-existence of the Inhul and "early Catacomb" populations. These include a cup from Astakhovo 3/2 [Bratchenko 2001:77, Fig. 3:3] (Fig. 10:5-6), a cup from grave Nikolaevka 1/10 and a cup-like vessel from grave Nikolaevka 1/5 [Bratchenko 2001: Fig. 12:2, 5] (Fig. 10:9).

Trying to prove an earlier age of the early stage of the Donets culture as compared to the Inhul culture, S.N. Bratchenko undertakes a deliberate distortion of the pictures of objects from the graves. The issue concerns the grave in the Rybasovo-II ravine (Kriviy Rih 4/10). The hammer-flattening of the tip of the blade of the knife-dagger from that grave is presented by S.N. Bratchenko as very emergent [Bratchenko 2001:167, Fig. 94:3-5] (Fig. 10:10), while in fact the tip of the knife-dagger was far more strongly hammered (Fig. 10:11). The author performs the same operation on grave Golubovsky 1/1, announcing that the bicameral catacomb [Samoylenko 1991] is a case of direct stratigraphy [Bratchenko 2001:11] (Fig. 11:1). S.N. Bratchenko also imprecisely reproduced a dagger from grave Oknitsa 3/5 [Bratchenko 2001: Fig. 94:3-5] (Fig. 10:3-4, 7). An evidence of the upper limit of survival of the Yamnaya population is a knife hammer-flattened point end found in the Yamnaya grave in the Orel Region [Marina 1990] (Fig. 10:1-2).

There are therefore, clear pieces of evidence of the co-existence of the Yamnaya and the Inhul populations in different areas of Ukraine.

Data from stratigraphy, though, are not so unquestionable. The relative chronology of barrow 3 at the village of Vinogradne (Molochna sanctuary) [Pustovalov 1999d] shows that one mound of the central barrow contained both late Yamnaya and "early Catacomb" graves (mound 8). In turn, that mound superseded the mound of barrow "D" made over the Inhul grave 18. However, the mound over the

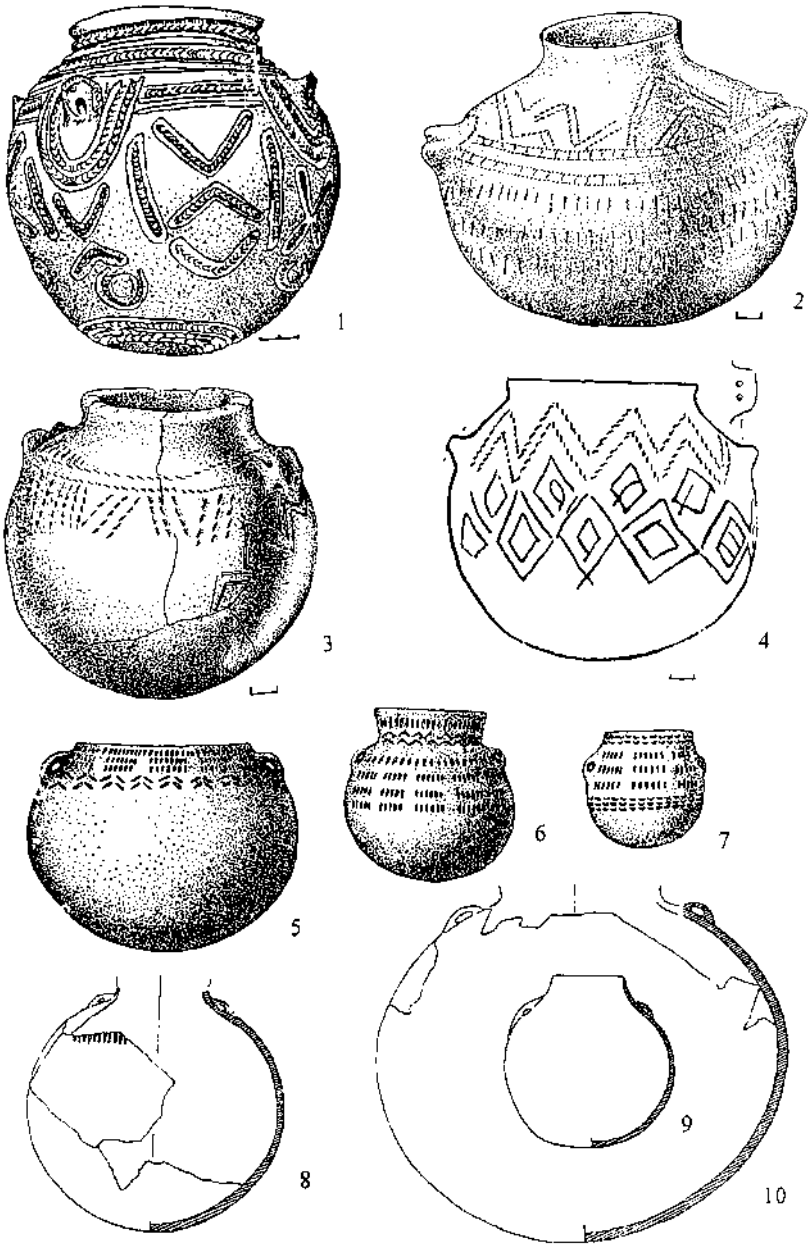

Fig. 9. Ceramics from graves of the Yamnaya and Eastern Catacomb cultures (1-4) and their analogues in the Globular Amphora culture (5-10): 1. Antonovka 7/8; 2. Lymany 1/9; 3. Volchansk II 1/7; 4. Akkermen I 8/6; 5-7. Kikova 1; 8-10. Świerszczów 27

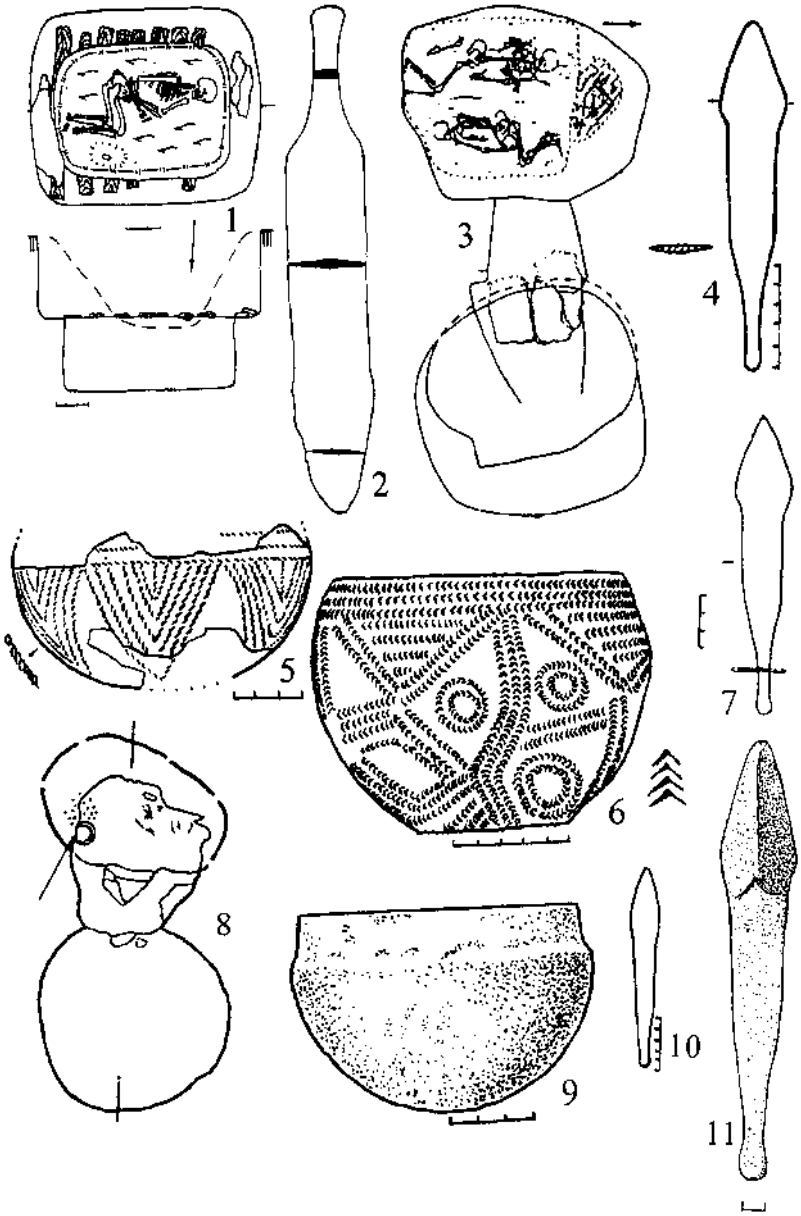

Fig. 10. Materials of the burial rite and inventory indicating the co-existence of Yamnaya and Catacomb populations: 1-2. Verbky 4/3; 3. Oknitsa 3/5 (Toshchev 1998); 4. Oknitsa 3/5 (Bratchenko 2001); 5. Astakhovo I 3/2; 6. Nikolaevka I 2/10; 7. Oknitsa 3/5 (Toshchev 1998); 8. Nikolaevka I 2/10; 9. Nikolaevka I 1/5; 10. Rybasovo II 4/10 (Bratchenko 2001); 11. Rybasovo II 4/10

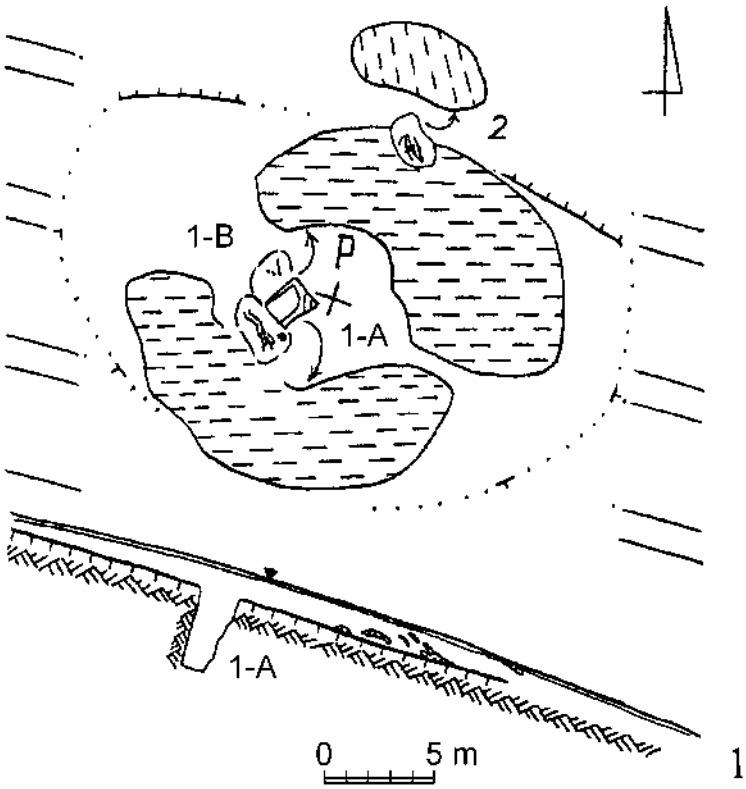

Fig. 11. Materials of the burial rite and inventory indicating the co-existence of Yamnaya and Catacomb populations: Golubovsky 1/1

Yamnaya grave 22 of the central barrow superseded or was synchronous to the later Catacomb layers added to barrow "D". This phenomenon is confirmed by the fact that the mound of barrow "A", in which the Inhul grave 30 was dropped, began to be destroyed by mound 7, made over the Yamnaya grave 25 [Pustovalov 1999d].

Therefore, for the Crimea, the Lower Dnieper, the Azov area, the region between the Orel and Samara rivers, the Inhulets and the Southern Bug, there are clear data about co-existence of the late Yamnaya, "early Catacomb" and the Inhul populations for a certain period of time.

Now let us consider the time limits of co-existence. The lower limit of the so-called "early Catacomb" graves belongs to the middle of the period of existence

of the Yamnaya culture [Pustovalov 2000d]. The upper limit is a matter of discussion. Let us turn to the analysis of facts. Hence, A.A. Melnik excavated grave 4/10 in the Rybasovo-II ravine in Kriviy Rih [Melnik 1986] (Fig. 12:5-7). The grave had a trapeze-shaped shaft, the steps, a long dromos and an oval chamber. The skeleton was placed curved on the side. The inventory included a bronze dagger with a triangular widened tip of the blade (Fig. 12:6-7). Such daggers were typical for the Middle Don culture [Pryakhin *et al.* 1991] and were referred by A.T. Sinyuk to 1600 — 1500 BC [Sinyuk 1996:168]. Possibly, the Ordzhonikidze 3/3 grave also did not belong to the Bakhmut culture, as A.V. Nikolova and E.P. Bunyatyan argue [Nikolova, Bunyatyan 1991:134-135], but continued a local tradition of Yamnaya-Catacomb graves. The quoted data allow stating that "early Catacomb" monuments survived until the end of the Catacomb entity, at least in the Dnieper Region.

Now, let us turn to the definition of the lower line of the Inhul culture that had been in full force at the late catacomb time.

Among ceramic materials of the Inhul culture, there was one specific item — an amphora from the Inhul grave Sokolovka 2/6 [Sharafutdinova 1972] (Fig. 7:5). Its analogues can be found among ceramics of the edge of 3000 — the fourth quarter of 3000 BC [Sharafutdinova 1972; Zervos 1957:33]. N.A. Chmykhov, studying ornaments of the Inhul ceramics, noted that they included samples dates, according to his system, to no later than the beginning of the last quarter of 3000 BC [Chmykhov, Chernyakov 1988:79].

The early date of the emergence of the Inhul culture (IC) is suggested by the finds of Inhul cups in early Donets Catacombs [Bratchenko 2001:70, Fig. 67:9; 68:7; 69]. Their shapes and ornaments leave no doubt about their relation to the Inhul culture (Fig. 10:5, 6, 9).

Finally, a number of battle celebration axes of the Inhul culture, decorated with relief ornament, had analogues in Anatolia, in Troy-II, and in the Dorak cemetery (mid-3000 BC) [Klochko, Pustovalov 1992].

Let us consider the upper limits of the Inhul and Eastern Catacomb ritual. In that sense, the following ceramics from graves are rather demonstrative; Rodionovka 7/6 [Melnik 1984, Fig. 136] and Vladimirovka 110/5 [Cherednichenko, Evdokimov 1975]. The first of the above graves was the Inhul grave, the other belonged to the Eastern rite. Both of the catacombs contained pots, proportions and details of which were already close to shapes of the Srubnaya culture (Fig. 12:1-4, 10-11). Therefore, the conclusion of V.I. Otroshchenko about the absence of contacts between the Srubnaya and Catacomb populations is not universal for the steppe zone [Otroshchenko 1990:76-78].

Hence, the lower limit of the emergence of the Inhul monuments goes down, even in traditional chronology, to the middle stage of the Yamnaya culture, and late Yamnaya and "early Catacomb" monuments survive until the end of the Catacomb entity. That conclusion involves zone-by-zone existence of all three ethnic groups

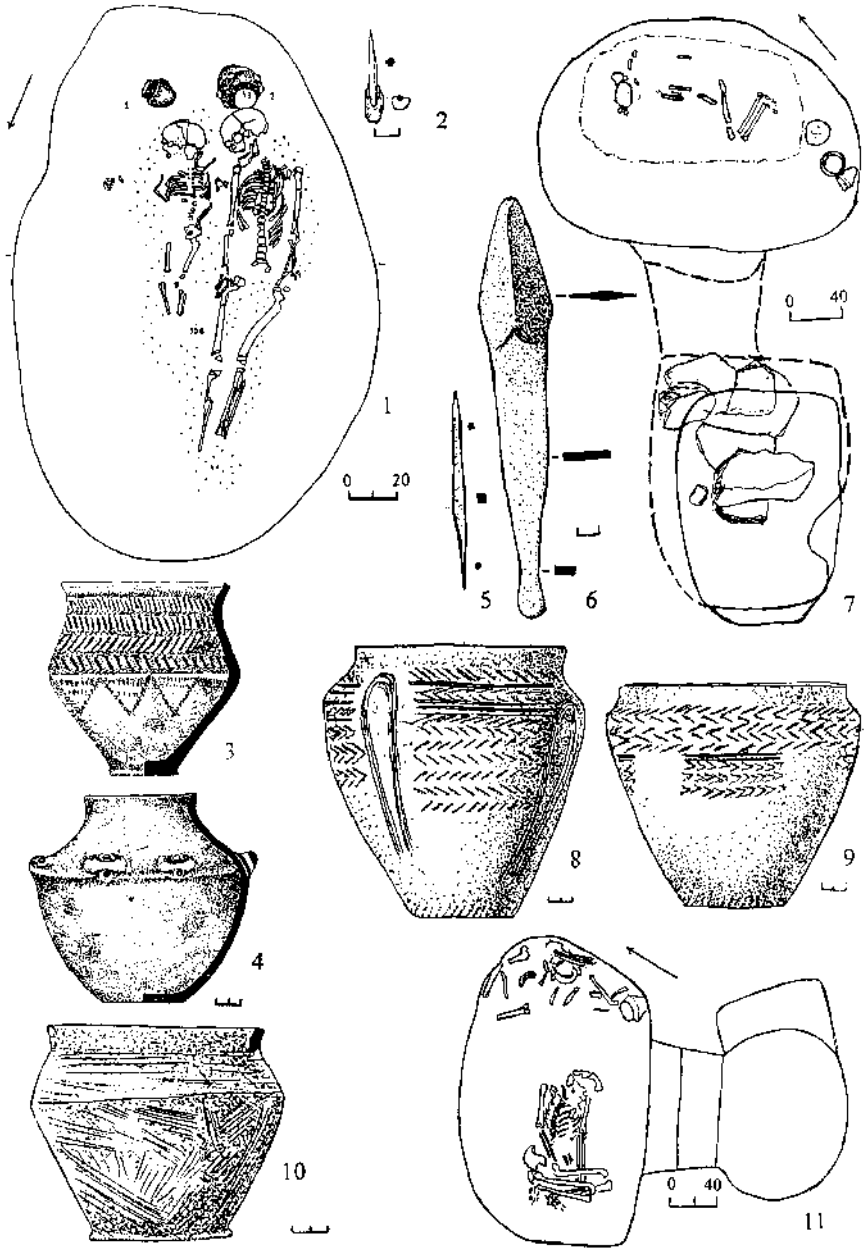

Fig. 12. Materials of the burial rite and inventory indicating the co-existence of Yamnaya and Catacomb populations: 1-4. Rodionovka 7/6; 5-9. Rybasovo 4/10; 10-11. Vladimirovka 110/5

of population. The zone-by-zone co-existence of the above groups is proved by the fact that the Budzhak ceramics occur not only in Yamnaya and Catacomb graves of the Right-bank Ukraine, but also in the pre-Azov Region. For instance, one of the five vessels found in the Yamnaya grave Vinogradne 24/14 was a cup on a saucer of the Budzhak type (Fig. 8:2). In the light of the above, it is interesting to note that in 3% of barrows of the Lower Dnieper Region the stratigraphical columns end with the Yamnaya graves.

The modelling rite that occurs in some graves of the Yamnaya entity also point out to the co-existence of those groups of the population [Pustovalov 1999b].

A clear evidence of the co-existence of the Yamnaya and Catacomb (including the Inhul) populations is presented by arrowheads that were the causes of death of the people buried in the Yamnaya graves. To date, over 60 of them have been found [Pustovalov 2000b; Teslenko 2000a].

Such graves are rather widely known. As an example, one may consider a fragment of an arrow-head from the Nova Odesa IV 2/6 cemetery; a fragment of the arrowhead found in pelvic bones of the skeleton from the Novo-Petrovka-II 1/7 cemetery; a fragment of an arrow-head from Kamenka 16/26 [Shaposhnikova *et al.* 1986]; from the Dniester — Danube Region, one may refer to a flint arrow-head from Semenovka 14/24 [Subbotin 1985]; an arrow-head from Nikolskoe 13/1 [Agulnikov 1999]; the Crimean monuments include Krasnoyarskoe 11/30 [Koltukhov, Toshchev 1998]; the Right-bank Dnieper Region includes Marevka 8/3; Shyrochany 9/4; Novoivanovka 3/2 [Samoylenko 1988]; "Bobushka" 3/23 [Pustovalov 1999]; from the western Azov Region one may refer to Vinogradne 15/8; 24/31 and Barvinovka 7/14 (the excavations performed by the Zaporizhzhia expedition in early 1980s); from the area between the rivers of Orel and Samara one may refer to Vasilevka-1 2/3 [Kovaleva *et al.* 1995]; Chkalovka-II 1/2 and 2/7 [Kovaleva, Shalobudov 1992]. There the arrowheads were found among the bones of the skeletons and in the bone. Some graves containing arrowheads have been found near Melitopol: Konstantinovka 2/10; 2/4 [Boltrik *et al.* 1991]. In the North-Western Pontic Region, arrowheads were found in the bones of the buried (i.e., had been the cause of death) in 17 cases. Six more cases, where exact location of the arrowheads was unclear, should probably be added to them [Ivanova 1999:6; Subbotin 1990:52]. The list of such graves may be continued (Fig. 13).

A noteworthy fact is that the types of axes found in the Yamnaya graves in a number of cases are identical with Catacomb axes. For instance, in Semenovka 8/16 the stone axe with a typical rib in the middle part [Subbotin 1985, Fig. 8] had analogues in Catacomb graves (Vinogradne 24/22) [Klochko, Pustovalov 1992, Fig. 4] (Fig. 14). Axes with several cannelures in the middle part from the Yamnaya graves of that region were also found in the Catacomb graves [Sanzharov 1999:Fig. 9]. Interestingly, in that case the Catacomb grave belonged to the Inhul type and was dated to the late Catacomb period [Sanzharov 1999; Andro-

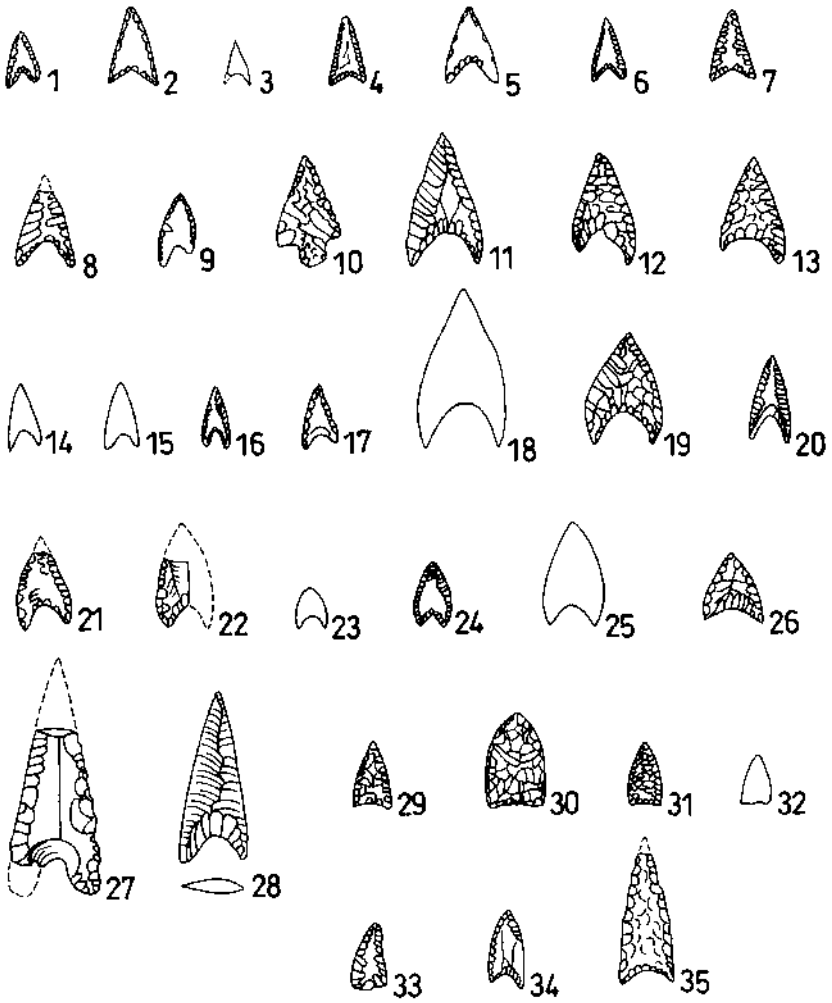

Fig. 13. Arrowheads of the Yamnaya and Catacomb cultures: 1. Konstantinovka 2/10 (Yamnaya); 2. Novoivanovka 3/2 (Yamnaya); 3. Barvinovka 7/14 (Yamnaya); 4. Kremenchuk (Mnogovalikovoy Pottery culture); 5. Golovkovka (Yamnaya); 6. Rysove (Catacomb); 7. Catacomb culture (after Dergachev 1999); 8. Shyrochany 9/4 (Yamnaya); 9. Semenovka 2/7 (Yamnaya); 10. Marevka 8/3 (Yamnaya); 11. Golovkovka 7/5 (Catacomb); 12. Veliky Tokmak 1/9 (Catacomb); 13. Vinogradne 19/8 (Catacomb); 14. Chkalovka II 1/2 (Yamnaya); 15. Chkalovka II 2/7 (Yamnaya); 16. Vasilevka I 2/3 (Yamnaya); 17. Semenovka 14/24 (Yamnaya); 18. Vinogradne 15/8 (Yamnaya); 19. Golovkovka 7/5 (Catacomb); 20. Slavne 1/2 (Catacomb); 21. Chkalovo 3/23 (Yamnaya); 22. Novopetrivka II 1/7 (Yamnaya); 23. Vinogradne 24/31 (Yamnaya); 24. Staroe 14/24 (Yamnaya); 25. Vinogradne 19/8 (Catacomb); 26. Golovkovka 24/2 (Catacomb); 27. Kamenka 16/26 (Yamnaya); 28. Boeva Mohyla (Mnogovalikovoy Pottery culture); 29. Talmaz 13/30 (Catacomb); 30. Krasnoyarskoe 11/30 (Yamnaya); 31. Tankove 9/24 (Yamnaya); 32. Novonikolske 1/5 (Catacomb); 33. Golovkovka 24/2 (Catacomb); 34. Babenkove 1/21 (Yamnaya); 35. Talmaz 3/15 (Catacomb)

sov *et al.* 1990:Fig. 5]. According to L.V. Subbotin, types of axes and other objects from the Yamnaya graves of that region were the most common for the Catacomb monuments. The cases of reverse stratigraphy (Cholmskoye 2/17, 24) allow to refer the end of co-existence of the Yamnaya and Catacomb populations to 1800-1700 BC [Subbotin 1990:51-52]. In other words, the comparison of the inventory of the Yamnaya graves of the North-Western Pontic Region and the Catacomb monuments displayed their co-existence for a rather long period of time.

E.V. Yarovoy referred the last post-Yamnaya group to the period from the edge of 3000-2000 BC to the first quarter of 2000 BC [Yarovoy 2000:26]. That is also suggested by finds of ceramics. Hence, pots on saucers that are typical for the Budzhak monuments or without a saucer (the post-Yamnaya group) were found both in Yamnaya (the Inhul region, Kovalivka VII 3/11), and Catacomb graves of the Inhul type (Volodymyrivka 13/10) [Cherednichenko *et al.* 1975].

As may be seen from the list, such graves occur over the entire territory of the steppe zone of Ukraine. The graves of the Yamnaya culture containing weapons comprise only 1%-2%, and the majority of weapons in them are the causes of wounds and therefore, could be regarded as objects that were included in the graves accidentally. The occurrence of arrow wounds in the Yamnaya culture is comparable only with the occurrence of wounds in Catacomb graves, which in itself is an indication of the kind of relations between those major ethnic groups. The types of arrows found in the Yamnaya graves offer a picture of relations with the Middle Dnieper Region (the Middle Dnieper culture) (Marevka 8/3), and different groups of the Catacomb population.

The most common kind of arrowhead that was the cause of possible death had the shape of an isosceles triangle with turn-off thorns that were brought slightly closer to each other (Fig. 13:14-20). That type of arrowhead also occurs in the Catacomb, including the Inhul graves (e.g., Vinogradne 19/8) [Klochko, Pustovalov 1992:Fig. 1:4].

The arrowhead from Semenovka 2/7 near Melitopol was interpreted by the author of the publication, B.D. Mikhaylov, as close to the arrowheads of the Maykop culture, the special feature of which was the presence of asymmetrical thorns [Mikhaylov 1990:115]. However, such types of arrowheads were also found in Catacomb graves [Klochko, Pustovalov 1992:120, 123]. Practically all of the finds of arrowheads listed above have analogues in the Catacomb graves, including the Inhul graves, though those types are not the only types of the diversity of Catacomb arrowheads.

In the context of the co-existence of the Yamnaya and Catacomb groups of population and the time till which the Yamnaya population survives, an interesting fragment of an arrowhead was found in a Yamnaya grave Kamenka 16.26 (Fig. 13:27). Such massive arrowheads existed already in the Mnogovalikovoy time [e.g.,

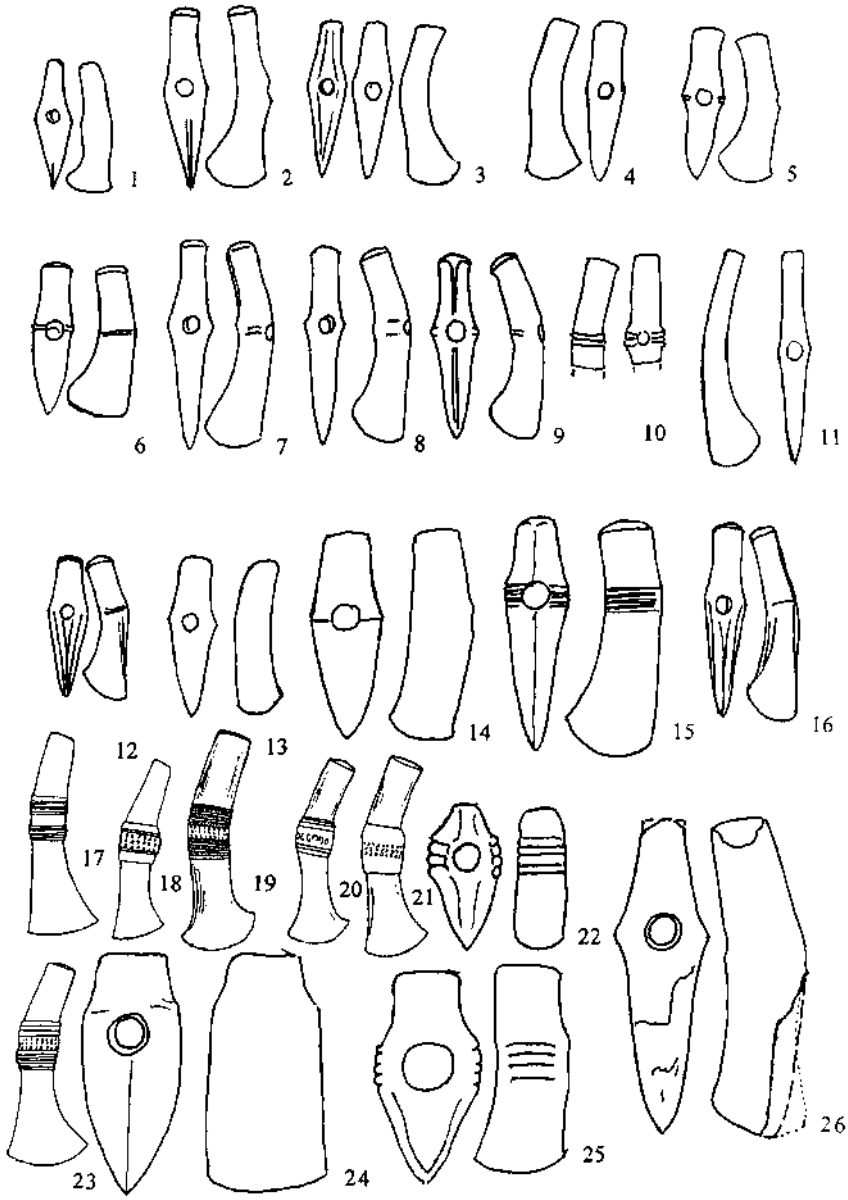

Fig. 14. Axes of the Yamnaya, Catacomb and Mnogovalikovoy Pottery cultures: 1. Luhansk 3; 2. Akkermen 8/7; 3. Krasnopartyzanske 7; 4. Starovelychkovska; 5. Baturyn I 2/9; 6. Shalushinske; 7. Anuchin collection, Northern Caucasus; 8. Mikhailivske; 9. Borodino; 10. Pervomayske 2/2; 11. Lebedi I 3/10; 12. Borodino; 13. Vinogradne 24/22; 14. Semenovka 8/16; 15. Baranivka 1/10; 16. Borodino; 17-18, 23. Dorak; 19-21. Troy II; 22. Golovkovka 24/2; 24. Oleksandrivka 3/4; 25. Burlatske 3/4; 26. Chkalovka 6/12

Polidovich 1993, Fig. 52:1] (Fig. 13:28). Of course, it should be noted that the Kamenka arrow was finished more primitively, but general proportions and sizes coincide. It is noteworthy that the arrowheads that are most frequently represented in Yamnaya graves also occur in graves of the Mnogovalikovoy Pottery culture [Litvinenko 1998:48, Fig. 1:6].

As we can see, the co-existence or even parallel existence of two major ethno--cultural entities of the Bronze Age in the Northern Pontic Region is now proven not only by the analysis of burial rites and inventory [Pustovalov 1998; 1999d; 2000d], but also radiocarbon dates. It appears that barrow stratification alone contradicts the co-existence argument. However, that issue is not completely clear either. There are cases of reverse stratigraphy [Pustovalov 1999d]. As noted above, in a number of cases the reverse stratigraphy was mistakenly presented as unreliable. The researchers who performed the excavations were taken hostage by traditional paradigms and were unable to assess the unusual phenomenon in an unbiased manner.

The massive excavation of barrows caused disagreement between stratigraphy data on the one hand, and the burial rite and inventory, on the other. Representatives of the "stratigraphical direction" basing their assumptions derived from relative barrow stratigraphy, had to conceal cases of reverse stratigraphy and burial rite and inventory data that contradicted their views — or explicitly dismiss them as wrong. Yet, such data in no case must be concealed. In a sample of 1000 units of observation, even three cases are statistically true and demand historical explanation. Such graves number about 200, or about 4% of all excavated Catacomb graves. Appealing to V.A. Gorodtsov in their assumptions, those authors forget that the main principle in Gorodtsov's scheme was not the strict sequence of the three archaeological cultures of the Bronze Age, but the systemic method itself, due to which the composition was performed [Pustovalov 2001b].

Unlike the representatives of the stratigraphical approach, the systemic approach of Gorodtsov is shared by a number of researchers who believe that there had been some period of co-existence of the Yamnaya and many groups of Catacomb populations. The contradictions that exist in that case as well between the predominant majority of cases of stratigraphy and the data of burial rites, inventories and even radiocarbon analysis should be resolved through historical interpretation, explanations of the fact in question but not through its rejection.

The class-caste system that dominated the early stages of the development of statehood in societies that emerged as a result of contacts between civilization centres within the periphery gives a key to understanding of ethnic, social, religious and economic processes in the Yamnaya-Catacomb epoch [Pustovalov 1990b; 1991a; 1992a; 1994a; 1995b; 1997a; 1999e; 2000c; 2000d]. Among other things, it allows the explanation of the strict sequence of graves in the barrows. If the barrow contains graves of representatives of one kin or a family, the person born in one ethno-social group could be buried either in accordance with the burial rite

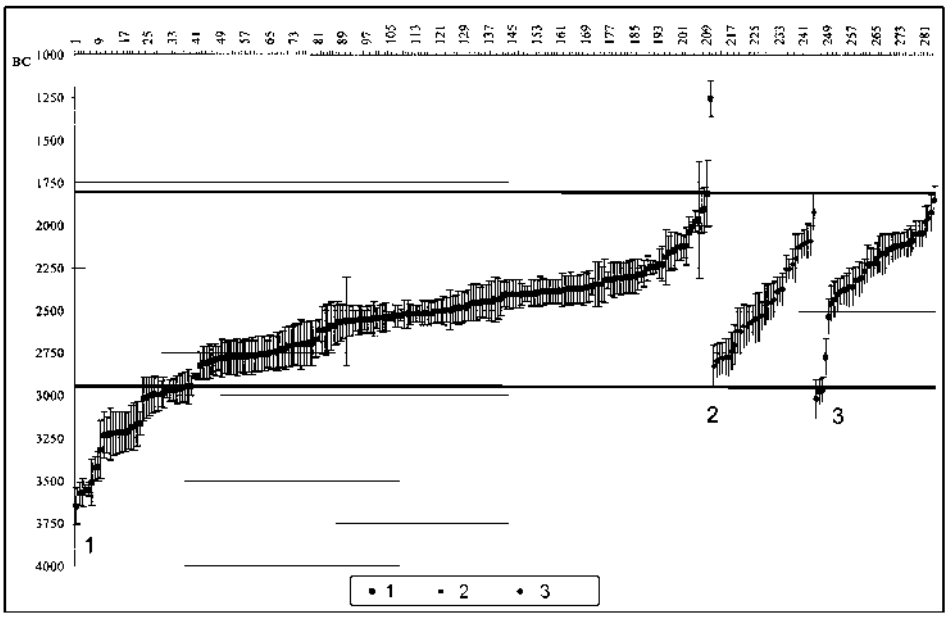

Fig. 15. Radiocarbon definitions of the Yamnaya, Eastern Catacomb and Inhul cultures: chart. 1 - Yamnaya culture; 2 - Eastern Catacomb culture; 3 - Inhul culture

of his or her ancestors or in accordance with the rite of the ethno-social group to which he/she had been included after an increase in his/her social status. For men that increase was possible through significant war achievements, for women through marriage [Pustovalov 1995b; 1999e]. Unequal relationships were severely punished in caste societies. Therefore, there were almost no cases of reverse stratigraphy [Pustovalov 2000d]. Hence, the strict and consistent sequence of graves of different ethno-cultural groups in the barrows could be a result of the caste system that existed in the Yamnaya-Catacomb society of the Northern Pontic Region.

V.A. Gorodtsov was right when he reflected in his scheme the sequence of peaks of development of the three ethnic population groups that co-existed on the territory of Ukraine and in the Northern Pontic Region in general, in the Yamnaya-Catacomb period. The solution of contemporary contradictions in the construction of periodisation of early and middle Bronze age in the steppe part of Ukraine is achieved through the use of a class-caste model. The idea of the class-caste model may be also productive for eastern regions of the Catacomb entity. Something similar was reconstructed by A.T. Sinyuk for the Middle Don [Sinyuk 1996]. Elements of the caste system may be traced in relations between the Yamnaya population with the Kemi-Oba population, in the Chernyakhov culture and in

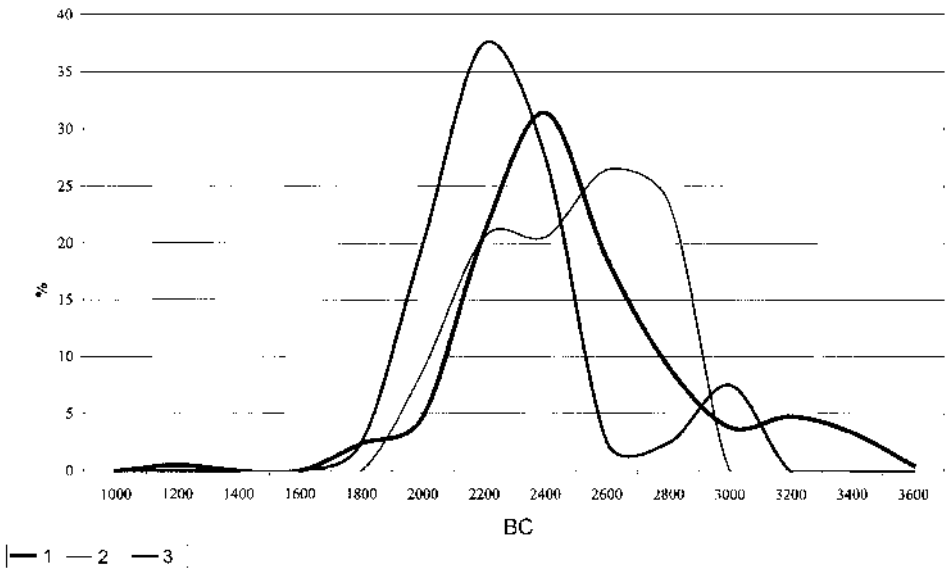

Fig. 16. Radiocarbon definitions of the Yamnaya (1), Eastern Catacomb (2) and Inhul cultures (3): chart (in %).

the Khazar society [Pustovalov 2000b]. The disagreement between the stratigraphy data and results of the analysis of the burial rite, the inventory and the radiocarbon analysis may serve as an indicator of the presence of a caste system in a particular society. This idea will be also productive for the analysis of the Yamnaya-Catacomb (Novotitarovka) monuments of the Northern Caucasus and for reconstruction of ethno-social relations at an early stage of the Late Bronze Age of Eastern Europe.

3.4. CONCLUSIONS

Analysis of the data of the burial rite, the inventory and the radiocarbon dating, indicate a long period of the co-existence of the Yamnaya and Catacomb, including the Inhul, populations. The existence of the Yamnaya population can be divided into two stages. The second stage is synchronous with the Catacomb entity. Practically speaking, the Yamnaya population on the territory of the Northern Pontic Region survives until the late Catacomb period. The time of co-existence is estimated for all the three groups of the population (Yamnaya, Eastern Catacomb and Inhul) as

800 years, while the co-existence of the Yamnaya and the Inhul is estimated to have lasted for 1,200 years (Fig. 15). Quite possibly, with the increase in the number of samples, the duration of co-existence with the Eastern Catacomb culture will also increase. It should be noted that all the three groups cease to exist practically at the same time. Interestingly, in case of the distribution of frequency of the same dates on the time scale peaks of charts for the Yamnaya and Inhul, the groups do not overlap. The two-peak distribution of the Eastern Catacomb graves may be a result of either insufficient number of definitions or a reflection of dependence of the Eastern Catacomb population on the other two groups (Fig. 16). The predominant majority of cases of barrow stratigraphy contradict that. However, that is explained by the class-caste nature of the Yamnaya-Catacomb society.

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 185-208
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE EARLY BRONZE AGE OF THE MIDDLE DON. SVATOVE, LUHANSK REGION

The Early Bronze Age burial site near the town of Svatove of the Luhansk Region was excavated in 1973-1974 (Fig. 1) by an expedition of the Institute of Archaeology, Academy of Sciences of the Ukrainian SSR, led by S.N. Bratchenko. The burial mounds, studied in the course of the expedition, contained Eneolithic (pre-Yamnaya) graves, the Yamnaya graves as well as graves of the middle and late

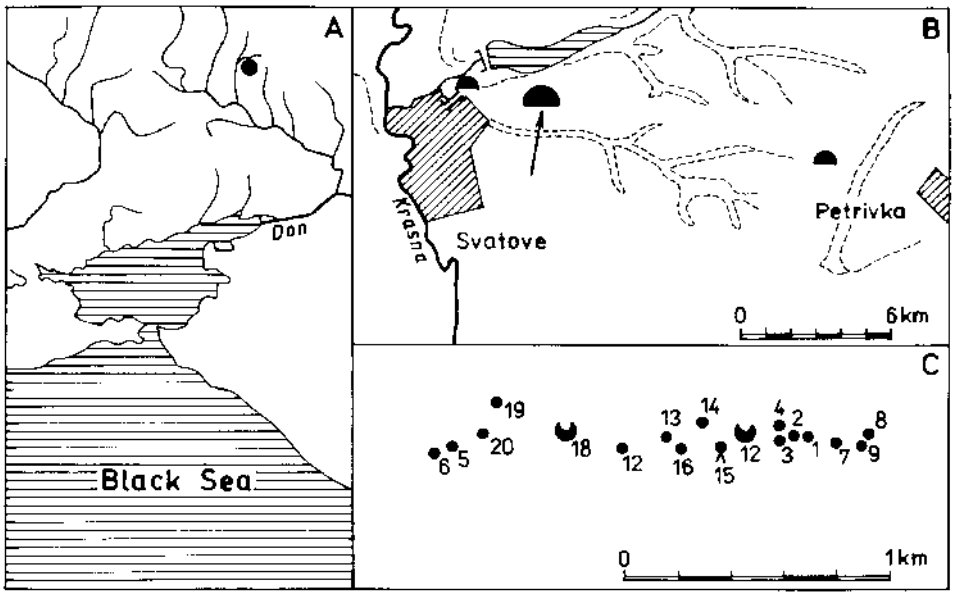

Fig. 1. The Svatove burial site, Svatove District, Luhansk Region. Maps (A-B) and plan (C)

Table 1

Svatove, Svatove District, Luhansk Region. Old dates of the graves

Lab. No.	Kurgan / grave	Culture	BP	BC
Ki-1213	12/1	Pre-Yamnaya	5400±80	4245±92
Ki-585	1/1	Yamnaya	4000±90	2475±142
Ki-586	2/1	Yamnaya	4010±180	2565±263
Ki-620	2/2	Catacomb	3560±120	1864±160
Ki-621	3/2	Catacomb	3150±180	1370±229
Ki-892	4/5	Catacomb	3820±35	2252±62
Ki-906	5/1	Catacomb	3710±60	2088±91
Ki-1568	7/5	Catacomb	3200±70	1452±73
Ki-1558	12/2	Catacomb	3800±90	2190±145
Ki-1559	12/4	Catacomb	4200±80	2773±109
Ki-1560	12/9	Catacomb	4200±65	2779±96
Ki-1561	13/2	Catacomb	4600±75	3335±160
Ki-1562	16/1	Catacomb	4100±80	2618±137
Ki-1229	18/1	Catacomb	3200±90	1436±108
Ki-1584	18/3	Catacomb	4200±80	2773±109
Ki-1564	18/4	Catacomb	3600±75	1917±112
Ki-1565	19/1	Catacomb	4700±70	3463±97
Ki-1566	20/1	Catacomb	4500±80	3200±129
Ki-1567	20/3	Catacomb	3900±50	2374±77

stages of the Donets Catacomb culture. A substantial number of those graves at that time were dated by means of the ^{14}C method (Table 1), and those dates are still considered as the etalon for the Early Bronze Age of the Donets Region [Telegin 1977; Telegin, Sobotovich, Kovalyukh 1978; 1981; Telegin 1992; Kaiser 1999].

1. LIST OF NEW DATINGS AND CULTURAL IDENTIFICATION OF SAMPLES

In 2002, through the use of a new technique, new dates have been obtained from samples of wood from those burial mounds that had been kept at the Kiev radiocarbon laboratory (Table 2) [calibration after Kovalyukh, Nazarov 1999].

Let us consider the graves in terms of culture-chronological levels.

Table 2

Svatove, Svatove District, Luhansk Region. New dates of the graves

Lab. No.	Kurgan / grave	Culture	BP	BC
Ki-9856	12/1	Pre-Yamnaya	4720±70	3476±99
Ki-9932	1/1	Yamnaya	4145±50	2740±105
Ki-9933	1/1	Yamnaya	4170±50	2766±94
Ki-9931	2/1	Yamnaya	4125±50	2692±115
Ki-9866	19/1	Catacomb	4155±60	2746±106
Ki-9861	13/2	Catacomb	4140±70	2730±117
Ki-9862	16/1	Catacomb	4110±80	2703±134
Ki-9867	20/1	Catacomb	4100±70	2612±130
Ki-9859	12/5	Catacomb	4090±70	2597±126
Ki-9858	12/4	Catacomb	4055±70	2570±107
Ki-9868	20/3	Catacomb	4050±60	2553±88
Ki-9863	18/1	Catacomb	4030±70	2551±103
Ki-9860	12/9	Catacomb	4020±70	2533±105
Ki-9857	12/2	Catacomb	3960±70	2445±107
Ki-9864	18/3	Catacomb	3920±70	2373±99
Ki-9865	18/4	Catacomb	3890±70	2354±100

1.1. THE "PRE-YAMNAYA" HORIZON

The "pre-Yamnaya" level is represented by grave 12/1 (Fig. 2). The grave was the main one in the largest — 2.9 meter high — burial mound of the group. It's "ceiling" was made of whole and split wooden beams that covered an area of 4 x 5 meters. The beams were heavily burnt and on the grave soil, which was also heavily burnt, there were remnants of burnt branches and small bones — all these were the evidence of a major burial fire.

Below the "ceiling" there were remnants of a wooden frame, about 200 x 170 cm in size. At the bottom of the pit, on the brownish ashes there was a male skeleton (adultus — maturus, man) — on the back, in a curved position, head to the South-East. Given the fact that some of the bones were displaced in the joints, and the skull lay immediately at the frame, the original position of the dead man had been half-seated on the back, with the legs drawn to the chest, knees up, but later the knees dropped to the right onto the household objects placed nearby (Fig. 2). At the feet of the skeleton the floor was sprinkled intensively with ochre powder. The objects found in the grave included a bronze chisel (5), two knives (3-4), a long shaft (4), a flint splinter (1), and there was a short shaft chisel (2) at the shoulder (Fig. 2:1-5).

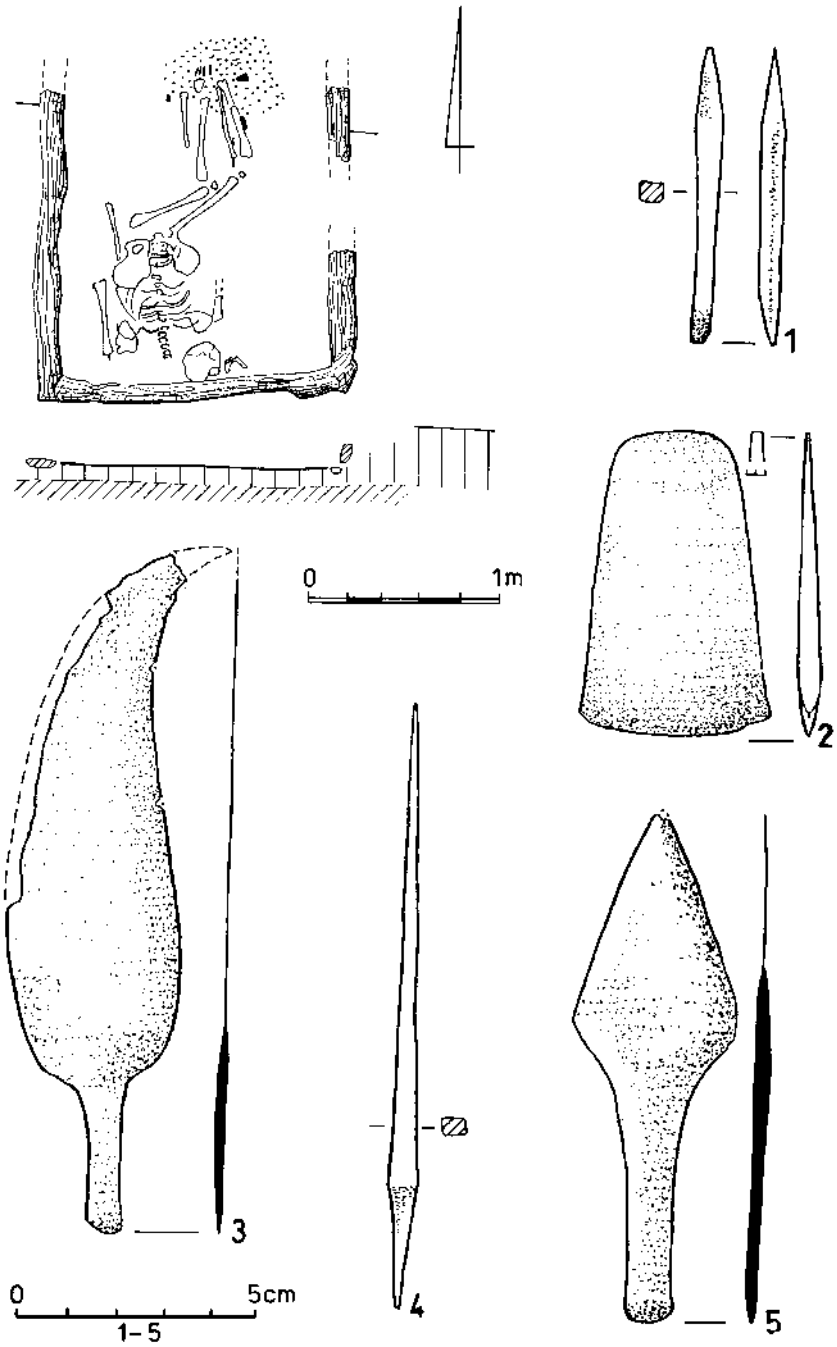

Fig. 2. The Svatove burial site, Svatove District, Luhansk Region. The "Pre-Yamnaya culture". Grave 12/1 and the objects found in it: chisel (1), hatchet (2), knife (3), awl (4), knife (5)

Judging by the burial construction — the wooden coffin — the frame, slightly buried in the soil, and partly, by the contents and typology of the bronze burial objects, the grave had the features of, and was synchronous with, the Maykop culture of the Northern Caucasus. The southward orientation was also typical for that culture. However, the curved position of the buried man was typical for local cultures or groups of the Eneolithic — Early Bronze Age. Hence, the grave was a syncretic one and belonged to a still poorly pronounced culture group that occurred in the Siversky Donets basin and, particularly, at the Lower Don [Bratchenko 1996:32-57]. According to numerous stratigraphic observations in those regions and at the Northern Caucasus, that culture group preceded the earliest complexes of the Yamnaya culture in its narrow, contemporary interpretation. The new ^{14}C date for these graves, the calibrated version of 3476±99 BC, fully corresponds with the new chronology, particularly that of the Maykop culture: about 3700-3200/3000 BC [Trifonov 1996:45-47]. That chronology is based both on the ^{14}C dates and the typology of artefacts from Asia Minor [Rezepkin 1991:197].

1.2. THE "YAMNAYA" HORIZON

The "Yamnaya" horizon is represented by graves 1/1 and 2/1. Grave 1/1 was a pit of 230 x 220 cm in size, badly damaged by rodents that had destroyed the remains of the buried body (Fig. 3). At the edges of the pit there were remnants of the wooden beams that used to cover it. The total area of the "ceiling" was 450 x 300 cm. The filling of the pit contained ground human bones; there were spots of white and grey ashes on the floor and a triangular flint splinter. Grave 2/1 was destroyed by the rodents even more than the first one.

These graves represent the Don-Donets version of the Yamnaya culture. Typical features of that version include a westward position of the buried bones and rare artefacts: vessels with a round bottom, bronze knives, hammer-like and other bone pins, silver or bronze temple rings or spirals. Grave 2/4 of that burial mound contained a vessel (Fig. 3:1) with an ornament typical for that version of the Yamnaya culture [Bratchenko 2001:Fig. 104A, B; 108-109].

The above mentioned set of decorations, as well as some similarities in ceramics (primarily from graves of the Dnieper and the North-Western Pontic area) the Yamnaya culture, as well as the Catacomb cultures of the Early and Middle Bronze periods are synchronous with the Corded Ware cultures of Central Europe [Bratchenko 2001:42-49, Fig. 102:7-12, 13-38]. The new ^{14}C dates from graves 1/1 and 2/1 in the calibrated version of 2740±105 BC, 2766±94 BC and

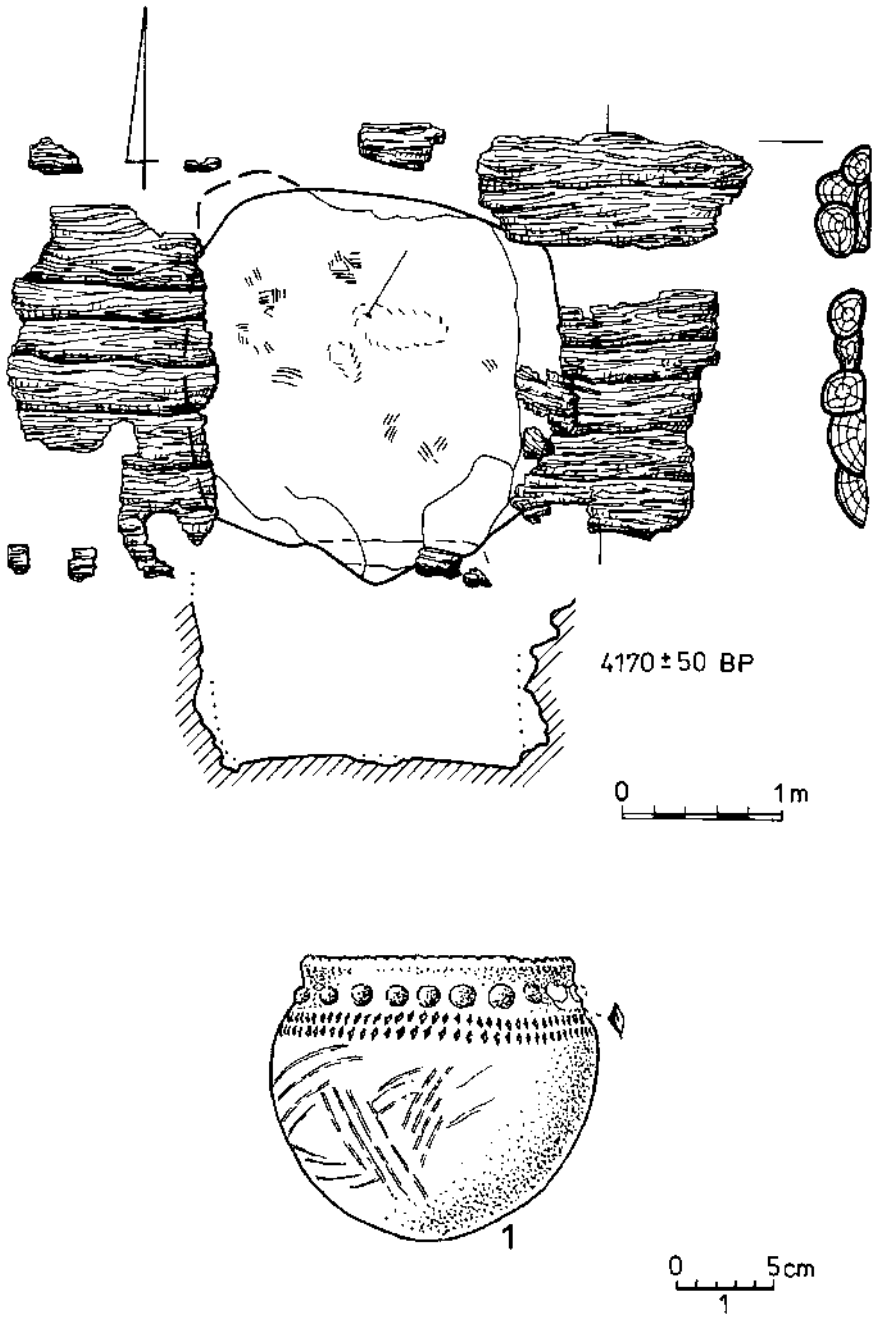

Fig. 3. The Svatove burial site, Svatove District, Luhansk Region. Yamnaya culture. Grave 1/1, and a pot from grave 2/4 (1)

2692±115 BC are much later than the dates of the Late Eneolithic — Early Bronze complexes, and earlier or partly contemporary with the chronology of the Middle Catacomb monuments of the middle period, more specifically, with the Svatove group (Table 3). That corresponds with their stratigraphic position and the general chronology of the Don-Donets version of the Yamnaya culture (about 3000-2700 BC).

1.3. THE "CATACOMB" HORIZON

The "Catacomb" horizon is represented with the graves of the Donets Catacomb culture, of which more than 1,200 are studied in the Siversky Donets alone. Those are mostly 'dropped-in' graves in burial mounds with the main graves of the Yamnaya culture or the Late Eneolithic.

Most belong to the middle, classical period of the culture — with its typical ceramics with corded and combed ornamentation in the shape of concentric circles, spirals, hanging down semi-circles ("the baroque style"), triangles, "fish-bones" (old patterns of the Eneolithic and the Yamnaya culture). In the Svatove burial site the most typical graves, from the perspective of the burial rite and the objects found, are the complexes of the middle period; 1/4, 12/2, 12/4, 12/5, 12/9.

Grave 1/4 was made like a catacomb. The entrance pit was of trapeze shape, 140 cm x 110 cm. At the bottom of the pit there was a pan with charcoal and a bull skull put on the cut-off extremities (Fig. 4). The pan was made of a fragment of a vessel with five "rollers" (Fig. 4:1). The oval burial chamber, 180 cm x 130 cm, had a ruined "ceiling". The entrance to the chamber was covered with wooden planks that had partly worn into the chamber. There were fragments of broken vessels on the floor and a vessel with salient sides, ornamented with impressions of a ribbon (or a woven cord), spirals and a flat cliché (Fig. 4:2). On the floor there were mixed bones of an adult human, ochre powder, and yellow dust. At the south-eastern wall there was some charcoal.

Grave 12/4 was a catacomb with a rectangular entrance pit (Fig. 5). At the bottom of the pit there were bones of a sheep or a goat, fragments of a vessel with coal (a pan) (Fig. 6:5), two phalanx (astragal), ochre powder and yellowish dust. In the western part of the pit there was a pile of wooden planks that covered the entrance to the burial chamber. The latter was 175 cm x 150 cm in size. At the bottom of the chamber, on the traces of white and brownish dust, there were remainders of an adult human skeleton and remainders of baby bones in front of it. In front of the buried bodies there had been three ceramic vessels and one wooden (not preserved):

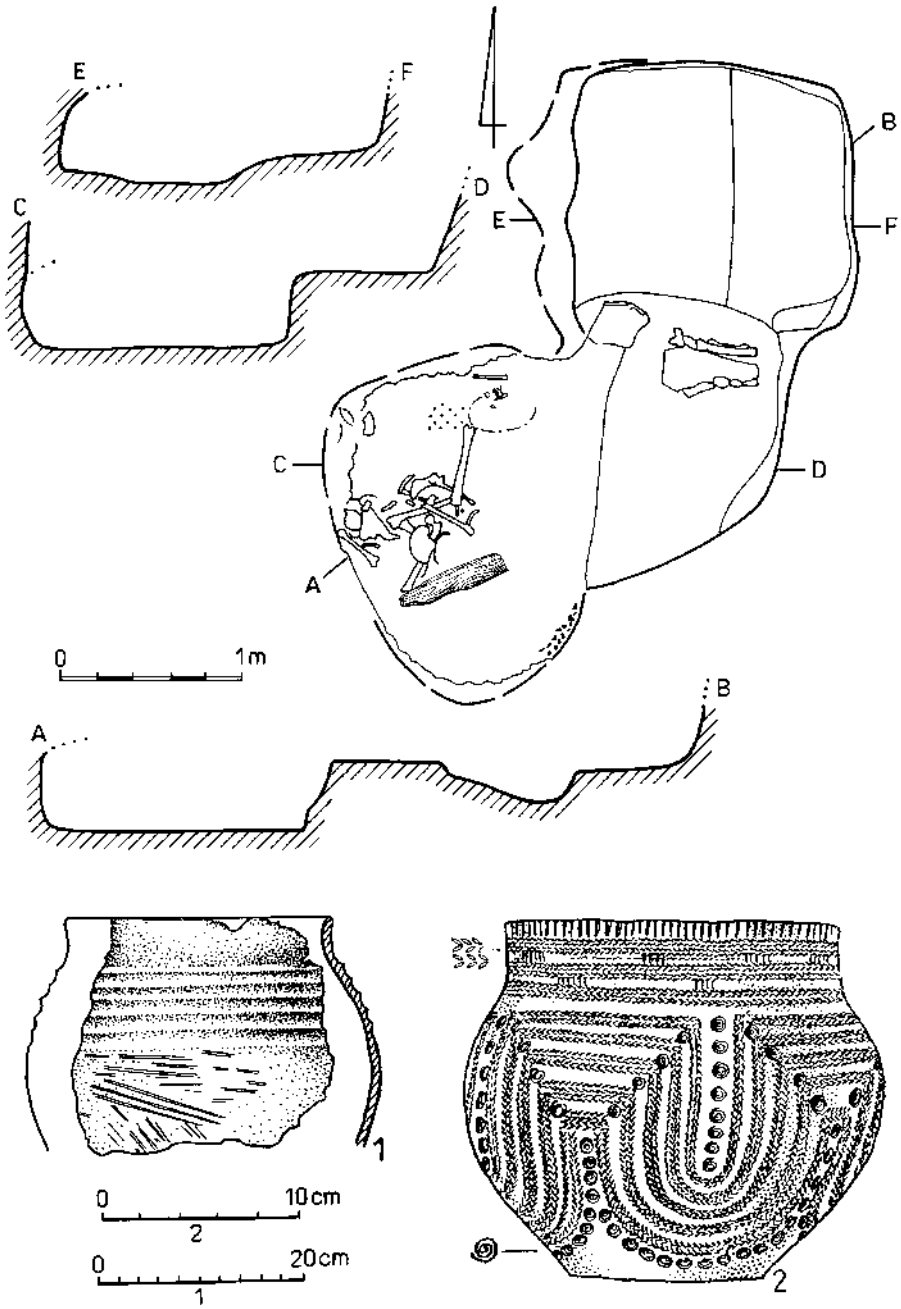

Fig. 4. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 1/4 and pots from it (1, 2)

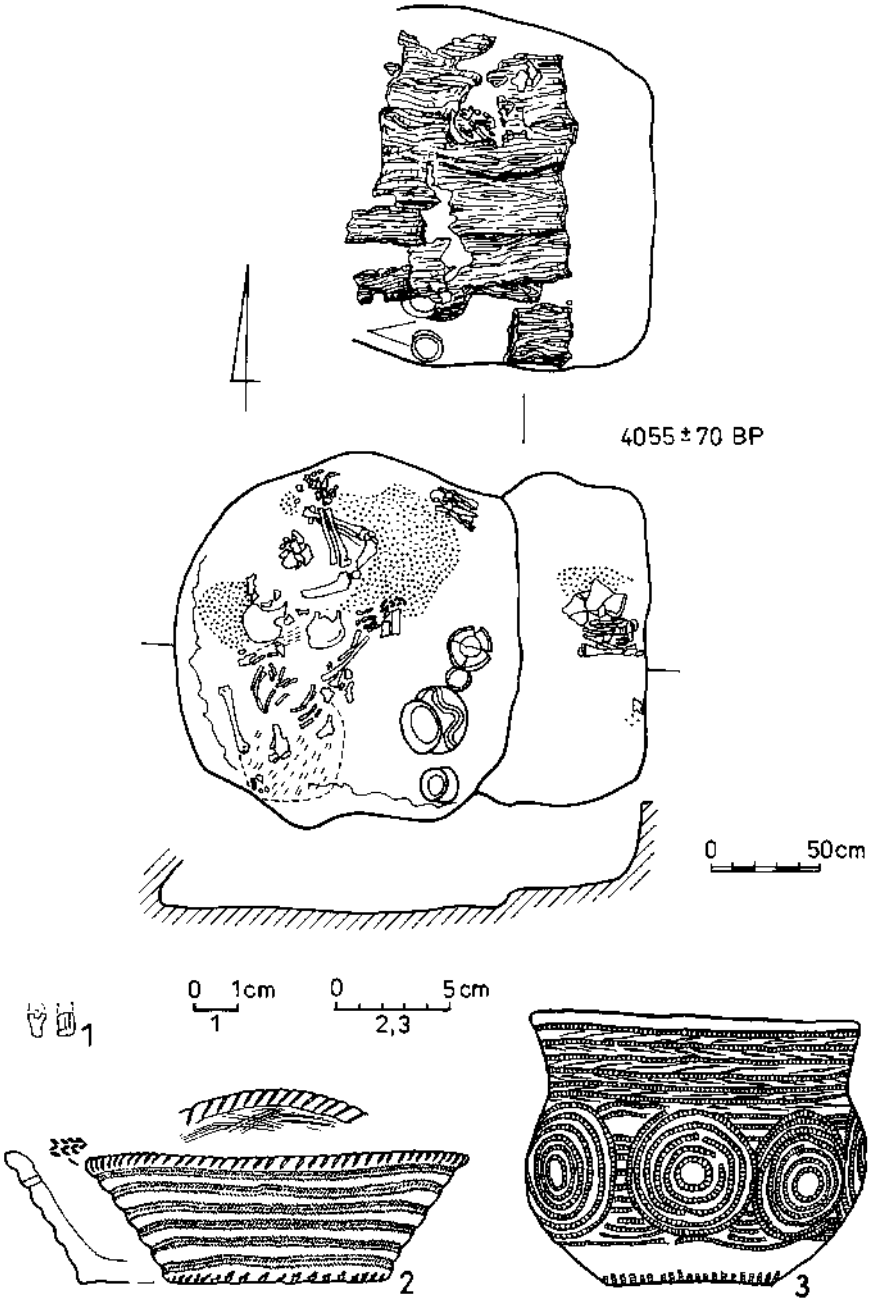

Fig. 5. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 12/4, bronze decoration (1) and pots (2,3)

1. A large vessel with the neck slightly narrowed to the rim, rounded sides, reddish surface. The vessel was ornamented with impressions of a ribbon, woven cord and a rounded cliché (Fig. 6:4).

2. A vessel with a high funnel-like neck and rounded sides. It was ornamented with impressions of woven cord that formed horizontal lines and concentric circles (Fig. 5:3).

3. A bowl with reddish surface and two holes at the edge, ornamented with impressions of woven cord (Fig. 5:2).

In front of the feet and stomach of the buried body there was ochre powder; in the corner opposite the feet there was a skull and extremities of a sheep or a goat. Next to the human skull there was a fragment of a bronze pendant made of a bent plate (Fig. 5:1).

Grave 12/5 was a catacomb with a rectangular entrance pit (Fig. 7), 195 cm x 100 cm in size, 4.8 m deep. At the bottom of the pit there were "scaffolds" that covered the entrance to the chamber, and a sheep or a goat skull. The chamber was 220 cm x 150 cm in size. On the floor, on brownish dust, there was a skeleton of an adult human. Next to the skull there was a vessel with some yellowish substance on the walls (Fig. 6:2). Next to it there was a pan made of a large fragment of a vessel, ornamented with impressions of a cord, spirals and a flat cliché (Fig. 6:1). In the pan there were pieces of coal and extremities of an animal. In front of the chest of the buried body there was a 16-cm bronze knife (Fig. 7:3) and a piece of ochre. Behind the back of the buried body, at the waist, there were fish teeth placed in an oval that had served as a necklace (Fig. 6:3).

Grave 12/9 was a catacomb with a rectangular entrance pit, 170 cm x 80 cm, 2 m deep (Fig. 8). The chamber was 170 cm x 100 cm; there was a skeleton of a young human on the floor. At the head of the buried body there had been a vessel ornamented with impressions of a cord (Fig. 8:1). Next to the stomach there had been a phalanx (Fig. 8:4) and ochre powder. On the left arm there was a necklace that consisted of four bronze beads (Fig. 8:2) and two bone beads (Fig. 8:3). Behind the back of the buried body there was a sheep skull placed on cut-off extremities and a flint blade (Fig. 8:5).

Grave 12/2 was a catacomb with an oval entrance pit, 150 cm x 110 cm in size (Fig. 9). At the bottom of the pit there was a bull skull put on the cut-off extremities, and two piles of extremities of a sheep (goat) nearby. The entrance to the burial chamber was covered with a massive wooden beam and smaller beams that had been split in two equal parts. The burial chamber was 200 cm x 150 cm. On the floor there were two skeletons — of an adult and a child. In front of the adult skull there was a large vessel ornamented with impressions of a cord (Fig. 10:5). In front of the face there was a piece of ochre (Fig. 10:2) and two sheep phalanx (Fig. 9:5). In front of the chest there was a mace made of polished marble (6.2 cm in diameter), with remainders of a wooden shaft with five bronze plates hammered into it (Fig.

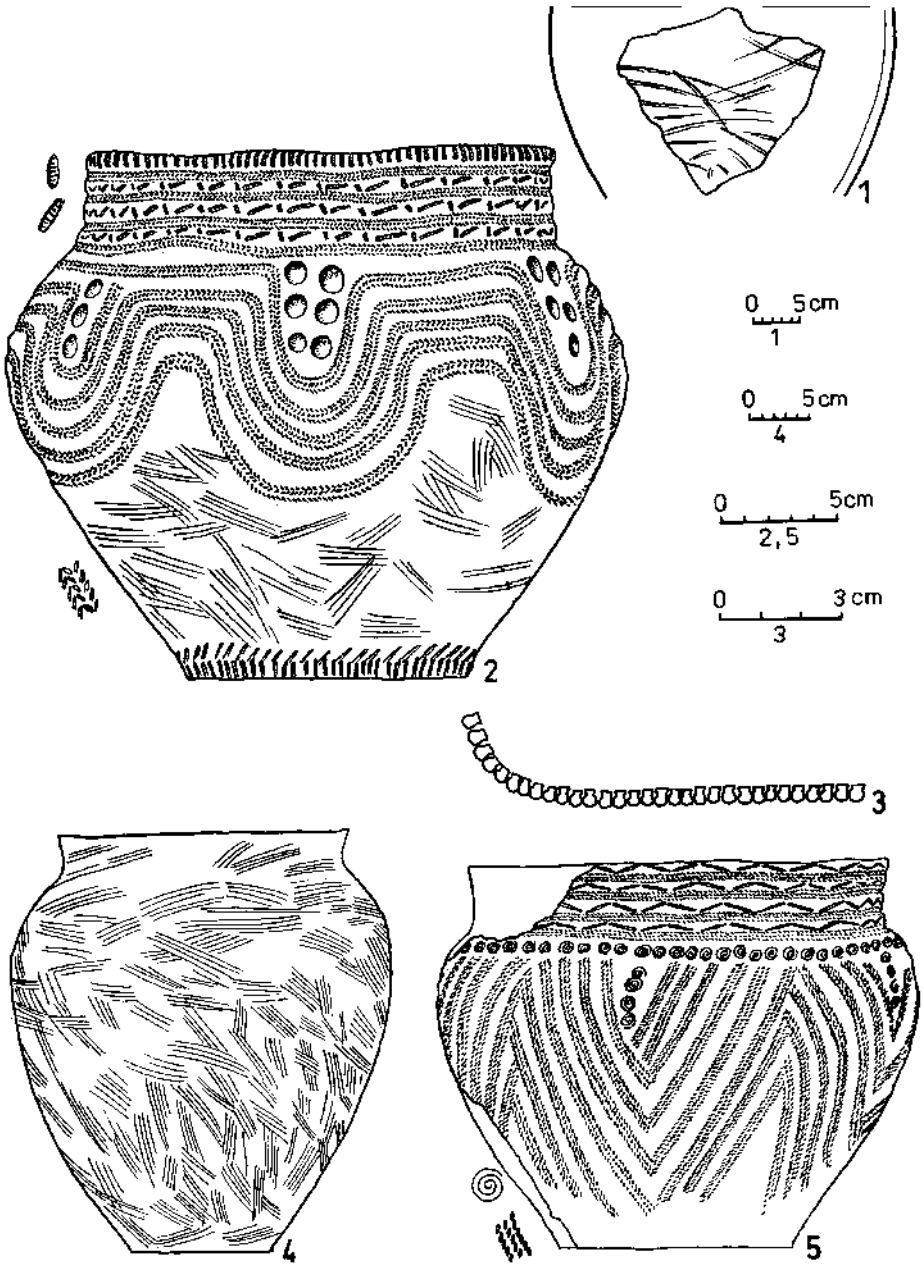

Fig. 6. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Pots from grave 12/5 (1, 2) and a necklace of fish teeth from the same grave (3). Pots from grave 12/4 (4, 5)

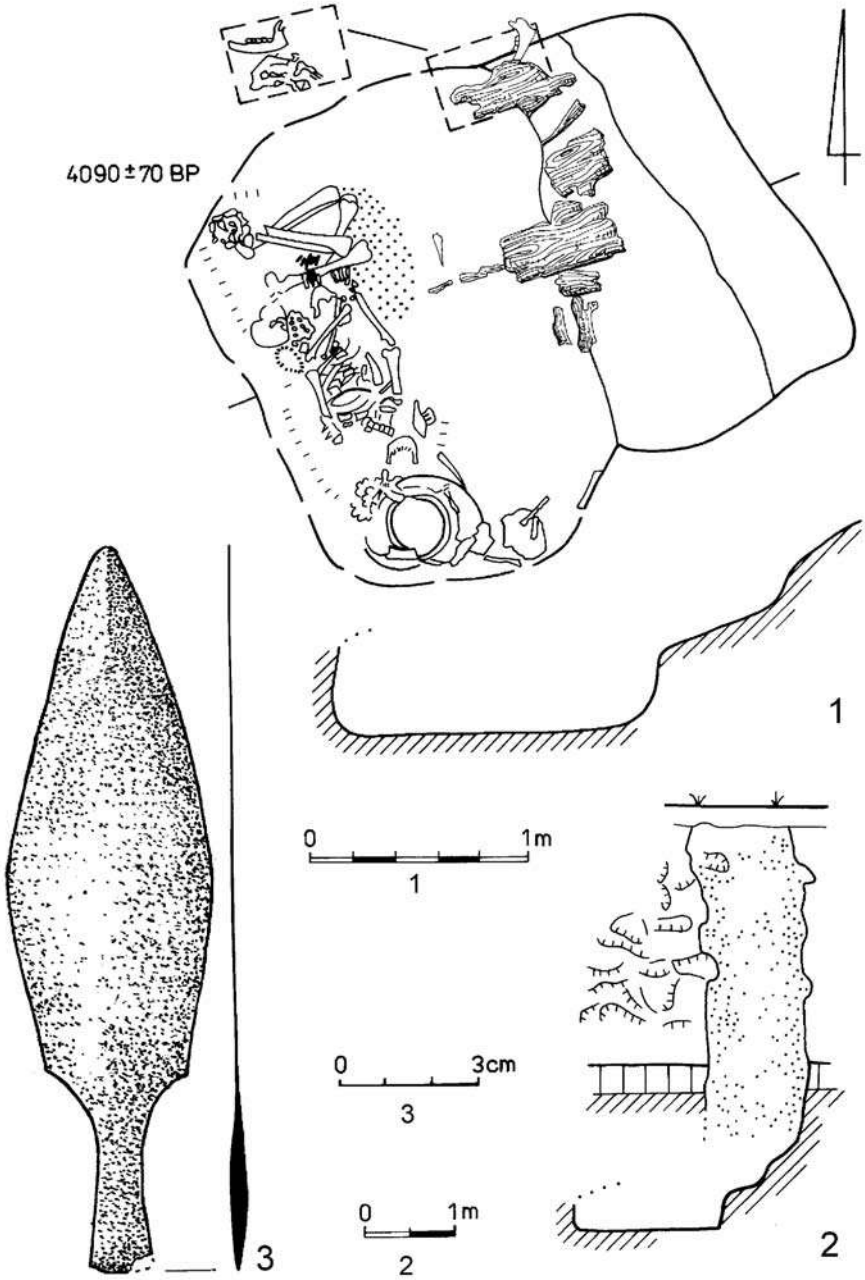

Fig. 7. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 12/5 (1), section (2) and a bronze knife (3)

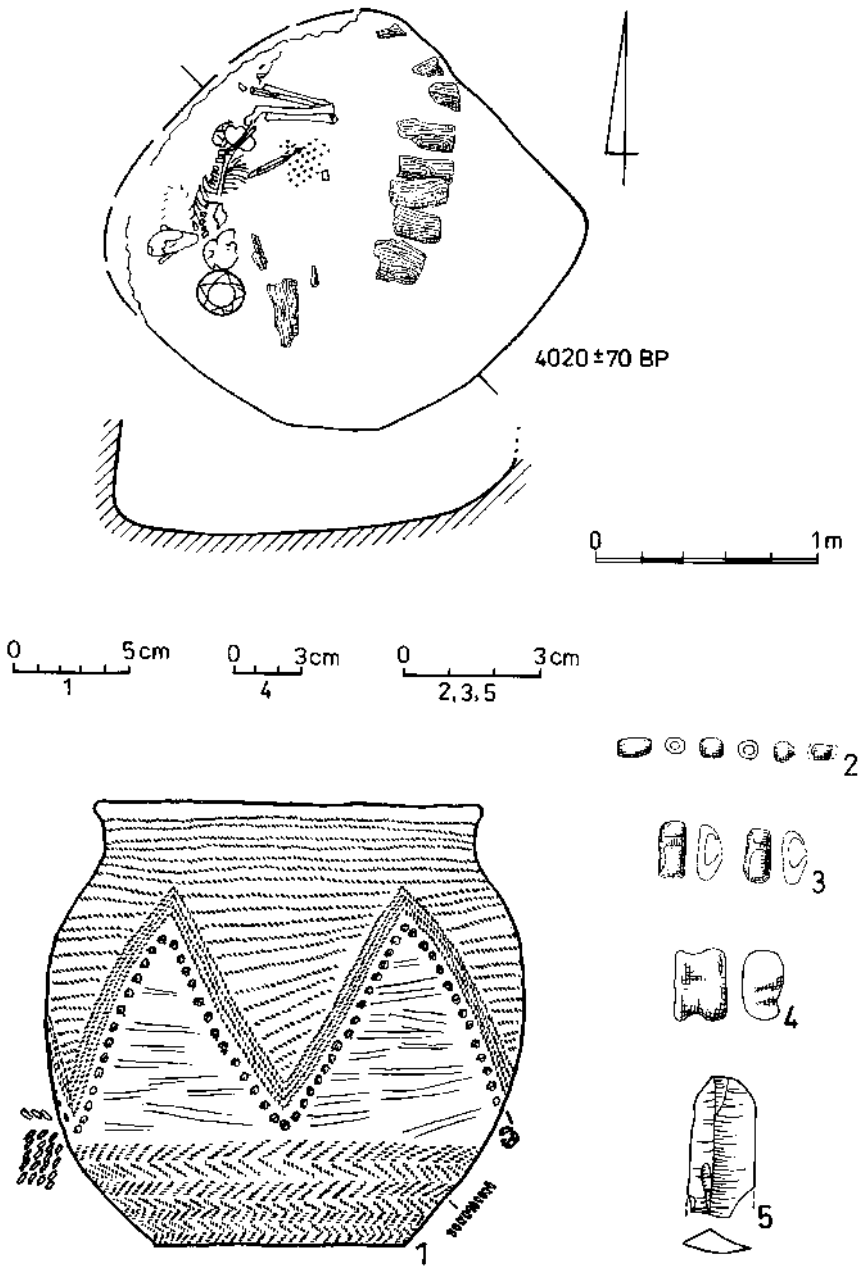

Fig. 8. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 12/9, pot (1), bronze beads (2), bone beads (3), astragal (4) and a flint plate (5)

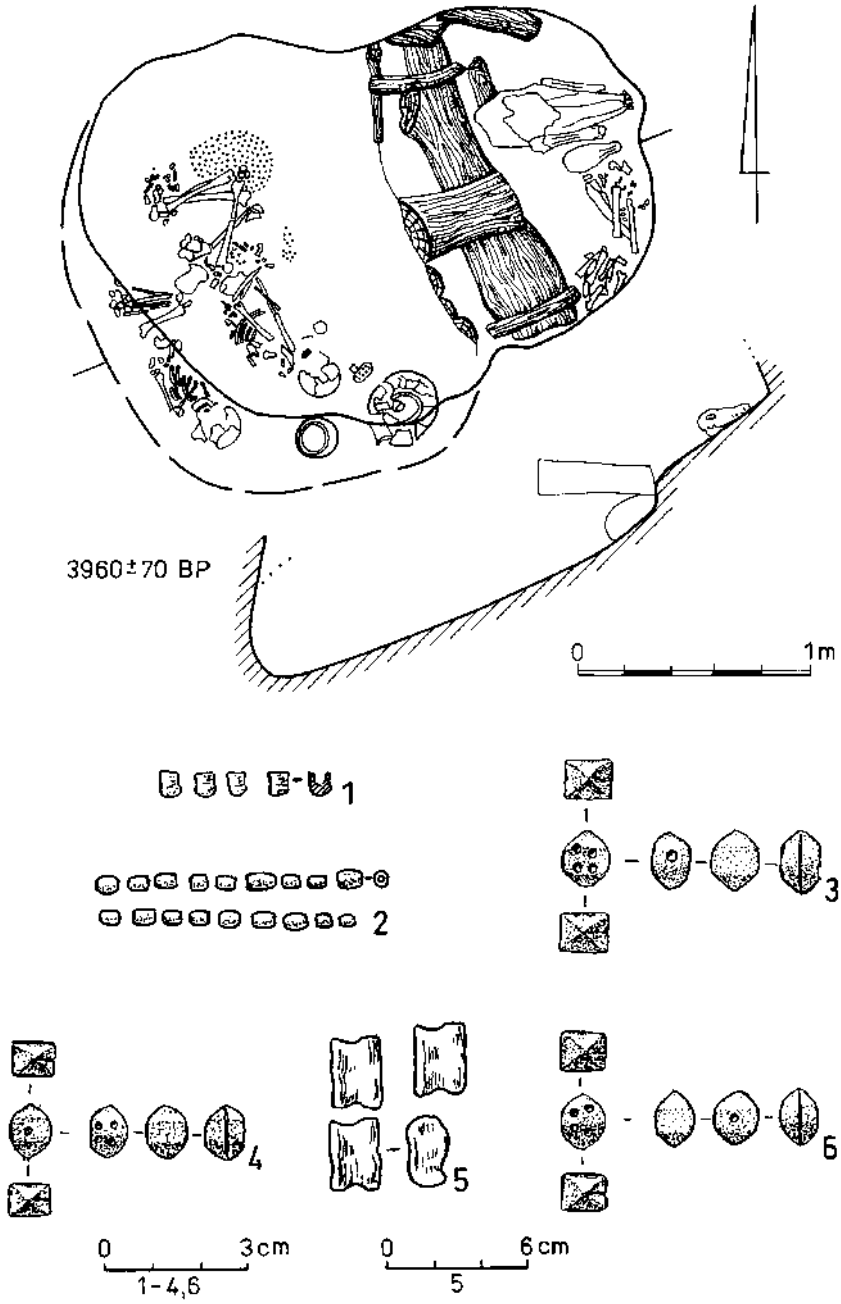

Fig. 9. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 12/2, fish teeth (1), bronze beads (2), dice (3-4, 6) and astragals (5)

10:1). At the hands of the skeleton there was a necklace made of fish teeth (Fig. 9:1) and 18 bronze beads (Fig. 9:2); next to them there were three bone objects for playing a game (Fig. 9:3-4, 6). Next to the child's skull there was a smaller pot, ornamented with impressions of a cord and a flat clinch (Fig. 10:4).

The late period of the Donets Catacomb culture was represented with graves 8/1, 18/1 and 18/4. The most diagnostic features of ceramics of that period are ornamentation of vessels with triangles of cord and semi-ovals or curves in combination with "rollers" and finger impressions.

Grave 8/1 was a catacomb with a rectangular entrance pit, 160 cm x 130 cm (Fig. 11). At the bottom of the pit there were fragments of animal skulls and extremities of four sheep, and wooden beams that had covered the entrance to the chamber. The chamber was 160 cm x 130 cm in size. On the floor, on brownish dust, there was a skeleton of an adult cut apart (dismembered) and a skeleton of a child. In front of the adult skeleton there was a tall vessel with a funnel-like neck, ornamented with impressions of a cord (Fig. 12:11) and a wooden bowl (25 cm in diameter) (Fig. 12:8), sprinkled with red ochre powder; among the chest bones there were two segment-shaped tools with double-sided retouch (Fig. 12:1, 2), and a polished mace made of grey-brown stone (Fig. 12:10).

In front of the child's skeleton there was a ceramic pot, ornamented with impressions of a cord (Fig. 12:9) and remainders of a wooden bowl (15 cm in diameter). Among the bones there were four bronze pendants (Fig. 12:3-7).

Grave 18/1 was a catacomb with a rectangular entrance pit, 160 cm x 130 cm in size. At the bottom of the pit there were bull and sheep skulls placed on the extremities (Fig. 13). The entrance to the pit was blocked with split wooden beams. The chamber was 200 cm x 120 cm in size. On the floor, on brownish dust, there was a skeleton of an adult human. In front of the skull there was a ceramic vessel, ornamented at the bottom with impressions of nails (Fig. 14:7), some ochre powder and remainders of a wooden bowl with a bronze plaque and cramps (20 cm in diameter) (Fig. 14:1, 1a-c). At the knees of the skeleton there was a smear of dust, 120 cm long, of yellowish dust, ochre powder and some brownish wooden rot. In the middle of the smear there were remainders of a wooden object, 50 cm long and 2 cm thick. Slightly below it there were four arrowheads (Fig. 14:2-5) and an animal tooth that had been used for retouching (Fig. 14:6). Probably, the objects were remainders of a leather case that had contained a bow and arrows.

Grave 18/4 was a catacomb with a rectangular entrance pit, 140 cm x 140 cm in size. The grave was dug into grave 18/7 (of the middle period) (Fig. 15). At the bottom of the pit there were wooden planks — 80-100 cm long, 10 cm wide. The chamber was 270 cm x 210 cm in size. On the floor, on think black dust, there were skeletons of two adults. In front of the "face" of the western skeleton there was a ceramic vessel, ornamented with three "rollers" with nail imprints (Fig. 16:3). Under the skull there was some reddish dust and ochre powder.

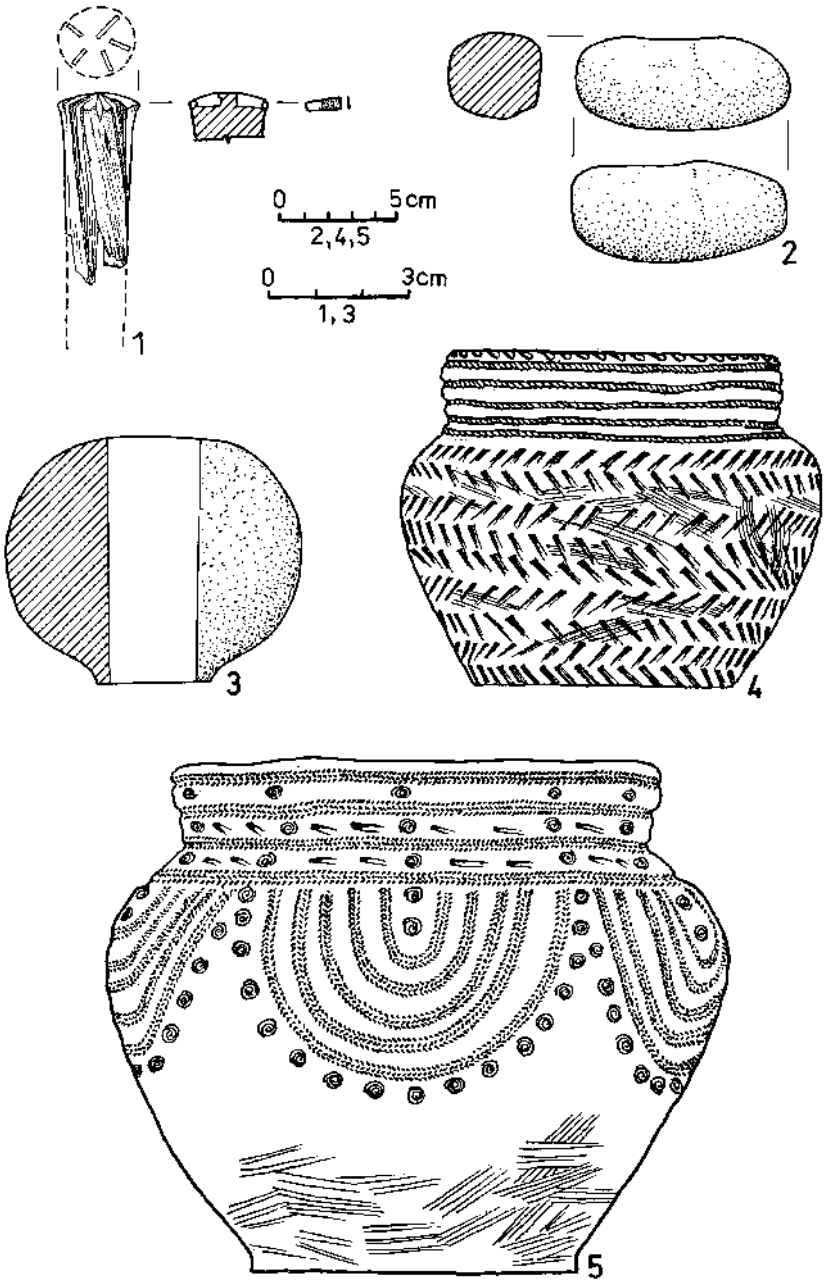

Fig. 10. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Objects from grave 12/2: mace shaft (1), lump of ochre (2), mace (3), pots (4, 5)

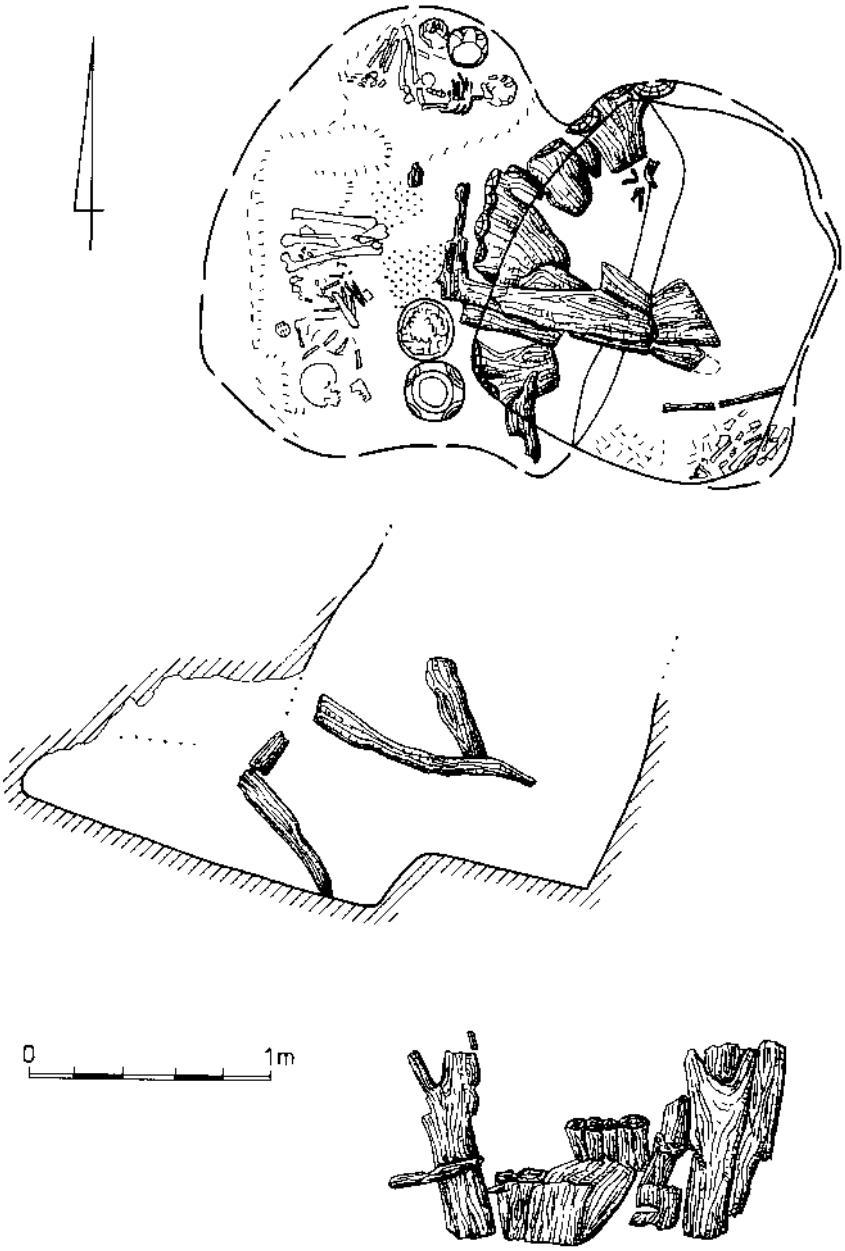

Fig. 11. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 8/1 and wooden cover of the entrance to the catacomb

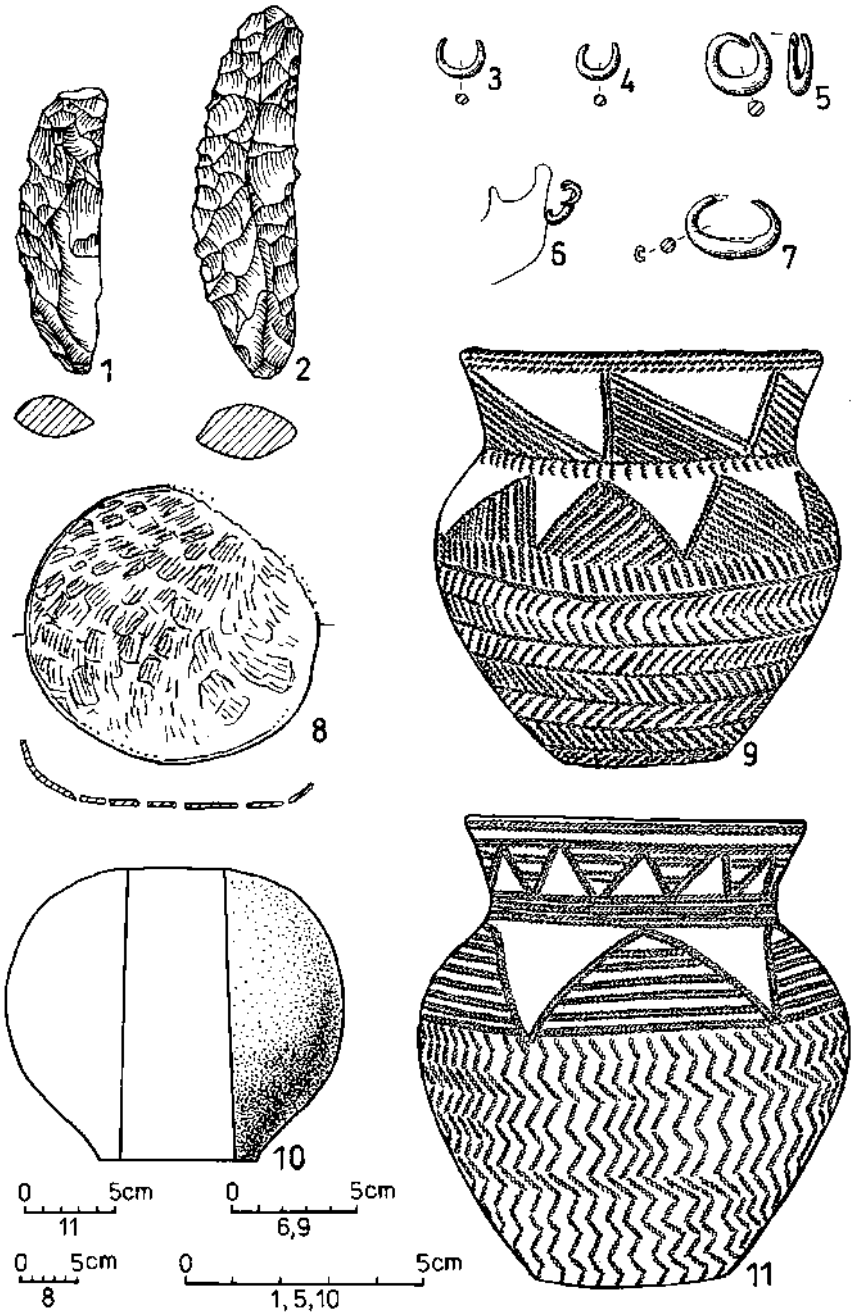

Fig. 12. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Objects from grave 8/1: flint tools (1,2), bronze pendants (3-7), wooden bowl (8), pots (9, 11) and mace (10)

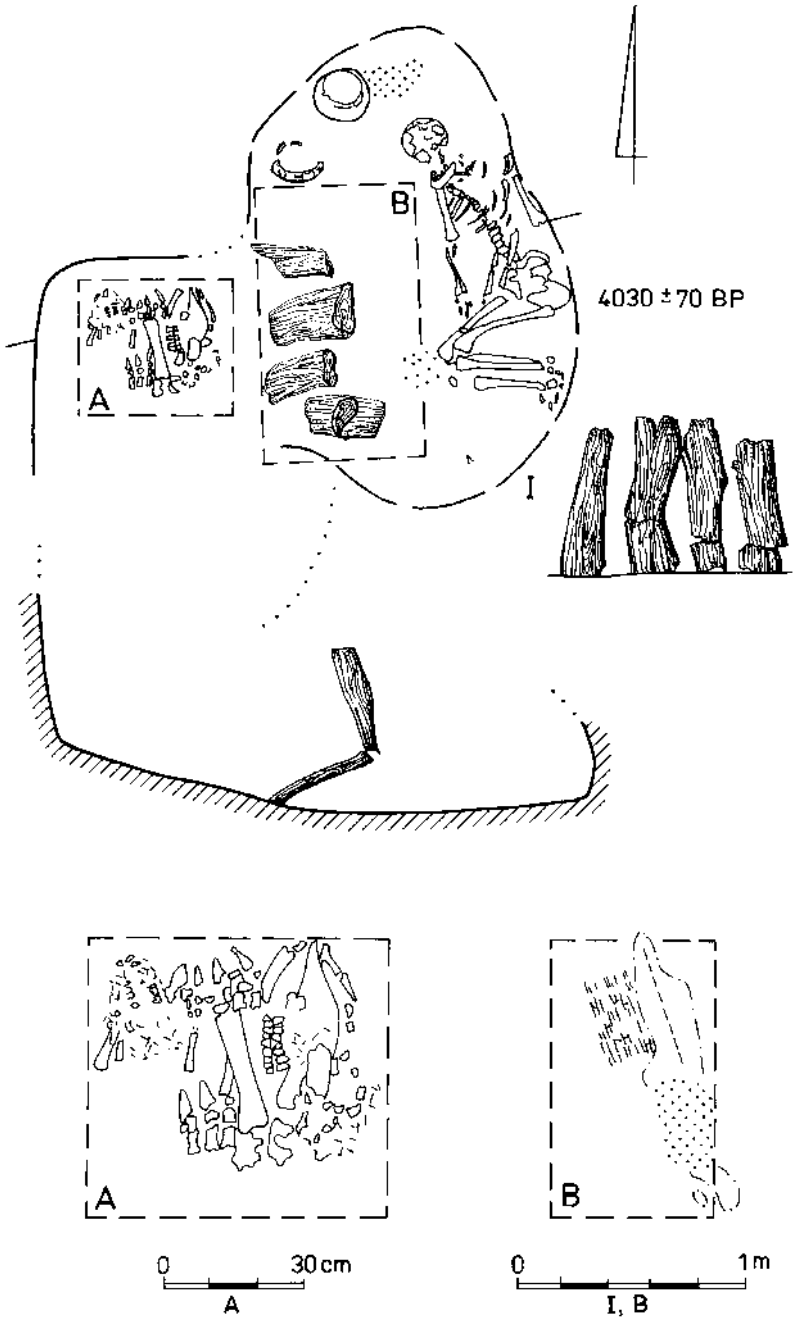

Fig. 13. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 18/1

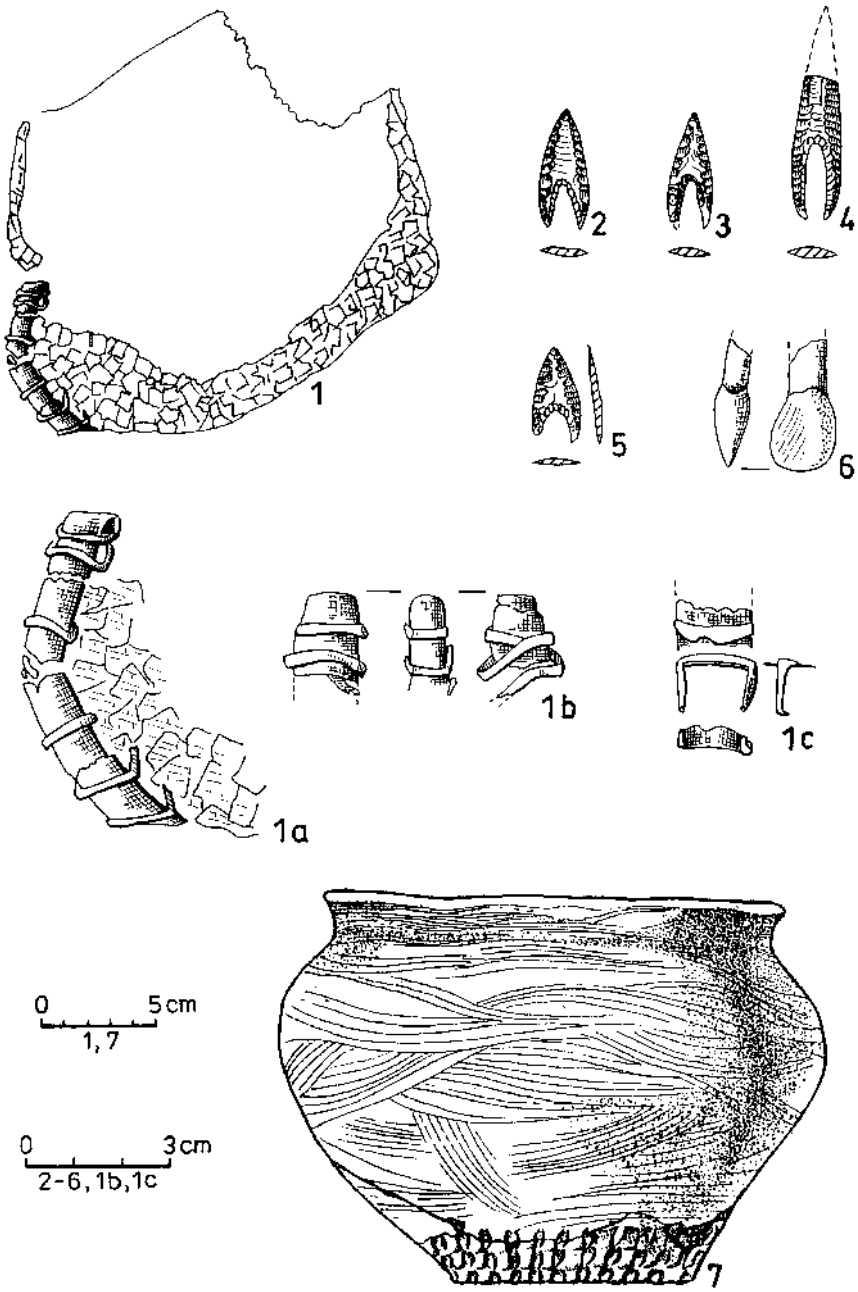

Fig. 14. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Objects from grave 18/1: wooden bowl with a bronze cramp (1, 1a-c), flint arrowheads (2-5), animal tooth (6), pot (7)

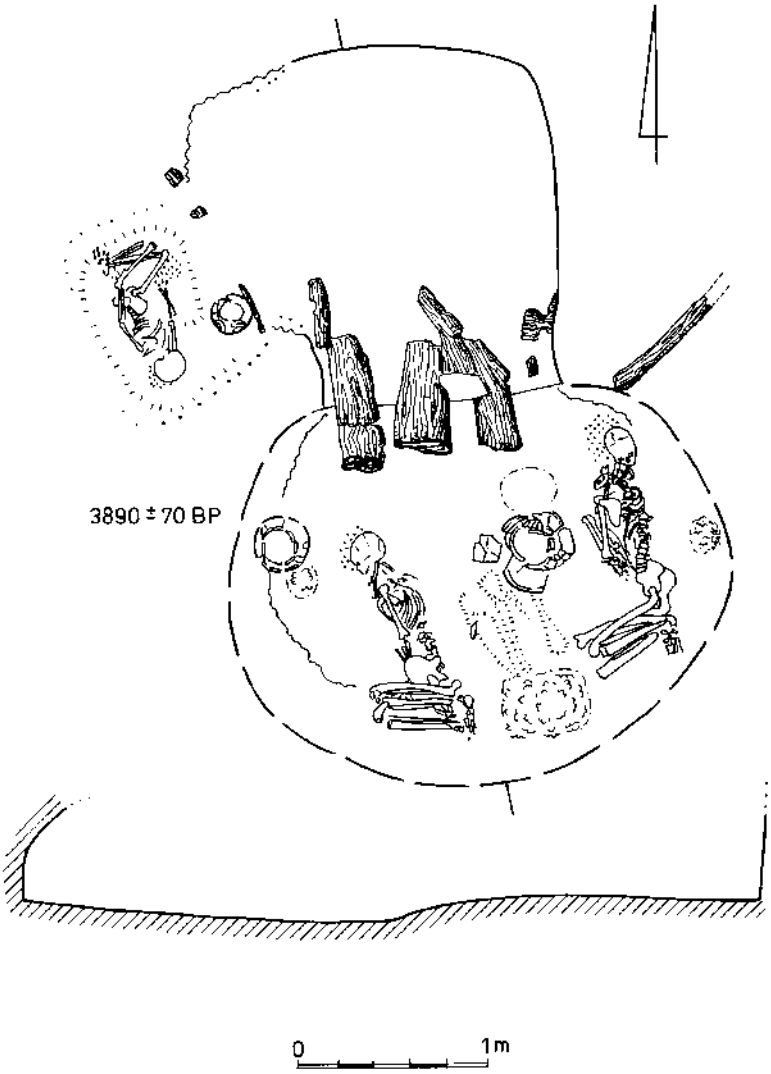

Fig. 15. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Grave 18/4

In front of the eastern skeleton there was a broken ceramic vessel, ornamented with impressions of a cord and a flat clinch (Fig. 16:4); next to it there was a line of some reddish dust on which there was a 7.3 cm bronze knife (Fig. 16:2). In the backbone of the skeleton there was a flint arrowhead (Fig. 16:1) that had probably wounded the man. Behind the back there was some ash and a piece of burnt wood.

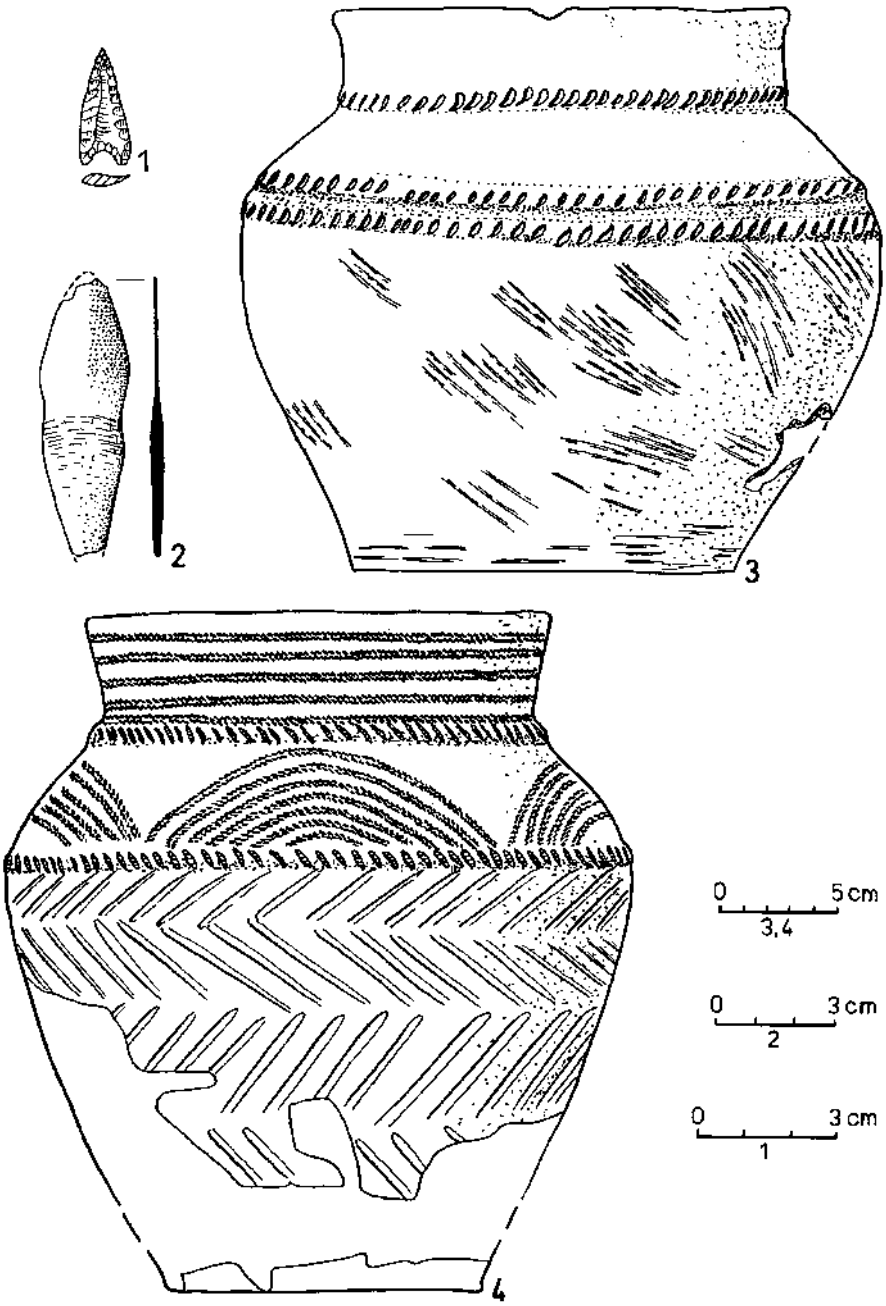

Fig. 16. The Svatove burial site, Svatove District, Luhansk Region. Catacomb culture. Objects from grave 18/4: flint arrowhead (1), bronze knife (2), pots (3-4)

Unfortunately, of the complexes described above the ^{14}C dates were received only from graves 12/2, 12/4, 12/5, 12/9. They are followed with the dates for complexes 13/2, 19/1, 20/1, 20/3 (Table 3).

Somewhat later dates were received for graves of a later period, though one of the cases (grave 18/1) is shown as synchronous with complexes of the previous period (Table 3).

Table 3

Svatove, Svatove District, Luhansk Region. Radiocarbon chronology of the graves

Culture / BC	Yamnaya		Middle Catacomb								Late Catacomb		
Grave	1/1	2/1	19/1	13/2	16/1	20/1	12/5	12/4	20/3	12/9	12/2	18/1	18/3	18/4
2850														
2800														
2750														
2700														
2650														
2600														
2550														
2500														
2450														
2400														
2350														
2300														
2250														

2. CHRONOLOGY OF THE DONETS CATACOMB CULTURE — CONCLUSIONS

Hence, the chronological range of graves of the Donets Catacomb culture, based on the materials of the Svatove group, is much narrower than the range suggested before [Telegin 1993:68-73; Kaiser 1999:141, Fig. 13]. However, too few

^{14}C dates are as yet available for the most numerous complexes of the late period that presumably had lasted almost till the end of 3000 BC.

On the other hand, some of the quoted dates for Catacomb and Yamnaya complexes of the region and the right bank of the Lower Dnieper [Nikolova 1999] coincide, and on that basis it is suggested that the cultures could be partly synchronous, though stratigraphically the Catacomb graves are always located above others. It is noteworthy that such synchrony is possible, but not on the same territory. The point is that the Catacomb monuments of the early period are located mostly in southern parts of the region from the lower Dnieper up to the Kuban, including the Lower Don (about 30 percent of all catacombs) [Bratchenko 2001:61, Fig. 120]. To the north and the west of those regions they occur increasingly rarely and gradually disappear. For instance, on the left bank of the Donets, between the tributaries of the rivers Oskol, Krasna and Derkul, they constitute only eight out of 248 (3.2%), and are not represented in the Svatove group. On the adjacent right bank such graves comprise only 4.5±3% (northern regions) and 13±3% (southern, Luhansk group). Hence, on those northern and western territories (the right bank of the Dnieper, the Pontic Region) graves in pits with usual Yamnaya objects were probably made in the early Catacomb period as well. These two culture complexes, different in terms of rites, were very similar in terms of the objects used, and identifying graves in pits that would unquestionably belong to the early Catacomb period would be problematic, due to a limited presence of objects in the Yamnaya graves.

Instead, graves in pits but with "shelves" on the mainland (that make them distinct from pits of the Yamnaya culture), with typically Catacomb inventory of the middle and late periods, occur in the basin of the Donets river and the western territories. At the Middle Don they are even more numerous than catacombs and occur in large numbers at the eastern Manych river.

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 209-211
PL ISSN 1231-0344

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RADIOCARBON DATING OF EARLY AND MIDDLE BRONZE AGE RELICS OF THE SIVERSKY DONETS (LUHANSK REGION). A PRELIMINARY REPORT

The Kiev Radiocarbon Laboratory prepared 14 new radiocarbon dates for samples taken from settlements and graves of the Early and Middle Bronze Age excavated within the recent years in the Luhansk region by an expedition of the Eastern Ukrainian State University, led by S.N. Sanzharov (Table 1; Fig.1).

Table 1

Siversky Donets river basin, Luhansk Region. Datings of bone samples from settlements and graves of the Early and Middle Bronze Age

No.	Identification of sample	Type of site	Culture	Lab. No.	Date BP	Date BC**
1.	Serebryanskoe,1997, sq. E-11	settlement	Pokrovsk Srubnaya	Ki-9511	5590±80(?)*	4412±74
2.	Slavyanogorsk,1981	settlement	Catacomb	Ki-9513	4890±80(?)*	3700±88
3.	Aleshin Ruchey-2, 1994, sq. K-3	settlement	Pokrovsk Srubnaya	Ki-9509	4080±80(?)*	2598±132
4.	Raygorodok, 2001, barrow 1/10	grave	Yamnaya	Ki-9518	3980±70	2457±107
5.	Chernikovo Ozero-1, 1996, pit 5	settlement	Pokrovsk Srubnaya	Ki-9514	3950±70(?)*	2433±108
6.	Krugloe, 2000, sq. E-13	settlement	Yamnaya	Ki-9516	3910±70	2371±98
7.	Raygorodok, 2001, barrow 1/9	grave	Yamnaya	Ki-9517	3890±70	2354±100
8.	Yarovaya-2, 1998, sq. B-12	settlement	Catacomb	Ki-9515	3840±70	2300±112
9.	Serebryanskoe,1997, sq. Zh-13	settlement	Pokrovsk Srubnaya	Ki-9512	3770±80(?)*	2158±127
10.	Nevskoe, 1998, barrow 5/6	grave	Catacomb	Ki-9522	3680±70	2037±101
11.	Nevskoe, 1998, barrow 2/10	grave	Catacomb	Ki-9521	3640±70	1995±105
12.	Nevskoe, 1998, barrow 2/5	grave	Catacomb	Ki-9520	3610±70	1927±107
13.	Shmelevoe, 1997	settlement	Pokrovsk Srubnaya	Ki-9519	3205±70	1455±73
14.	Krugloe, 2000, sq. M-11	settlement	Pokrovsk Srubnaya	Ki-9510	1880±70(?)*	-154±82

*(?) — datings too old or too young, perhaps connected with earlier activity on the settlement.
** Weninger 1993.

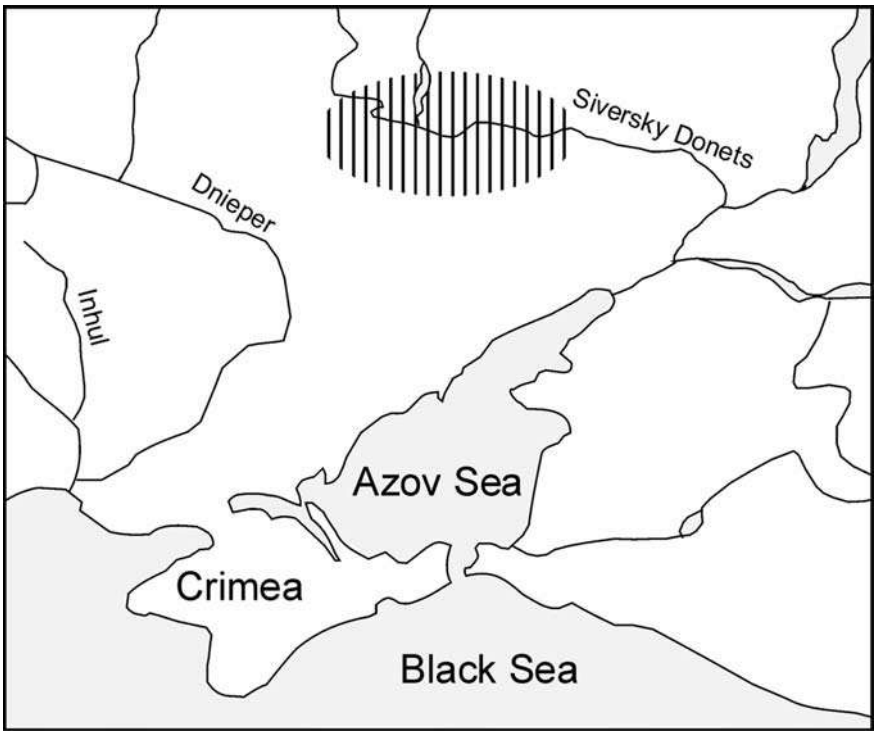

Fig. 1 Siversky Donets river basin, Luhansk Region. Location of radiocarbon dated sites

Of the received radiocarbon dates, not all matched established archaeological dates of the respective studied monuments. The most significant differences could be observed for samples of bones collected at the settlements. Let us try to find reasons of such differences and analyze all of the studied monuments.

The nature and climate of the territory occupied by the Luhansk region include steppe and terrace (mountain) forest-steppe zones. Settlements of the Bronze Age are located in the beds of the Siversky Donets river and its tributaries. The cultural layers of those settlements are — most frequently — thin, poorly filled with finds, without clear stratification. Most of those were not long-term settlements but short-term places of stay. Cultural layers of those monuments contain ceramics and other artefacts (including bones) of different epochs. Therefore, cultural-chronological definition of such monuments represents a rather difficult task.

Hence, the Serebryanskoe settlement (excavations of 1997), due to the general mass of ceramic materials referred to the Pokrovsk Srubnaya culture (end of the Middle — beginning of the Early Bronze Age); a sample of square (kv.) E-11

produced an Eneolithic date — 5590±80 BP (Ki-9511), and a sample from kv. Zh-13 gave the date that belonged to the Yamnaya and the Catacomb cultures — 3770±80 BP (Ki-9512). A sample from another Srubnaya settlement — Aleshin Ruchey (excavations of 1994), site 2, kv. 3-k (taken from a hut — !) also produced a date of the Eneolithic period — 4080±80 BP (Ki-9509). A sample from the Srubnaya settlement Chernikovo Ozero-1, (excavations of 1996), pit 5 (from a garbage pit — !) — was dated back to the Yamnaya and the Catacomb cultures — 3950±70 BP (Ki-9514). A sample from a settlement of the Srubnaya culture Krugloe (excavations of 2000), kv. M-11 — gave a date of the Roman period — 1880±70 BP (Ki-9510).

A sample from the settlement of Slavyanogorsk (excavations of 1981), referred to the Catacomb culture (Early Bronze Age), produced a date of the Eneolithic period — 4890±80 BP (Ki-9513).

Meanwhile, samples taken from graves of the Yamnaya culture (Raygorodka--2001, bar.1/10 — 3980±70 BP — Ki-9518; Raygorodka-2001, bar.1/9 — 3890±70 BP — Ki-9517) and graves of the late period of the Donets' Catacomb culture (Nevskoe-1998, bar. 5/6 — 3680±70 BP — Ki-9522; Nevskoe-1998, bar. 2/10 — 3640±70 BP — Ki-9521; Nevskoe-1998, bar. 2/5 — 3610±70 BP — Ki-9520) quite correspond with the relevant radiocarbon dates (performed in accordance with modern technology), obtained at other monuments with identical archaeological cultural-chronological definitions.

Dates obtained from samples taken from settlements of the Yamnaya culture — Krugloe-2000, kv. E-13 (3910±70 BP — Ki-9516), the Donets Catacomb culture — Yarovaya-2, 1998, kv.B-12 (3840±70 BP — Ki-9515) and the Pokrovsk Srubnaya culture — Shmelevoe-1997 (3205±70 BP — Ki-9519) are also quite acceptable.

An absolutely obvious conclusion is that archaeologists should be more careful when selecting samples for radiocarbon date-setting, particularly when dealing with monuments of complex or indefinite stratigraphy. Such samples should be taken, if possible, from clearly identified cultural and stratigraphic contexts. Similarly, it is possible to make a conclusion about accuracy of paleozoological definitions for such monuments — for instance, reconstruction of composition of a flock — for animal bones contain nothing on them to suggest what archaeological culture they belong to.

The most interesting of the obtained series of dates are the dates of graves of the late stage of the Donets Catacomb culture from burial mounds near the village of Nevskoe that allow to refer that stage to 2100-1800 BC. It is also necessary to take into account the date obtained from the Shmelevoe settlement of the Pokrovsk Srubnaya culture that fits within 1500-1400 BC, which is fully compatible with traditional archaeological dates of monuments of the late stage of that culture [Otroshchenko 2001].

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 212-240
PL ISSN 1231-0344

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AN INTERRUPTED PROCESS OF CULTURAL INTEGRATION BETWEEN THE UPPER BUG, VISTULA AND DNIESTER RIVERS IN THE EARLY SECOND HALF OF THE THIRD MILLENNIUM BC (IN LIGHT OF TAXONOMIC AND CHRONOLOGICAL ANALYSES OF GRAVE ASSEMBLAGES ON GRZĘDA SOKALSKA)

1. INTRODUCTION

In the last dozen or so year a tremendous progress has been made in the study of the Corded Ware culture (CWC) in south-eastern Poland (in particular in the Carpathian foothills), together with the adjacent areas of the Carpathians in Ukraine and Slovakia and in the southern portion of the Lublin Upland, i.e., on Grzęda Sokalska [Koman, Machnik 1997; Machnik 1998; 1999; 2001; Machnik *et al.* 2001; Machnik, Mačala 2001; Włodarczak 2001].

The progress involved not only discovering and excavating many new *kurgans* and flat graves (on loess uplands around Kraków) belonging to the populations of the said culture as well as the first traces of settlements or encampments and axe workshops [Valde-Nowak 2001; Valde-Nowak, Strakošova 2001; Machnik, Sosnowska, Cyhyłyk 1997], but also exploring (owing to paleobotanical and geomorphological investigations) the natural environment in the period when the culture thrived in the area described above and immediately earlier [Harčar 2001; Harmata 1995; Komornicki *et al.* 1990; Maruszczak 1988; Starkel 1997; 2001; Szczepanek 2001; Wacnik 1999; 2001].

The discoveries supplied, besides new data on cultural taxonomy and chronology, much information allowing us to broaden our knowledge of many aspects of the CWC as well. The new information concerned not only the spiritual life (relating to the funerary rites) of its populations, but also the social structure, forms of economy and various kinds of contacts, some of them stretching over long distances, among individual groups of the culture in question [Machnik 1998; 1999].

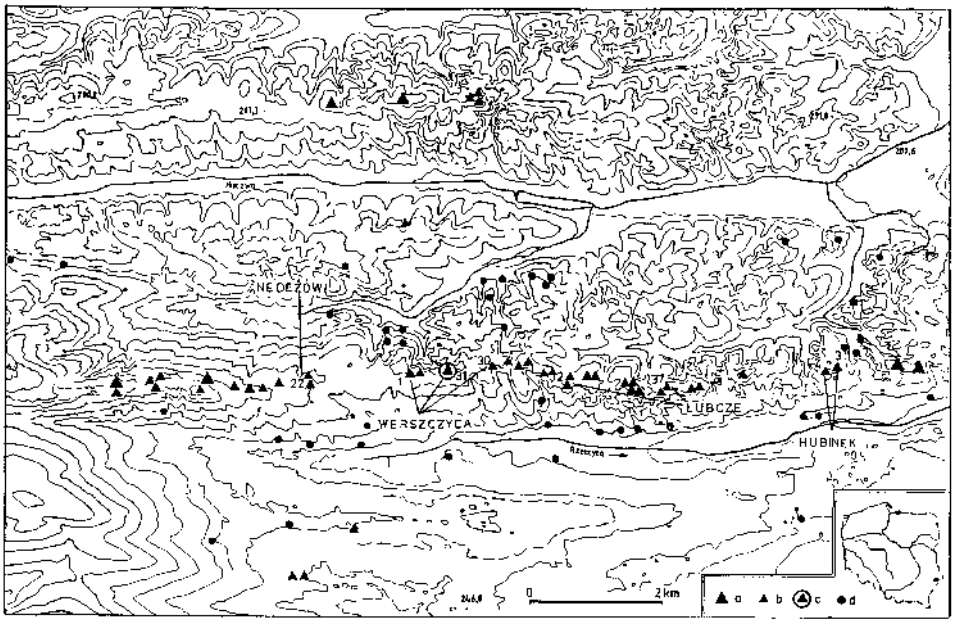

Fig. 1. Location of *kurgans* in the southern part of Grzęda Sokalska; a - large *kurgans* of unknown chronology, b - CWC *kurgans* (radiocarbon dated *kurgans* are indicated by a line and the number of site), c - *kurgan* on site 31 in Werszczyca investigated in 2000, d - Neolithic settlement sites (chiefly of the FBC)

The greatest number of sources especially concerning the last of the above--mentioned aspects has been yielded by rescue excavations [Bagińska 1988] of disappearing CWC *kurgans* on Grzęda Sokalska systematically carried out since 1988 [Koman, Machnik 1993]. It was there, in some graves, that artifacts were found, in particular clay vessels, exhibiting traits characteristic of distant Czech and German CWC groups [Bagińska 1996:62, Fig. 4a; 1997:49, Fig. 4f; 1998:73, Fig. 4]. What was even more surprising for certain reasons was the fact that there were also artifacts among them that showed affinities with the territorially isolated Middle Dnieper culture (MDC) [Koman, Machnik 1993:44, Fig. 3:3,4; Bagińska 1998:72, Fig. 3a, b].

Successive discoveries revealed that in the latter case we dealt not only with traits that could be a sign of local imitation of distant Middle Dnieper patterns, but also with authentic MDC vessels as far their shapes and ornamentation patterns were concerned [Koman 1998:65, Fig. 4:1-2, 8, 10]. Thereby, an interpretation of some MDC artifacts, being a typical set of grave goods, was corroborated as the remains of a burial of an MDC representative who had migrated to the CWC territory [Machnik, Pilch 1997]. The artifacts had been found by accident when

excavating sand in Młodów near Lubaczów, not far from Grzęda Sokalska (about 50 km to S). That it was not merely an isolated case, however, is testified to by excavations recently carried out on Grzęda Sokalska. They prove that a group of MDC people did, in fact, appear there.

Given the situation, the imitation of some MDC stylistic traits in pottery by CWC populations becomes more understandable not only on Grzęda Sokalska but also on a broader territory between the upper Bug, Vistula and upper Dniester rivers (which has already been pointed out) or even as it seems on the Małopolska Upland [Machnik 1999:240; Fig. 8].

The obtained radiocarbon dates for a number of human burials on Grzęda Sokalska (Fig. 1), containing either authentic MDC vessels or vessels only imitating them as far as their form and ornamentation are concerned, are, on the one hand, younger than the dated graves from the older phase of the CWC located underneath *kurgan* mounds [Machnik 1999:241-248], on the other hand, they coincide, in general terms, with the period when the Globular Amphora culture (GAC) disappeared (waned) from the neighboring areas of Volhynia and Podolia [Kadrow, Szmyt 1996]. Hence, a conclusion could be drawn that only when the GAC declined or disappeared altogether from the discussed area, it was possible for MDC populations to penetrate the sphere of compact CWC range.

What has been presented here, being to a large extent a recapitulation of a broader work concerning the presence of MDC representatives on Grzęda Sokalska [Machnik 1999], does not explain what attitude could have been taken by the new arrivals from the Dnieper drainage towards local populations; neither does it tell us what the newcomers later fate was, nor what the process of cultural changes, resulting from a contact between the two populations different to some extent, looked like. However, the results of the latest investigations in this area, presented below, seem to shed some light, too, on these important issues having a direct bearing on the prehistory of the period.

2. THE RESULTS OF THE LATEST INVESTIGATIONS ON GRZĘDA SOKALSKA

What we have in mind here is the results of investigations of yet another *kurgan* in the discussed area carried out in 2000, this time at site 31 in Werszczyca [Bagińska, Machnik 2003]. Its mound, almost completely flattened due to ploughing (its original diameter at the base was about 11m), covered two CWC graves, of which one was encircled by a symbolic groove (Fig. 2). On the rim of the *kurgan* mound, on the SE side, there were five more burials, of which three (graves

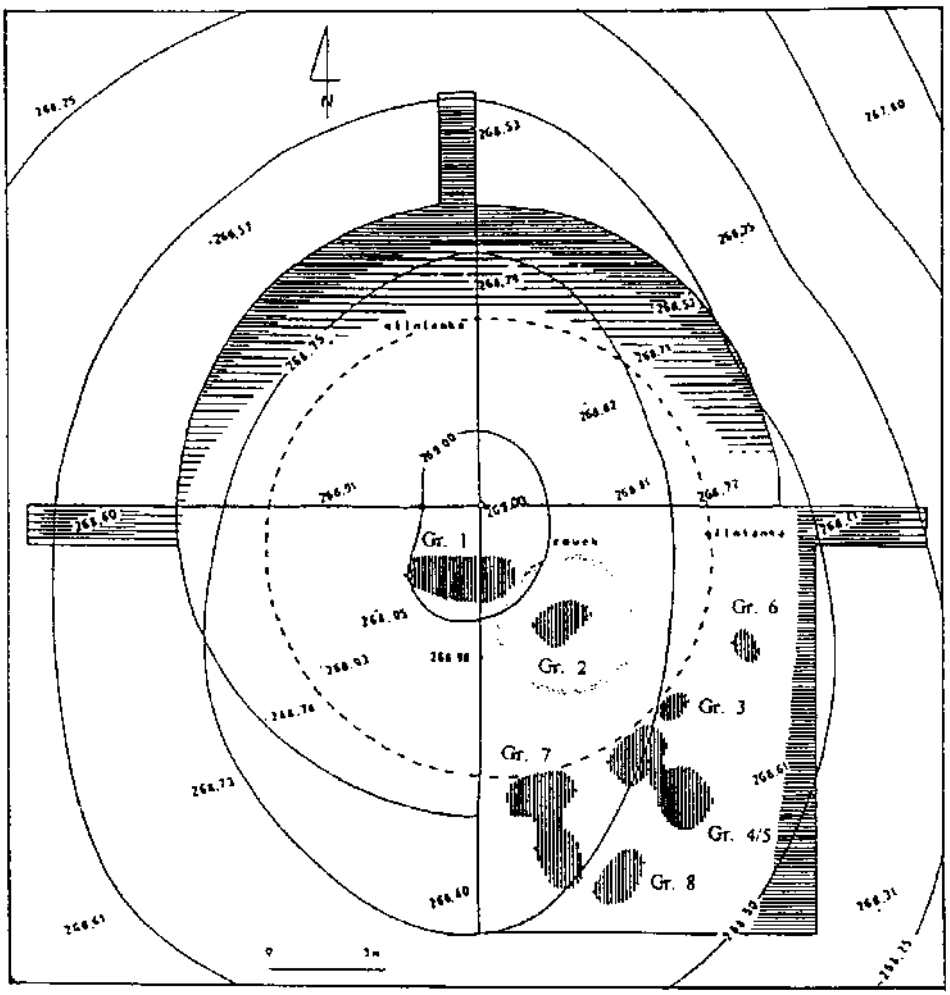

Fig. 2. Werszczyca, site 31, location of graves under the *kurgan* mound and on its rim (foll. J. Bagińska, J. Machnik 2003)

nos. 3, 4/5, 7) could have been placed right on the very original edge of its base (Fig. 2).

Two of these burials (nos. 4/5 and 7) were typical niche graves [Bagińska, Machnik 2003:42, Fig. 4]. The position of their chambers was, apparently, adjusted to the course of the edge of the *kurgan* base; hence, they were dug when the *kurgan* mound was already in place (Fig. 2).

In the first of the niche graves, no. 4/5, next to the skeleton of a young male (aged 18-20 years), lying on his right side in a contracted posture with his head pointing S [Bagińska, Machnik 2003:41, Fig. 3a], there were grave goods consisting

of two bone chisels, a bone awl, a flint axe, a retouched tool of the same material, a whetstone and two clay vessels [Bagińska, Machnik 2003:46, Fig. 6].

The vessels deserve particular attention. The first of them [Bagińska, Machnik 2003:4, Fig. 6h] is an amphora with six elbow-like handles at the base of a narrow neck and a small bottom formed like a foot. The amphora is decorated on its neck with horizontal cord impressions below which there are festoons made of short vertical bands of such impressions. The vessel is an example of an intermediate variety between types IIb and IVa (according to Machnik's classification) known from late grave assemblages of the CWC Kraków-Sandomierz group on the Sandomierz Upland, e.g. in Mydłów, Sandomierz district [Bargieł 1990:Fig. 1], occurring also (undoubtedly under the influence of this group) between the Dniester and San rivers, e.g. in Berezec near Komarno [Cyhyłyk, Machnik 1996:155, Fig. 4:2]; finally, we know it also from an earlier discovery made on Grzęda Sokalska itself [Bagińska 1998:72, Fig. 3c].

The other vessel from the mentioned grave is a small beaker [Bagińska, Machnik 2003:46, Fig. 6a] clearly indicating connection to a type of MDC hourglass beakers. A very close analogy to it, as far as shape is concerned, is offered by an undecorated specimen from an MDC grave at Prorva, Belarus [Kryvaltsevich, Kovalyukh 1999:160, Fig. 6:1].

Several beakers similar in form are known from outside of the MDC range, in the area between the Bug, San and Vistula rivers, namely from Dratów, Puławy district, Mokrelipie, Zamość district, Zamość, Brusno and Brzezinki, Lubaczów district [Machnik 1966:Tab.XVIII:2, 5, XIX:1a, 2b; Machnik *et al.* 2001:395, Fig. 4]. To these specimens, being undoubtedly imitations in different degrees of the above-named type of MDC beakers, we shall return in the latter part of this paper.

In the second niche grave (no. 7) in Werszczyca (Fig. 2), containing a decapitated skeleton of a dog lying along the S-N axis [Bagińska, Machnik 2003:41, Fig. 3b], the only artifact found was a large clay beaker spread over the grave chamber by rodents [Bagińska, Machnik 2003:43, Fig. 5g]. The beaker represents one of the variants of type IV beakers (according to Machnik's classification) in the CWC in Małopolska. It finds certain analogies in younger CWC grave assemblages in both the area occupied by the Kraków-Sandomierz group of the CWC [Machnik 1966:Tab. XIV:5a; Kempisty, Włodarczak 2000:77, Fig. 50] and outside of it, e.g. in Roztocze [Machnik 1966:Tabl. XVIII 3a, XX 1a; XX 2a] and Grzęda Sokalska itself, in some graves explored there earlier [Koman 1999:53, Fig. 9:8].

Similarly located as the two niche graves, i.e. on the original rim of the *kurgan* mound (immediately next to grave no. 7), grave no. 3 (Fig. 2) was a burial place of a several-month-old child [Bagińska, Machnik 2003:40, Fig. 2c]. It contained a small clay beaker with its neck broken off [Bagińska, Machnik 2003:43, Fig. 5c] typical both in terms of form and ornamentation of MDC vessels [Artemenko 1967:53, 75,

Fig. 39:3, 44:1,3; Machnik, Pilch 1997:154, Fig. 8:12, 20]. A strikingly similar vessel was found during exploration of a CWC *kurgan* in Kołokolin near Rohatyn on the upper Dniester [Sulimirski 1968:Pl. 7:7]. It must have been among the goods of a grave located, similarly to the case of grave no. 3, on the rim of a pre-existing *kurgan* mound built over a grave from the older phase of the CWC [Sulimirski 1968:Pl. 7:7].

Another grave in Werszczyca, no. 6, situated only approx. 1.70 m away from grave no. 3 to NE and clearly outside of the original rim of the *kurgan* mound base (Fig. 2) contained a burial of a child slightly less than one year old and two small vessels [Bagińska, Machnik 2003:40, Fig. 2d]. One of them was a straight-walled beaker decorated on its upper part only with horizontal cord impressions [Bagińska, Machnik 2003:43, Fig. 5b], typical of the late phase of the CWC and frequently encountered in the youngest grave assemblages of its Kraków-Sandomierz group [Kempisty, Włodarczak 2000:21, 71, Fig. 21:1; 46:2; Włodarczak 2001:129, Fig. 20]. The other vessel was a beaker characteristic only of the MDC [Bagińska, Machnik 2003:43, Fig. 5a]. This is evidenced not only by its hourglass form and a broad, almost rounded bottom, but also by the motif of incised interlaced triangles separated by horizontal bands of double cord impressions, so peculiar to the pottery ornamentation of this culture, covering almost the whole vessel surface. As close analogies, one can quote here a beaker from *kurgan* 1 in Moshka, close to the village of Khodosevichi, Belarus [Artemenko 1964:34, Fig. 1:3] or a specimen from grave no. 3 in the *kurgan* in Palik in the same area [Artemenko 1964:56, Fig. 18:3].

The last of the graves (Fig. 2) located outside of the original perimeter of the *kurgan* mound on the discussed site (about 0.5 m to SE from the entrance pit to niche grave no. 7) is grave no. 8 containing a burial of a *Maturus* woman with its only grave good being a bone disk [Bagińska, Machnik 2003:40, 43, Fig. 2e, 5f]. This must be a grave of the Mierzanowice culture (MC) from the Early Bronze Age, which is indicated by the disk and the radiocarbon date obtained for the skeleton [Bagińska, Machnik 2003:50, Tab. 1].

3. THE SIGNIFICANCE OF DISCOVERIES ON SITE 31 IN WERSZCZYCA FOR THE QUESTION OF CO-OCCURRENCE OF THE CWC AND MDC ON GRZĘDA SOKALSKA

As we have seen, the investigation of this site resulted in the discovery of another three graves (nos. 3, 4/5, 6) containing authentic MDC vessels. What is new about this discovery is the fact that in two cases (graves nos. 4/5 and 6) such vessels were parts of compact grave assemblages together with the vessels of the late

phase of the CWC indicating connections to the pottery of the Kraków-Sandomierz group of this culture. Also, in both cases, the dead (an adult male in grave no. 4/5 and a child in grave no. 6) lay almost exactly along the S-N axis, i.e. an orientation typical of this very group. In one case, however, (grave no. 4/5) a male was buried in a niche grave typical of the Kraków-Sandomierz group. If the orientation of the dead along the S-N axis is encountered in the MDC (next to other orientations) [Artemenko 1962:82], then no niche grave, as far as we can tell, has been found in it yet. On Grzęda Sokalska, this is already at least the sixth[1] explored niche grave including grave no. 7 on site 31 in Werszczyca described in the previous section. Four of them, i.e. graves nos. 3 and 4 in *kurgan* 2 on site 25 in Łubcze [Koman 1999:48-53], grave no. 2 on site 37 in the same locality [Bagińska 1997:47-48, Fig. 2A, 3B] and already-mentioned grave no. 7 on site 31 in Werszczyca (Fig. 2) contained only vessels typical of the late phase of the CWC showing affinities to the pottery of the Kraków-Sandomierz group. In the fifth, however, unearthed on site 4 in Hubinek [Bagińska 1998:70-71, Fig. 1-2], containing two human burials [Bagińska 1998:72-73, Fig. 3c, 4], vessels were found of both the late phase of the CWC as well as beakers with traits typical of the MDC [Bagińska 1998:72, Fig. 3a, b]. However, the analysis of the overall situation in this grave would rather suggest that the body, next to which the vessels were found (as well as non-ceramic artifacts) could have been placed in the grave chamber (niche) already containing human remains placed there earlier along with CWC vessels [Machnik 1999:227ff.]. Hence, CWC and MDC vessels would not make up a classic compact assemblage in this case as they do in graves nos. 4/5 or 6 on site 31 in Werszczyca, but would belong instead to two separate categories according to the classification presented below.

Thus, graves nos.4/5 and 6, uncovered on site 31 in Werszczyca, supplied a special category of source that had been missing so far and that provided evidence for absolute contemporaneity of occurrence (use) of vessels exhibiting authentic MDC traits and vessels of the late phase of the CWC indicating clear connections to the Kraków-Sandomierz group of the culture (and for the use of niche graves in the same time and place as well). Above all, however, the discovery shed new light on the character of contacts between the representatives of both taxonomic units.

Before we take a closer look on this question, it is necessary to examine taxonomic traits and chronologies of all the categories of grave assemblages that can be distinguished now. This applies to the grave assemblages found in *kurgans* or on their edges on Grzęda Sokalska with the exception of those which precede the building of the mounds, i.e. belong to the Lublin-Volhynia culture [Koman 1997:40-43] or the Funnel Beaker culture (FBC) [Bagińska 1999].

[1] It is possible that another niche grave discovered was grave no. 1 on site 3 in Hubinek [Koman 1998:61, 63, Fig. 1, 2], which is described in the latter part of this paper.

4. CATEGORIES OF COMPACT GRAVE ASSEMBLAGES

The basis for distinguishing different categories of compact grave assemblages is such a set of traits of constituent artifacts that can be defined in terms of the degree of their affinities with the following archaeological cultures: CWC, MDC and MC. In the first two cases, the basis for categorization is, above all, traits of clay vessels as it is only on them that characteristic indicators (form and ornamentation) of one or the other culture are manifested, whereas goods made of other materials (e.g. stone shaft-hole axes and flint axes or arrowheads) are, as a rule, of intercultural character in both taxonomic units.

In the case of MC assemblages, however, their identification does not have to be based on pottery, which, by the way, is not always found in the graves of this culture [Kadrow, Machnik 1997]. These assemblages can be well identified also thanks to characteristic objects made of other materials (e.g. copper, bone or "faience").

On the basis of such criteria, it is possible to distinguish the following seven categories of compact assemblages, which are designated by consecutive capital letters of the alphabet (A-G).

Category A includes assemblages containing vessels exhibiting pottery traits characteristic, in general terms, of the older phase of the CWC in Małopolska and in some other regions, e.g. Silesia or Kujawy (Fig. 3). On Grzęda Sokalska, this category comprises an assemblage from the central grave in *kurgan* 1, on site 24, in Łubcze [Bagińska 1988], also from the same locality, an assemblage from grave no.1 (central?), in *kurgan* 1 and from grave no. 2 (central?), in *kurgan* 2, on site 26 [Koman 1989:8, 11, Fig. 1:1, 4], from the central grave in *kurgan* 2, on site 1 [Koman, Machnik 1993:45, Fig. 4], from grave no. 1 (central), in *kurgan* 2, on site 27 [Koman 1997:39, Fig. 3], from grave no. 1 (central), in *kurgan* 2, on site 2 [Koman, Machnik 1993:43, Fig. 2], from grave no. 2 (central), in *kurgan* 2, on site 25 [Koman 1999:46, Fig. 4] and finally from Werszczyca, from grave no. 1 (central), in *kurgan* 1, on site 29 [Bagińska 1989:13, Fig. B] and from grave no. 2 (central?), in *kurgan* 1 on site 1 [Bagińska 1997:49, Fig. 4 i-j].

Category B comprises assemblages including vessels exhibiting traits of the younger phase of the CWC only, at the same time clearly indicating connections to the pottery of the Kraków-Sandomierz group of this culture (Fig. 4). In the discussed area, this category includes an assemblage from grave no. 1, in *kurgan* 9, on site 16, in Łubcze [Bagińska 1991] and also in the same locality, from grave no. 2, on site 37 [Bagińska 1997:48, Fig. 3:f-g], from graves nos. 3 and 4, in *kurgan* 2, on site 25 [Koman 1999], from grave no. 1, in the *kurgan* on site 3, in Hubinek [Koman 1998:62, Fig. 2] and finally the assemblage already discussed in this paper coming from grave no. 7, on site 31 in Werszczyca [Bagińska, Machnik 2003].

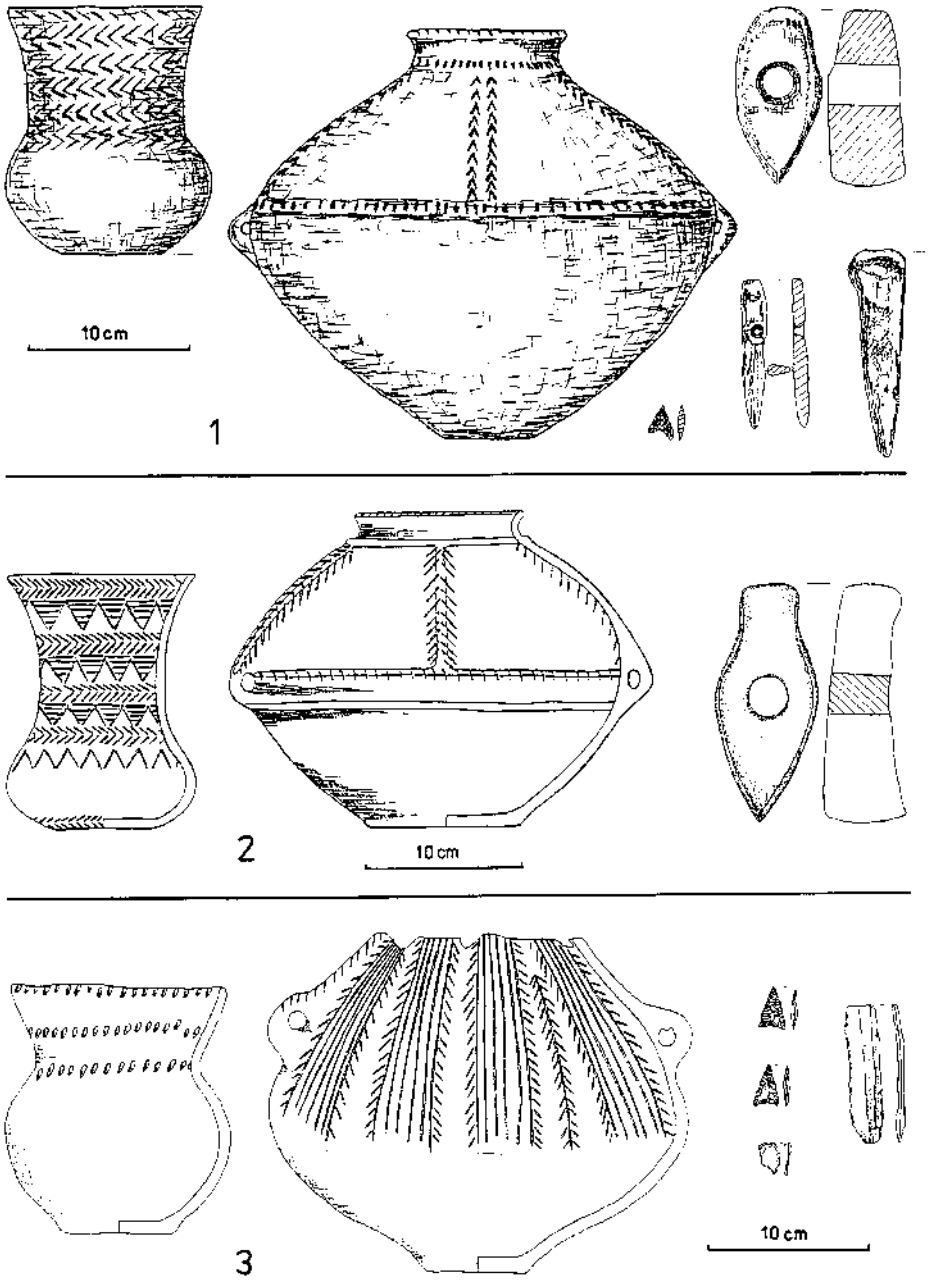

Fig. 3. Grave assemblages of category A from CWC *kurgans* on Grzęda Sokalska; 1 - Łubcze, *kurgan* 2, grave no. 2; 2 - Werszczyca, site ?, grave no. 2; 3 - Werszczyca, site 29, grave no. 1

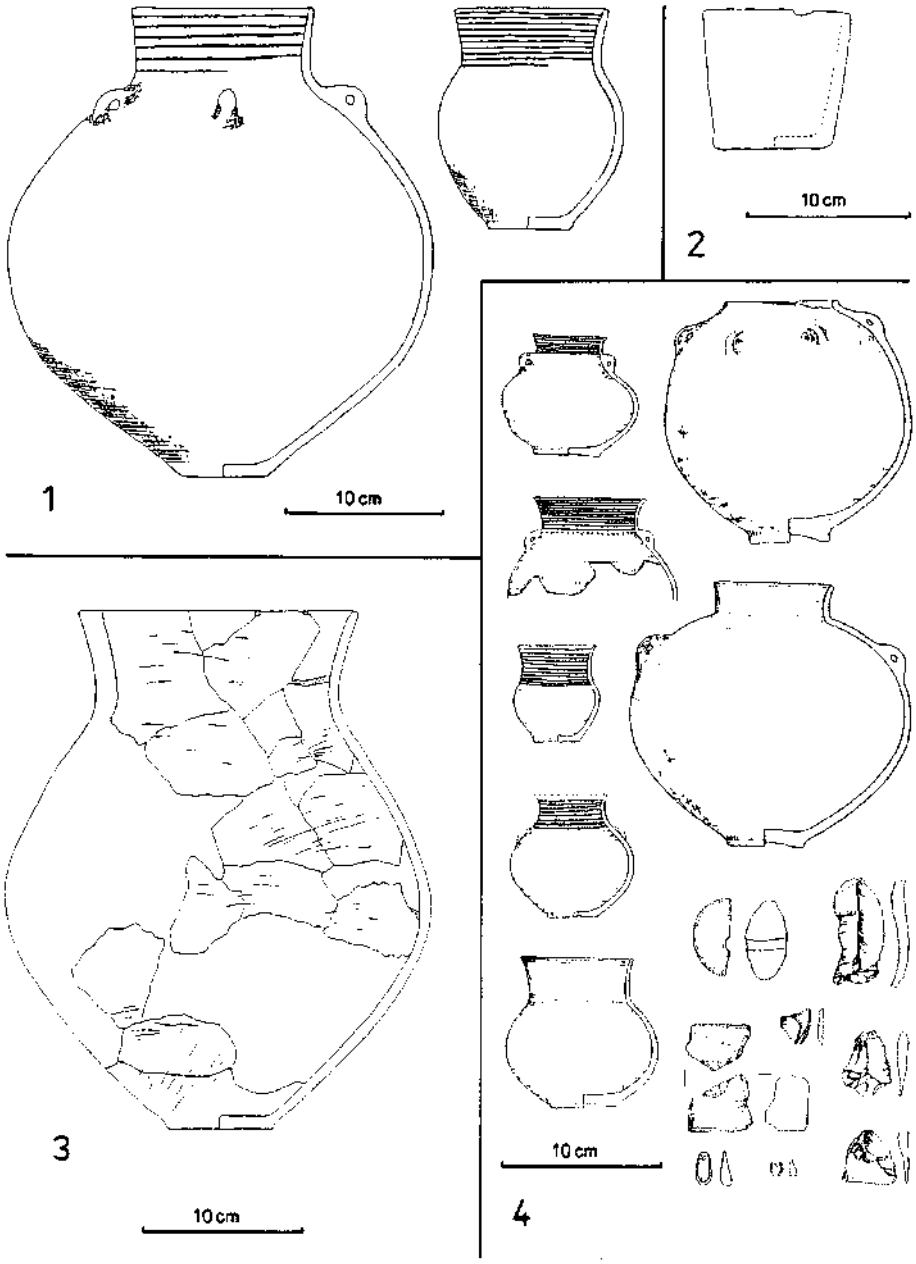

Fig. 4. Grave assemblages of category B from CWC *kurgans* on Grzęda Sokalska; 1 - Łubcze, site 37, niche grave no. 2; 2 - Łubcze, site 16, *kurgan* 2, grave no.1; 3 - Werszczyca, site 31, niche grave no. 7; 4 - Hubinek, *kurgan* A, niche grave (?) no. 1

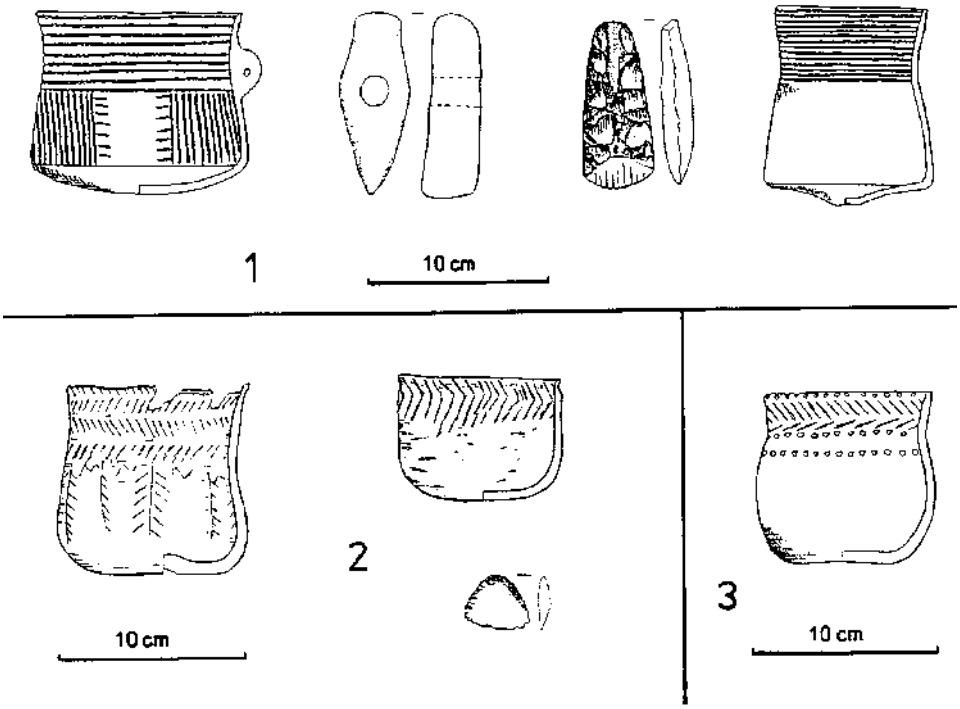

Fig. 5. Grave assemblages of category C from CWC *kurgans* on Grzęda Sokalska; 1 - Hubinek, site 4, niche grave; 2 - Hubinek, site 3, grave no. 3; 3 - Werszczyca, site 31, grave no. 3

Category C consists of assemblages including vessels showing traits typical only of MDC pottery (Fig. 5)[2]. On Grzęda Sokalska, they were found in graves nos. 2 and 3, on site 3, in Hubinek [Koman 1998:65, Fig. 4], in a niche grave in the *kurgan*, on site 4, in Hubinek [Bagińska 1998:72, Fig. 3ab][3] and in already discussed grave no. 3, on site 31, in Werszczyca.

Category D is distinguished only on the basis of assemblages unearthed on the above-named site, in graves nos. 4/5 and 6 and contains beakers displaying authentic traits of MDC pottery as well as vessels having traits of the late phase of the CWC, specifically of its Kraków-Sandomierz group (Fig. 6).

In this category must be also included an assemblage from grave no. 2, in *kurgan* 2, on site 22, in Nedeżów [Bagińska 1996:62, Fig. 4], however, a large amphora

[2] These are assemblages which using other division criteria (taking into account only the range of MDC traits) have been subsumed under the first category [Machnik 1999:239, Machnik *et al.* 2001:391; Bagińska, Machnik 2003].

[3] Provided, of course, that one takes two small beakers exhibiting MDC traits to form part of a separate grave assemblage in respect of the CWC amphorae found there. For a more detailed discussion of the question see the latter part of this paper.

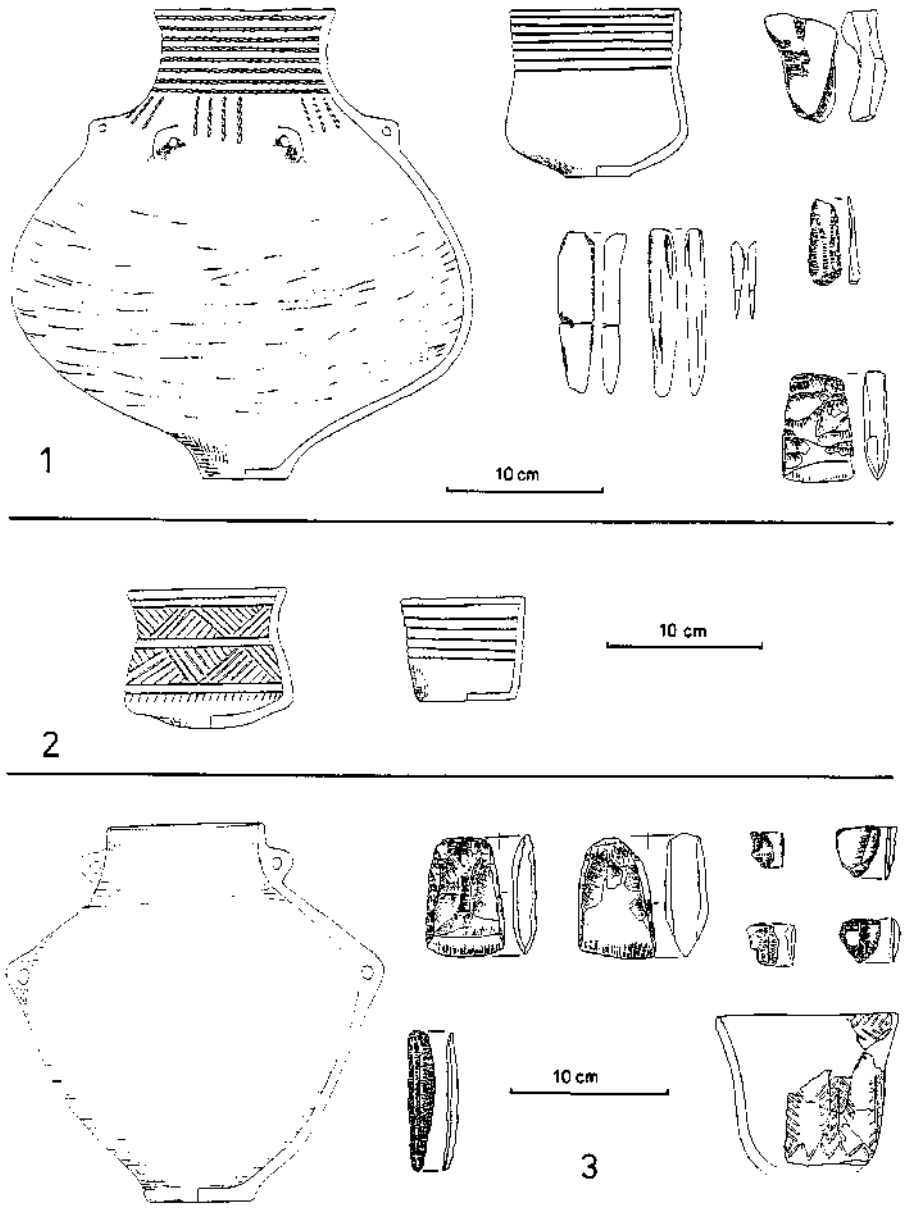

Fig. 6. Grave assemblages of category D from CWC *kurgans* on Grzęda Sokalska; 1 - Werszczyca, site 31, niche grave 4/5; 2 - Werszczyca, site 31, grave no. 6; 3 - Nedeżów, site 22, *kurgan* 2, grave no. 1

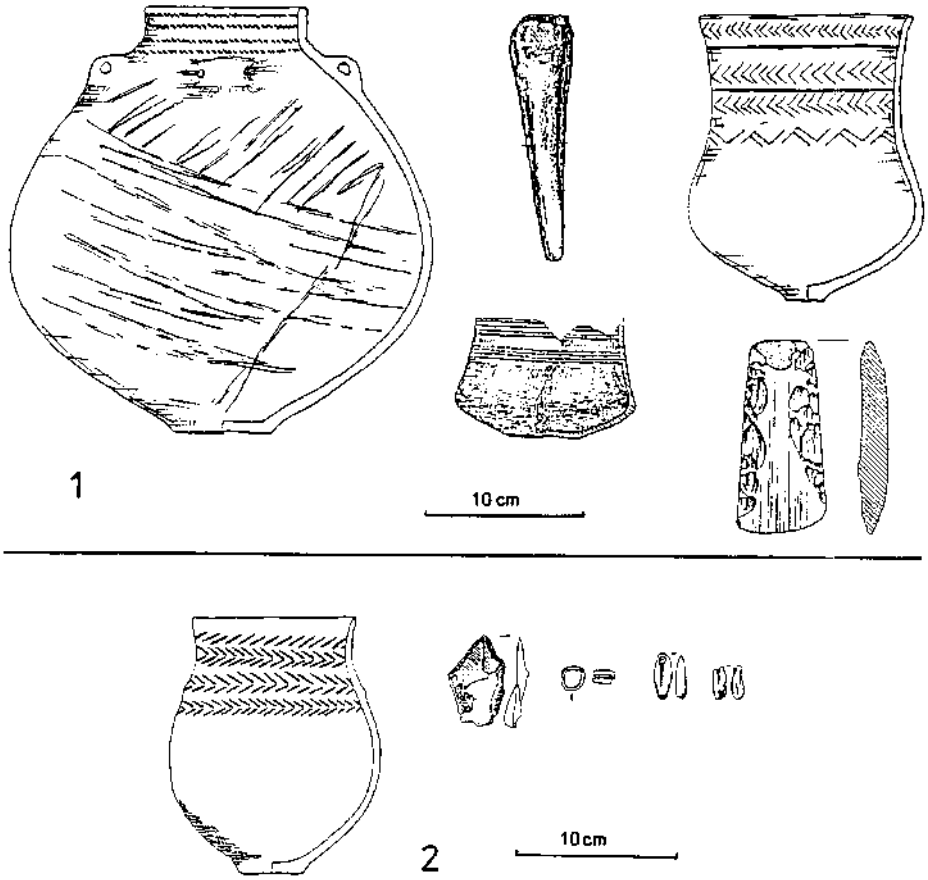

Fig. 7. Grave assemblages of category E from CWC *kurgans* on Grzęda Sokalska; 1 - Łubcze, site 2, *kurgan* 2, grave no. 2; 2 - Łubcze, site 37, grave no. 3

accompanying an MDC beaker in this assemblage clearly indicates connections not to the vessels of the CWC Kraków-Sandomierz group but to the amphorae of the late (III) phase of the CWC in Bohemia [Bagińska 1996:62, 65, Fig. 4a].

Category E comprises assemblages that, besides vessels typical of the late phase of the CWC, include specimens that in their ornamentation are reminiscent of MDC beakers, whereas their form reminds one of CWC pottery but exhibits also certain local traits, e.g. the way bottoms are shaped into a foot (Fig. 7)[4].

[4] These are assemblages which, when a smaller set of sources is considered (covering only assemblages exhibiting an appropriate degree of affinity with MDC pottery), have been included in the second category [Machnik 1999:239] or the third one [Machnik *et al.* 2001:392].

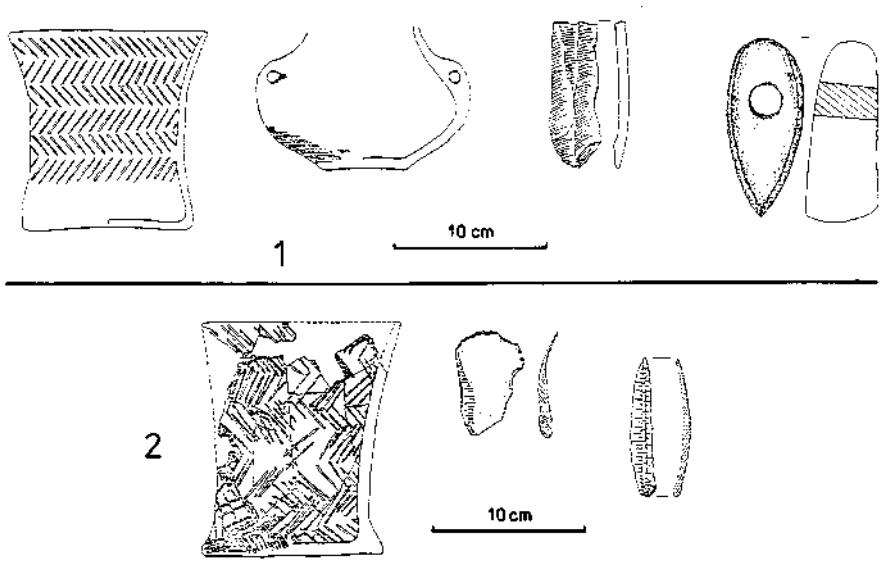

Fig. 8. Grave assemblages of category F from CWC *kurgans* on Grzęda Sokalska; 1 - Werszczyca, site 1, grave no. 1; 2 - Werszczyca, site 30, grave

In the area in question we encounter such an assemblage in grave no. 2, in the *kurgan*, on site 2, in Łubcze [Koman, Machnik 1993:44, Fig. 3]. In this category one may also include an assemblages with a vessel of "mixed" CWC and MDC traits in grave no. 3, on site 37, in the said locality [Bagińska 1997:48, Fig. 3e].

Category F consists of assemblages in which vessels, represented here by single straight-walled beakers (without any other accompanying specimens), are merely a pale imitation of MDC pottery (Fig. 8)[5]. What I have in mind here is the assemblages in grave no. 1, in the *kurgan* on site 1, in Werszczyca [Bagińska 1997:49-50, Fig. 4a-d] and in grave no. 1, in the *kurgan* on site 30, in the same locality [Bagińska 1990:22, Fig. B].

Outside of Grzęda Sokalska, in this category one may include a grave assemblage from Wola Węgierska [Machnik, Sosnowska 1998:11, Fig. 11], containing a beaker similar in shape and ornamentation to the specimens from Werszczyca named above as well as several other assemblages from the areas between the upper Vistula and upper Dniester rivers [Machnik *et al.* 2001:395-397, Fig. 4-5]. Sometimes, as in the case of the central grave in *kurgan* 1, in Brzezinki, we may encounter an assemblage in which, next to a beaker whose form seems to be reminiscent of

[5] These are assemblages which, when a smaller set of sources is considered (covering only assemblages exhibiting an appropriate degree of affinity with MDC pottery), have been included in the third category [Machnik 1999:240] or the fourth one [Machnik *et al.* 2001:391].

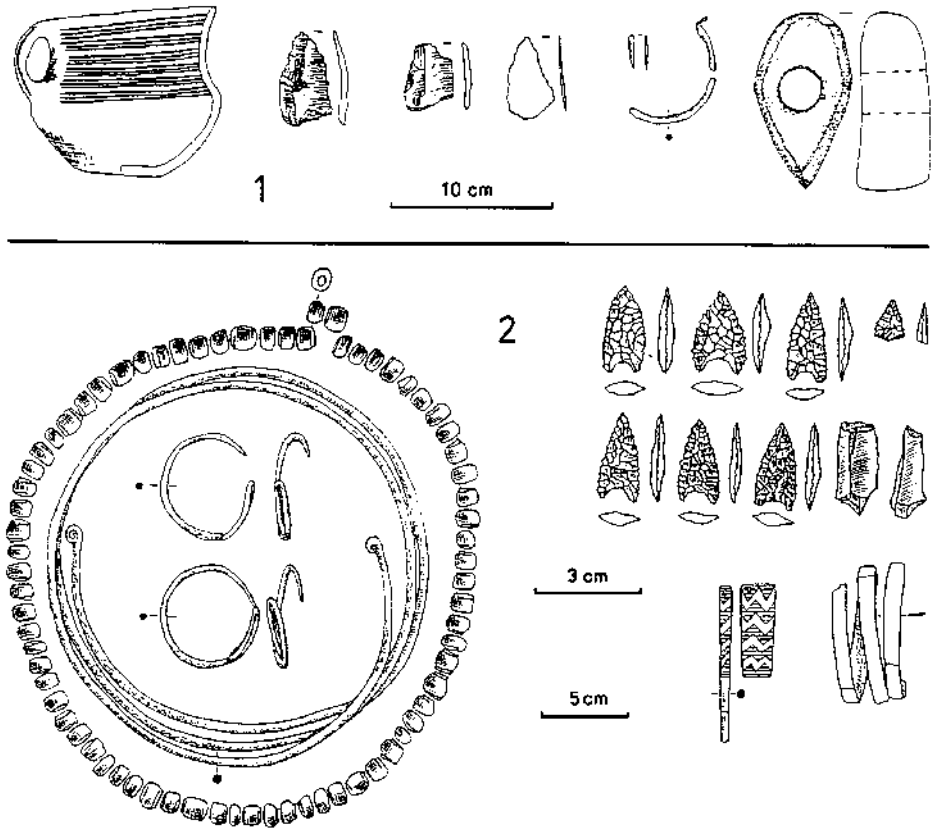

Fig. 9. Grave assemblages of category G (Mierzanowice culture) from CWC *kurgans* on Grzęda Sokalska; 1 - Łubcze, site 37, grave no. 1; 2 - Łubcze, site 38, grave no. 4

MDC influence, there is also a vessel showing traits of the late phase of the CWC [Machnik 1966:Tab. XIX:2:b.][6].

On Grzęda Sokalska, discoveries were made, as it has already been mentioned, of eleven graves of the MC of different chronologies in the mounds of CWC *kurgans* or in their areas [Bagińska 1997a]. Because of the significance of the occurrence of these burials in the area in question for our discussion of the reasons why the

[6] Both vessels were found at the bottom of the grave pit, whereas fragments of others, showing traits of the older CWC [Machnik 1966:Tab. XIX:c] were found either in the roof part of the material filling the pit or in the central part of the *kurgan* mound. The latter may have found their way to the *kurgan* together with the earth used to build it. It is possible, however, that they come from an older grave which was destroyed during the digging of the grave pit of the younger burial, through the *kurgan* mound, containing the vessels mentioned above. This conception could be borne out by the analysis of soil consistency in the mound suggesting that there could have been made a funnel-like dig reaching the very bottom of the grave pit in the place where the two complete vessels were found [Machnik 1966:241].

process of integration of the CWC-MDC was interrupted, we have formed one more, final, **category G** to include artifact assemblages found in these graves (Fig. 9). Admittedly, in the majority of these graves there was no pottery, but there were other goods such as "faience" beads, characteristic bone pins or copper ornaments that not only justified their assignment to that culture, but also specified, in most cases, its chronological phase (see section on chronology).

In the discussed area, these are the following grave assemblages:

(a) with pottery: grave no. 1, on site 37, in Łubcze [Bagińska 1997:197, Fig. 4] and grave no. 2, on site 25, in Nedeżów [Bagińska 1997a:193, Fig. 1a, c-d], and

(b) without pottery: grave no. 1, on site 1, in Łubcze [Koman, Machnik 1991:11], grave no. 1, in *kurgan* 2, on site 25 [Koman 1999:45, 50, Fig. 7:1-5] and graves nos. 1, 2, 4, on site 38, in the same locality [Bagińska 1997a:192-196, Fig. 2-3], grave no. 3, on site 1, in Werszczyca [Bagińska 1997a:193, 198, Fig. 1b, e-f] and finally grave no. 8, on already well-known site 31, in the same locality [Bagińska, Machnik 2003:43-44, Fig. 5f].

Thus, the division of grave assemblages found on Grzęda Sokalska made here features a much larger number of categories than previous divisions [Machnik 1999; Machnik *et al.* 2001]. Now, there are as many as seven categories of which a majority, i.e. four (C, D, E and F), have any degree of affinity with the MDC-beginning with the occurrence of exclusively its authentic traits (category C) to the presence of its only vague reminiscences (category F).

Besides them, there have been two other categories distinguished (A and B) containing only CWC traits and the last one (G) representing already the MC. Among all the categories, specific temporal relationships hold as well, which shall be presented in the next section.

5. THE CHRONOLOGY OF THE DISTINGUISHED CATEGORIES OF GRAVE ASSEMBLAGES

The construction of relative and absolute chronologies of individual categories of assemblages is based on their stratigraphic position within *kurgans* or on their rims as well as on radiocarbon dates obtained for some of them. As we know, in most of the *kurgans* investigated on Grzęda Sokalska, there were more than one burial discovered. They were located, as we have seen, in different places.

And so, under *kurgan* mounds, could be found all the graves with category A assemblages, i.e. with vessels displaying traits of, generally speaking, the older phase of the CWC or with no pottery at all and containing only flint goods (which

is typical of this phase too) as it can be observed in grave no. 1 on site 31 in Werszczyca [Bagińska, Machnik 2003:39, 43, Fig. 1, 5d-e]. In *kurgans* that had been less damaged, where the original ground level was preserved under the mounds and thus could be easily observed, it was found out that burials with assemblages of this category (sunk into the original ground level) usually occupied a central position. Hence, a conclusion can be drawn that it was for them that the *kurgan* mounds were built.

In light of the typological and comparative analysis of vessels found in these burials, as well as other artifacts, e.g. stone shaft-hole axes or flint arrowheads, assemblages included in category A may differ among themselves in terms of chronology[7], although, generally, they represent the older phase of the CWC.

So far, only for two grave assemblages of the said category we have ^{14}C dates. These are grave no. 2, in the *kurgan* on site 1, in Werszczyca [Machnik 1999: 237, 247, Fig. 6b, 17] and grave no. 1, in *kurgan* 2 on site 2, in Łubcze [Machnik 1999:234, 244, Fig. 3b, 11]. In both cases the dates are early enough not to vary much from expectations. For they fall on the first centuries of the 3rd millennium BC. However, in the case of the first of these graves, it could be even the very beginning of this period[8]. They are, as we shall see, older enough than radiocarbon-dated assemblages of other categories distinguished by us on Grzęda Sokalska.

The assemblages of the next category, i.e. B, which includes vessels displaying traits of only the late phase of the CWC, chiefly of its Kraków-Sandomierz group, occupy, all of them as it seems now, a younger (secondary) stratigraphic position with respect to burials containing category A assemblages. This is certainly the case with graves nos. 3 and 4 at *kurgan* 2, on site 25, in Łubcze [Koman 1999:43, Fig. 2], grave no. 2 at the *kurgan*, on site 37, in the same locality [Bagińska 1997:47-48, Fig. 2A, 3], as well as grave no. 7, at the *kurgan* on the discussed earlier site 31, in Werszczyca [Bagińska, Machnik 2003:39, 43, Fig. 1, 5g], which were placed on (dug into) the original rim of the *kurgan* mound (Fig. 2).

Grave no. 1 in the *kurgan*, on site 3, in Hubinek, considered by its discoverer as central [Koman 1998:61-64, Fig. 1-3], must also have been sunk too into an already existing *kurgan*. This contention is borne out by its location closer to the original rim of the mound than the center of space covered by the mound [Koman 1998:61, Fig. 1]. The *kurgan* was seriously damaged, its mound completely ploughed out, hence, the pit of the proper central grave, usually rather shallow, may not have survived as is the case with several other explored *kurgans* on Grzęda Sokalska (e.g. in *kurgan* 2 on site 16, in Łubcze or on site 37, in Werszczyca [Bagińska 1991; 1997:47, 50, Fig. 2A]).

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[7] A time difference may be observed, for instance, between the assemblage from the central grave in *kurgan* 2 on site 1 in Łubcze [Koman, Machnik 1991] and the assemblage from grave no. 2 in *kurgan* 2 on site 26 in the same locality [Koman 1989]

[8] This follows from the dating of the oldest CWC graves found under *kurgans* in the Carpathian zone [Machnik 2001].

It must be noted, too, that all burials placed on the original rim of the *kurgan* mound and containing category B assemblages were niche graves. Grave no. 1 in the *kurgan* on site 3, in Hubinek may have been originally a niche grave, too, which is suggested by its irregular shape and dimensions departing from, in particular shape, the standards of regular pit graves. As a rule, central graves were niche ones. The outline and dimensions of this grave feature must be a result of the collapse of the niche ceiling, which is a frequent occurrence in the case of such graves[9].

Unfortunately, none of category B assemblages has been dated using the radiocarbon technique. To determine their absolute chronology, if only approximately, we can use, by way of comparison, the dates obtained for some category D assemblages on Grzęda Sokalska. In some of these assemblages there occur (next to vessels typical of the MDC), similarly to category B, vessel types exhibiting late CWC traits. Alternatively, we can use dates relating to some late assemblages of the Kraków-Sandomierz group offering a certain analogy to the discussed category. In the first case, this will be dates obtained for the assemblages from graves nos. 4/6 and 6 on site 31 in Werszczyca, the probability ranges of which coincide, as we shall see, ca. 2460 BC. A temporal proximity to grave no. 4/5 thus dated by at least one grave with a category B assemblage, namely, grave no. 7 on the same site, is, in our opinion indicated by an unusual location of both burials at the same *kurgan* (Fig. 2), which shall be discussed later on in this paper. In the other case, the situation is more complex as the ranges of probability distributions of a series of ^{14}C dates are very broad for most of the late assemblages of the Kraków-Sandomierz group (e.g. for graves no. 43, 78, 133, 135 in Żerniki Górne) [Kempisty, Włodarczak 2000; Włodarczak 2001]. Nonetheless, in several cases, for instance, burials nos. 84, 125, 134 in Żerniki Górne [Włodarczak 2001:125-126, 128, Fig. 16-17, 19] containing beakers and amphorae to which affinity is shown by vessels of these types from B category assemblages (e.g. a beaker from grave no. 2 on site 37 in Łubcze) [Bagińska 1997:48, Fig. 3g] or an amphora from grave no. 4 in *kurgan* 2 on site 25 in the same locality [Koman 1990:53, Fig. 9:2, 7], the ranges of probability distributions coincide ca. 2470 BC[10]. As we can see, there is a surprising coincidence between the most probable dating of a category D assemblage and some assemblages from the late phase of the Kraków-Sandomierz group containing vessels offering analogies for specimens included in our category B assemblages. This would corroborate to some extent the legitimacy of referring to more or less this time, i.e. **2470-2460**, the act of deposi-

[9] A result of such a collapse in a niche grave is usually a superimposition of the outlines of both parts of the grave, i.e. the grave chamber (niche) and entrance shaft, when projected horizontally. This can be observed in many collapsed graves of this type in the Kraków-Sandomierz group on the Małopolska Upland [Kempisty, Włodarczak 2000].

[10] A younger [?] than these ranges is shown by the distribution of probabilities obtained as a result of the radiocarbon dating of grave no. 15[76] from Złota on Grodzisko II (with three vessels reminiscent of specimens of category B [Włodarczak 2001:129, Fig. 20]. However, in this case too, the oldest of possible dates (i.e. 2460 BC) does not differ much from 2470 BC being the contact point between the ranges of probability distributions of radiocarbon dates relating to the named assemblages from Żerniki Górne.

ting of some of the already mentioned assemblages of this very category, i.e. B, on Grzęda Sokalska[11].

The stratigraphic position of assemblages of the next category, C (with vessels typical only of the MDC) is similar to that of the majority of category B assemblages just discussed. Graves containing them were placed on the rims of already existing *kurgans*, hence, they are younger than burials with category A assemblages placed beneath *kurgan* mounds. Taking into account the situation in the niche grave on site 4 in Hubinek, already discussed herein, (where it is highly likely that a secondary burial took place), it should be accepted that some C category assemblages might be slightly younger than some assemblages of B category (see footnote 11).

Two of the four category C assemblages (graves nos. 2 and 3 on site 3 in Hubinek) have been radiocarbon-dated. In both cases, the ranges of probability, albeit very broad, do overlap over certain segments [Machnik 1999:243, Fig. 10]. Taking into account that some beakers making up these assemblages are almost identical as far as their form and technology are concerned [Koman 1998:65, Fig. 4:1, 10], it must be assumed that they were made more or less at the same time. Therefore, we can speak here only of a very short segment in the range when the dates overlap. Of three such possibilities (2620–2610, 2580–2550 and 2540–2490 BC), the most probable is the range of **2540–2490 BC** (possibly, its younger segment, i.e. ca. 2490 BC) because, as we already know, basically only about the middle of the 3rd millennium BC (when GAC settlement in Volhynia and Podolia began to wane) it was possible for MDC populations to infiltrate the area discussed here [Machnik 1999:250]. The dating assumed for category C assemblages, clearly younger than that for category A assemblages, is also fully consistent with their mutual stratigraphic positions in *kurgans* on Grzęda Sokalska.

Three graves discovered in the microregion of interest to us here and containing category D assemblages (where vessels typical of the MDC are found together with those having traits of the late phase of the CWC) occupy, similarly to the assemblages of categories B and C, a younger stratigraphic position with respect to graves with category A assemblages. In two cases (graves nos. 4/5 and 6 on site 31 in Werszczyca) graves were located on the original rim of the *kurgan* mound (Fig. 2), while in one case (grave no. 1 on site 22 in Nedeżów) over an older central grave. It is worth noting here that one of the former burials (grave no. 4/5 in Werszczyca), having a niche form, was placed immediately next to analogous niche grave (no. 7) containing a category B assemblage (Fig. 2). This may be an indication that both graves were placed next to the *kurgan* in close succession.

[11] It is not impossible that some assemblages of category B are slightly older while others are somewhat younger than the dates quoted. This is suggested by the typological and comparative analysis of the vessels making up the assemblages. And so, for instance, younger than assemblages in graves nos. 3 and 4 on site 25 in Łubcze [Koman 1999:49-53, Fig. 7:6-1; 9:1-8] seems to be the assemblage from grave no. 1 on site 3 in Hubinek, in which two-handled amphorae are decorated in a manner reminding us of the patterns of pottery decoration from the Early Bronze Age [Koman 1998:62, Fig. 2:1-4].

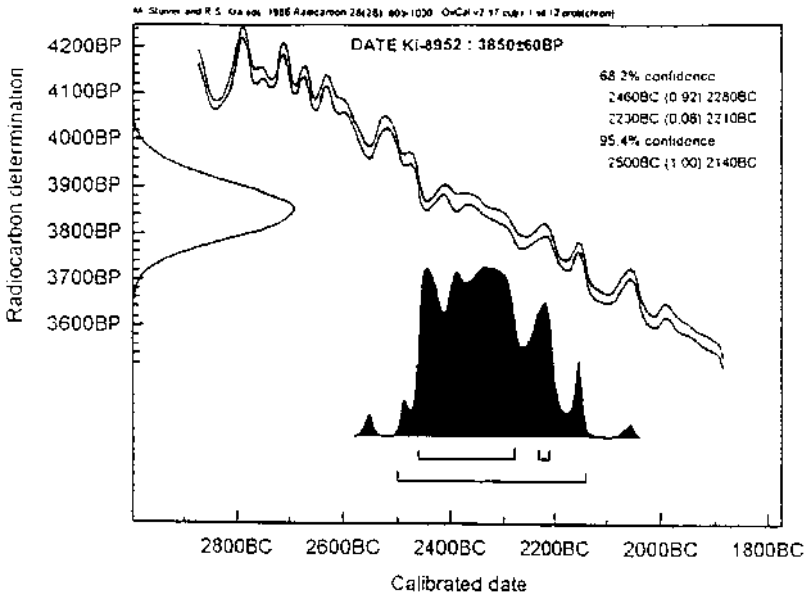

Fig. 10. Werszczyca, site 31, grave 4/5 (category D); diagram showing radiocarbon dating after calibration (foll. J. Bagińska, J. Machnik 2003)

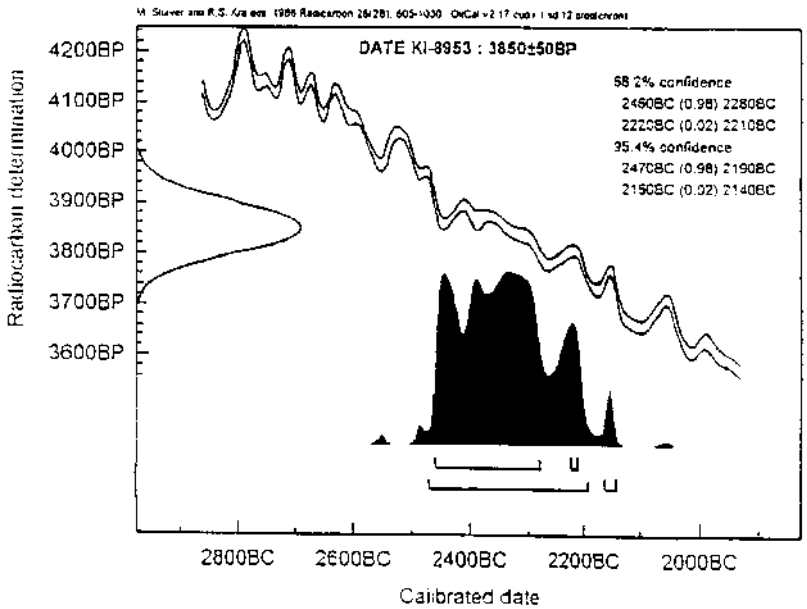

Fig. 11. Werszczyca, site 31, grave 6 (category D); diagram showing radiocarbon dating after calibration (foll. J. Bagińska, J. Machnik 2003)

All the three assemblages of category D have been dated using the radiocarbon technique. The ranges of probability distributions of dates obtained for two of these assemblages, i.e. for graves nos. 4/5 and 6 on site 31 in Werszczyca [Bagińska, Machnik 2003:52, Fig. 10], are almost identical (Figs. 10, 11), whereas the third assemblage, i.e. in grave no. 1, in *kurgan* 2, on site 22 in Nedeżów [Machnik 1999:145, Fig. 13], has a broader range of probability than the other two. Nonetheless, the ranges of probabilities of dates for all the three assemblages meet ca. **2460**. It is the most probable date taking into account the composition of assemblages of this category containing both MDC beakers and vessels having traits of the late CWC.

The above-quoted date referring to category D is corroborated by a radiocarbon chronology obtained for some graves of the late (III) third phase of the CWC on the well-known cemetery in Vikletice in Bohemia [Buchvaldek, Koutecký 1970]. To the pottery (specifically to amphorae) of this phase, affinity is shown, as we already know, by an amphora from the third assemblage of category D, namely from grave no. 1, in *kurgan* 2, on site 22 in Nedeżów. It just so happens that the ranges of probability distributions of the dates for three late Bohemian assemblages, i.e. from graves nos. 41, 58 and 119 [Buchvaldek, Koutecký 1970:74, 105, 168, Fig. 13, 44, 107] overlap with ranges of dates obtained for our assemblages of category D and coincide ca. 2460 as well[12].

Comparing the acceptable, discussed earlier, dating of category C assemblages with the dating of category D assemblages, we can see that the latter are younger than the former by several dozen years. In fact, the difference could have been smaller, if one takes into account unusual similarity manifested by the use of the same ornamentation canon on a beaker in a category D assemblage from grave no. 1, in *kurgan* 2, on site 22 in Nedeżów and on a classic MDC vessel in a category C assemblage from grave no. 3, on site 3 in Hubinek [Bagińska 1996:62, Fig. 4c][13]. It will not be out of place here to quote an acceptable range of probability distribution of ^{14}C dates, i.e. 2540–2490 BC, that was obtained for the already-mentioned grave no. 1 belonging to the MDC on site 2 in Prorva, Belarus [Kryvaltsevich, Kovalyukh 1999:154]. For the sake of reminding, the grave contained a beaker offering a rather close analogy to the specimen forming part of the category D assemblage from grave 4/5, on site 31, in Werszczyca (Fig. 6).

The stratigraphic position of two graves discovered so far on Grzęda Sokalska and containing category E assemblages (in which vessels displaying traits of the late CWC co-occur with beakers showing clear MDC influences) is similar to that of burials with assemblages of categories B, C and D. The first of them, i.e. grave no.

[12] I have received the information on radiocarbon dates for the above-named CWC graves in Vikletice directly from Dr. Piotr Włodarczak, for which I am grateful to him.

[13] It is worth mentioning that the full range of probability of ^{14}C dates for this category D assemblage from Nedeżów is closer to such a range for the mentioned category C assemblage from Hubinek than to the full ranges for two other category D assemblages, i.e. from graves nos. 4/5 and 6 on site 31 in Werszczyca [Machnik 1999:245, Fig. 13; Bagińska, Machnik 2003:52, Fig. 10].

2, in *kurgan* 2, on site 2 in Łubcze cut, as we know, the outer groove encircling (together with an inner one) the pit of the central grave, containing a category A assemblage; hence it must have been sunk into the rim of a pre-existing *kurgan* mound covering the pit [Koman, Machnik 1993:43, Fig. 2A]. The other burial, i.e. grave no. 3, on site 37, in Łubcze (containing remains of three individuals) was similarly located on the original rim of the *kurgan* opposite niche grave no. 2 located on the rim too and containing, as we know, a category B assemblage [Bagińska 1997:47, Fig. 2A]. In this case, no grave for which the *kurgan* had been built could be found, possibly due to serious damage caused by ploughing. For obvious reasons, this cannot be grave no. 1 situated closer to the center [Bagińska 1997:46-47, Fig. 18, 1A] coming from the Early Bronze Age and containing an assemblage of category G (Fig. 9).

Both assemblages of category E have been dated using the radiocarbon technique [Machnik 1999:144, 146, Fig. 11, 15]. The date obtained for the first of them, i.e. grave no. 2, *kurgan* 2, on site 2, in Łubcze, must be considered much too early if one takes into account the fact that the assemblage comprised next to a beaker indicating connections to the MDC also CWC vessels. One of such vessels [Koman, Machnik 1999:44, Fig. 3:3], in form and ornamentation in particular, reminds one of the pottery traits of the decline phase of the CWC or even more strongly of the vessels of the oldest MC phase [Kadrow, Machnik 1997:22, Fig. 6]. Furthermore, the date has to be rejected because it was impossible for MDC populations to appear in the upper Bug drainage long before the middle of the 3rd millennium BC; neither was it possible for any influence of the culture to come to bear on the area in question that early [Machnik 1999; Machnik *et al.* 2001].

Closer to expectations is the date referring to the other assemblage of category E contained in grave 3, on site 37, in Łubcze, provided one takes into account the youngest probability range of dates from 2470 to 2430 BC [Machnik 1999:246, Fig. 15]. Somewhere in between would fit the date of placing the grave at the *kurgan* built, as we know, over grave no. 1 containing an assemblage of category A. Thus, it would be somewhat younger than the date assumed above for assemblages of category D. An argument in favor of this chronological position of category E assemblages is supplied, too, by the radiocarbon dating [Włodarczak 2001:120, Fig. 11] of an assemblage of this category in grave sunk into *kurgan* K in Łukawica, Lubaczów district, i.e., outside of Grzęda Sokalska[14]. The most likely range of probability distributions of the dates for this assemblage is 2430–2410 BC; although a slightly older date is not out of the question, i.e. **ca. 2450**.

Two assemblages of category F distinguished so far on Grzęda Sokalska (containing vessels only remotely similar to MDC pottery) come from, as we already

[14] In this assemblage one should include only two vessels, namely, a large unornamented beaker exhibiting traits of the late phase of the CWC and another one, smaller and straight-walled, richly ornamented and indicating connections to MDC vessels. Other artifacts, i.e. a stone shaft-hole axe and a flint axe as well as a flint flake tool, come from, as far as it can be told, from and older destroyed grave, for which the *kurgan* was built [Machnik 1966:249, Tab. XXIV:2].

know, an unnumbered grave in the *kurgan* on site 30 in Werszczyca [Bagińska 1990] and grave no. 1, in the *kurgan* on site 1 in the same locality [Bagińska 1997]. Admittedly, at the time of their discovery, they both were situated within the space covered by the *kurgan* mound but their stratigraphic position is not entirely clear. In the first case, the grave cut into the groove encircling a space approx. 7 m in diameter, in the center of which there could have been a grave(s) which was/were later destroyed; in the other case, the burial was located exactly in the middle of a space (also about 7 m in diameter) surrounded by a similar groove as above. In the latter case, it was, however, a younger grave feature (so-called burial surrounded by a groove) than grave no. 2 unearthed in the same *kurgan* [Machnik 1999:235-236] and centrally situated in the original *kurgan* perimeter that could be reconstructed. The grave contained, as we already know, a category A grave assemblage dated at the early 3rd millennium BC. Hence, in both situations, we would deal not with the oldest graves within these *kurgans*. However, in the case of site 1 in Werszczyca, grave no. 1 could have been dug before the mound was finally formed and encompassed another older burial that had possibly been covered by some other smaller mound; whereas in the case of the *kurgan* on site 30 in Werszczyca, the grave in question must have been sunk into its mound.

So far, none of the two grave assemblages of category F on Grzęda Sokalska has been dated using the radiocarbon technique. For the purpose of determining their chronology, albeit approximately, one can use a ^{14}C date for a grave discovered in *kurgan* 1 in Wola Węgierska in Dynów Foothills containing a straight-walled beaker [Machnik, Sosnowska 1998:11, Fig. 11a] whose shape and ornamentation are analogous to those of both beakers from the category F assemblages. The analogies concern, in this case, the so-called secondary traits that may indicate temporal proximity of the compared specimens. Within the broad range of the probability distribution of the calibrated date from Wola Węgierska, covering the period of 2600–2050 BC [Machnik 2002:129, Fig. 10], the most probable seems to be the interval of 2470–2270 BC. To narrow down the range, one could use a radiocarbon date for another assemblage, this time from a grave (most likely a secondary one) in *kurgan* I in Brzezinki, Lubaczów district [Machnik 1966:240-241]. Owing to the fact that it comprised, next to an amphora showing traits of the late phase of the CWC, a beaker being, as it seems, a pale imitation of a specific type of MDC vessels (e.g. a specimen from the already mentioned grave 6, on site 31 in Werszczyca or from grave no. 1, on site 2 in Prorva, Belarus), it can be also included, similarly to the assemblage from Wola Węgierska, in category F. Curiously enough, after calibration, the range of probability distributions of dates for this grave [Włodarczak 2001:120, Fig. 11] overlaps with such a range obtained for the assemblage from Wola Węgierska over the period of **2460–2450 BC**[15].

[15] I rely here, as in other cases, on the analysis of calibration results of the obtained radiocarbon dates made, at my request, by Prof. Sławomir Kadrow, Ph.D., for which I would like to cordially thank him here.

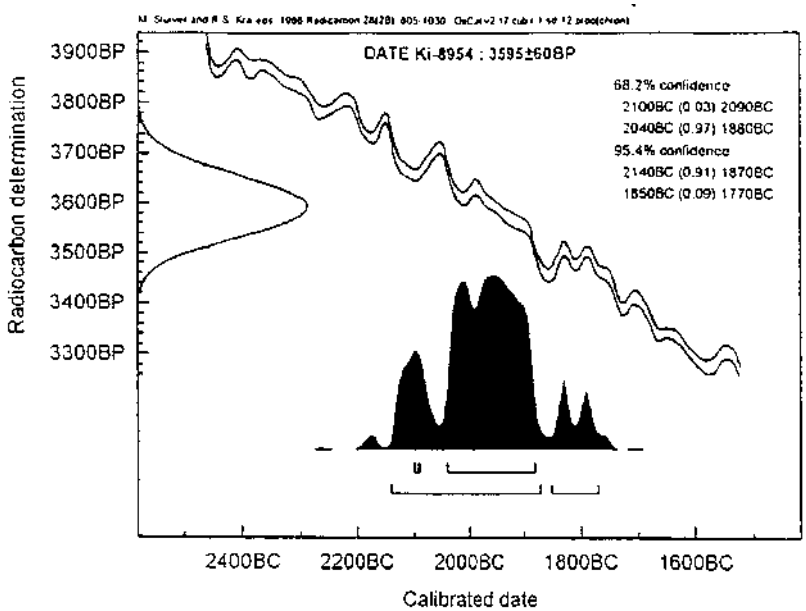

Fig. 12. Werszczyca, site 31, grave 8 (category G); diagram showing radiocarbon dating after calibration (foll. J. Bagińska, J. Machnik 2003)

If we adopted these dates for category F assemblages on Grzęda Sokalska, of special interest to us here, the time of their depositing in this area would be close to the chronology adopted by us for category E assemblages discussed earlier. By no means it would be surprising as vessels making part of assemblages of both categories while showing certain MDC traits are only an imitation or rather a local transformation of the pottery of this culture. The degree of the transformation is different in each of these categories, though. Considering that the degree of similarity seems to be higher in vessels in category E assemblages than in those of category F, one can theoretically assume that the former are slightly older than the latter.

Graves containing assemblages of the last of the distinguished categories, i.e. G, on Grzęda Sokalska, belonging already to the MC, were found either within the space originally covered by a *kurgan* mound or on its rim. The first group includes assemblages from graves nos. 1, 2 and 4 on site 38 in Łubcze [Bagińska 1996a], grave no. 1 on site 25 [Koman 1999:45, 50, Fig. 7:1-5] and from grave no. 1 on site 37 [Bagińska 1997:40, 47] in the same locality as well as from grave no. 2, on site 25, in Nedeżów [Bagińska 1997a:190]. The other group comprises the assemblages from grave no. 1, in *kurgan* 2, on site 1 located in the roof part of the clay-pit from which clay was taken to build the CWC *kurgan* [Koman, Machnik 1991:9, 11, Fig. 1], from

grave no. 3 (probably of the MC), on site 1 in Werszczyca [Bagińska 1997:49-50, Fig. 4e] and the assemblage from grave no. 8, on site 31, in Werszczyca, already discussed in this paper, located about 2.5 m from the original rim of the *kurgan* mound. In both cases, the burials with category G assemblages should be treated as younger than the graves for which *kurgans* were built. This is true also for the graves that were situated in the space covered by their mounds. For the graves were placed there by sinking them into the mounds as was certainly the case with *kurgan* 2, on site 25, in Łubcze, where a burial (grave no. 1) with a category G assemblage cut into the corner of a grave pit centrally located under the *kurgan* mound and containing a category A assemblage [Koman 1999:43, 45, Fig. 2]. Also in two other cases, namely, on site 37 in Łubcze [Bagińska 1997:47, Fig. 2A] and on site 25 in Nedeżów [Bagińska 1992:10, Fig. 1] graves with category G assemblages were sunk (dug in) in the more or less central part of the *kurgan*, most likely through its mound. It could have been them that damaged the pre-existing graves with assemblages of category A.

The burials containing category G assemblages come form different MC phases, beginning with the Early Mierzanowice phase, or even the Proto-Mierzanowice one, [Bagińska 1997a:203-204], temporally close to or in part even contemporaneous with younger CWC grave assemblages in Małopolska [Kadrow, Machnik 1997; Włodarczak 2001:118, Fig. 9]. This is suggested by the range of calibrated probability distributions of the dates for grave no. 1, on site 37 in Łubcze [Machnik 1999:246, Fig. 16] coming most likely from that very phase of the MC. In its broadest length, the range covers the period of 2510–2290 BC. Relying on ^{14}C dating of Małopolska MC assemblages [Machnik, Kadrow 1997:169, 170, Fig. 70-71], a younger period should be adopted here, i.e., **2450–2300 BC** within that broad range. It would be a period, considering its lower limit, very close to the dates adopted by us for the assemblages of categories E and F on Grzęda Sokalska. It is worth noting again here the similarity in ornamentation between a cup from the above-discussed MC grave (Fig. 9), on site 37, in Łubcze and a beaker from a category E assemblage (Fig. 7) in grave no. 2, in *kurgan* 2, on site 2 in the same locality [Machnik 1999:139, Fig. 5:5]. The similarity was one of the arguments that we used for rejecting the ^{14}C date obtained for this assemblage as being too early[16].

The comprehensive chronological analysis of the distinguished categories of grave assemblages unearthed during excavations of *kurgans* on Grzęda Sokalska

[16] As being consistent with the expectations, one may also accept a radiocarbon date obtained for another assemblage of category G in the area in question, namely, for the assemblage from grave no. 8, on site 31 in Werszczyca [Bagińska, Machnik, 2003:43-44, 53, Fig. 5f, 11]. The range of probability distributions of this date, i.e. 2140–1770 BC corresponds to the chronology of the classic and beginnings of the late phase of the MC [Kadrow, Machnik 1997:169, Fig. 70-71]. Such a dating of this assemblage is also supported by a bone disc making part of it [Bagińska, Machnik 2003:43, Fig. 5f] and being one of grave goods typical of this very development phase of the MC. By contrast, there is no consistency whatsoever with expectations in the case of a ^{14}C date obtained for the unquestionably late assemblage of category G from grave no. 2, on site 25, in Nedeżów [Bagińska 1997a:193, Fig. 1a, c-d]. The date obtained for this assemblage, 4270±60BP (Ki-6302) is absolutely too early because it corresponds to the oldest dates obtained for the CWC.

justifies two major conclusions. First, all assemblages from category B to category G are younger than those of category A (i.e. showing traits of the older phase of the CWC), for which the investigated *kurgans* were built. Second, there is no convincing evidence for any major time differences in depositing assemblages of individual categories beginning with category B. On the contrary, the ^{14}C dates obtained for them, after calibration, would indicate in some cases close chronological proximity. This, in turn, agrees with certain stratigraphic observations (see the location of two niche graves containing assemblages of categories B and D on the original rim of the *kurgan* on site 31 in Werszczyca; Fig. 2).

Of course, there must have been some time differences between these assemblages but they were not very large, at most several decades. The same conclusion can be drawn from the situation discovered in a niche grave in the *kurgan* on site 4 in Hubinek. For if one assumed that the vessels found there, characteristic of category B assemblages, were actually grave goods of an earlier deceased person, whose bones had been moved to the wall of the grave chamber when a body accompanied by category C grave goods was placed in the grave, the time difference between the two burials (hence between assemblages B and C) would not be greater than it takes a human body to decompose making it possible for the same grave to be used again.

6. CONCLUSIONS. AN ATTEMPT TO EXPLAIN THE PROCESS OF CULTURAL CHANGES ON GRZĘDA SOKALSKA IN LIGHT OF THE ANALYSIS OF THE DISTINGUISHED CATEGORIES OF GRAVE ASSEMBLAGES

The first community that appeared on Grzęda Sokalska after the FBC was the population of the older phase of the CWC. In light of radiocarbon dating, this could have happened as early as in the first two centuries of the 3rd millennium BC. The traces of these people are *kurgans* with graves containing assemblages of category A distinguished here. The vessels and other artifacts included in these assemblages (e.g. stone shaft-hole axes and flint arrowheads), encountered across large areas of the vast range of the CWC, indicate that the phase of *kurgan* building could have lasted on Grzęda Sokalska a long time-certainly to about the middle of the 3rd millennium BC. Those were the times (the first half of the 3rd millennium BC) when GAC populations still lived in areas to the north and east of Grzęda Sokalska, i.e. on the considerable portion of the Lublin Upland, Volhynia and Podolia, while the Małopolska Upland was inhabited by the communities of the late phase of the local, Kraków-Sandomierz group of the CWC, which would soon eliminate the so-called Złota culture on the Sandomierz Upland.

The situation changed around the middle of the 3rd millennium BC when we observe a noticeable weakening and soon afterwards a complete demise of GAC settlement in the vast areas of Volhynia and Podolia [Kadrow, Szmyt 1996; Szmyt 1999]. These areas, separating like a wide belt until then (i.e. in the first half of the 3rd millennium BC) the zone of "compact settlement" of CWC populations from the eastern peripheral branch of this culture [Buchvaldek 1981], which undeniably the MDC was, thus stopped being a barrier for the eastern movement of CWC representatives [Machnik 1996; 1999] and the western movement of MDC populations. An archaeological trace of the appearance of a small group of MDC representatives on Grzęda Sokalska at the turn of the 26th century BC is category C of grave assemblages. Their arrival could have been preceded by a reconnaissance by some individuals of this culture south of Grzęda Sokalska, in the area of today's Lubaczów not far away, who left behind a trace in the form of a grave assemblage of the same category in Młodów [Machnik, Pilch 1997].

MDC representatives who arrived in the region found there population groups exhibiting cultural traits of the already younger phase of the CWC. They left behind an archaeological trace in the form of grave assemblages of category B. The change of traits with respect to those of category A, although it could have begun earlier under the cultural impact coming from the west (chiefly from the Małopolska Upland) in the early phase of the Kraków-Sandomierz group of the CWC, was certainly a result of an influx of individuals from this group in its late development phase on Grzęda Sokalska. A similar situation undeniably took place, albeit incidentally, in the area of Lublin, where so far only two human burials belonging to that group of the same period have been found [Głosik 1968:Tab. V].

The contact between the representatives of two branches of the great CWC complex on Grzęda Sokalska, of which the MDC was part as well, in all likelihood was peaceful. Both communities (i.e. of the Małopolska CWC and MDC) initially kept their individual cultural traits, at least in giving their dead typical vessels to accompany them in their graves. The vessels are the basis on which we distinguish category B and category C assemblages. The burials containing assemblages of both categories were placed close to the bases of mounds of already existing CWC *kurgans*. There could have been cases, as can be seen at site 4 in Hubinek, when for the purpose of burying a new arrival from the east (MDC) an available chamber of a niche grave was used, a chamber that had been made for a deceased person of the Kraków-Sandomierz group of the CWC.

As a result of a some kind of cohabitation or even closer integration, for instance through marriages between MDC people and CWC representatives showing cultural traits of the late phase of the Kraków-Sandomierz group, a peculiar form of cultural syncretism was reached. Its early manifestation and stage at the same time, taking place in all likelihood already in the first generation of immigrants, would be

graves with category D assemblages. The grave goods placed in such graves included both authentic MDC beakers and vessels with traits of the Kraków-Sandomierz group of the CWC; the latter was also characterized by the niche form of the grave itself. Such would be the beginnings of the new, recently distinguished, syncretic Sokal group [Machnik *et al.* 2001].

A manifestation of deepening syncretism (its successive stage), taking place probably in the generation of children, possibly born to mixed marriages of CWC people and newcomers from the Dnieper drainage, is observed in our opinion in grave assemblages of category E. These assemblages, as we know, include beakers having altered, but still distinguishable MDC traits and CWC vessels exhibiting a certain local character. Therefore, the integration process of both communities must have been advanced enough in this case at that time.

A certain interpretation ambiguity is posed from this point of view by assemblages of category F that occur far beyond Grzęda Sokalska [Machnik *et al.* 2001:39, Fig. 5]. The vessels forming part of them are only a pale imitation of MDC beakers. They could have been made by the generation of grandchildren of those who placed only authentic MDC beakers (category C assemblages), only CWC vessels (category B assemblages) or both (category D assemblages) in the graves of their dead.

The cultural process resulting from the integration of two different human populations did not last very long on Grzęda Sokalska as it can be concluded from the chronological analysis of archaeological sources presented above. It might have continued for the lifetime of two or three human generations. The effects of the process are observable, however, also outside of Grzęda Sokalska, in the area between the upper Bug, Dniester and Vistula rivers. They manifest themselves as beakers showing certain MDC traits and indicting connections, in form and ornamentation, above all to specimens from known category F assemblages, as well as E ones, always, however, in a context indicating their affiliation to the CWC [Machnik, Pilch 1997:160, Fig. 9:6, 15; Machnik *et al.* 2001:395, Fig. 4 D, G]. They are a product of imitation of Bug patterns (from Grzęda Sokalska) by other groups of CWC populations or they were quickly spread over the area mentioned above during pastoral treks of these societies [Machnik 1999].

Regarding some of the distinguished categories of grave assemblages, i.e. D-F, as a manifestation of successive stages (degrees) of social integration, and certainly of cultural syncretism, one can observe in it a tendency to gradually lose MDC traits while retaining CWC ones. This may be evidence of a stop in the influx of MDC people to Grzęda Sokalska or adjacent areas (after the arrival of first groups around the middle of the 3rd millennium BC) and enrichment of the local CWC (late-Corded) substrate by cultural traits peculiar to the MDC. It is possible that initially this was caused to some extent by the eastern expansion of the late CWC populations (late-Corded element) into Volhynia and Podolia already rid of

GAC settlement. The ultimate factor, preventing any further integration that had begun in the middle of the 3rd millennium BC between individual branches of the vast CWC complex (including the MDC) and bringing about a rather quick demise of this culture on both the Małopolska Upland and in the entire drainage of the upper Vistula, upper Bug and upper Dniester rivers, was the rise of a new culture, i.e. the MC. It left its trace on Grzęda Sokalska, as we know, in the form category G assemblages with one of such assemblages (in grave no. 1 on site 37 in Łubcze) being a mark of the oldest stage of this culture and at the same time of the upper chronological limit of the CWC in this area falling undoubtedly on ca. 2400 BC.

The dynamics of the dissemination of early MC traits towards the east, in particular in Volhynia, is amazing [Kadrow, Machnik 1997:30, Fig. 7; Machnik, Tkaczuk 2003:494, Fig. 9][17]. The colonization by MC settlers from the west or only a total covering of these areas by a new style (most probably both) brought about again an isolation of the drainage of the middle and upper Dnieper from the area located between the upper Bug, Vistula and Dniester, despite the fact that the MDC continued to exist in its home areas. This is borne out by some late copper goods contained in its grave assemblages [Artemenko 1964:47, Fig. 11; 1967:29-37, Fig. 18-27] in particular by the so-called *Schaftlochäxte* (shaft-hole axes) [Artemenko 1964:40, Fig. 5:19; 1967:30, 31, Fig. 19:2, 20:6].

Translated by Piotr T. Żebrowski

[17] The so-called Volhynia bridge could have become especially impermeable. It is there that we deal with mass occurrence, as far as the Horyń River in the east, of pottery showing traits of the early phase of the MC (without any traces, as it seems, of any other cultures at that time). The traits lasted there longer than in neighboring Podolia [Kadrow, Machnik 1997:139 ff.]. Whereas in the latter area, next to assemblages having early Mierzanowice traits, there occur other assemblages with clear CWC traditions and others indicating strong southern influences coming from the lower Danube drainage, chiefly from the Schneckenberg-Glina III culture. The latter are initially recorded mainly in southern Podolia and Pokucie gradually spreading with time to the remaining part of Podolia (for instance, the so-called Jedynec group) and causing a break in the development of MC elements in this area making their presence there shorter than in neighboring Volhynia [Machnik 1991:172].

Baltic-Pontic Studies
vol. 12: 2003, 241-246
PL ISSN 1231-0344

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ABSOLUTE CHRONOLOGY OF THE MIDDLE DNIEPER CULTURE BETWEEN THE UPPER BUG, VISTULA AND DNIESTER RIVERS

The present paper is a commentary on the work by Jan Machnik also in this volume. I shall attempt here to corroborate absolute chronology brackets presented there with the highest possible precision. They concern elements of the Middle Dnieper culture (MDC) found in the younger assemblages of the Corded Ware culture (CWC), above all, in the drainage of the upper Bug. For this purpose, I shall rely on the principles of the wiggle matching technique [Weninger 1986:38-40; see also Manning, Weninger 1992; Kadrow 2001] used to calibrate the results of radiocarbon dating.

Limiting oneself to probabilistic methods alone when calibrating radiocarbon dates usually leaves one with results that contradict historical knowledge. This was made abundantly clear when samples relating to the period of the Old Kingdom in Egypt were dated [Weninger 1986:11]. A simple summing of probability distributions of ^{14}C dates in the range of 1 sigma (68.2%) for samples from grave assemblages containing MDC elements yields surprisingly wide chronological brackets of this phenomenon. They fit into periods of 2900–2800 and 2700–2300 BC [Włodarczak 2001:Fig. 4]. Not very convincing, either, is an attempt to "visually" and hence arbitrarily interpret the diagram of summed probability distributions of the dates. As a result of this attempt, the MDC elements were preliminarily dated at 2650–2450 BC [Włodarczak 2001:105]. The results of penetrating chronological analyses by Jan Machnik (see his paper in this volume) show the temporal brackets of this phenomenon to be much narrower. In addition, even only general knowledge about the time depth of integration processes [Kwaśniewski 1987:163-164] and cultural syncretization [Posern-Zieliński 1987:337-339] makes one narrow down the temporal brackets of their specific and historical instances.

Jan Machnik, who coined the concept of the "Sokal group" of the CWC [Machnik *et al.* 2001; Bagińska, Machnik 2002], pointed out to its syncretic character. It resulted from integrating processes going on during three consecutive stages (artifact groups D-F) not counting an influx (group C) of alien (Middle Dnieper) populations into the upper Bug drainage occupied at that time by populations of the Late CWC (group B). The moment of influx dates the whole period of integration of MDC elements with the environment of the CWC to the 25th century BC (or more precisely to ca. 2490–2400 BC).

A way of coming closer to the actual calendar age of a given sample is using the archaeological wiggle matching technique. Its use requires additional knowledge on the actual age of the sequence of samples being dated [Kadrow 2001:75; see also Bell *et al.* 1990:73-76]. Relying on such knowledge, in accordance with the rules of Bayesian statistics [Sibson 1977:55], it is possible to assign to respective probabilities of such dates different degrees of acceptance. Consequently, from a broad interval of values on the scale of calendar years obtained as a result of probabilistic calibration, one can select much narrower values. The latter are characterized by a level of mathematical probability that is not lower than that of other values but the logical probability of which is higher than that of other values.

The additional knowledge enabling us to determine the actual age of the sequences of dated samples comes from the archaeological analysis of grave assemblages comprising MDC elements carried out by Jan Machnik. Additional information is offered by relevant literature. The knowledge may be summarized as follows: (1) in eastern Poland, Volhynia and Podolia, a decline of the Globular Amphora culture (GAC) is observable between 2600–2500 BC; it had disappeared altogether from this area by 2400 BC [Kadrow, Szmyt 1996; Szmyt 1999:83-85; Machnik *et al.* 2001:394], (2) the decline followed by the disappearance of the GAC settlement may have enabled penetration of the area located between the upper Bug, Vistula and Dniester rivers by the populations of the MDC (group C assemblages), (3) in the said area, under stimuli coming from the west, from the area occupied by the Kraków-Sandomierz group, a late phase of the local CWC (group B assemblages) had developed somewhat earlier, (4) the syncretic Sokal group is made up of grave assemblages of types D, E and F, and (5) the end of which may be marked by the emergence of proto-Mierzanowice groups on the upper Bug River (group G assemblages).

An important element of this knowledge is an assumption about the brevity of syncretization processes, for which as a model reference may serve the processes of stabilization in the societies of *colluvies gentium* type [Zimmer 1990:141; Kadrow 1995:127-131] with the corresponding stages of pidgin and creole languages [Hall 1962:151-155] lasting up to three generations (or not more than 100 years).

To determine the date of MDC groups' arrival on the Upper Bug, we have only two ^{14}C dates from Hubinek (Ki-6889 3995±55 BP and Ki-6990 4070±60 BP). The

ranges of 68.2% (1 sigma) of probability distributions after calibrating these dates are as follows: Ki-6889 — 2620–2610 and 2580–2450 BC, and Ki-6990 — 2860–2810, 2680–2550 and 2540–2490 BC (Table 1). In the periods of 2620–2610, 2580–2550 and 2540–2490, the ranges of probabilities of both dates coincide. Working on the assumption that MDC infiltration into the drainage of the upper Bug was brief, it can be presumed that the event took place within one of the above-named intervals. Taking into account the process of "thinning out" of GAC settlement on the Volhynia-Podolia bridge in 2600–2500 BC, it should be assumed that the most probable time of this infiltration could have been the years between **2540** and **2490** BC.

Table 1

Radiocarbon datings from selected features of the Corded Ware culture and the Middle Dnieper culture

Site	Lab. No.	Feature	BP	Probability range of sigma-1	% of probability	Category of the grave assemblages [after Machnik, An Interrupted. . . in this volume]
Hubinek 3	Ki-6890	grave 3	4070±60	2860-2810 2680-2550 2540-2490	11,5% 41,4% 15,2%	C
Hubinek 3	Ki-6889	grave 2	3995±55	2620-2610 2580-2450	1,9% 66,3%	C
Nedeżów 22	Ki-6894	kurgan 2; grave 1	4020±55	2620-2460	68,2%	D
Wereszczyca 31	Ki-8953	kurgan 1; grave 6	3850±50	2460-2440 2430-2420 2410-2370 2360-2270 2260-2200	1,1% 2,1% 11,4% 34,0% 19,6%	D
Wereszczyca 31	Ki-8952	kurgan 1; grave 5/6	3850±60	2460-2420 2410-2270 2260-2200	4,9% 44,6% 18,7%	D
Łubcze 2	Ki-6298	grave 2	4160±50	2880-2830 2820-2800 2790-2660 2650-2630	13,3% 6,1% 47,0% 1,9%	E
Łubcze 37	Ki-6300	grave 3	4050±55	2840-2810 2670-2640 2630-2470	3,5% 3.6% 61,1%	E
Łukawica	Bln-1093	kurgan K	3800±100	2430-2420 2410-2370 2360-2130 2090-2040	1,2% 5,8% 54,0% 7,2%	E
Brzezinki	Bln-1089	kurgan I	4030±100	2860-2810 2750-2720 2700-2450	8,4% 3,1% 56,7%	F-like
Wola Węgierska	Gd-11353	kurgan; grave	3920±50	2470-2330 2320-2300	64,7% 3,5%	F-like
Wola Węgierska	Gd-11354	kurgan; ditch	3860±70	2460-2270 2260-2200	56.6% 11,6%	F-like

A trace of certain integration processes and of the existence of a syncretic group is assemblages of types D and E, and in part of type F. In accordance with the anthropological-cultural model presented above, the dates for the assemblages should not precede the chronology of pure MDC assemblages (type C) given there.

We have three dated grave assemblages of type D (Ki-8952, Ki-8953 and Ki-6894). The ranges of 68.2% of probability distributions of these dates are respectively as follows: Ki-8952 — 2460–2420, 2410–2270 and 2260–2200 BC; Ki-8953 — 2460–2440, 2430–2420, 2410–2370, 2360–2270 and 2260–2200 BC and Ki-6894 — 2620–2460 BC (Table 1). The probability distributions of these dates coincide about **2460** BC. This period is younger than the time of the influx of MDC populations, thus being in keeping with the logic of development of a syncretic group. In the period measured by the length of one generation from the moment MDC migrants had arrived at territories occupied by the CWC, the first mixed structures arose whose archaeological manifestation is the assemblages of the syncretic group.

Another three dates are related to type E assemblages (Ki-6298, Ki-6300 and perhaps Bln-1093). The ranges of 68.2% of probability distributions of these dates are respectively as follows: Ki-6298 — 2880–2830, 2820–2800, 2790–2660 and 2650–2630 BC; Ki-6300 — 2840–2810, 2670–2640 and 2630–2470 BC and Bln-1093 — 2430–2420, 2410–2370, 2360–2130 and 2090–2040 BC (Table 1). The first of these dates (Ki-6298) is too old and as such should be excluded from further discussions. Its upper limit (2630 BC) markedly departs from the logically most probable date of the beginning of the influx of MDC migrants, i.e. 2490 BC. Unfortunately, the probability ranges of calibrations of the next two dates do not coincide. The upper limit of one of them (Ki-6300) is marked by 2470 BC, while the lower limit of the next one (Bln-1093) is indicated by 2430 BC. Somewhere between these two dates, i.e. in the middle of the 25th century BC, type E assemblages must have appeared.

Only indirectly can one determine the absolute chronology of type F assemblages. Certain typological affinities with vessels found in assemblages of this type are also observable in graves deprived of any MDC elements and ^{14}C dated (e.g. Gd-11353 and Gd-11354 from Wola Węgierska and Bln-1089 from Brzezinki). The ranges of 68.2% of probability distributions of these dates are respectively as follows: Gd-11353 — 2560-2530 and 2500–2280 BC; Gd-11354 — 2460–2270 and 2260–2200 BC and Bln-1089 — 2860–2810, 2750–2720 and 2700–2450 BC (Table 1). The ranges of probability distributions of all these dates coincide in the period from 2460 to 2450 BC. This fact strongly bears out the attempt to date the assemblages of the syncretic Sokal group at the middle of the 25th century BC.

In the light of the above analyses, it can be assumed that around the end of the 26th century BC or in the early 25th century BC (ca. 2500 BC; Fig. 1),

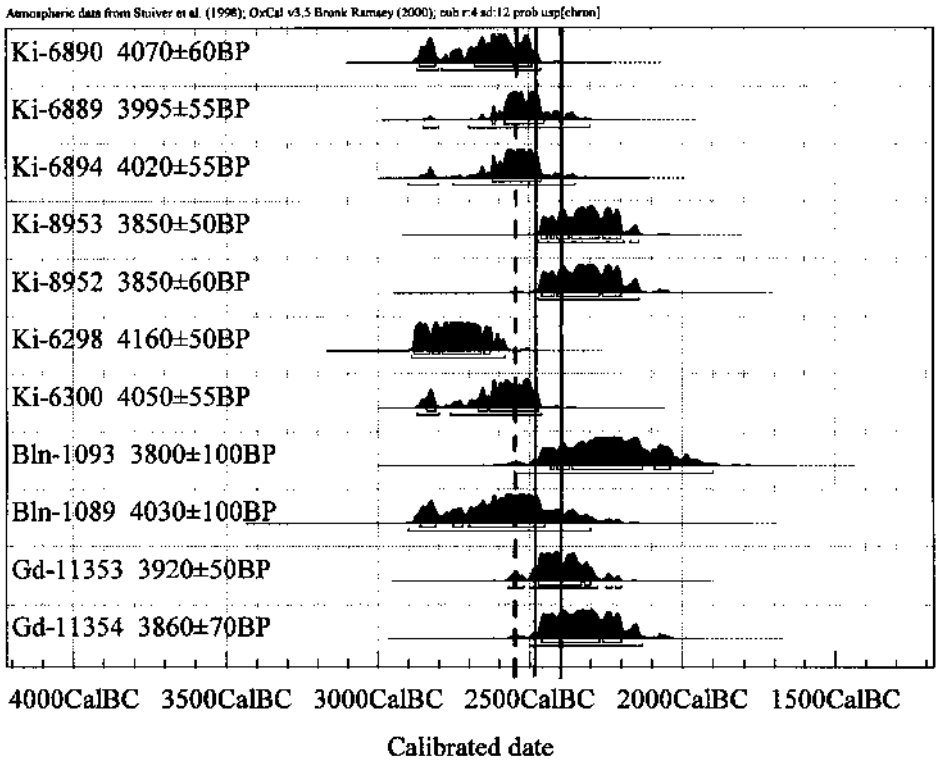

Fig. 1. Absolute chronology of the Middle Dnieper traits (2540/2490–2400 BC) against the background of the probability distribution of the radiocarbon datings from the features which contain given traits

there appeared a small group of migrants from the MDC area (type C assemblages) in the drainage of the upper Bug. The migrants took advantage of the steady decline of the permanent GAC settlement network on the Volhynia-Podolia bridge. They settled in the environment of local CWC groups of phase II, the populations of which dug grave pits of their dead into pre-existing, earlier *kurgan* mounds. During the life of a single generation, integration processes brought about the rise of social syncretic structures, the first archaeological manifestations of which are type D assemblages (ca. 2460 BC at the latest; Fig. 1). Only slightly later could have appeared type E and F assemblages being effects of an advancement of the integration processes and diffusion of newly created elements. This could have happened during the life of another one or two successive generations.

The absence of any further migrations from the east and the influx of the populations of the Proto-Mierzanowice phase of the MC stopped the process of maturing

and stabilizing the Sokal group (ca. 2400 BC at the latest). The obtained results of wiggle matching fully bear out the conclusions of Jan Machnik's archaeological analysis.

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 247-252
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE BEAKERS WITH SHORT-WAVE MOULDING COMPONENT IN THE DEVELOPMENT OF THE MIDDLE DNIEPER CULTURE

The internal divisions of the Corded Ware culture (CWC) complex in the borderland between the East and West of Europe are among those that we know the least about. This is especially true for relationships between Circum-Baltic (CWC-B), Circum-Carpathian (CWC-C) and Middle Dnieper (MDC) variants or rather, more specifically, for their share in the settlement of the taiga between the upper Neman and Pripets rivers (physiographically speaking: Polesie province [Kondracki 1969]).

Recently, this state of affairs has been slowly changing mainly owing to the studies by M.N. Kryvaltsevich. Notice should be taken of considerable progress in radiocarbon dating of the northern ("forest") MDC [Kryvaltsevich 1996; Kryvaltsevich, Kovalyukh 1999] or in the taxonomic assessment of "horizon A" or more generally "corded horizon" in Belarus [Kryvaltsevich, Kaletchyts 2000; Kryvaltsevich 2001]. The mentioned author gives proof that CWC infiltration along the Podlassie → Upper Dnieper Area trail took place chiefly in the times of "local group" and "epicorded" horizons [cf. Machnik 1979] and concerned both the CWC-B and CWC-C (in the quoted approach the name "Carpathian-Volhynia-Podolia" is used).

The present paper may be treated as an attempt to detail the above-outlined conclusions using new data. Namely, the two highly informative ^{14}C dates that have been obtained for an MDC settlement (!) at Prorva, Homel Region, from a settlement microregion known already from the work on radiocarbon chronometry of the Dnieper CWC [Kryvaltsevich 1996; 1999]. A significant incentive is a possibility to date "beakers with short-wave mouldings" known as *Wellenleistentöpfe* (WLT). Such vessels — associated mainly with CWC settlement materials — are recorded in a vast area from the Rhine drainage in the west to as far as the Dnieper drainage in the east (Fig. 1A) [Kurzawa 2001:Fig.7; Kryvaltsevich 2001]. An opinion prevails that these forms may serve as identifiers of "horizon A". This opinion is

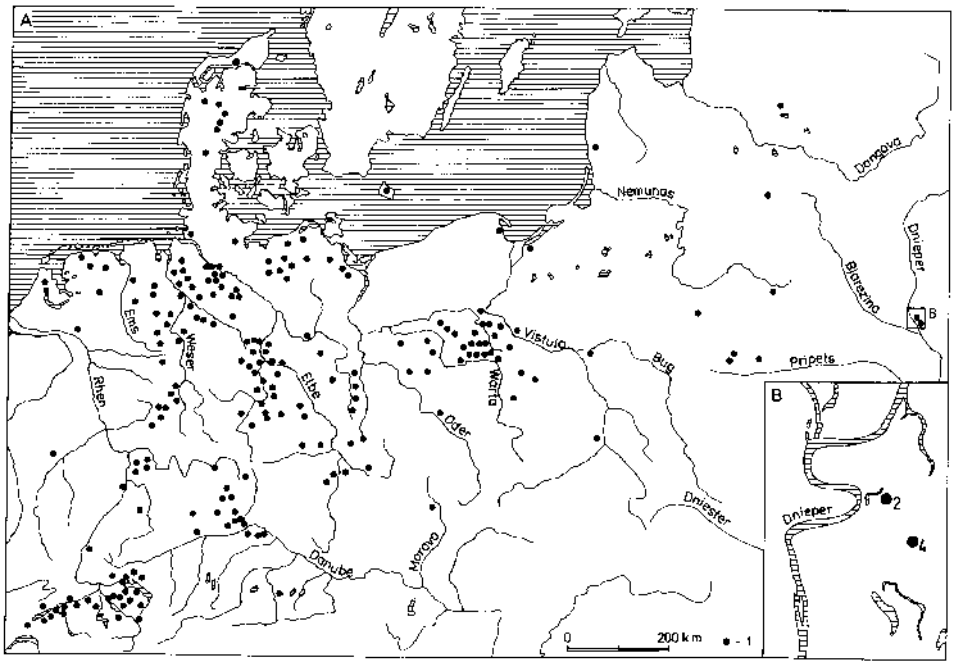

Fig. 1 The range of WLT pots (A) and the location of sites Prorva 2 and Prorva 4 (B). According to Kurzawa 2001 and Krautwurst 2002, with supplements by the authors. 1 - sites with a WLT pots.

supported by early radiocarbon dates obtained for them, e.g. on the Polish Lowlands (Krusza Podlotowa-2, Kujawy-Pomerania Province, 2804±103BC) [Kośko, Kurzawa 1997:Fig.5, 121-122].

A broader assessment of current trends in the discussion of this question throughout Europe has been recently given by J. Kurzawa [2001:155-165] and R. Krautwurst [2002].

1. PRORVA, HOMEL REGION, RAHACHOV DISTRICT, SITE 4. LIST OF DATES

Site Prorva 4 is situated on a dune, in the old riverbed of the left-bank Dnieper being a part of an MDC settlement complex (Fig. 1B) [Kryvaltsevich, Kovalyukh 1999]. The site was identified in 1996 (I. Yazepenka, M. Kryvaltsevich, A. Rikunov) by making a probe excavation 1 x 4 m in size. Investigation was carried out in 1999

(I. Yazepenka). Two excavations were made of a total area of 172 m^2. The following stratigraphy was recorded:

(1) dark-grey sandy humus (20-45 cm thick);

(2) a thin layer of sand saturated with charcoals (10-15 cm thick);

(3) a layer of fine-grain sand of a black-grey hue (30-65 cm thick);

(4) rock-bed-pale yellow, fine-grain sand (55-95 cm from the ground surface).

Features (a pit and a groove structure) were recorded in layers 2 and 3. Both in the "cultural layer" (2-3) and in that of the features, MDC pottery accompanied by earlier ceramic goods of the Dnieper-Donets culture (DDC) was unearthed along with flint artifacts. A sequence of two settlements can be established — DDC and MDC — with the source materials of the latter clearly dominating in the examined area (including features). With the stratigraphic-cultural situation being as described above (state of multiculturalism), it was impossible to use samples of charcoal for ^{14}C dating of selected taxa. Such a chance, however, was offered by layers of a carbon deposit covering some surfaces of MCD vessels.

In the ^{14}C laboratory of the Department of Environmental Radiochemistry, Institute of Geochemistry and Physics of Minerals, Ukrainian Academy of Sciences, in Kiev two samples (a, b) of the carbon deposit were analyzed [calibration: Weninger *et al.* 2002].

a. Ki 9216: 3875±100 BP = 2330±140 BC. The sample was taken from a pot with a short-wave moulding, the 13-15 fragments of which had been recorded at the depth of 20-50 cm (Fig. 2:1). Made of clay with a temper of potsherds, the vessel had walls 9-13 mm thick. In the Dnieper drainage, vessels of this type are identified with the final — IV — stage of the eastern-Polesie variant of the DDC or the beginning of the developed stage of the MDC. In relation to the central European CWC, they are associated with its horizon A.

b. Ki 9218: 3810±100 BP = 2250±150 BC. The sample was taken from a pot decorated with a "gusenichniy stamp" (a stick around which a string or thread is wound; Fig. 3). Made of clay with a temper of medium-fine breakstone, the vessel had walls 9-11 mm thick. Vessels having these techno-stylistic traits are classified as settlement ("kitchen") pottery of the Dnieper-Desna variant of the MDC [Artemenko 1987:40, Fig. 13].

A joint calibration of both dates justifies dating the MDC settlement of Prorva 4 at ca. 2291 BC.

The date fits into the interval of 2760-2170 BC in which the MDC Prorva settlement microregion has until recently been thought to have developed (cemeteries Prorva 1 and Prorva 2) [Kryvaltsevich, Kovalyukh 1999:154-155, Tab.1; Klochko, Kośko, Szmyt 1999:276].

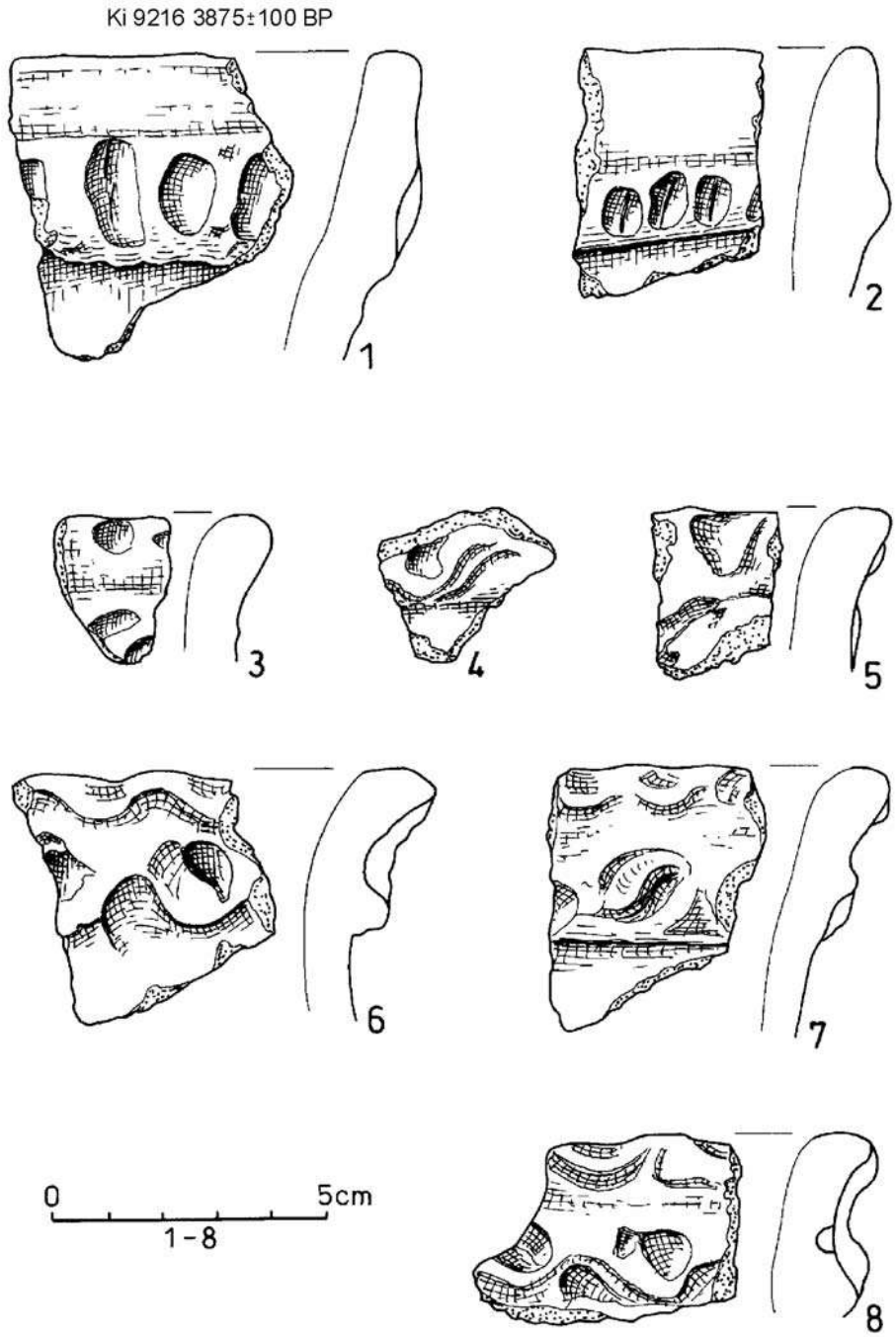

Fig. 2 WLT pots from Upper Dnieper Area. 1-2 - Prorva, site 4 (1 - ^{14}C dated fragment); 3-6 - Prorva, site 2; 7-8 - Luchyn

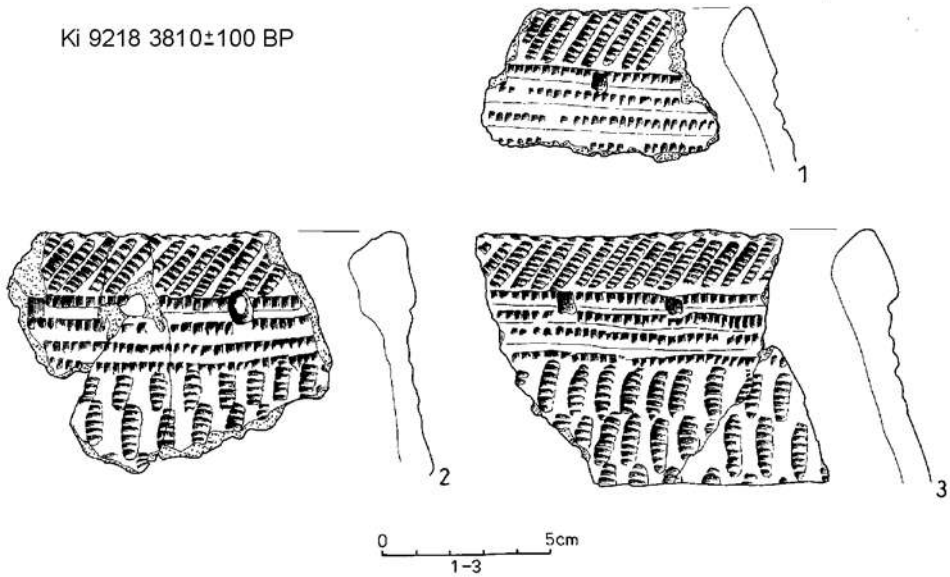

Fig. 3 Prorva, Homel region, site 4: pots decorated with impressions of a "stick around which string is wound" (*gusenichniy* stamp)

2. THE POSITION OF WLT VESSELS ON THE MDC PERIODIZATION SCALE

As it has already been mentioned, the incentive to ^{14}C date the materials from site Prorva 4 was the possibility to assess chronologically the position of WLT vessels on the Dnieper. WLT pots — occurring chiefly in settlement pottery assemblages — have been left out from the MDC chronometry currently being constructed, as it is exclusively "cemetery-based". The assessment of the chronological position has an impact on two important aspects of the investigation of the Corded Ware culture complex:

(a) interpretation of the WLT as an indicator of horizon A also within the range of the Dnieper branch of the Corded Ware culture complex (MDC) and

(b) provenance of the "corded horizon" or rather the "western stimulus" in the development of the MDC, among the identifiers of which the WLT is sometimes mentioned.

a. The ^{14}C dates place the Dnieper WLT pots around 2291 BC (Fig. 2), i.e., on the comparative scale of "western" CWC branches, at the point of contact between the Kraków-Sandomierz group and the Mierzanowice culture (phase I) in Małopolska [Włodarczak 1998:38, Fig. 3] or synchronically with CWC phases 2, 3, 4 in

Kujawy [Czebreszuk *et al.* 2000:Fig. 1]. Hence, in both cases, their connection to horizon A (phase I of the CWC) is excluded. The dates, at the same time, present an argument in favour of the conception that WLT forms had a diverse, generally long, chronology within the range of CWC groupings in different regions [Kurzawa 2001:163-165; Krautwurst 2002:91].

b. Among the views on the provenance of the MDC, endogenous conceptions clearly dominate. They point to Eastern Europe as its place of origin [cf. Artemenko 1987:41-42]. Considerable controversies are generated, however, by more detailed assessments, namely, those of the set of culture-making agents associated with both the prologue and further stages of the system's integration. WLT pots are, on this background of provenance discussions, a "minority" exogenous element of a generally "western" provenance [Kryvaltsevich, Kaletchyts 2000; Kryvaltsevich 2001]. Observations from site Prorva 4 give more details on their origin. It follows that WLT pots were a component of the late CWC transmitted along the Podlasie → Upper Dnieper Area trail mentioned earlier. The dates bear out the suggested general chronology of the said infiltration ("local groups" and "epicorded" horizons) making the chronology more precise-ca. 24th-23rd century BC. We have also enough information to be more specific about the point of departure of the trail. The current state of exploration of the range of WLT use (Fig. 1) justifies joining their taiga forms (Belarus) with the territory of the CWC-B or rather with its centres in Wielkopolska and Kujawy (Wielkopolska-Kujawy group) or the south-eastern coast of the Baltic (Rzucewo-Pamariu culture).

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 253-306
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE TRZCINIEC CULTURAL CIRCLE BETWEEN THE VISTULA AND DNIEPER BASINS

INTRODUCTION

The absolute dating of the Trzciniec complex has gained the status of one of the central issues of the Bronze Age in the prahistoriography of the eastern and central European countries over the last decade [e.g. Czebreszuk 1996; 1998a; 1998b; 2001; Górski, Kadrow 1996; Kempisty, Włodarczak 1996; Górski 1998a; 1998b; Kovalyukh *et al.* 1998a; 1998b; Makarowicz 1998a; 1998b; 1998c; 2001a; 2001b; Włodarczak 1998; Lysenko 2001b; Taras *et al.* 2002; Czebreszuk *et al.* 2003]. In the six years that have passed since the last collective publication of ^{14}C determinations for the Trzciniec Cultural Circle (TCC), the number of dates obtained for this taxon has grown more than two times (from 76 to 187). A particularly high increase in the number of dates has been observed in the area on the Middle Dnieper River, Ukraine and in Małopolska, Poland. The overall number of dated sites has grown from 19 to 39 with the greatest, qualitative leap taking place in the same time primarily in the eastern subcircle of the TCC.

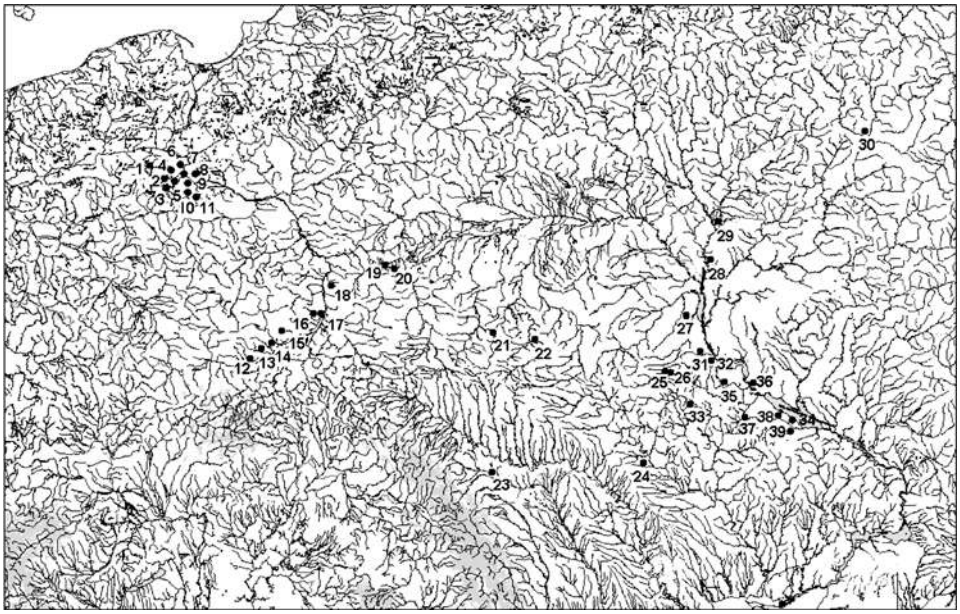

Fig. 1. Location of the Trzciniec Cultural Circle sites dated on the basis of the ^{14}C method. 1 - Biskupin 2a; 2 - Krusza Podlotowa 8; 3 - Żegotki 3; 4 - Kuczkowo 1; 5 - Piecki 1; 6 - Radojewice 29; 7 - Siniarzewo 1; 8 - Grabie 4; 9 - Borowo 12; 10 - Rybiny 14; 11 - Rybiny 17; 12 - Kraków-Nowa Huta-Cło; 13 - Słonowice G; 14 - Żerniki Górne; 15 - Miernów; 16 - Dacharzów 1; 17 - Dwikozy; 18 - Kazimierzów; 19 - Zienki; 20 - Dubeczno 1; 21 - Ivanye; 22 - Neteshin; 23 - Magala; 24 - Hordeevka; 25 - Malopolovetske-2A; 26 - Malopolovetske-3; 27 - Zdvizhevka; 28 - Pustynka; 29 - Abakumy; 30 - Rzhanitsa-Besets-2; 31 - Velikaya Bugaevka; 32 - Obuchov; 33 - Zhuravlikha; 34 - Borovitsa; 35 - Rossava; 36 - Bubnovaya Slobodka; 37 - Ksaverovo; 38 - Verguny; 39 - Subotov

1. RADIOCARBON DATABASES IN REGIONS

Out of 187 ^{14}C determinations obtained for the TCC* (Tables 1-6; Fig. 1), 102 come from the western subcircle (Vistula basin) while 85 concern the eastern one (basins of the Dnieper, Pripets and Southern Bug rivers as well as Carpathian Foothills and Volhynia). The best-sampled regions, i.e. those for which we have series of ^{14}C dates, include Małopolska (69) and Kujawy with Pałuki (33) in the west, and the middle Dnieper area (61) in the east. The other areas have yielded relatively few dates while there are no radiocarbon dates whatsoever for Mazowsze — one of the most important mesoregions for the study of the beginnings of the TCC.

* Including dates for transitional assemblages from the Iwno culture (IC) to TCC and the Mnogovalikovoy Pottery culture (MPC), and transitional assemblages from MPC to Trzciniec culture (TC).

The majority of analyses were made using short-living organic materials, mainly bones and, in a single case, shells (133 or 72.0%), and transformed short-living materials (charred bones — 4 or 2.1%). Forty-eight (or 25.9%) dates were obtained for long-living materials — charcoal and wood. In two cases we do not have any specific information on the nature of sample. Standard deviations range from 25 to 350 years. In the case of 57.0% of dates, the standard error is 50 years or less. An absolute majority of dates, after calibration, found their way to the plateaus of the calibration curve; only a small number of them are situated in its steep segments, which allows us to precisely determine chronologies [Czebreszuk, Szmyt 2001; Raetzel-Fabian 2001; Makarowicz 2001a].

Guided by modern methodological requirements, we have selected for calibration a group of determinations obtained from short-living and long-living organic materials coming from grave and settlement contexts unambiguously associated with the "Trzciniec" tradition [Czebreszuk, Szmyt 1998; 2001:177]. The results of radiocarbon dating were controlled by comparing them with the results of typological analyses and — less frequently — with stratigraphy, and eliminating evidently erroneous dates. For the purpose of determining the absolute chronology of units of formal systematics of both TCC subcircles (types, complexes, phases or horizons) and their chronology in particular regions, a group of most reliable dates was selected, i.e. those characterized by the highest informative value (chiefly dates of types IA and IIA) [Czebreszuk, Szmyt 1998], that did not contravene their archaeological assessment (typological and stylistic) and had a standard deviation of below 80 years. The last of the criteria was arbitrarily adopted because of a sizeable set of dates having a relatively high standard deviation (70 years). Discarding these dates would have considerably lowered the reliability of results. In some cases, these requirements were waived, especially when insisting upon them would have radically lowered the number of interpreted dates for a given region. When calculating the sums of probability distributions for dates from Kujawy and the middle Dnieper area as well as both subcircles no account was taken of radiocarbon dates referring to assemblages of an alternative cultural assignment as well as transitional complexes from the Iwno culture (IC) to the Trzciniec horizon (TH) and from the Mnogovalikovoy Pottery culture (MPC) to the Trzciniec culture (TC).

The obtained dates determine the chronology of 39 TCC sites: 15 settlements, 22 burials and 2 ritual features. They are shown in Tables 1-6, which also give commentaries on their reliability, i.e. consistency with the expected chronology of a given assemblage arrived at using strictly archaeological methods. The most representative of the dated TCC assemblages are characterized in general terms and presented in a graphic form (Figs. 2-25). In some cases, an absolute chronology was inconsistent with knowledge based on the hitherto established sequences of changes of various material culture components (mainly pottery stylistic, less frequently

metal artefacts). In the cases when datings differed much from expectations (Tables 1-6, comments column), we concluded that the sample analysed, for various reasons, did not refer to the "Trzciniec" episode at a given site and therefore was excluded from further studies.

2. THE WESTERN SUBCIRCLE OF THE TRZCINIEC CULTURAL CIRCLE

The western branch of the discussed cultural phenomenon was made up of two separate settlement zones that differed in terms of the natural environment and cultural traditions. In the north, on the lowlands covered mainly by sandy soils, Trzciniec structures were rather movable (only small settlements were built there) and susceptible to diverse local cultural inspirations and external influences. As a result of them, a large number of source assemblages, taxonomically diversified, developed. They are relics of activities by communities who in various degrees contributed to the emergence of the "Trzciniec world." The process can be better explained by using the concept of *horizon* (TH) or *cultural package* rather than that of *archaeological culture* [Kośko 1979; Makarowicz 1998a; Czebreszuk 1998; 2001]. In the south, after a relatively short period of mobility, some Trzciniec structures acquired characteristics of stable "village" communities. Settlements, in particular on the loess soils of western Małopolska, were long-lived and as a rule much bigger than in the north. For these reasons, the discussed phenomena can be easier explained in this zone using the traditional concept of *archaeological culture* — the TC [Górski, Kadrow 1996; Górski 1998a; 1998b].

2.1. THE LOWLANDS ZONE

The periodization system of the lowlands (chiefly Kujavian) branch of the TCC was developed primarily by analysing settlement assemblages and — to a lesser degree — sepulchral ones. Several units of formal systematics were distinguished and called horizons, from TH 1 to TH 7, and complexes (combining the traits of TH 1 and TH 3 — TH 1/TH 3) [Czebreszuk 1996; 1998; Makarowicz 1998a; 1998b; 1998c]. Also, transitional assemblages combining traits of the IC and the TH were distinguished. The units were systematized into four horizons of real periodization: proto-, early, classic and late Trzciniec ones [Makarowicz 1998a:156ff]. Some assem-

blages do not lend themselves to unambiguous interpretation in terms of cultural unit. Hence, there arises a dilemma, are they still IC or already TH, which we suggest to resolve by giving an alternative assignment (IC-TH) or treating them as "syncretic" assemblages (IC/TH).

The northern portion of the western subcircle, i.e. Kujawy and Pałuki, yielded 33 dates for 4 grave sites, 1 ritual feature and 6 settlement sites (Fig. 1, Table 1).

In the discussed mesoregion, ^{14}C determinations as a rule confirm conclusions following from typological analyses. One of few departures from the rule is the case of two dates concerning the assemblage from Radojewice 29, Kujawy (Table 1:7 and 12) [Makarowicz 2000a:473ff]. The dates, obtained from samples of bones coming from a mass grave containing remains of seven individuals, are inconsistent with their expected age. The sum of probability distribution of both dates is located in the time bracket of 1980 and 1870 BC, i.e. at least 400-500 years earlier than expected. The formal and stylistic traits of bronze goods (e.g. a pin and a ridgelike bracelet) as well as the technology of a vessel (now destroyed) show affinities with the Tumulus culture (TuC). This sets the chronology of the grave at the BB, i.e. 1600-1400 BC or, more precisely, at the younger period of this bracket. The pin with a head shaped like spiral disc has a long chronology — from period BA2 up to BC or even the beginnings of the BD [Gedl 1975, chronological table], i.e. from 1600 to 1300 BC. Hence, these artefacts should be placed, in accordance with the typological classification, in the late Trzciniec assemblages of TH 5 — TH 7 types [Makarowicz 2000a:531].

Another interpretation problem is posed by the dating of the material from a ritual feature of the enclosure type from site 2 in Biskupin, Pałuki (Table 1:2-4, 6) [Grossman 1998]. The obtained radiocarbon dates suggest that it was used at a maximum ca. 850 years (2350-1500 BC) or at a minimum 450 years (2350-1900 BC). Hence, the feature could have been used by both communities of the IC (phases I-III) and Early Trzciniec societies representing TH 1. Relying on sequences of ^{14}C determinations, a distinction into two major phases of its use can be made: between 2350 and 2150 BC and between 2150 and 1900 BC [contra — Grossman 1998:194ff]. Because of the nature of the feature, it is hardly possible to assign individual dates to specific materials as samples came from various parts of a vast system of "ditches" (from their bottoms and different stratigrafic levels of the fill). Generally speaking, all published vessels exhibit more or less clear "Iwno" traits. The only feature (of little diagnostic significance anyway) of a nascent TCC tradition (TH 1) at the site is an S-profile pot decorated with a cordon under the rim. In the light of these facts, it seems that it is more appropriate to assign this set of sources — as an "Iwno" one showing pre-Trzciniec characteristics — to the proto-Trzciniec horizon.

A similar interpretation dilemma presents itself when we analyse an assemblage from Grabie 4, feature 27, Kujawy [Makarowicz 1998a]. The only ^{14}C de-

Table 1

Radiocarbon datings of the Trzciniec Cultural Circle assemblages from the lower Vistula drainage basin (including syncretic — Iwno Culture/Trzciniec Complex assemblages)

No.	Site/ feature	Cultural unit/ phase	Conv BP	Cal BC (1 σ)	Lab. code	Sample material	Context	Cat.	Comments
1	2	3	4	5	6	7	8	9	10
1.	Grabie 4/ 27	IC – TH?	3650±90	2140-1880 (68,2%)	Gd-2644	bone	grave	IC	uncertain cultural context
2.	Biskupin 2a/ ditch I	IC/TH 1	3630±100	2140-1880 (66,3%)	Gd-6664	charcoal	ritual	IIC	alternative cultural identification
3.	Biskupin 2a/ ditch II	IC/TH 1	3620±45	2040-1910 (65,5%)	Ki-6308	bone	ritual	IC	alternative cultural identification
4.	Biskupin 2a/ transversal ditch	IC/TH 1	3610±45	2030-1880 (68,2%)	Ki-6309	bone	ritual	IC	alternative cultural identification
5.	Żegotki 3/ A 112	IC III-TH 1	3605±50	2030-1880 (68,2%)	Ki-6896	bone	pit	IB	transition stage
6.	Biskupin 2a/ ditch II	IC/TH 1	3600±40	1980-1880 (57,8%)	Ki-6307	bone	ritual	IC	alternative cultural identification
7.	Radojewice 29/ A 110	TH 5 – TH 7	3590±40	1980-1880 (61,7%)	Ki-6883	bone	grave	IA	too early dating no compatible with the typological analysis
8.	Żegotki 3/ A 89	IC III-TH 1	3580±30	1960-1880 (66,3%)	Ki-6102	bone	pit	IB	transition stage
9.	Rybiny 17/ 1	TH 2	3560±50	1980-1870 (45,4%)	Ki-5589	bone	pit	IB	too early (?) dating no compatible with the typological analysis
10.	Żegotki 3/ A 47	IC III-TH 1	3545±40	1940-1880 (38,2%)	Ki-6902	bone	grave	IA	transition stage
11.	Żegotki 3/ A 47	IC III-TH 1	3540±45	1940-1880 (36,0%)	Ki-6103	bone	grave	IA	transition stage
12.	Radojewice 29/ A 110	TH 5 – TH 7	3540±45	1940-1860 (36,0%) 1850-1770 (32,2%)	Ki-6884	bone	grave	IA	too early dating no compatible with the typological analysis
13.	Żegotki 3/ A 47	IC III-TH 1	3540±40	1940-1860 (34,6%) 1850-1770 (33,6%)	Ki-6908	bone	grave	IA	transition stage
14.	Żegotki 3/ A 47	IC III-TH 1	3540±30	1920-1870 (31,6%)	Ki-6904	bone	grave	IA	transition stage

1	2	3	4	5	6	7	8	9	10
15.	Żegotki 3/ A 47	IC III-TH 1	3525±30	1850-1770 (49,2%)	Ki-6905	bone	grave	IA	transition stage
16.	Żegotki 3/ A 47	IC III-TH 1	3520±35	1890-1750 (68,2%)	Ki-6903	bone	grave	IA	transition stage
17.	Rybiny 17/ 1	TH 2	3520±40	1890-1750 (68,2%)	Ki-5125	charcoal	pit	IIB	
18.	Borowo 12/ 19E	TH 1/3	3520±60	1920-1740 (68,2%)	Ki-5608	charcoal	pit	IIB	
19.	Żegotki 3/ A 47	IC III-TH 1	3515±30	1890-1770 (68,2%)	Ki-6907	bone	grave	IA	transition stage
20.	Żegotki 3/ A 47	IC III-TH 1	3505±35	1890-1750 (68,2%)	Ki-6906	bone	grave	IA	transition stage
21.	Żegotki 3/ A 47	IC III-TH 1	3490±45	1880-1740 (68,2%)	Ki-6101	bone	grave	IA	transition stage
22.	Rybiny 17/ 1	TH 2	3480±60	1880-1730 (64,2%)	Ki-5590	charcoal	pit	IIB	
23.	Rybiny 14/ 9	TH 2	3470±80	1890-1680 (68,2%)	Gd-2297	charcoal	pit	IIB	
24.	Rybiny 17/ 1	TH 2	3450±60	1780-1680 (41,4%)	Ki-5128	bone	pit	IB	
25.	Rybiny 17/ 1	TH 2	3420±55	1780-1630 (57,8%)	Ki-5127	bone	pit	IB	
26.	Siniarzewo 1/ E 95	TH 1/3	3410±40	1770-1630 (68,2%)	Ki-5907	bone	pit	IB	
27.	Rybiny 17/ 1	TH 2	3390±45	1750-1620 (68,2%)	Ki-5126	shell	pit	IB	
28.	Borowo 12/ 19	TH 1/3	3380±55	1750-1600 (67,2%)	Ki-5605	charcoal	pit	IIB	
29.	Siniarzewo 1/ G 144	TH 1/3	3310±45	1630-1520 (64,1%)	Ki-6503	bone	pit	IB	
30.	Kuczkowo 5/ D 105	TH 3	3305±40	1620-1520 (68,2%)	Ki-6490	bone	pit	IB	
31.	Biskupin 2a/ditch	IC-TH 1	3270±90	1640-1440 (64,0%)	Gd-6917	bone	ritual	IC	uncertain cultural context
32.	Piecki 1/ 47	TH 6	3240±25	1525-1485 (39,4%)	Ki-5682	bone	pit	IB	
33.	Krusza Podlotowa 8/ 3	TH 7/LC	3190±60	1520-1400 (68,2%)	Gd-5118	bone	grave	IC	transition stage?

IC - Iwno Culture; LC - Lusatian Culture; TH - Trzciniec Horizon
Data after: Czebreszuk 1996; Czebreszuk, Szmyt 2001; Makarowicz 1998a; 2001

termination obtained from bones from a collective grave (Table 1:1) seems to be too early for the Trzciniec complex, although similar dates were made for mass graves from Żerniki Górne, Małopolska [Kempisty, Włodarczak 1996; Górski, Kadrow 1996; 2001; Włodarczak 1998]. However, in view of the latest formal and stylistic analyses of pottery and bronze goods, and stratigraphic observations, these dates have been considered unreliable (cf. section 2.2 below). But again, the ritual alone — mass burial, absence of anatomical arrangement, presence of a timber structure (poles supporting a wooden (?) "ceiling" of the grave) — indicates a possibility of its assignment to the TCC. The feature might be also associated with

the IC tradition, where collective graves are encountered as well but are formally different from Trzciniec funerary rules [Kośko 1993; Makarowicz 1998a]. The impossibility to verify the absolute chronology due to the lack of any grave goods makes us opt for the alternative attribution of the feature in question, i.e. to IC — TH.

For syncretic assemblages, combining traits of the late (III) phase of the IC and the early development stage of the TCC (i.e. TH 1), there are 11 determinations from site Żegotki 3, Kujawy. Two of the dates come from settlement features (feature A 112 and A 89; Table 1:5 and 8 — Fig. 2 and 3), while the remaining 9 relate to a single inhumation (feature A47) (Table 1:10, 11, 13-16, 19-21) [Makarowicz 1998b:143, Table 1; 2000a]. The sum of probability distribution of all the dates sets the chronological brackets of the transitional stage from the IC to the TH at 1940-1770 BC [Makarowicz 2001a:212]. This is in agreement with the characteristics of the materials placed in both the settlement features and in the grave. The former showed clear traits of the IC and the Single Grave culture (SGC), namely, S-profile pots of the *Riesenbecher* type (Fig. 2:1, 2, 5), a bowl (Fig. 2:6), beakers and vases (Fig. 2:3; 3:4), incised horizontal ornaments (Fig. 3:4) and relief ornaments — cordons under the rim (Fig. 2:1-3, 5; 3:6). The grave, in turn, yielded up a beaker with a "tap" (*Zapfenbecher*) decorated with incised lines and a bone pin with a rectangular, horizontally perforated head. Both artefacts find analogies in the environment of the late IC (e.g. Szelejewo, Kujawy) and the classic Únětice culture (UC) [Makarowicz 1998a].

For "pure" TH 1 materials no radiocarbon determinations are available now. However, there are 4 dates obtained from charcoal and bones, and relating to assemblages combining the traits of TH 1 and TH 3 (TH 1/TH3) from settlements in Borowo 12 (feature 19E and 19; Table 1:18 and 28; Fig. 4) and Siniarzewo 1 (feature E 95 and G 144, Table 1:26 and 29; Fig. 5), both from Kujawy [Makarowicz 1998b:Table 1]. The sum of probability distributions supports their placement in the time interval between 1770 and 1520 BC. The two sites also yielded up materials exhibiting typical Trzciniec traits such as ornaments of incised, wavy lines, both vertical and horizontal, (Fig. 4:1; 5:1, 3) and thick and bevelled lip rims of S-profile pots decorated with cordon under the rim (Fig. 4:1, 2, 4, 5, 7, 12). In Borowo, discoveries were made of the motif of a vertical cordon in the context of incised-stroked ornaments (Fig. 4:3) and pottery decorated with textile impressions (Fig. 4:11) [Ignaczak 1996].

A series of 7 radiocarbon determinations was obtained for TH 2 assemblages (Figs. 6-8). They come form settlements in Rybiny 14 (1 date from feature 9; Table 1:23) and Rybiny 17 (6 dates from feature 1, Table 1:9, 17, 22-25, 27) [Makarowicz 1989; 1998a; 2000b]. The dated material included bones, mollusc shells and charcoals from the inside of dwelling units. In the first case (Rybiny 14), it was a household feature located in the central portion of a post-structure

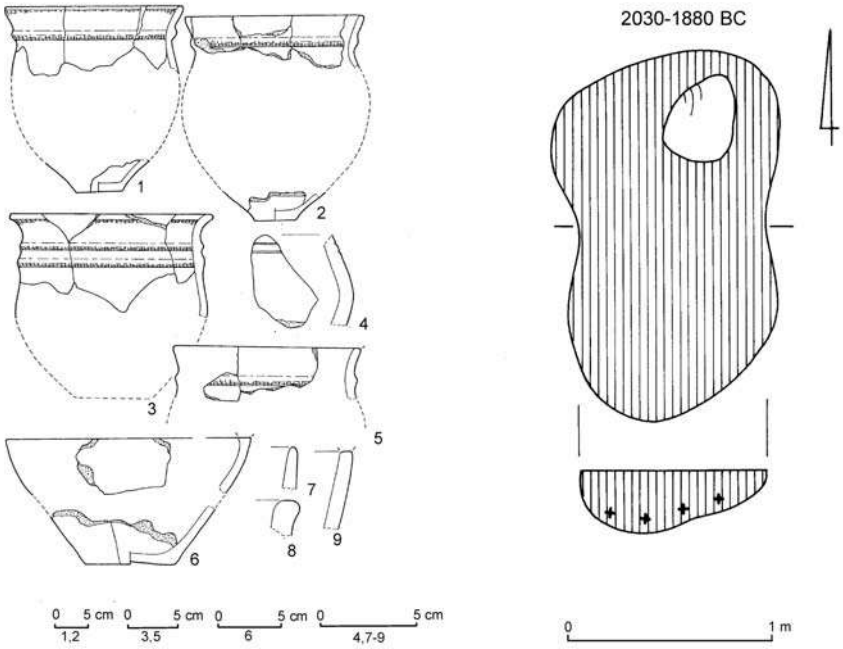

Fig. 2. Żegotki 3, Kujawy. Feature A112 and pottery from the feature. After Makarowicz 2001a

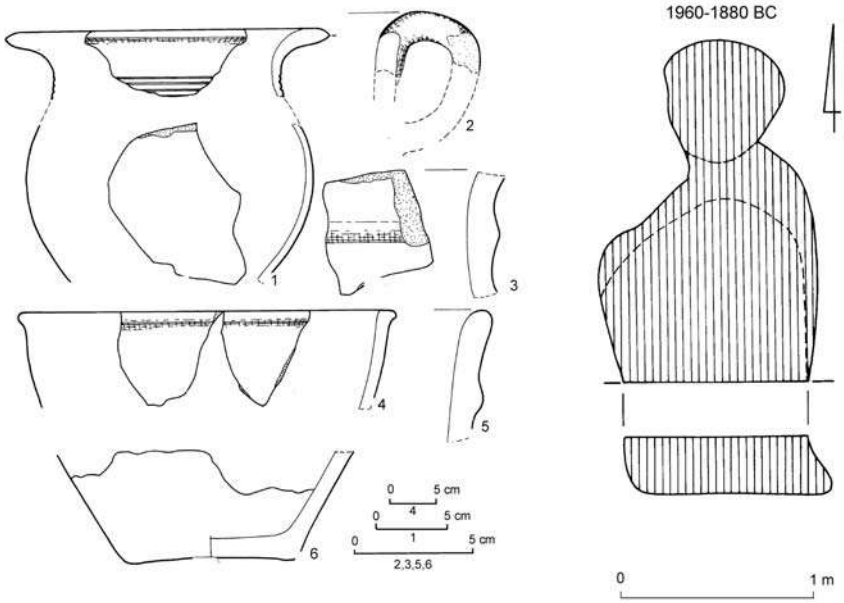

Fig. 3. Żegotki 3, Kujawy. Feature A89 and pottery from the feature. After Makarowicz 1998a; 2000a

house (Fig. 6) while in the other (Rybiny 17), it was the sunken floor house (Fig. 7). The sum of probability distributions of all the determinations indicates that TH 2 assemblages should be placed in the bracket of 1890-1680 BC. One of the dates from Rybiny 17 (feature 1), obtained from bones (Table 1:9), in the light of formal and stylistic assessment seems slightly too early. Rich ceramic material from both sites shows IC traits and early classic TCC ones. The former include beakers and vases with tulip-shaped rims (Fig. 6:1, 2; 8:1, 2, 9), bowls (Fig. 6:10), in particular bow-profile ones (Fig. 8:5, 7), vases, beakers and pots (Fig. 6:7, 8, 10; 8:2, 3, 6-11), incised ornaments (multiple horizontal and vertical lines, metopic motifs and zone-metopic ones, "chevrons") and relief ornaments (applique bosses, cordons under the rim) (Fig. 6:1, 2; 8:1, 3, 10, 11). TCC patterns appear on S-profile pots decorated with horizontal cordons (Fig. 6:7, 8; 8:6, 7). Vessels of various types were decorated with stamp or stroke ornamentations, motifs of incised arches, vertical cordon interrupted by repeated horizontal incised lines (Fig. 6:1, 2; 8:1-7, 9, 10) and horizontal cord impressions. The stylistic analysis of these vessels is, in general, consistent with the radiocarbon dates and allows us to place both assemblages in the period between 1800 and 1700 BC.

For TH 3 we have a single date referring to a household pit (feature D 105) from a settlement site in Kuczkowo 5, Kujawy (Table 1:30). Material from the pit, showing traits characteristic of classic Trzciniec assemblages, was dated, in agreement with the typological assessment, at 1620-1520 BC [Makarowicz 2000a:528ff].

No radiocarbon dates have been obtained so far for TH 4 and TH 5. The period when they occurred was determined solely on the basis of the stylistic traits of pottery and rare bronze goods. The results of dating a grave assemblage from Radojewice 29, in which late "Trzciniec" traits (TH 5 — TH 7) are readily observable, have been already commented above.

Single determinations have been obtained for TH 6 and TH 7 assemblages (Fig. 9; Table 1). The first date comes from a settlement feature in Piecki 1, Kujawy (feature 47, Table 1:32) [Makarowicz 1998b:Table 1]. The material combines late TH stylistic patterns with early TuC inspirations, namely, cordons under the rim in pottery ornamentation (Fig. 9:1, 9), vessels with prominent shoulders (Fig. 9:2, 3, 8), undecorated containers having the morphology of a beaker, pot and bowl (Fig. 9:1, 3, 5). It was dated to the period of 1525-1485 BC, which is consistent with its typological assessment. An expecting date for TH 7 (Table 1:33) was made from charcoal coming from a grave in Krusza Podlotowa 8 (feature 3), Kujawy [Makarowicz 1998b:Table 1]. Two bodies placed there had been given a bronze pin bent in its upper part, having a spindle-shaped head and an "eye". Typologically close specimens come from late TuC and early Lusatian culture (LC) environments [Gedl 1975:tabl. XL; Kłosińska 1997] and may be dated at BC-BD in Paul Reinecke's periodization.

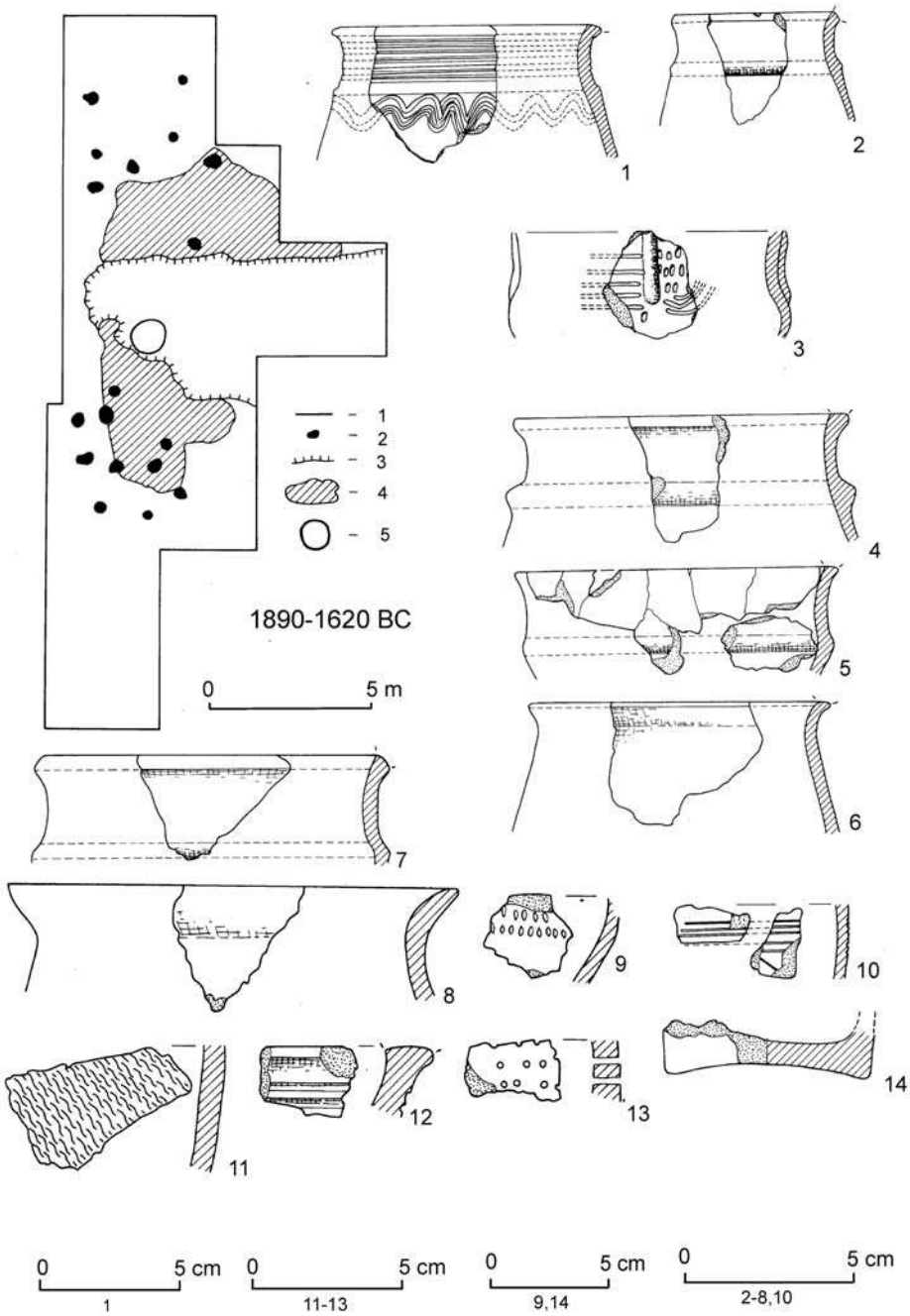

Fig. 4. Borowo 12, Kujawy. Features 19 and 19E and selection of pottery from the features. After Ignaczak 1996; legend: Makarowicz 1998a

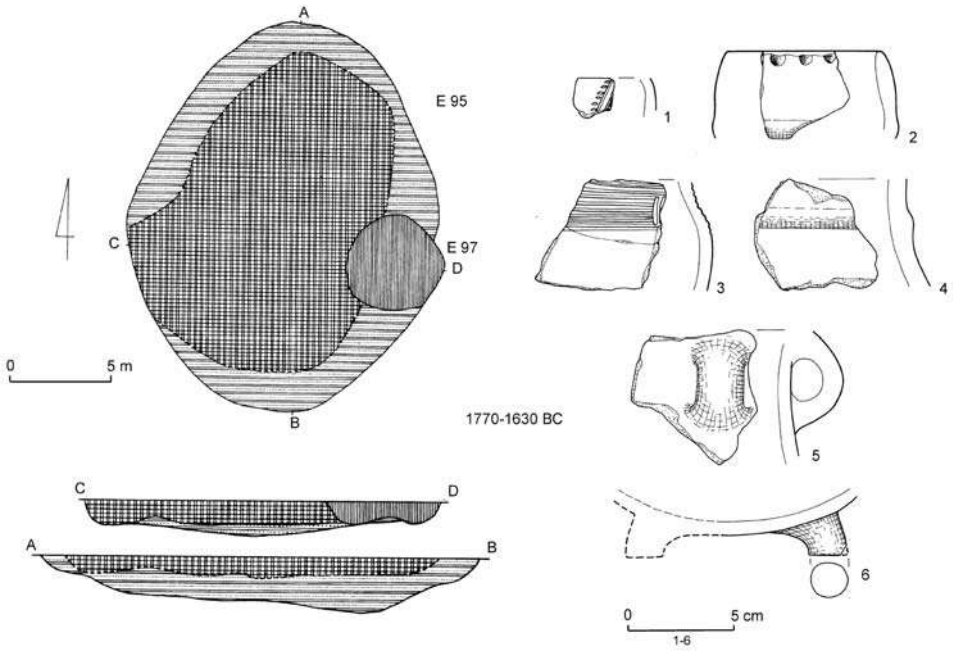

Fig. 5. Siniarzewo 1, Kujawy. Feature E 95 and pottery from the feature. After Makarowicz 2000a

The set of radiocarbon dsterminations obtained for the lowlands (Kujavian) assemblages of the TCC allows us to draw a few general conclusions making the time brackets of Trzciniec phenomena there more specific [see Makarowicz 1998a]. The earliest, single proto-Trzciniec traits appeared already in SGC and BB (including IC) groups beginning with the middle of the 3rd millennium BC. In the northwest of the TCC oecumene (Kujawy, Pałuki, Chełmno Land, middle Warta drainage), the transformation of Iwno structures into Trzciniec ones took place between 1950/1900 and 1800 BC (TH 1 and TH 2 assemblages). East TCC patterns occurred in TH 2 and especially in TH 1/3 and TH 3 assemblages since ca. 1700-1600 BC. In TH 1, TH 2, TH 3 and TH 1/TH 3 assemblages, until ca. 1600 BC, we can observe clear IC traits which are absent from later taxa (from TH 5 to TH 7). The traits of cultures from the south (Mad'arovce culture — MaC, Otomani/Füzesabony culture — OC/FC) emerged at the earliest between 1700 and 1600 BC, while the traits of the TuC became noticeable in 1600/1500-1300 BC. In the area in question, TCC structures disintegrated ca. 1300-1200 BC, i.e. contemporaneously with the settlement of the early Lusatian culture (LC) [Czebreszuk *et al.* 1997; Ignaczak 2002; Czebreszuk *et al.* 2003].

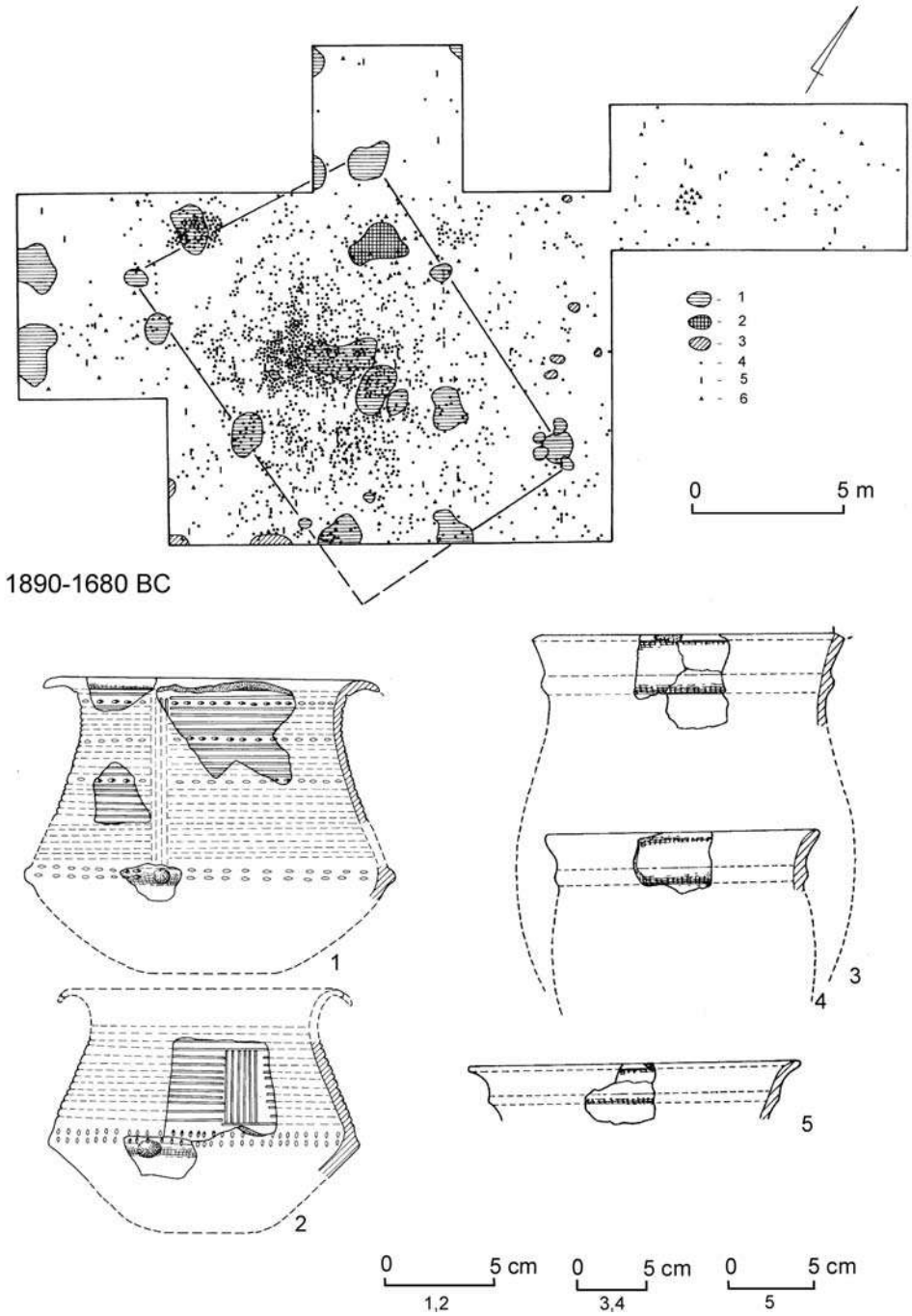

Fig. 6. Rybiny 14, Kujawy. A house and selection of pottery from the feature. Legend: Makarowicz 2000b

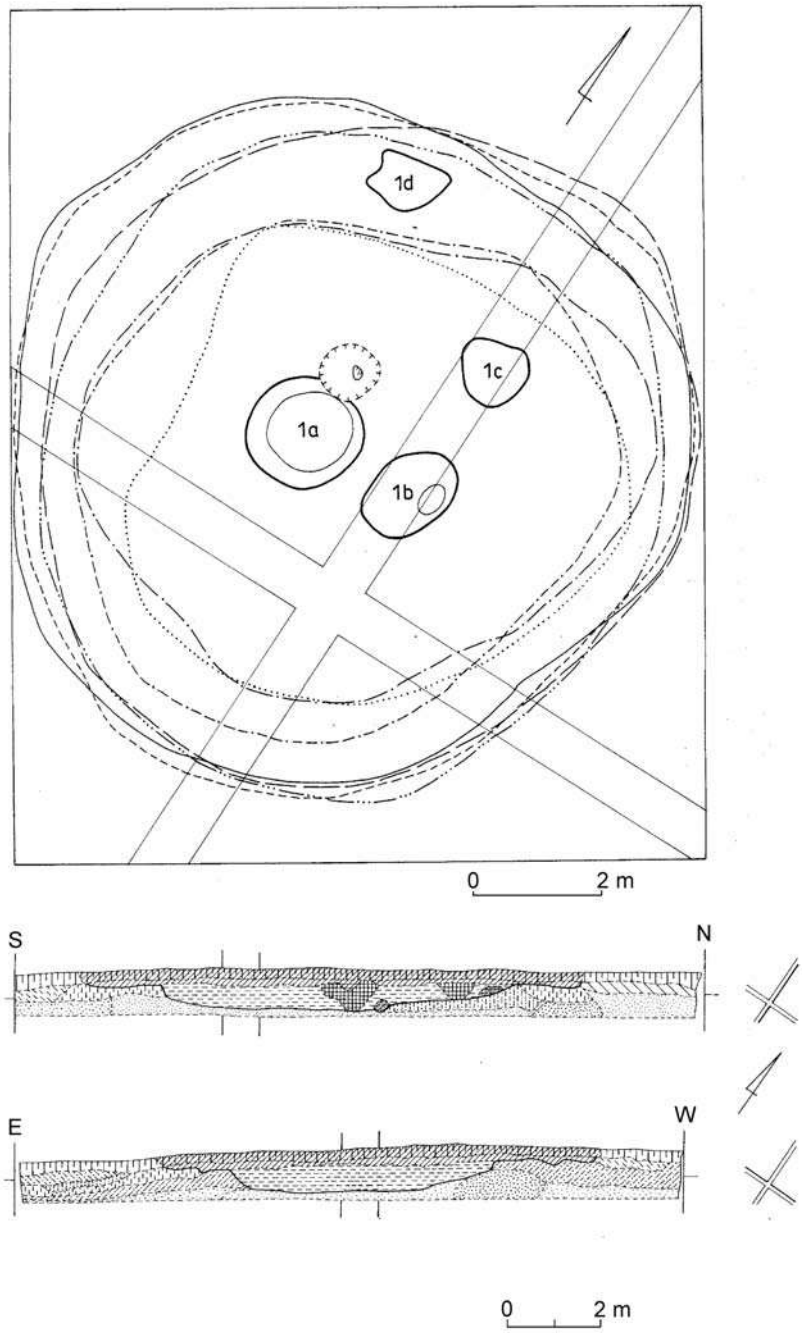

Fig. 7. Rybiny 17, Kujawy. Plan and cross section of the house (feature 1). Legend: Makarowicz 2000b

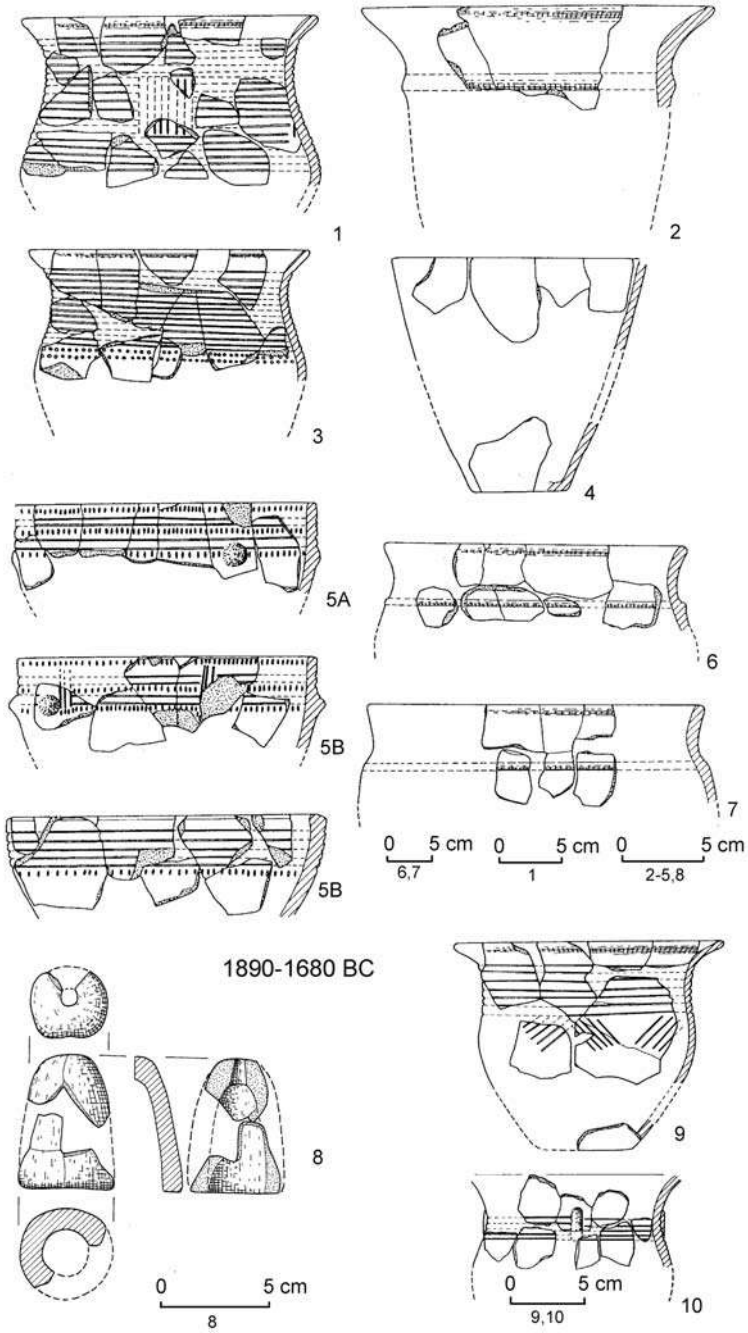

Fig. 8. Rybiny 17, Kujawy. Selection of pottery (1-7, 9, 10) and a clay tuyere (8) from the house (feature 1). After Makarowicz 2000b

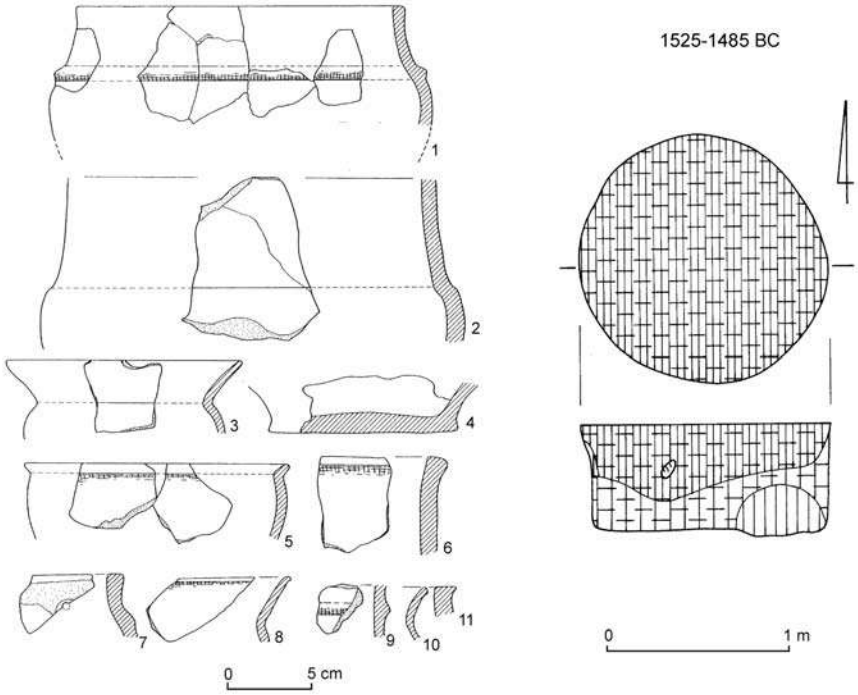

Fig. 9. Piecki 1, Kujawy. Feature 47 and pottery from the feature. After Makarowicz 1998a

2.2. THE UPLANDS ZONE

The periodization system of the western Małopolska branch of the Trzciniec culture was developed after analysing about 130 homogenous settlement and grave assemblages. They were divided into six types (A1, A2, A3, B, C, C/D) reflecting stylistic and formal differences of the pottery [Górski 1994; 1997; 1998a; 1998b]. The development of pottery from A1 to C/D assemblages was rather evolutionary and shifts from one type to another are not by leaps but smooth [Górski, Kadrow 1996; Górski 1998c; 1998d; 2002].

There are 68 radiocarbon determinations coming from the southern part of the discussed cultural subcircle. They concern 7 sepulchral features, 1 ritual feature (burial house) and 2 settlement ones (Fig. 1; Table 2).

The chronology of settlement materials from Słonowice needs to be verified* [Calderoni *et al.* 2000; Górski, Kadrow 2001]. One of the dates obtained for this

* The present authors would like to thank Dr. Krzysztof Tunia for the opportunity to verify materials from radiocarbon-dated features and kind permission to publish feature drawings.

Table 2

Radiocarbon datings of the Trzciniec Cultural Circle assemblages from the upper Vistula drainage basin (Małopolska and Lublin Upland)

No.	Site/ feature	Cultural unit/phase or assem-blages type	Conv BP	Cal BC (1 σ)	Lab. code	Sample material	Context	Cat.	Comments
1	2	3	4	5	6	7	8	9	10
1.	Żerniki Górne 1/102	TC/A2?	3590±60	2040-1870 (62,8%)	Ki-5112	bone	grave	IA	too early dating no compatible with the typological analysis
2.	Żerniki Górne 1/73	TC/A2	3570±55	1980-1870 (49,7%)	Ki-5113	bone	grave	IA	too early dating no compatible with the typological analysis
3.	Żerniki Górne 1/3	TC/A2?	3560±55	1980-1870 (45,1%)	Ki-5117	bone	grave	IA	too early dating no compatible with the typological analysis
4.	Dubeczno 1/ hearth	TC/A1	3520±50	1920-1740 (68,2%)	Gd-5124	charcoal	barrow	IIA	
5.	Żerniki Górne 1/71	TC/A2	3510±40	1890-1740 (68,2%)	Ki-5832	bone	grave	IA	too early dating no compatible with the typological analysis
6.	Żerniki Górne 1/69	TC/A2?	3495±50	1880-1740 (68,2%)	Ki-5829	bone	grave	IA	too early dating no compatible with the typological analysis
7.	Żerniki Górne 1/62	TC/A2	3470±35	1780-1730 (28,9%) 1880-1840 (25,0%)	Ki-5831	bone	grave	IA	too early dating no compatible with the typological analysis
8.	Słonowice G/ XVII/ 21	TC/A3	3450±65	1880-1680 (68,2%)	Rome-862	charcoal	pit	IIB	too early dating no compatible with the typological analysis

1	2	3	4	5	6	7	8	9	10
9.	Dacharzów 1/ 1A	TC/A1	3450±80	1890-1680 (65,2%)	Ki-8615	wood	grave	IIA	
10.	Miernów 2/ barrow II	TC/A1	3450±100	1890-1620 (68,2%)	K-1838	charcoal	grave	IIA	
11.	Zienki/?	TC/A1	3445±50	1780-1680 (48,0%)	????	charcoal	hearth under the barrow	IIA	
12.	Dacharzów 1/ 1A-I	TC/A1	3445±90	1890-1630 (68,2%)	Ki-8089	bone	grave	IA	
13.	Żerniki Górne 1/86	TC	3420±40	1770-1680 (56,9%)	Ki-5830	bone	grave	IA	too early dating no compatible with the typological analysis
14.	Dacharzów 1/ 1A-IV	TC/A1	3415±70	1780-1620 (56,3%)	Ki-8317	bone	grave	IA	
15.	Dubeczno 1/ barrow	TC/A1	3410±70	1780-1610 (58,5%)	Ki-9197	bone	grave	IA	
16.	Zienki/?	TC/A1	3390±50	1750-1610 (68,2%)	????	charcoal	hearth under the barrow	IIA	
17.	Dacharzów 1/ 1B	TC	3390±200	1940-1440 (68,2%)	Ki-8107	wood	grave	IIA	
18.	Żerniki Górne 1/5	TC/A2-B	3380±60	1750-1600 (62,2%)	Ki-5833	bone	grave	IA	too early (?) dating no compatible with the typological analysis
19.	Dacharzów 1/ 1A-IV	TC/A1	3360±70	1700-1580 (43,2%)	Ki-8318	bone	grave	IA	
20.	Dacharzów 1/ 1A	TC/A1	3350±50	1690-1580 (50,4%)	Ki-8614	wood	grave	IIA	
21.	Dacharzów 1/ 1A	TC/A1	3340±60	1690-1520 (68,2%)	Ki-8548	wood	grave	IIA	
22.	Dacharzów 1/ 1B-V	TC	3340±60	1690-1520 (68,2%)	Ki-8095	bone	grave	IA	
23.	Dacharzów 1/ 1A-IV	TC/A1	3340±70	1690-1520 (68,2%)	Ki-8094	bone	grave	IA	
24.	Dacharzów 1/ 1A-I	TC/A1	3340±160	1780-1430 (62,4%)	Ki-8090	bone	grave	IA	
25.	Dacharzów 1/ 1A	TC/A1	3335±45	1690-1580 (46,2%)	Ki-8610	wood	grave	IIA	
26.	Słonowice G/ 67/XVI	TC/A1	3335±55	1690-1520 (68,2%)	Rome-859	charcoal	pit	IIB	
27.	Dacharzów 1/ 1B	TC	3320±70	1690-1520 (68,2%)	Ki-8549	wood	grave	IIA	
28.	Dacharzów 1/ 1A-III	TC/A1	3310±70	1690-1510 (68,2%)	Ki-8316	bone	grave	IA	

1	2	3	4	5	6	7	8	9	10
29.	Dacharzów 1/ 1B	TC	3300±50	1630-1510 (63,0%)	Ki-8616	wood	grave	IIA	
30.	Dacharzów 1/ 5	TC/A2-B	3290±60	1640-1510 (61,5%)	Ki-8617	bone	grave	IA	
31.	Dacharzów 1/ 1B	TC	3280±45	1630-1500 (66,6%)	Ki-8611	wood	grave	IIA	
32.	Dacharzów 1/ 1B-V	TC	3270±70	1630-1490 (56,1%)	Ki-8319	bone	grave	IA	
33.	Dacharzów 1/ 5	TC/A2-B	3270±70	1630-1490 (56,1%)	Ki-8098	bone	grave	IA	
34.	Dacharzów 1/ 1A-III	TC/A1	3270±70	1630-1490 (56,1%)	Ki-8314	bone	grave	IA	
35.	Kazimierzów /2	TC	3260±90	1630-1430 (66,0%)	Ki-8282	wood	grave	IIA	
36.	Dacharzów 1/ 1A-III	TC/A1	3220±70	1530-1410 (58,5%)	Ki-8315	bone	grave	IA	
37.	Kazimierzów /2	TC	3210±70	1530-1400 (60,6%)	Ki-8283	bone	grave	IA	
38.	Słonowice G/ 21/XXI	TC/A1	3200±60	1520-1410 (68,2%)	Rome-858	charcoal	pit	IIB	
39.	Dacharzów 1/ 5	TC/A2-B	3180±70	1530-1390 (65,9%)	Ki-8314	bone	grave	IA	
40.	Słonowice G/ 28/XVI	TC	3170±60	1520-1390 (68,2%)	Rome-860	charcoal	pit	IIB	non- -homogenic material
41.	Dacharzów 1/ 1A	TC/A2	3170±100	1530-1310 (62,4%)	Gd-10479	bone	grave	IA	
42.	Dacharzów 1/ 5	TC/A2-B	3160±70	1520-1380 (63,0%)	Ki-8321	bone	grave	IA	
43.	Dacharzów 1/ 10	TC	3070±70	1420-1250 (63,4%)	Ki-8323	bone	grave	IA	
44.	Dacharzów 1/ 12	TC	3050±70	1410-1250 (57,4%)	Ki-8105	bone	grave	IA	
45.	Dwikozy	TC/late=C	3040±40	1320-1250 (37,5%)	Gd-3217	charcoal	burial house	IB	
46.	Dwikozy	TC/late=C	3040±50	1390-1250 (60,1%)	Gd-1940	charcoal	burial house	IB	
47.	Kraków- -Nowa Huta Cło/S-102	TC/A2	3040±60	1400-1210 (65,8%)	Gd-11456	charcoal	pit	IIB	to late dating no compatible with the typological analysis
48.	Kraków- -Nowa Huta Cło/G-108	TC/A1?	3040±190	1460-1010 (66,2%)	Gd-14031	bone	grave	IA	to late dating no compatible with the typological analysis
49.	Dwikozy	TC/late=C	3020±40	1320-1210 (49,1%)	Gd-1941	charcoal	burial house	IB	

1	2	3	4	5	6	7	8	9	10
50.	Dacharzów 1/10	TC	2995±70	1320-1120 (60,5%)	Ki-8324	bone	grave	IA	
51.	Dacharzów 1/10	TC	2980±70	1320-1120 (61,7%)	Ki-8102	bone	grave	IA	
52.	Dwikozy	TC/late=C	2960±40	1260-1110 (65,5%)	Gd-3218	charcoal	burial house	IB	
53.	Słonowice G/1/XIX	TC/C	2960±60	1270-1050 (66,4%)	Rome-861	charcoal	pit	IIB	
54.	Dacharzów 1/11	TC/C	2950±70	1270-1040 (67,3%)	Ki-8103	bone	grave	IA	
55.	Dacharzów 1/8	TC	2940±70	1260-1010 (68,2%)	Ki-8099	bone	grave	IA	
56.	Dwikozy	TC/late=C	2940±35	1220-1110 (48,3%)	Gd-3220	charcoal	burial house	IB	
57.	Dwikozy	TC/late=C	2920±50	1220-1010 (68,2%)	Gd-1937	charcoal	burial house	IB	
58.	Dwikozy	TC/late=C	2920±50	1220-1010 (68,2%)	Gd-1939	charcoal	burial house	IB	
59.	Dwikozy	TC/late=C	2890±40	1130-1000 (67,3%)	Gd-3219	charcoal	burial house	IB	
60.	Dwikozy	TC/late=C	2890±50	1130-990 (61,9%)	Gd-1938	charcoal	burial house	IB	
61.	Dacharzów 1/2	TC/A2-B	2840±60	1120-900 (68,2%)	Ki-8096	bone	grave	IA	to late dating no compatible with the typological analysis
62.	Dacharzów 1/1A	TC/A1	2830±70	1130-890 (68,2%)	Ki-8106	wood	grave	IIA	to late dating no compatible with the typological analysis
63.	Dacharzów 1/2	TC/A2-B	2820±60	1050-890 (66,2%)	Ki-8320	bone	grave	IA	to late dating no compatible with the typological analysis
64.	Dacharzów 1/1A-II	TC/A1	2820±80	1080-890 (57,2%)	Ki-8092	bone	grave	IA	to late dating no compatible with the typological analysis
65.	Dacharzów 1/11	TC/C	2800±70	1020-890 (53,5%)	Ki-8325	bone	grave	IA	to late dating no compatible with the typological analysis

1	2	3	4	5	6	7	8	9	10
66.	Dacharzów 1/1A-II	TC/A1	2800±80	1050-890 (68,2%)	Ki-8091	bone	grave	IA	to late dating no compatible with the typological analysis
67.	Dacharzów 1/2	TC/A2-B	2790±70	1010-830 (68,2%)	Ki-8097	bone	grave	IA	to late dating no compatible with the typological analysis
68.	Dacharzów 1/10	TC	2770±80	1000-830 (68,2%)	Ki-8101	bone	grave	IA	to late dating
69.	Dacharzów 1/1A	TC/A1	2710±350	2300-400 (68,2%)	Gd-9621	bone	grave	IA	to late dating no compatible with the typological analysis

TC – Trzciniec Culture
Data after: Włodarczak 1998; Górski, Kadrow 2001; Taras *et al.* 2001; Florek, Taras 2003

site (Rome-863) comes from a feature containing early LC materials [Calderoni *et al.* 2000, Fig. 2, 3]. Another determinations (Table 2:40) concerns a shallow feature (28/XVI) disturbed by another pit making it hardly possible to consider its fill as a homogenous assemblage [Calderoni *et al.* 2000, Fig. 7a]. The date for feature 21/XVII (Table 2:8) is not consistent with archaeological criteria (it is too early), on the basis of which it is possible to count the assemblage among materials of type A3. Three of the four other dates (feature 67/XVI, feature 21/XXI, feature 1/XIX — Table 2:26, 38, 53) fit well into the periodization scheme of TC materials in the western Małopolska area. The first two features can be classified as "progressive" type A1 assemblages (i.e. exhibiting traits of type A2 assemblages — Fig. 10A:1-6; 10B:1-13). The obtained results of absolute dating are as expected. The third measurement, whose value fits well into the scheme of TC development on loess soils around Kraków, is the dating of pit 1/XIX (Table 2:53). The pottery shows traits of type B assemblages (an amphora with "whiskers" under the handles — Fig. 11:2) and — mainly — of type C (relatively many vessels decorated with vertical flutes Fig. 11: 3, 6, 11, 18). Hence, the materials should be placed in the earlier period of occurrence of type C assemblages. The probability distribution for the date concerning a sample taken from feature 1/XIX is rather broad (1270-1050 BC) but it can be deemed as consistent with the expected one [see Górski, Kadrow 2001: Tab. 144].

Very characteristic type A1 materials were recovered from barrow II in Miernów, Małopolska (Fig. 12) [Kempisty 1978:10-18, Fig. 1-12]. The date obtained

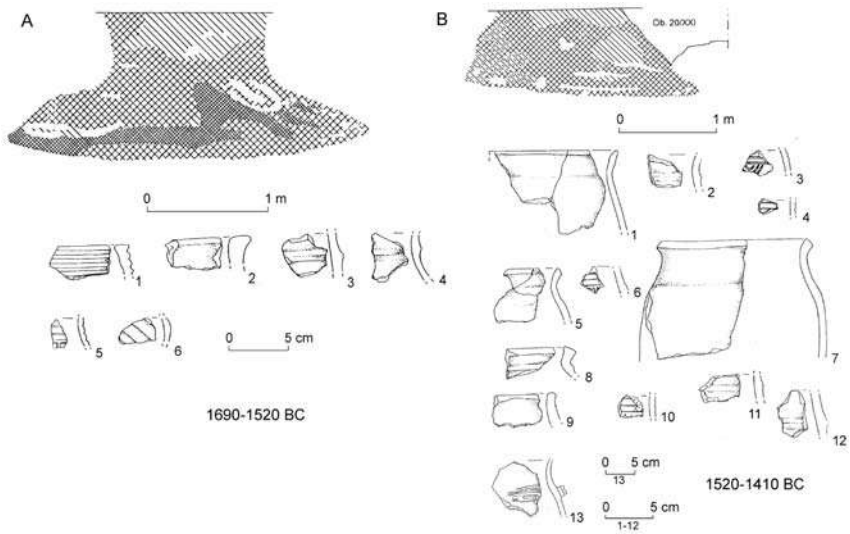

Fig. 10. Słonowice G, Małopolska. A - feature 67/XVII and pottery from the feature; B - feature 21/XXI and pottery from the feature. After Górski, Kadrow 2001. Drawn by A. Bieniek-Wiśniewska

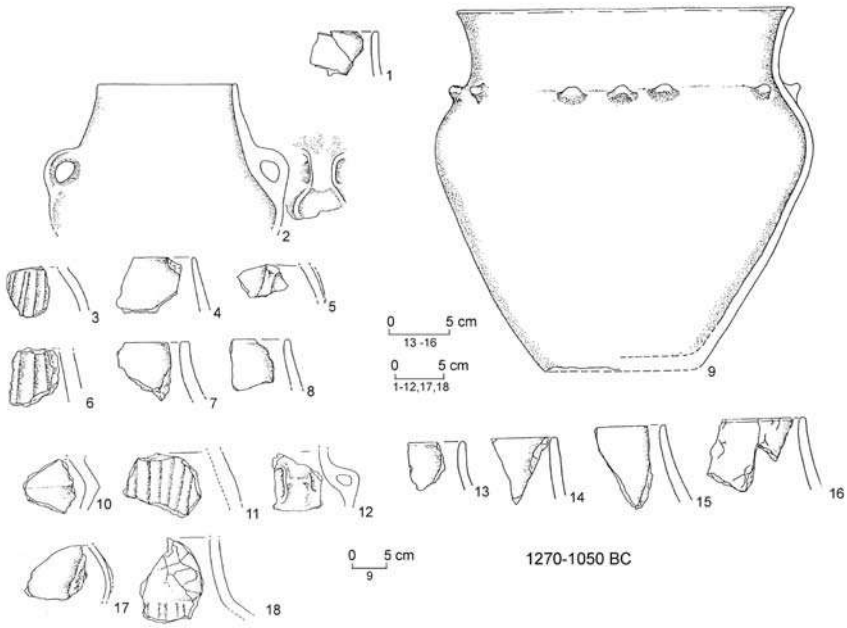

Fig. 11. Słonowice G, Małopolska. Pottery from the feature 1/XIX. After Górski, Kadrow 2001. Drawn by A. Bieniek-Wiśniewska

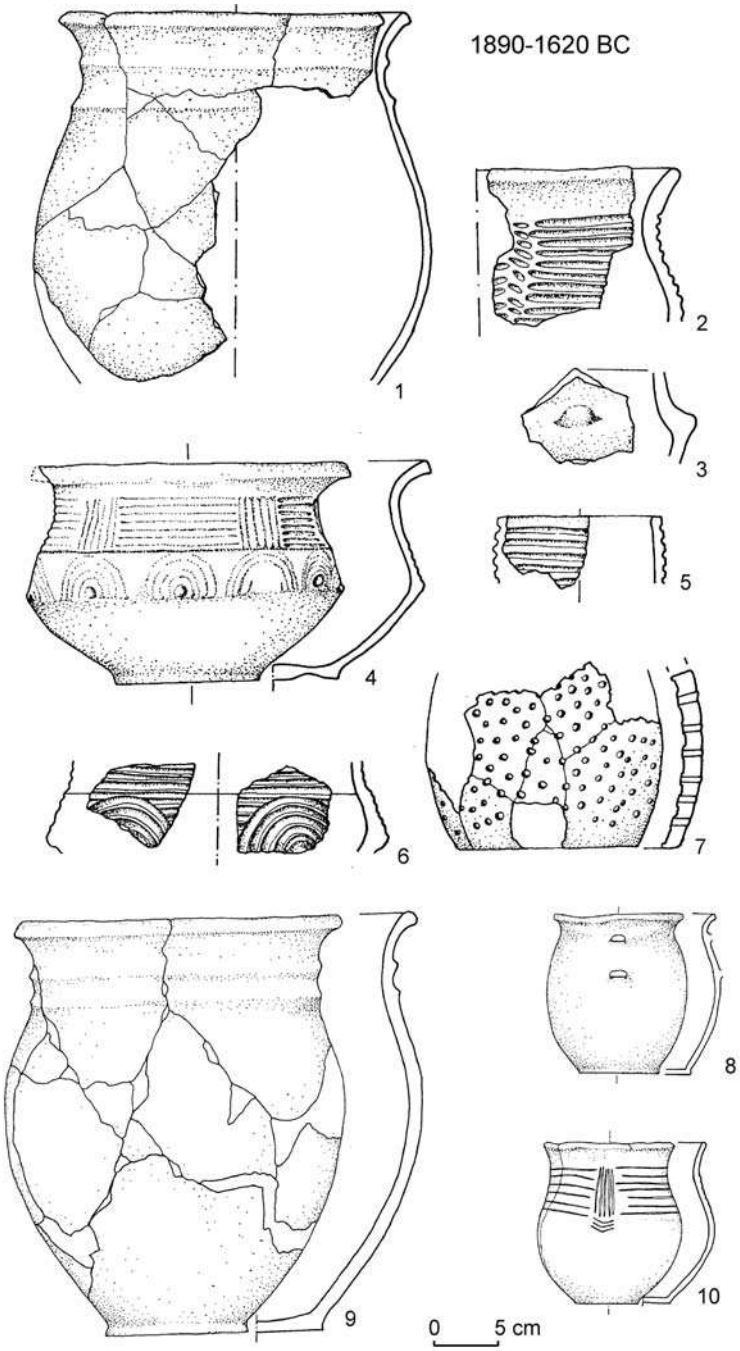

Fig. 12. Miernów 2, barrow II, Małopolska. Pottery from the barrow. After Kempisty 1978. Drawn by A. Bieniek-Wiśniewska

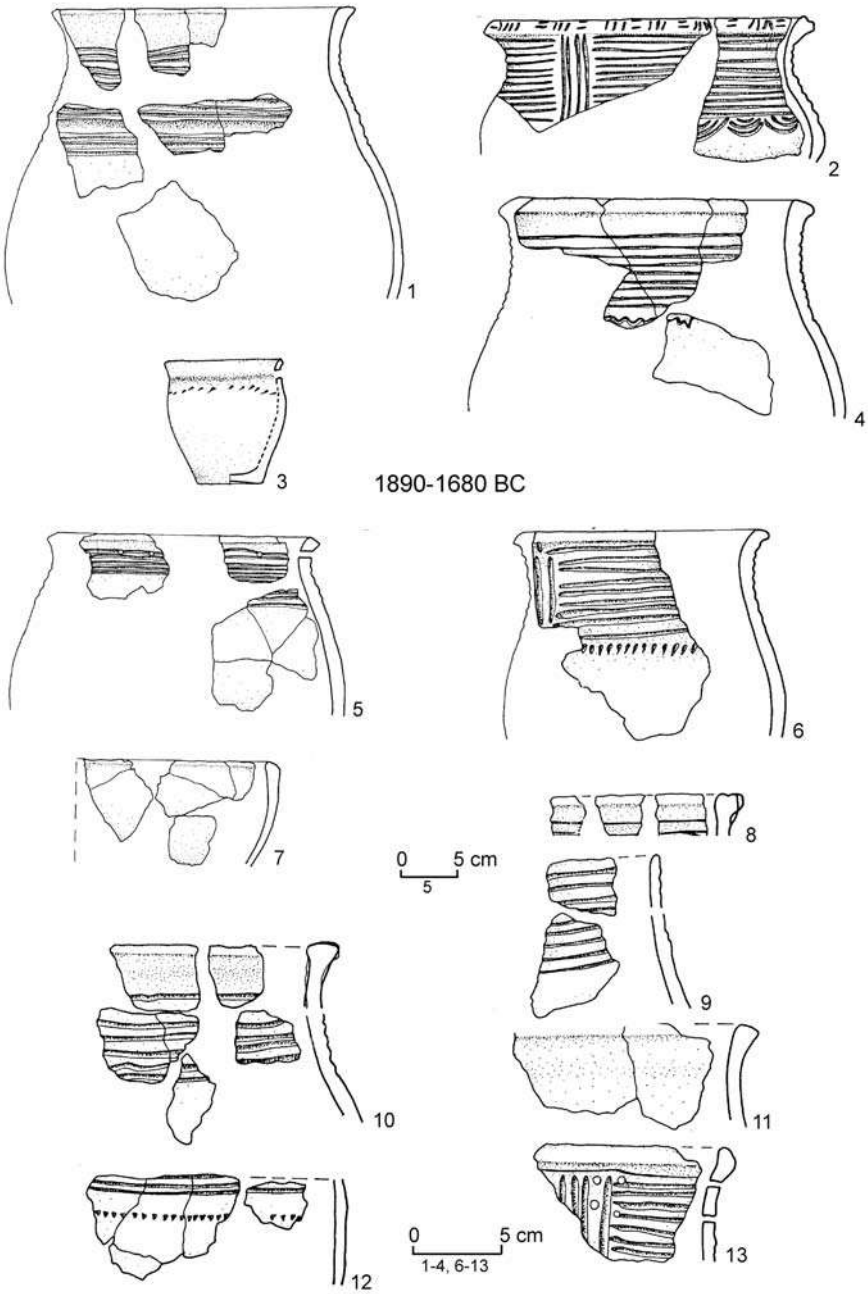

Fig. 13. Dubeczno 1, Lublin Upland. Pottery from the barrow. After Taras 1995. Drawn by A. Bieniek--Wiśniewska

from charcoals found in the pit under the barrow mound carries a relatively large standard error (Table 2:10) but it does not contradict typological observations or findings from Słonowice [Górski, Kadrow 1996:Tab. 1]. In stylistic terms, the vessel set from barrow II in Miernów, including S-profile pots with a double cordons and a bevelled rim (Fig. 12:1, 9), vases bearing incised ornaments (metope and repeated horizontal lines — Fig. 12:2, 4, 10) as well as spiral and boss ones (Fig. 12:4, 6), is older than materials from the features in Słonowice.

Also older are radiocarbon dates made for materials from a barrow in Dubeczno 1 in the Lublin province (Table 2:4 and 15) [Taras 1995; Florek, Taras 2003:61, Fig. 23]. Vessel forms and stylistics, e.g. pots decorated with incised and wavy lines (Fig. 13:1, 4-6), metopic ornaments (Fig. 13:2, 6, 13), wedge-shaped stamp impressions (Fig. 13:12) [cf. Taras 1995:202, Table. XV-XXIII], correspond to western Małopolska assemblages of type A1. It seems justified to believe that the oldest TC assemblages in the Lublin province in terms of stylistics, similarly to the lowlands zone (cf. absolute dating of TH 1 and TH 2 assemblages in Kujawy) [Makarowicz 1998a:102-105], emerged much earlier than in western Małopolska.

Relatively late dates are assigned to TC materials from Kraków-Nowa Huta-Cło, Małopolska, found in a collective grave (feature G-108, Table 2:48) and a settlement feature (feature S-102, Table 2:47). Pottery from the grave may be classified as type A1, whereas that from pit S-102 may be attributed to type A2 (however, with a high share of traits of type A1) [Górski, Kadrow 2001:145, Tab. 23, Abb. 43-44]. The results do not fit, in principle, into the chronological brackets set for this type of TCC assemblages in the south of Poland.

A very long series of radiocarbon dates comes from a sepulchral complex in Dacharzów, Małopolska (Table 2) [Taras *et al.* 2002; Florek, Taras 2003]. The oldest and at the same time central part of the complex was formed by graves built of stone (1A and 1B) under a barrow. From the perspective of the vicinity of Kraków, the goods found in grave 1A should be classified as type A1 (pots with incised-stroked ornament — Fig. 14:1, 3) with the proviso that they are not the oldest materials of this type. The formal and stylistic assessment of ceramic materials and the dating of a bronze pin (Fig. 14:4) [Florek, Taras 1997:78-79, Abb. 6:a-f] found in the grave, placing them at the older part of BB period [Blajer 1998:338], are consistent with their radiocarbon dating at around the turn of the 17th century BC (Table 2:9, 12, 14, 17, 19-25, 27-29, 31, 32, 34, 36, 41, 62, 64, 66, 69) [Taras *et al.* 2002:161, tab. 1, 2, Fig. 3]. Very late dates were obtained for grave 2 (Table 2:61, 63, 67), which yielded up a large set of pottery [Florek, Taras 1997:Abb. 10]. The goods found in the grave certainly correspond to the younger development stages of the TC, but the set is not very distinctive. A vase on a slender and empty stem indicates connections to vases and beakers on stems known from this area and dated at the late phase [cf. Gardawski 1959:tabl. XXXV:1; XXXVI:8]. The only vessel of this type, well seated in the realities of relative chronology, comes from pit 5 at the cemetery in Żerniki

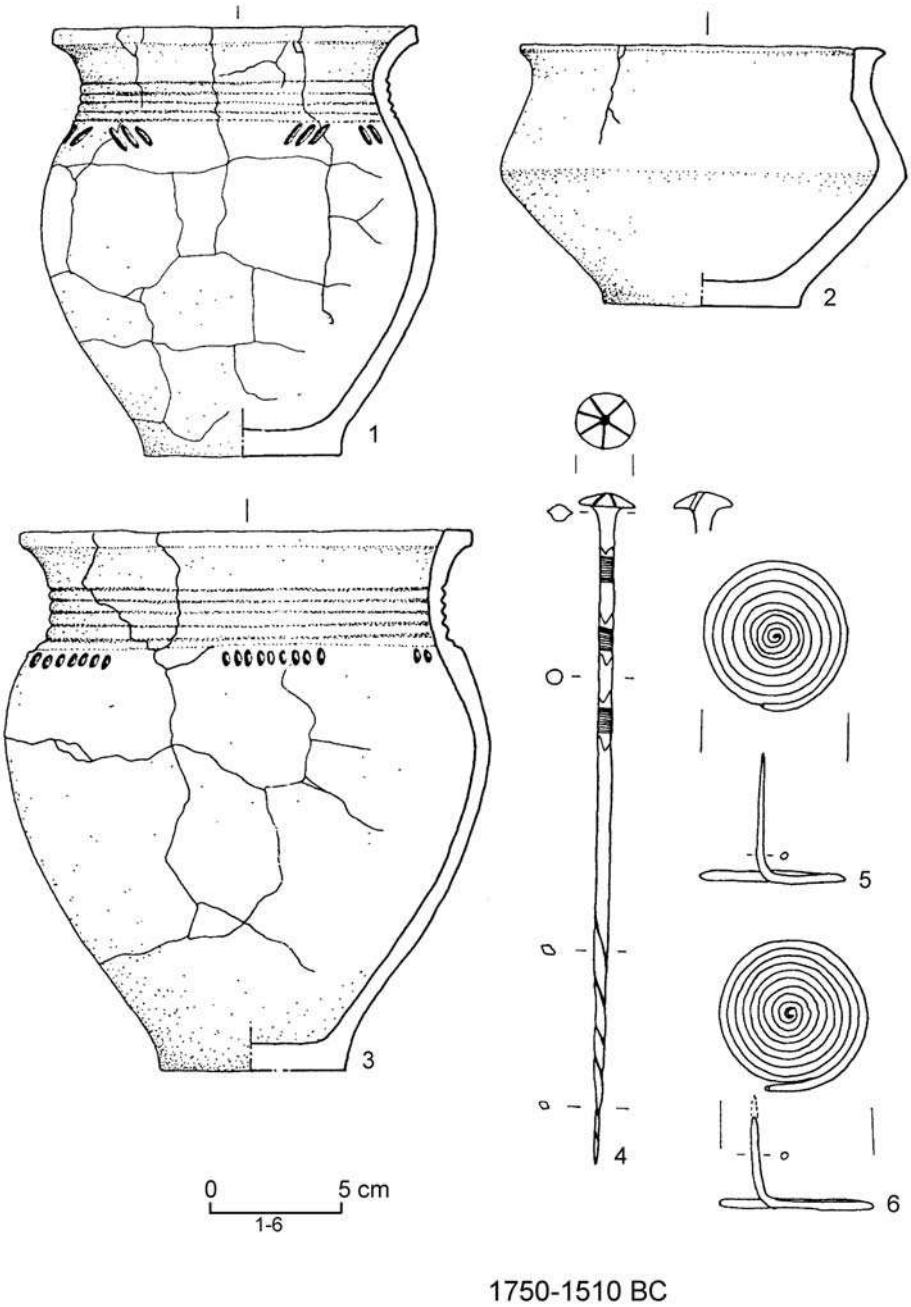

Fig. 14. Dacharzów 1, Małopolska. Pottery from feature 1A. After Florek, Taras 2003. Drawn by A. Bieniek-Wiśniewska

Górne 1, Małopolska the dates for which can be, in principle, fitted into phase B of the Bronze Age. The dating of this assemblage virtually after 1000 BC seems to be too late [Taras *et al.* 2002:tab. 2. Fig. 3]. In terms of pottery stylistics, the grave goods can be placed within rather broad brackets whose limits are determined by western Małopolska assemblages of types A1-A2 and C. This assessment is based above all on the stressing of vessel tectonics by giving prominence to "shoulders" [Florek, Taras 1997:Abb. 10:b-d, g, h]. Consequently, the absolute dating of this grave should be much earlier. This opinion corresponds well with the dating of grave 5, containing a pot with identical traits as vessels from grave 2 [Florek, Taras 1997:Abb. 9a], at 1620-1400 BC (Table 2:18, 33, 39, 42). The question of the chronology of grave 2 in Dacharzów, however, should be approached for the time being with great care. Taking into account the differences between its stylistic and radiocarbon dating, it must be remembered that our knowledge of the chronological differentiation of the TC and the cultural situation in the region of Sandomierz at the time is highly unsatisfactory.

For determining the chronology of the late TC in the region of Sandomierz, valuable information is furnished by the dating of a mass grave in Dwikozy [Ścibior, Ścibior 1990]. It was a burial of the "burial house" type (Fig. 15). Nine radiocarbon dates were obtained from the burnt timber structure (Table 2:45, 46, 49, 52, 56-60) [Ścibior, Ścibior 1990:Tab. 2]. The ceramic grave goods correspond to the latest TC pottery from western Małopolska (type C assemblages — Fig. 15:1-10, 12) but have peculiar, local traits [Ścibior, Ścibior 1990:Fig. 9-10]. As the sepulchral structure in Dwikozy was used only once, wiggle matching analysis was performed assuming that in all probability the time span of the timber used to build the structure over the grave was not greater than 100 years. In this way the most probable date, i.e. ca. 1050 BC [Górski, Kadrow 2001:Tab. 19, Abb. 7], for this feature was obtained. The assemblage found in the grave included two vessels decorated with vertical flutes (Fig. 15:6, 9), which in the vicinity of Kraków are characteristic of type C assemblages. A similar ornament is found on the bottom part of a vessel unearthed in grave 11 in Dacharzów. The absolute dating of this grave (Table 2:54) is very close to the chronometry of the Dwikozy assemblage. The materials from both features (in particular from Dwikozy) mark the last (terminal) phase of the TC in the region of Sandomierz. In comparison to the assemblages from the vicinity of Kraków, these dates are relatively late. If we consider, however, the fact that early LC settlement in the region of Sandomierz is rather enigmatic, we can assume that Trzciniec structures lasted there for a long time.

From Żerniki Górne 1, Małopolska we have a series of 8 radiocarbon determinations (Table 2:1-3, 5-7, 13, 18), according to which the barrow and the accompanying cemetery of collective graves were used between 1900 and 1700/1600 BC [Włodarczak 1998:Table 3], hence in phases A1 b and A2 of the Bronze Age [Włodarczak 1998:175; Górski, Kadrow 2001:133]. Samples for ^{14}C measurements were

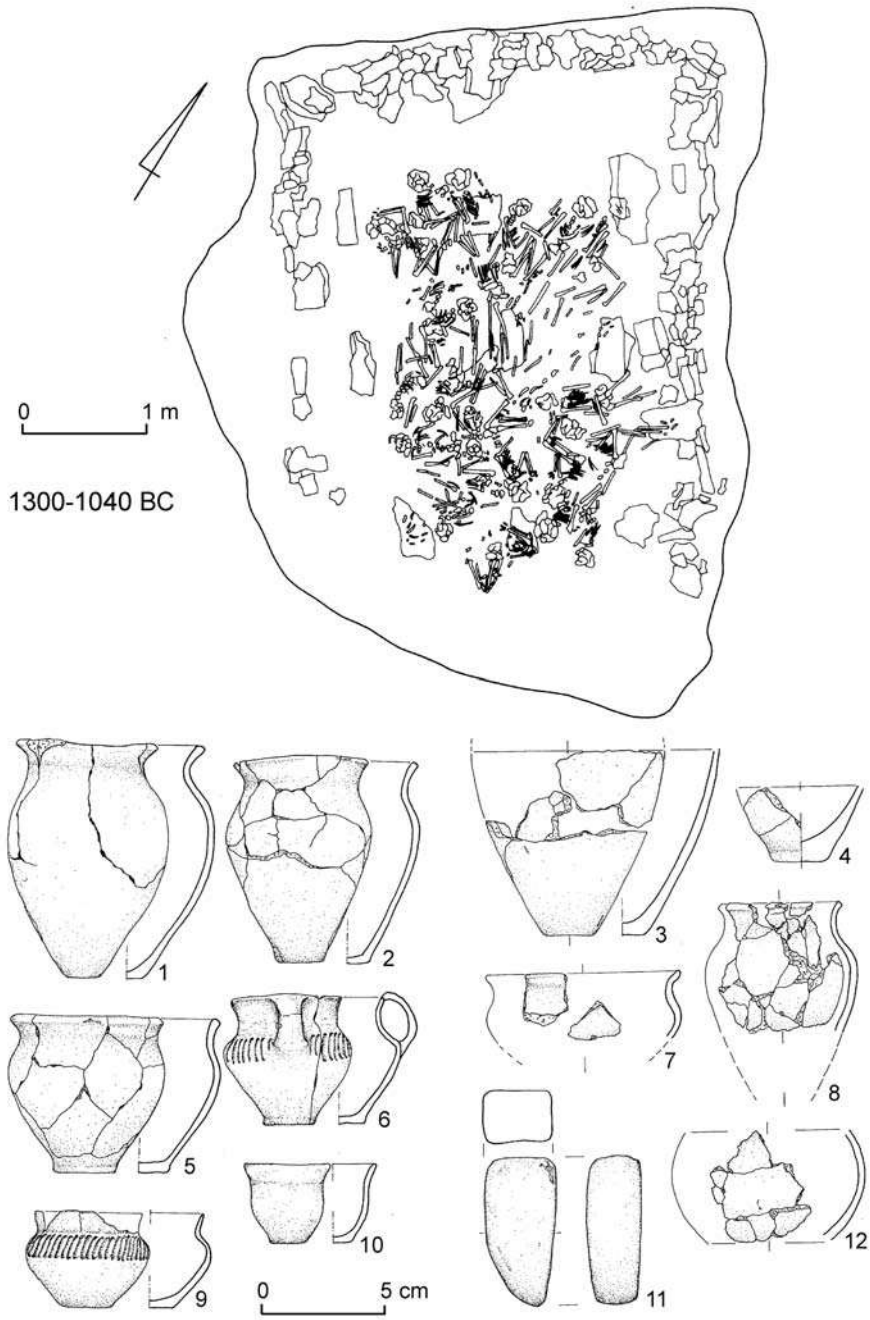

Fig. 15. Dwikozy, Małopolska. A burial house and pottery from the house. After Ścibior, Ścibior 1990. Drawn by A. Bieniek-Wiśniewska

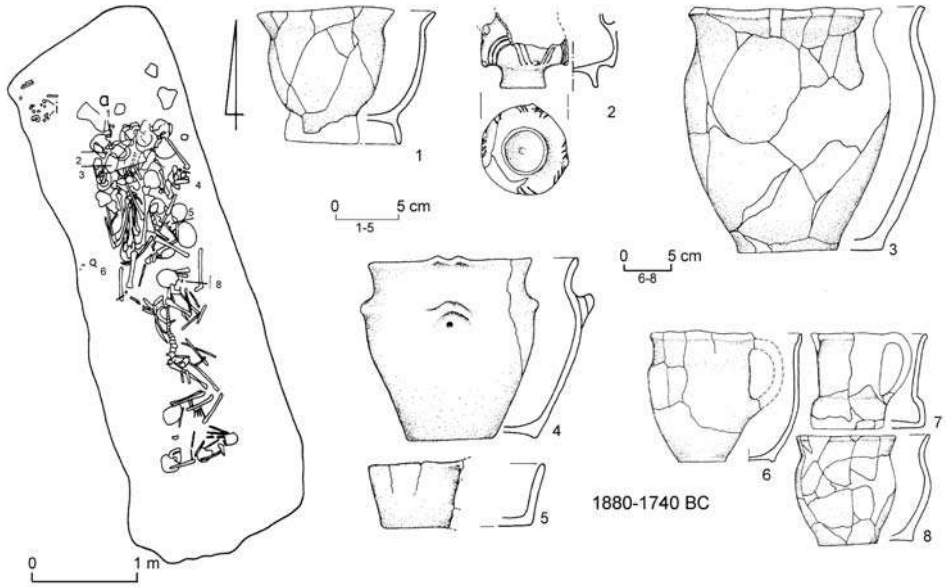

Fig. 16. Żerniki Górne 1, Małopolska. Grave 69 and pottery from the house. After Kempisty 1978. Drawn by A. Bieniek-Wiśniewska

taken from bones of individuals buried in the mass graves used for a long time. Approved until now, the results of dating the cemetery seem to contradict in most cases the dating based on typological criteria. Some materials should be identified with A2 assemblages whereas others indicate Transcarpathian connections forming a stylistically separate group of vessels. In the southern zone of the TC range, vessels showing traits of southern cultures (FC MaC, Veterov culture — VC, TuC, Piliny culture — PC) sporadically occur with pottery identified as type A1 assemblages and much more frequently with that of types A2 and A3. Pottery finds showing Transcarpathian traits as a rule do not occur in homogeneous assemblages with leading pottery forms characteristic of type A1 assemblages. Some Żerniki Górne determinations come from scanty assemblages which for this reason are difficult to assess typologically (graves 3, 5, 62, 71, 86, 102) [Kempisty 1978:Fig. 213, 215, 223, 224, 235, 236, 246, 259]. A rather unimpressive collection comes from grave 73 [Kempisty 1978:Fig. 244, 245]. Besides bones, however, it yielded up a bronze pin dated with certainty at phase B1 of the Bronze Age [Gedl 1983:77]. The radiocarbon date (Table 2:2) is, however, at least 200 years older than the age following from the analysis of the artefacts. An analogous situation takes place in the case of mass grave 69 (Table 2:6). It yielded up two highly characteristic vessels — jugs [Kempisty 1978:Fig. 228/2, 229/5]. One of them finds analogies in the late phase

of the MaC (Fig. 16:7) while the other (a specimen on a stem, with an undercut lower portion of the belly, decorated with "drooping" bosses) was made following the style of the late FC (Fig. 16:2). Analogies to the sets of vessels exhibiting southern traits and found at the cemetery in Żerniki Górne as well as, generally, on loess soils in the vicinity of Kraków are encountered in the environment of the late phases of the MaC and in the early phases of the PC, Suciu de Sus and generally TuC [Górski 2003]. This, in turn, makes it impossible to move the dating of these materials far beyond the transition period between phases A and B of the Bronze Age. Hence, it seems that for some unknown reasons most (all?) measurements of the absolute age concerning the TC in Żerniki Górne are too old. This assessment is corroborated by the analysis of dating of graves dug into the barrow. The highest probability of dating the older of them (grave 3 — Table 2:3) fits into the interval between 1980-1870 BC. Meanwhile, in the barrow, hence in an older stratigraphic position, two vessels were discovered of which one is decorated in a manner typical of the FC [Kempisty 1978:ryc. 260:1, 2]. It is out of the question that such vessels could be produced in the cultural environment of western Małopolska in the 20/19th century BC.

Stylistically the oldest FC materials beyond the northern arch of the Carpathians were found in a fortified settlement in Trzcinica [Gancarski 1994; 2002]. Relying on a numerous series of radiocarbon dates, we suggest to date the early FC settlement on the northern Carpathian piedmont at the end of the 17th century BC [Gancarski 1999; Calderoni *et al.* 2000]. The emergence of the settlement fits well into the history of territorial development of FC societies which expanded to the north, including Spisz, in the latter period of the culture's middle phase (a younger portion of BA2) [Furmánek, Veliačik, Vladár 1991:82, 84]. The youngest materials of phase BB1 can also be found in Małopolska and they do not have any analogy in older FC assemblages.

Summing up, it has to be noted that in the vicinity of Kraków, TCC groups appeared in a mature form and do not show any significant connections with the Mierzanowice culture (MC) [Górski, Kadrow 1996]. In the northern stretch of the Central Polish Uplands (regions of Sandomierz and Lublin) and on the Polish Lowlands, assemblages close to the oldest A1 and A2 types from Małopolska, e.g. TH 1 and TH 2 in Kujawy, are dated considerably earlier [Czebreszuk 1996:159-164; Makarowicz 1998a:102-105]. Radiocarbon chronology confirms the "moving" of TC pottery stylistics from the Polish Lowlands in the direction of old uplands. In western Małopolska, a confirmation was obtained of a reliable dating of A1 assemblages at as late as the end of the 17th and the 16th centuries BC although successive attempts to determine their absolute chronology may push back the dating by at least one century. Theoretically, one can expect slightly earlier dates in the region of Sandomierz. It has to be stressed, however, that similarly to the situation in western Małopolska, a "barrier" to the Trzciniec settlement could have been for-

med by intensive and long-lasting settlement of the MC. In the vicinity of Kraków, only a single date determines the chronology of the youngest, type C assemblages (13th-12th century BC). The TCC disappeared relatively soon in the vicinity of Kraków due to the emergence of LC societies. However, it lasted much longer in areas where new trends had a weaker impact, which is shown by the dating of its late assemblages in the region of Sandomierz (especially Dwikozy and Dacharzów, feature 11).

3. THE EASTERN SUBCIRCLE OF THE TRZCINIEC CULTURAL CIRCLE

The eastern subcircle of the TCC occupied the forest and forest-steppe areas of the drainages of the Pripets, Dnieper, Southern Bug, Dniester and Prut rivers (Black Sea drainage) as well as portions of the drainage of the upper and middle Neman River (Baltic Sea drainage). The relationships between culture and environment (landscape zones) allow us to distinguish in the eastern branch of the TCC two development trends, namely, Trzciniec (forest) and Komarov (Carpathian Foothills-forest steppe) [Lysenko 2002a:128-130].

The sites of the "Trzciniec" development trend, connected to the zone of Europe's mixed-pine forests, chiefly occupy sod-podzol soils of Polissya. In this zone cremation burials dominate. The sites of the "Komarov" development trend are found in the landscape zones of the Carpathian Foothills and the forest-steppes of right-bank Ukraine (in particular black soil on loess), where oak and hornbeam-oak forests were interspersed with meadow steppes. The land surface features are more varied in this zone in comparison to the areas occupied by the "Trzciniec" line. In the "Komarov" funerary rituals inhumations prevailed including the ritual of dismemberment of corpses; cremation was rare [Lysenko 2001a].

From the eastern subcircle of the TCC 83 dates were obtained for 7 settlements and 11 sepulchral features (Fig. 1, Tables 3-6).

3.1. THE "TRZCINIEC" DEVELOPMENT TREND

The "Trzciniec" development trend of the eastern subcircle of the TCC includes the following groups: Pripets [Berezanskaya 1972:130] (Turovo-Mozyr according to M.M. Kryvaltsevich [1995:7; 1997]), Sosnitsa (Bryansk and Chernikhiv Po-

Table 3

Radiocarbon datings of the Trzciniec Cultural Circle assemblages from Ukrainian Belarusian, and Briansk Polissya

No.	Site/ feature	Cultural unit/ phase	Conv BP	Cal BC (1 σ)	Lab. code	Sample material	Context	Cat.	Comments
1	2	3	4	5	6	7	8	9	10
1.	Rzhanica-Besets-2/ barrow 1/9, sample 137	TCC	3600±90	2050-1870 (49,6%)	Ki-648	?	grave	?	too early dating
2.	Rzhanica-Besets-2/ barrow 1/9, sample 136	TCC	3270±80	1630-1440 (65,5%)	?	?	grave	?	
3.	Pustynka	TCC	3140±100	1520-1290 (65,6%)	Ki-588	charcoal	house?	IIB	
4.	Zdvizhevka/1	TCC	3095±30	1410-1370 (39,9%) 1345-1315 (23,5%)	Ki-6221	bone	house	IB	
5.	Abakumy-1	TCC	3100±30	1415-1370 (41,8%)	IGS-641	charcoal	house	IIB	
6.	Pustynka/X	TCC	3060±40	1400-1260 (68,2%)	Ki-6220	bone	house	IB	
7.	Abakumy-1	TCC	2900±30	1130-1010 (68,2%)	IGS-643	charcoal	house	IIB	too late dating no compatible with the typological analysis
8.	Abakumy-1	TCC	2850±30	1070-970 (56,7%)	IGS-642	charcoal	house	IIB	too late dating no compatible with the typological analysis

TCC - Trzciniec Cultural Circle

Data after: Berezanskaya 1974; 1982; Telegin, Subotovich, Kovaliukh 1981; Kovalyukh *et al.* 1998; Krivalcevič 2001

lissya) [Berezanskaya 1972:130-134; Artemenko 1987:106-113], North Polissya [Kryvaltschevich 1995:16; 1997], Neman [Lakiza 2001, Fig. 4; Rimantienė, Ostrauskas 1998:203-215], and Kiev-Zhitomir [Lysenko 2001a:5-7]. The Kiev-Zhitomir group corresponds to the sites of the Kiev variety of the Eastern TC distinguished by S.S. Berezanskaya and located on sod-podzol soils of Kiev Polissya and the Dnieper valley [1972:129-130].

The lower date of the TCC's appearance in Ukrainian and Belarussian Polissya is marked by the life of the Middle Dnieper culture (MDC), i.e. the interval between 2900 and 1700 BC [Kryvaltsevich, Kovalyukh 1999:151-162]. The formation of TCC groups in the area in question may be dated at ca. 1700 BC.

For TCC assemblages from Ukrainian and Belarussian Polissya, we have dates concerning settlements in Zdvizhevka (Kiev-Zhitomir group), Pustynka and

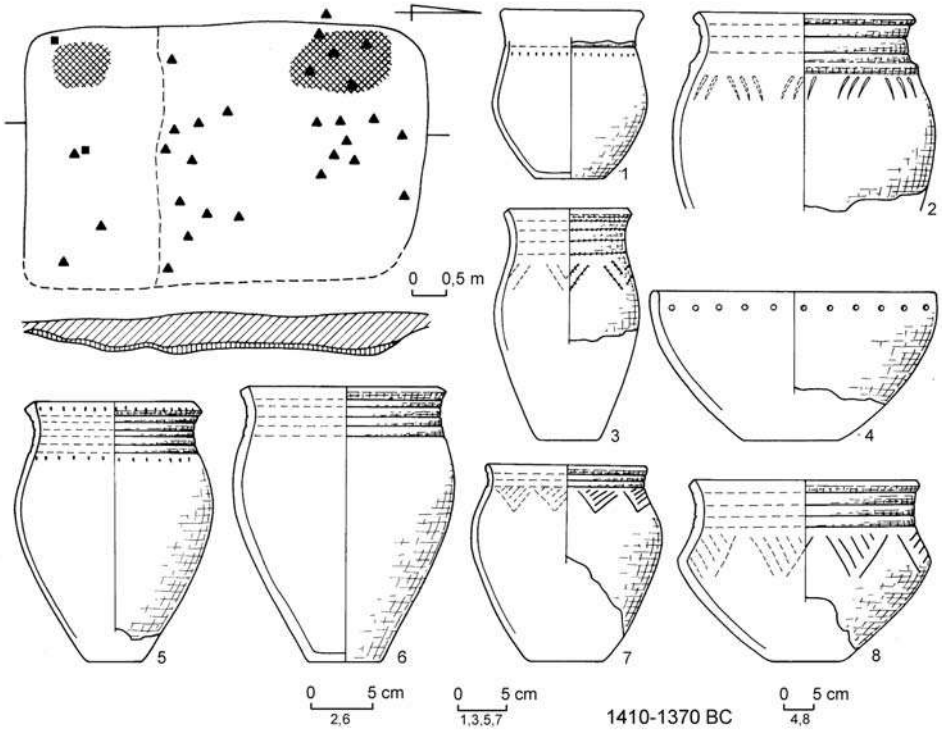

Fig. 17. Zdvizhevka, Zhitomir, Polissya. A house and pottery from the house. After Berezanskaya 1972; 1982

Abakumy-1 (Sosnitsa group) as well as graves from a cemetery in Besets-Rzhanitsa-2 (Table 3).

The date for the settlement in Zdvizhevka, Ukrainian Polissya (Table 3:4) is a result of a measurement made on a tooth of a bull unearthed in the fill of house 1. Dated at the 15/14 century BC, the pottery exhibits early Trzciniec traits (S-profile pots — Fig 17:1-3, 5, 6, incised horizontal lines, barbed wire and triangle ornament — Fig. 17:3, 7, 8) [Berezanskaya 1972:170, 171, 173, Fig. III and IV], which is consistent with its stylistic assessment.

For the settlement in Pustynka, Ukrainian Polissya there are two dates (Table 3:3 and 6). The first was made on charcoal discovered in a house (the number of feature is not known) [Berezanskaya 1974:143; 1982:21]; while the second was made on animal bones discovered in house 10 [Kovalyukh *et al.* 1998b:140]. The pottery from the settlement, published only in part, has both early traits (corded and multi-cordons ornament, barbed wire) and late ones (punctures, holes). For this reason, until materials from the settlement are published in full, there is no

1405-1310 BC

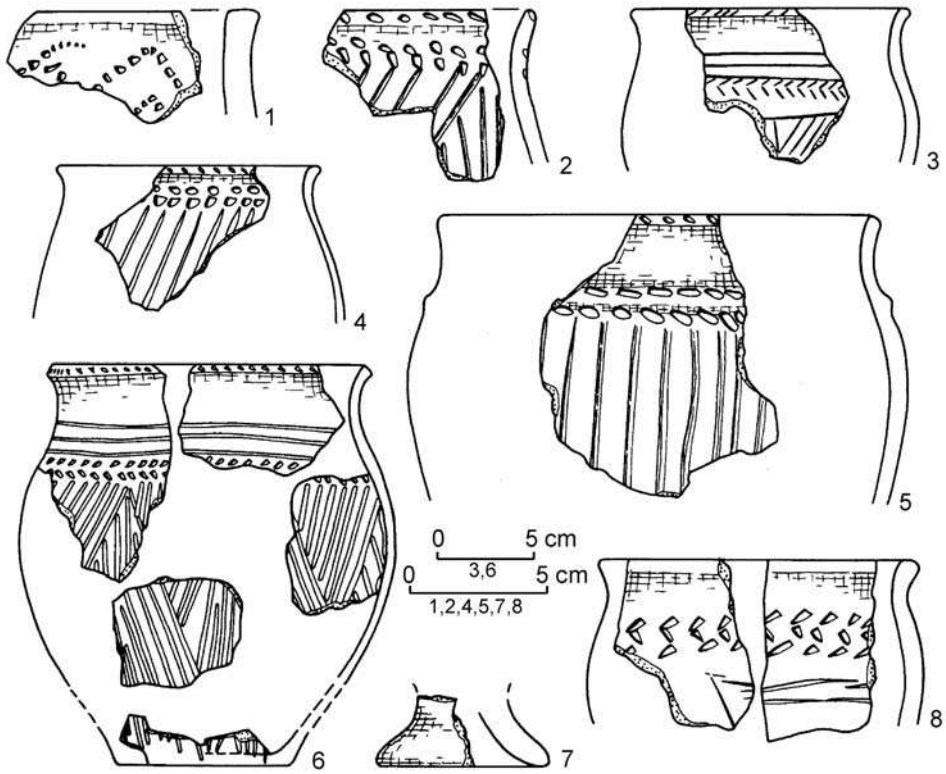

Fig. 18. Abakumy-1, Chernikhov, Polissya. Pottery from the feature. After Kryvalcevič 2001

evidence to consider it as developing at the same time and to make the obtained dates refer to the whole site.

A Sosnitsa type set of vessels, close to the ceramic assemblage from Pustynka, was discovered in the settlement in Abakumy-1, Belarussian Polissya (e.g. incised lines, stamp impressions — Fig. 18:1-8) [Kryvalcevič 2001:323-324, Table 2, Fig. 6]. Three dates refer to this set. The measurements were made on coal from the burnt walls of the feature (Table 3: 5, 7, 8). Only the first of the three dates seems to be consistent with the stylistic assessment of the ceramic material.

For the group of materials in question, two radiocarbon determinations were obtained by making measurements on timber from grave 1 in barrow 12 and on unknown organic material from grave 9 in barrow 1 from the cemetery in Besets--Rzhanitsa-2 (Table 3:1, 2) [Telegin *et al.* 1981:80, 84]. The author of the excavations,

I. I. Artemenko, classified these graves as belonging to the middle stage of the Sosnitsa culture (SC) [Artemenko 1987:110]. One of these two dates, obtained by measurements made in the Kiev laboratory (Table 3:1), is definitely too early if one considers the chronology of the feature determined on the basis of the stylistics of the ceramic material.

For late TCC assemblages from Polissya (Lebedov culture according to S. S. Berezanskaya, Late SC according to I. I. Artemenko) no radiocarbon dates have been obtained so far.

3.2. THE "KOMAROV" DEVELOPMENT TREND

The "Komarov" development trend of the eastern subcircle of the TCC includes the following groups: Komarov (Dniester area) [Sveshnikov 1990:79-82], Volhynia (forest-steppe part of the Pripets drainage [Sveshnikov 1990:82-86] — Rovne variety of the Eastern TC according to S.S. Berezanskaya [1972:126-129]), Hordeevka-Bilogrudovka (forest-steppe part of the Southern Bug area) and Kiev--Cherkasy [Lysenko 2001a:7-11].

3.2.1. THE ABSOLUTE CHRONOLOGY OF THE KOMAROV AND VOLHYNIA GROUPS

A periodization of the Komarov culture (KC; primarily assemblages from the Carpathian Foothills and Volhynia) was suggested by I.K. Sveshnikov who relied on the typology of ceramics and metal goods [Swiesznikow 1967:73].

For TCC assemblages from western Ukraine there are four ^{14}C dates: three for the Volhynia group, including one from Ivanye, barrow 2 (Table 4:2; Fig. 19:1-18) [Sveshnikov 1968:167] and two from a cemetery in Netishin, barrow 7, grave 13 (Table 4:2, 4) [Berezanska *et al.* 2003] as well as a single date for the Komarov group, specifically for Horizon I of the settlement in Magala, Carpathian Foothills (Table 4:1) [Sementsev *et al.* 1969:255].

The material from the barrow in Ivanye, Volhynia can be classified as the younger development phase of the Volhynia group. It is characterized by the co-occurrence of bronze and gold goods of Transcarpathian origin (Fig. 19:1, 2, 4, 5, 7, 9-14, 18) and vessels of the KC type (Fig. 19:3, 7, 8, 16, 17) [Sveshnikov 1968].

The sources (expecially pottery stylistic) from the cemetery in Netishin, Volhynia can be attributed to the Volhynia group. It shows some traits of the so

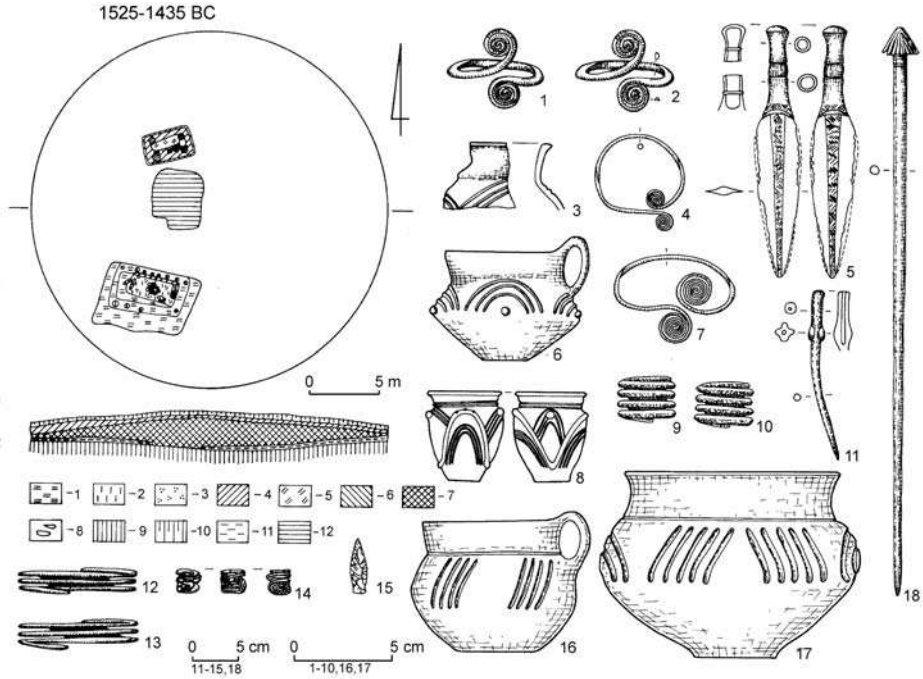

Fig. 19. Ivanye, barrow 2, Volhynia. A barrow and artefacts from the barrow. 1, 2, 4, 5, 7, 9-13, 18 - bronze; 3, 6, 8, 16, 17 - clay; 14 - gold; 15 - flint. Legend - see: Sveshnikov 1968, 161; Dąbrowski 1972. After Sveshnikov 1968; Dąbrowski 1972

Table 4

Radiocarbon datings of the Trzciniec Cultural Circle assemblages from Carpathian Foothills and Volhynia

No.	Site/ feature	Cultural unit/ phase	Conv BP	Cal BC (1 σ)	Lab. code	Sample material	Context	Cat.	Comments
1	2	3	4	5	6	7	8	9	10
1.	Magala I/?	TCC	3380±80	1750-1520 (68,2%)	Le-489	charcoal	hearth	IIB	
2.	Netishyn, barrow 7/13	TCC	3280±50	1630-1490 (65,9%)	Ki-????	charcoal	grave	IIA	
3.	Ivanye, barrow 2	TCC	3235±35	1525-1435 (68,2%)	GrN-?	wood	grave	IIA	
4.	Netishyn, barrow 7/13	TCC	3220±50	1525-1435 (68,2%)	Ki-????	charcoal	grave	IIA	

TCC – Trzciniec Cultural Circle
Data after: Sveshnikov1968; Semencov *et al.* 1969; Florek, Taras 2003

called Podlasie-Mazowsze group of the western subcircle of TCC (multiple horizontal, diagonal and vertical lines, cordons under the rim, motifs of incised arches, "chevrons", stamp or stroke ornamentations) [Berezanska *et al.* 2003:Fig. 21-26].

Horizon I of the Magala site is characterized by the presence of pots with cordons under the rim, thin-walled pottery decorated by repeated incised lines, punctures or dents and hatched triangles [Smirnova 1976:Fig. 3-6]. Horizon II at Magala already represents the Noa culture (NC) although some assemblages (e.g. material from dugout 3) still show certain "Komarov" traits. The co-occurrence of elements of both groups can be interpreted in two ways: as an effect of the spreading of the NC in the region or as the adoption of NC traits by local societies of Komarov group as a result of intensive contacts.

The lack of new radiocarbon dates prevents us from precisely determining the chronology of the change of TCC structures into the NC in the Carpathian Foothills or the period when the formations throve in the forest-steppe part of Volhynia.

3.2.2. THE ABSOLUTE CHRONOLOGY OF THE HORDEEVKA-BILOGRUDOVKA GROUP

The most important site of the late Bronze Age, practically fully explored and dated using the ^{14}C method, located in the forest-steppe part of the Southern Bug valley, is the cemetery in Hordeevka (Gordievka) [Berezanskaja, Kločko 1998]. The site is considered an independent cultural phenomenon related to the interactions with groups of the TuC from the Carpathian Basin. Next, these people "assimilated" the traits of the following local cultures: Komarov, Eastern Trzciniec, Bilogrudovka, Vysotsk, Mnogovalikovoy Pottery, Srubnaya and Belozerka [Berezanskaya, Lobay 1994:152; Berezanskaya 1999:147]. Sometimes it is also considered a product of "the local, autochthonous culture of the Middle Dniester area" [Krushelnitska 1998:193-196, Fig. 108].

It seems that there are no grounds whatsoever for distinguishing a separate Bilogrudovka culture within the TCC. Until now, the distinction has been based chiefly on prehistoriographic tradition rather [Lysenko 2002b:92-93] than true differences [cf. a similar view by S.S. Berezanskaya 1985:512].

Next to Hordeevka, in the forest-steppe drainage of the Southern Bug, we know of tens of sites that can be associated with the Bilogrudovka culture [Berezanskaya 1985:map 12:I], e.g. a number of less spectacular cemeteries that supply artefacts analogous to Hordeevka ones, such as Beliy Kamen [Makarevich 1940:463-466], Chebotarka [Kozlovska 1930:31], or Pechera [Rybalova 1961:21-23]. Against their background, the Hordeevka cemetery can be interpreted not as a foreign phenome-

Table 5

Radiocarbon datings of the Trzciniec Cultural Circle assemblages from forest-steppe part of Southern Bug basin

No.	Site/ feature	Cultural unit/ phase	Conv BP	Cal BC (1 σ)	Lab. code	Sample material	Context	Cat.	Comments
1	2	3	4	5	6	7	8	9	10
1.	Hordeevka, barrow 27	TCC/ Hord. I	3460±70	1890-1680 (68,2%)	Ki-5080	bone	grave	IA	too early dating no compatible with the typological analysis
2.	Hordeevka, barrow 26	TCC/ Hord. I	3240±50	1530-1430 (56,5%)	Ki-9253	wood	grave	IIA	
3.	Hordeevka, barrow 26	TCC/ Hord. I	3180±50	1520-1410 (68,2%)	Ki-9252	wood	grave	IIA	
4.	Hordeevka, barrow 26	TCC/ Hord. I	3120±50	1450-1310 (66,7%)	Ki-9254	wood	grave	IIA	
5.	Hordeevka, barrow 28	TCC/ Hord. I	3110±50	1440-1310 (68,2%)	Ki-9257	wood	grave	IIA	
6.	Hordeevka, barrow 32/2	TCC/ Hord. IV	3020±55	1320-1210 (44,8%)	Ki-5079	bone	grave	IA	
7.	Hordeevka, barrow 33	TCC/ Hord. IV	3010±50	1320-1210 (48,2%)	Ki-5083	bone	grave	IA	
8.	Hordeevka, barrow 31	TCC/ Hord. III	3005±50	1320-1190 (58,2%)	Ki-9258	wood	grave	IIA	
9.	Hordeevka, barrow 27	TCC/ Hord. I	2980±50	1310-1120 (68,2%)	Ki-9255	wood	grave	IIA	too late dating no compatible with the typological analysis
10.	Hordeevka, barrow 35	TCC/ Hord. IV	2980±60	1320-1120 (66,1%)	Ki-5081	bone	grave	IA	
11.	Hordeevka, barrow 27	TCC/ Hord. I	2950±50	1220-1050 (58,0%)	Ki-9256	wood	grave	IIA	too late dating no compatible with the typological analysis
12.	Hordeevka, barrow 37	TCC/ Hord. IV	2920±50	1220-1010 (68,2%)	Ki-5082	bone	grave	IA	

TCC – Trzciniec Cultural Circle; Hord.I-IV – horizons of Hordeevka cemetery (substantial for Hordeevka-Bilogrudovka group of TCC)

Data after: Berezanskaja, Kločko 1998; Ślusarska 2003

non but as an elite necropolis of "Bilogrudovka" populations located at the junction of two important routes crossing the forest-steppe, both on the Southern Bug and in the south [Lysenko 2002c:104-111].

Hordeevka is the only Late Bronze Age cemetery in the region under discussion that has been radiocarbon-dated (Table 5:1-12). Relying on ^{14}C dates and the analysis of metal goods, V.I. Klochko distinguished four chronological horizons at the cemetery: I (BB-BD/1500-1300 BC — barrows 6, 22-28), II (BD-HaA1/1300-1200 BC — barrows 2, 3, 5, 7-19, 21, 29, 40), III (HaA2/1200-1100 BC — barrows 31, 38, 39, 42) and IV (HaB/1100-1000 BC — barrows 32-35, 37) [Klochko 1998:343-351; see also Ślusarska-Michalik, Radiocarbon..., in this volume]. The first two horizons are synchronous with the emergence of the developed TCC on the Dniester and in Volhynia and considered by V. I. Klochko as early Bilogrudovka. The late horizons are contemporaneous with the Bilogrudovka horizon of the Middle Dnieper area.

We believe that the periodization of the cemetery in Hordeevka may be taken as a benchmark for the absolute chronology of the Hordeevka-Bilogrudovka group of the TCC. Horizon I was preceded by a pre-Hordeevka horizon — a stage when the TCC spread from the Dniester area into the Southern Bug area (cemetery in Bar, the older cultural stratum in Sandraki or Gaysine).

3.2.3. THE ABSOLUTE CHRONOLOGY OF THE KIEV-CHERKASY GROUP

The set of radiocarbon dates concerning the TCC on the forest-steppes on the Middle Dnieper numbers 61 measurements (Table 6) [Kovalyukh *et al.* 1998b:130--140; Klochko *et al.* 1998:667-673; Klochko 1999:163-195; Lysenko 2001a].

Of key importance for the periodization of the Kiev-Cherkasy group prove to be the materials from the cemetery in Malopolovetske-3 and the settlement in Malopolovetske-2A [Kravchenko, Petrauskene 1993:79-80; Lysenko 1998a:95-117; Lysenko, Lysenko 1998:101-106; 2000:86-88; 2001:147-159; 2002:168-177; Lysenko *et al.* 1999:116-121]. Relying on radiocarbon dates, both published earlier and new ones, and after a comparison of the materials of the Malopolovetske group of sites with other sites from the same region was made, the distinction into five chronological horizons within the group is suggested: MP-I (Mnogovalikovoy Pottery culture — MPC), MP-II (Malopolovetske), MP-III (Teklino), MP-IV (Moshny), MP-V (Bilogrudovka) [Lysenko 2001a].

Horizon MP-I (horizon of the Mnogovolikovoy Pottery culture)

At the cemetery in Malopolovetske-3, in this stage one can include grave 25 (Table 6:3). The deceased was buried in a pit with a niche, in a contracted posture,

Table 6

Radiocarbon datings of the Trzciniec Cultural Circle assemblages from forest-steppe part of Middle Dneper

No.	Site/ feature	Cultural unit/ phase	Conv BP	Cal BC (1 σ)	Lab. code	Sample material	Context	Cat.	Comments
1	2	3	4	5	6	7	8	9	10
1.	Rossava, barrow 7/ 1	MP-I/ III	3610±30	1980-1910 (48,1%)	Ki-5827	bone	grave	IA	too early dating no compatible with the typological analysis
2.	Velikaya Bugaevka/ 109-2001	MP-I	3450±70	1880-1680 (68,2%)	Ki-9555	bone	grave	IA	
3.	Malopolovetske-3, c. 6/ 2 (25-1997)	MP-I	3430±35	1770-1680 (62,3%)	Ki-6213	bone	grave	IA	
4.	Malopolovetske-3, c. 5/ 4 (20-1996)	TCC/ MP-II	3350±40	1690-1600 (54,3%)	Ki-6211	bone	grave	IA	
5.	Malopolovetske-3, c. 2/ 1 (12-1995), sample 2	TCC/ MP-II	3345±35	1690-1600 (55,8%)	Ki-6356	burnt bone	grave	IIIA	
6.	Malopolovetske-3, c. 5/ 2 (18-1996)	TCC/ MP-II	3340±40	1690-1600 (49,9%)	Ki-6209	bone	grave	IA	
7.	Malopolovetske-3, c. 7/ 1 (28-1997), sample 4	TCC/ MP-II	3340±40	1690-1600 (49,9%)	Ki-6319	bone	grave	IA	
8.	Malopolovetske-3, c. 4/ 1 (15-1994-97)	TCC/ MP-II	3330±40	1690-1600 (49,9%)	Ki-6207	bone	grave	IA	
9.	Rossava, barrow 8/5	MP-I	3325±50	1690-1520 (68,2%)	Ki-5829	bone	grave	IA	
10.	Malopolovetske-3, c. 5/ 1 (19-1996)	TCC/ MP-II	3310±35	1620-1520 (68,2%)	Ki-6210	bone	grave	IA	
11.	Malopolovetske-3, c. 2/ 2 (11-1995)	TCC/ MP-II	3310±50	1640-1520 (61,5%)	Ki-6354	bone	grave	IA	
12.	Malopolovetske-3, c. 5/ 5 (21-1996)	TCC/ MP-II	3300±35	1620-1520 (68,2%)	Ki-6212	bone	grave	IA	
13.	Malopolovetske-3, c. 7/ 1 (28-1997), sample 2	TCC/ MP-II	3300±40	1620-1520 (68,2%)	Ki-6317	bone	grave	IA	
14.	Malopolovetske-3, c. 2/ 1 (12-1995), sample 1	TCC/ MP-II	3300±45	1630-1510 (64,6%)	Ki-6355	burnt bone	grave	IIIA	

1	2	3	4	5	6	7	8	9	10
15.	Malopolovetske-3, c. 7/ 1 (28-1997), sample 1	TCC/ MP-II	3290±40	1620-1515 (68,2%)	Ki-6316	bone	grave	IA	
16.	Ksaverovo, barrow 2/5	MP-I/ III	3290±35	1620-1500 (68,2%)	Ki-6225	bone	grave	IA	
17.	Malopolovetske-3, c. 14/ 6 (10-1995)	TCC/ MP-III	3290±40	1620-1515 (68,2%)	Ki-6348	bone	grave	IA	
18.	Malopolovetske-3, c. 5/ 3 (17-1996)	TCC/ MP-III	3280±40	1620-1510 (68,2%)	Ki-6208	bone	grave	IA	
19.	Bubnovaya Slobodka, barrow 9/2	MP-I	3275±40	1620-1500 (68,2%)	Ki-6223	bone	grave	IA	
20.	Malopolovetske-3, c. 5/ 3 (17-1996), sample 1	TCC/ MP-III	3270±12	1600-1560 (47,4%)	Ki-6325	bone	grave	IA	
21.	Malopolovetske-3, c. 1/ 3 (3-1994 ?.)	TCC/ MP-III	3270±30	1610-1500 (68,2%)	Ki-6204	bone	grave	IA	
22.	Malopolovetske-3, c. 14/ 4 (8-1995)	TCC/ MP-III	3270±40	1620-1490 (68,2%)	Ki-6350	bone	grave	IA	
23.	Malopolovetske-3, c. 7/ 1 (28-1997), sample 3	TCC/ MP-II	3270±45	1620-1490 (66,3%)	Ki-6318	bone	grave	IA	
24.	Malopolovetske-3, c. 14/ 1 (2-1993)	TCC/ MP-III	3260±40	1610-1550 (28,8%) 1540-1490 (27,8%)	Ki-6353	bone	grave	IA	
25.	Borovitsa, barrow 1/2	MP-I/ III	3250±35	1530-1440 (50,4%)	Ki-6222	bone	grave	IA	
26.	Malopolovetske-3, c. 1/ 4 (5-1994)	TCC/ MP-III	3250±40	1530-1440 (49,2%)	Ki-6205	bone	grave	IA	
27.	Rossava, barrow 8/7	MP-I/ III	3240±30	1525-1445 (68,2%)	Ki-6218	bone	grave	IA	
28.	Malopolovetske-3, c. 14/ 3 (7-1995)	TCC/ MP-III	3240±50	1530-1430 (56,5%)	Ki-6349	bone	grave	IA	
29.	Malopolovetske-3, c. 1/ 1 (1-1993)	TCC/ MP-III	3225±45	1525-1430 (68,2%)	Ki-6352	bone	grave	IA	
30.	Malopolovetske-3, c. 5/ 3 (17-1996), sample 3	TCC/ MP-III	3220±12	1480-1455 (38,1%) 1515-1495 (30,1%)	Ki-6327	bone	grave	IA	
31.	Malopolovetske-3, c. 14/ 5 (9-1995)	TCC/ MP-III	3220±45	1520-1435 (68,2%)	Ki-6351	bone	grave	IA	
32.	Rossava, barrow 8/ 2	MP-I/ III	3210±30	1515-1440 (68,2%)	Ki-6217	bone	grave	IA	

1	2	3	4	5	6	7	8	9	10
33.	Malopolovetske-3, c. 1/ 5 (6-1994)	TCC/ MP-III	3210±30	1515-1440 (68,2%)	Ki-6206	bone	grave	IA	
34.	Rossava, barrow 4/ 2	MP-I/ III	3200±30	1500-1430 (68,2%)	Ki-6215	bone	grave	IA	
35.	Malopolovetske-3, c. 5/ 3 (17-1996), sample 2	TCC/ MP-III	3190±12	1460-1439 (42,3%)	Ki-6326	bone	grave	IA	
36.	Rossava, barrow 7/ 1, Sample 2	MP-I/ III	3190±30	1500-1425 (68,2%)	Ki-6216	bone	grave	IA	
37.	Rossava, barrow 2/ 1	MP-I/ III	3180±40	1465-1410 (46,0%)	Ki-6214	bone	grave	IA	
38.	Malopolovetske-3, c. 7/ 4 (72-2000)	TCC/ MP-III	3180±70	1530-1390 (65,9%)	Ki-9549	bone	grave	IA	
39.	Zhuravlikha, barrow 3/ 6	MP-I/ III	3170±35	1465-1405 (50,0%)	Ki-6224	bone	grave	IA	
40.	Subotov/ 4, floor, sample 2	TCC/ MP-V	3100±40	1430-1310 (68,2%)	Ki-5505	charcoal	house	IIB	too early dating no compatible with the typological analysis
41.	Obukhov-1	TCC/ MP-V	3090±70	1440-1260 (68,2%)	Ki-872	wood	house	IIB	too early dating no compatible with the typological analysis
42.	Malopolovetske-3, c. 16/ 1 (83-2001)	TCC/ MP-IV	3080±45	1410-1290 (64,3%)	Ki-9557	wood	grave	IIA	
43.	Malopolovetske-3, c. 17/ 1 (87-2001)	TCC/ MP-II	3080±80	1440-1250 (62,8%)	Ki-9551	bone	grave	IA	too late dating no compatible with the typological analysis
44.	Malopolovetske-3, c. 16/ 1 (83-2001)	TCC/ MP-IV	3060±45	1400-1260 (68,2%)	Ki-9558	wood	grave	IIA	
45.	Malopolovetske-3, c. 16/ 1 (83-2001)	TCC/ MP-IV	3050±60	1400-1250 (61,5%)	Ki-9561	burnt bone	grave	IIIA	
46.	Malopolovetske-3, c. 16/ 1 (83-2001)	TCC/ MP-IV	3050±45	1390-1250 (66,3%)	Ki-9559	wood	grave	IIA	
47.	Malopolovetske-3, c. 16/ 1 (83-2001)	TCC/ MP-IV	3040±45	1390-1250 (61,6%)	Ki-9556	wood	grave	IIA	

1	2	3	4	5	6	7	8	9	10
48.	Subotov/ 4, floor, sample 1	TCC/ MP-V	3040±50	1390-1250 (60,1%)	Ki-5502	charcoal	house	IIB	too early dating no compatible with the typological analysis
49.	Subotov/ 4, pit 1	TCC/ MP-V	3030±60	1390-1210 (63,6%)	Ki-5504	charcoal	house	IIB	too early dating no compatible with the typological analysis
50.	Subotov/ 4, sample 4	TCC/ MP-V	3010±50	1320-1210 (48,2%)	Ki-5508	bone	house	IB	too early dating no compatible with the typological analysis
51.	Subotov/ 4, sample 5	TCC/ MP-V	2980±60	1320-1120 (66,1%)	Ki-5503	bone	house	IB	
52.	Malopolovetske -3, c. 7/ 2 (63-2000)	TCC/ MP-III	2970±60	1300-1110 (60,5%)	Ki-9560	bone	grave	IA	too late dating no compatible with the typological analysis
53.	Subotov/ 4, sample 3	TCC/ MP-V	2950±45	1220-1110 (47,1%)	Ki-5501	bone	house	IB	
54.	Subotov/ 4, sample 2	TCC/ MP-V	2940±50	1220-1040 (61,7%)	Ki-5506	bone	house	IB	
55.	Malopolovetske-2/1 (1992 ?)	TCC/ MP-V	2910±30	1130-1040 (57,5%)	Ki-6219	bone	house	IB	
56.	Subotov/ 4, sample 1	TCC/ MP-V	2910±55	1220-1000 (68,2%)	Ki-5507	bone	house	IB	
57.	Malopolovetske -3, c. 7/ 3 (68-2000)	TCC/ MP-III	2900±70	1220-970 (66,4%)	Ki-9548	bone	grave	IA	too late dating no compatible with the typological analysis
58.	Malopolovetske -3, c. 16/ 1 (83-2001)	TCC/ MP-IV	2790±80	1020-839 (68,2%)	Ki-9550	burnt bone	grave	IIIA	too late dating no compatible with the typological analysis
59	Verguny/ 5	TCC/ MP-V	2785±60	1000-890 (52,2%)	Ki-9552	bone	grave	IA	too late dating no compatible with the typological analysis

60	Verguny/ 13	TCC/ MP-V	2730±60	930-820 (66,2%)	Ki-9553	bone	grave	IA	too late dating no compatible with the typological analysis
61.	Malopolovetske -3, c. 7/ 2 (63-2000)	TCC/ MP-III	2710±80	930-800 (65,2%)	Ki-9547	bone	grave	IA	too late dating no compatible with the typological analysis

* **MP-I, II, III, IV, V** – horizons of Malopolovstske complex (substantial for Kiev-Cherkasy group of TCC; TCC - Trzciniec Cultural Circle

c. - complex

Data after: Klochko 1999; Kovalyukh *et al.* 1998; Kločko *et al.* 1998; Lysenko 2001

lying on his right side, the head pointing west and hands stretched along the body [Lysenko 1998a:Fig. 18:10].

As horizon MP-I, one can classify grave 109 from a cemetery at Velikaya Bugaevka (Table 6:2). The deceased lay crouched, on the right side, the head facing north-northeast; his right hand was extended towards a knee while the left one — elbow bent — situated perpendicularly to the body [Babenko, Lysenko 2001; 2002].

A number of burials related to the MPC were explored in barrows in the village of Bubnovaya Slobodka, Cherkasy District [Belyaev *et al.* 1983]. Grave 2 in barrow 9 was dated at 1620-1500 BC (Table 6:19) [Lysenko 2001b]. The deceased lay crouched, on his left side, the head facing north. The pit was rectangular and had a wooden cover. Next to the knees, a bone belt buckle was discovered. Analogous buckles could be found in the other MPC graves in the barrow. It must be noted that grave 2 was the main feature in the barrow, and that in grave 1, with which mound III was associated, next to a buckle, a find was made of a large piece of a Babino-type vessel (MPC) decorated with cordons.

V. I. Klochko dates the burials of the MPC unearthed at a cemetery in Rossava between 1950-1600 BC [Klochko 1999:195, Table 1, 2]. It seems that in the MPC horizon one can include — in a reliable way (relying on the obtained ^{14}C date, Table 6:9, and the characteristics of the burial ritual) — only grave 5 in barrow 8 [Klochko 1999:Fig.14]. Over a rectangular burial pit, a wooden cover was built. The deceased lay in a contracted posture on his left side with the head pointing northeast. The other burials from Rossava, similarly to the graves from Ksaverovo, Zhuravlikha and Borovitsa should not be classified as belonging to the MPC horizon. ^{14}C dates from these features correspond to horizons MP-I and MP-III (Table 6:1, 9, 16, 25, 27, 32, 34, 36, 37, 39). Most of these burials lack any grave goods and the arrangement of the dead is analogous to that practiced in both horizons at the cemetery in

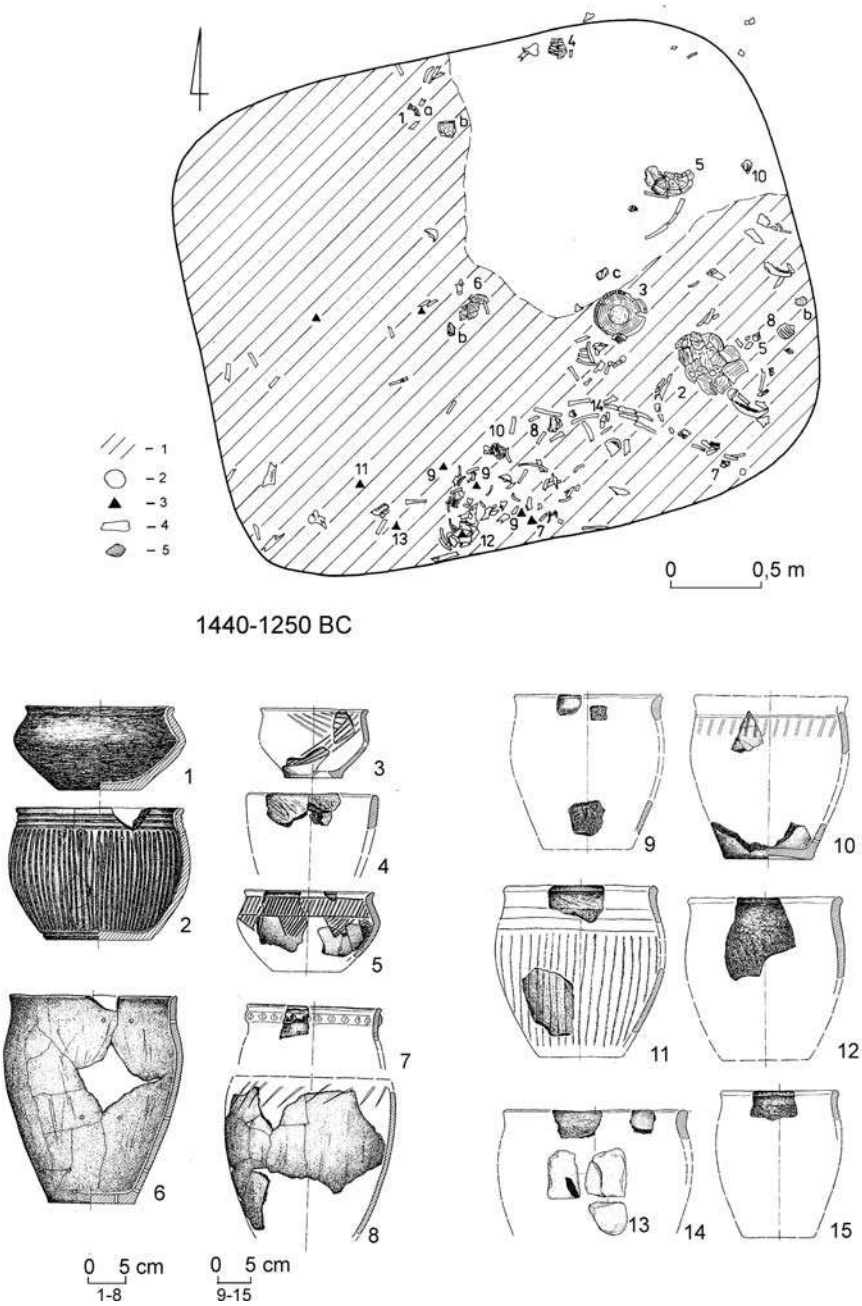

Fig. 20. Malopolovetske-3, Middle Dnieper area. Grave 87 and pottery from the grave. Legend: a - bone artefact; b - stone artefact; c - clay artefact (non-ceramic). 1 - soil containing animal bones; 2 - soil without animal bones; 3 - sherd (small fragment); 4 - larger animal bone; 5 - sherd (large fragment). After Lysenko 2001b

Malopolovetske. The graves are related to the relics of "mnogovalikovoy" traditions from late stages when Babino-type pottery [Litvinenko 2003] was undergoing transformations in the region under the influence of other traditions (Malopolovetske, TCC, Srubnaya) [Palaguta 1996; 2001; Kushtan 2001; Lysenko 2001b].

Therefore, the Mnogovalikovoy horizon (MP-I) can be interpreted as an initial period in the formation of the Kiev-Cherkasy group of the TCC and dated between 1800 and 1600 BC.

Horizon MP-II (Malopolovetske horizon)

The horizon is represented at the cemetery in Malopolovetske-3 by burial complexes no. 2, 4, 5 (graves 11, 12, 15, 16, 18-23), containing Trzciniec and Srubnaya culture (SrC) pottery [Lysenko 1998b, Fig. 7; 8:1-12; 10; 11; 14-16], and by ditch 5 from complex 7 (graves 28-31, 66). The burials of this horizon are dated between 1600-1500 BC (Table 6:4-8, 10-15, 23) [Kovalyukh *et al.* 1998b:132, 140, Tabl. 3, Fig.3]. Analogous pottery comes from a cenotaph (?) — grave 87 from complex 17. A radiocarbon date obtained for it (Table 6:43, Fig. 20) seems to be too late. The rectangular burial pit measuring 3.4 x 2.2 m contained over 700 bones (exclusively animal ones) and fragments of at least 15 vessels (Fig. 20:1-15).

A characteristic trait of horizon MP-II is the presence of Malopolovetske pottery combining patterns of Babino III (MPC) and Trzciniec traditions of pottery production [Lysenko, Kushtan 1997:109-112; Lysenko 1998:91-97]. Vessels following the SrC tradition in the horizon find direct analogies in the Berezhnovka-Maevka SrC, in particular, in the pottery of the Maevska group in the region of Dnepropetrovsk and Luhansk [Kovalova, Valkoboy 1976:3-22; Otroshchenko 2001, Fig. 26, 29].

Using the ^{14}C method, one may date horizon MP-II of the Kiev-Cherkasy group between 1650/1600 and 1500 BC.

Horizon MP-III (Teklino horizon)

At the cemetery in Malopolovetske-3, this horizon was dated at 1500-1400 BC [Kovalyukh *et al.* 1998a:137, 140, Table 3, Fig. 3]. It is represented by two, spatially separate, groups of burials. In the first one, the dead were strongly contracted, lay on their sides and were oriented mainly eastwards (graves 2, 7-10, 17, 46, 73-75), whereas in the other group, the dead lay flat on their backs and were oriented mainly westwards (graves 3, 32, 37, 41, 48, 55, 62, 69, 71, 90, 100, 101, 106). The chronology of the first group is determined by ten dates (graves 2, 7-10, 17) while the second group's chronology is defined by a single date (grave 3) (Table 6:17, 18, 20-22, 24-26, 28-31, 33, 35). The dating of grave 1 introduces a correction to the lower chronological limit of grave 3, which is dug into complex 1. The burials of both funerary rituals did not have any grave goods [Lysenko 1998a:Fig. 4:1; 5:1-4].

The third group as far as the funerary ritual is concerned comprises elite burials containing bronze ornaments of "Komarov" type and "Trzciniec" pottery (Fig. 21 and 22). It must be noted that all burials in horizon MP-III at the discussed ce-

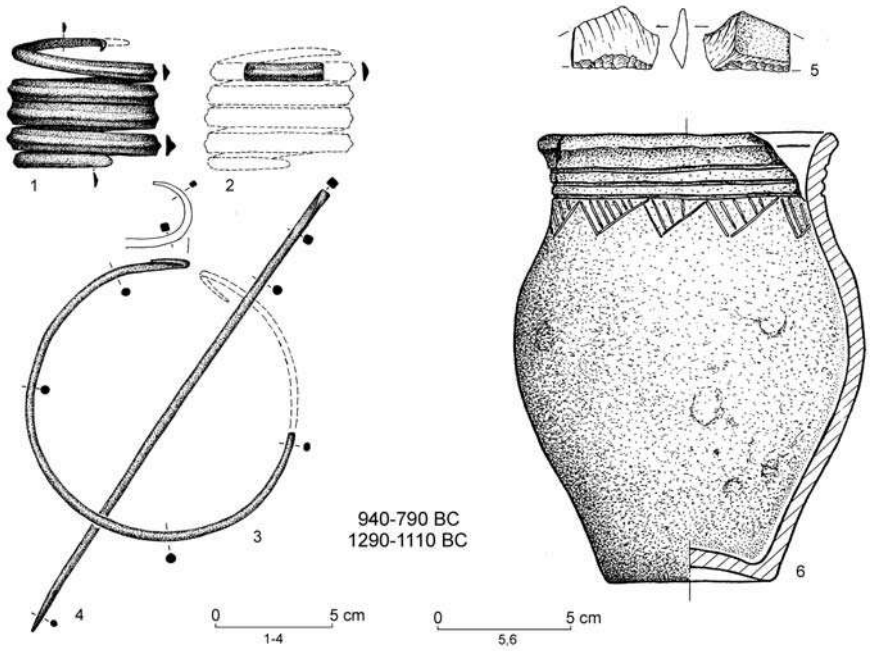

Fig. 21. Malopolovetske-3, Middle Dnieper area. Artefacts from grave 63. 1-4 - bronze; 5 - flint; 6 - clay. After Lysenko 2001b

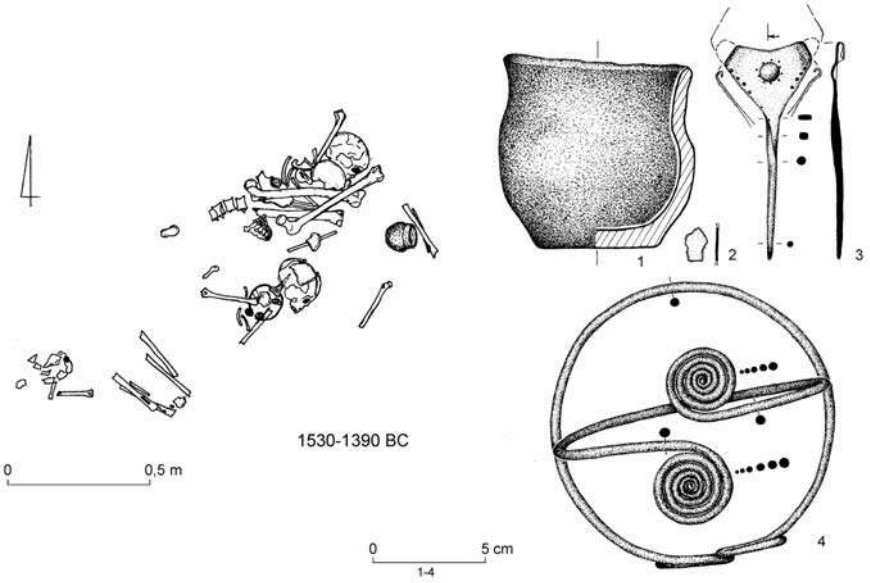

Fig. 22. Malopolovetske-3, Middle Dnieper area. Grave 72 and artefacts from the grave. 1 - clay; 2-4 - bronze. After Lysenko 2001b

metery that contained metal objects were characterized by corpse dismemberment. Radiocarbon dates were obtained for graves 1, 63, 68, 72 (Table 6:29, 38, 52, 57, 61) [Lysenko 2001b].

Burials 63 and 68 contained skull fragments and long bones of the legs of the dead [Lysenko 2001b]. In grave 63 the following items were discovered: two multicoil bracelets, a necklace, a pin with its head broken-off (Fig. 21:1-4), a flint tool (Fig. 21:5) and a tulip-shaped pot (Fig. 21:6). In grave 68, two necklaces with spiral discs, of which one bore traces of repairing, were found. Grave 72 contained remains of three bodies laid in three clusters (Fig. 22) [Lysenko 2001b]. In it, a discovery was made of an undecorated cup (Fig. 22:1), a piece of a bronze sheet (Fig. 22:2), a pin with a disk-like head and a necklace with spiral discs (Fig. 22:4). Radiocarbon dates concerning graves 63 and 68 (Table 6:52, 61 and 57) are too late and inconsistent with the typological analysis of artefacts recorded in them. These burials, located under the mound in the complex centre, could not have been later than burial 72 dug into the mound. The date obtained for it (Table 6:38) harmonizes well with the dating of burial 1-1993 (Table 6:29), in which similar ornaments were unearthed [Lysenko 2001b]. The stratigraphy of complex 7a and the similarity of ornaments in graves 1, 63, 68 and 72 justify their inclusion in the discussed horizon.

Generally speaking, horizon MP-III of the Kiev-Cherkasy group may be dated between 1500 and 1400 BC.

Horizon MP-IV (Moshny horizon)

The best-explored site of this horizon is the eponymous settlement in Moshny. Materials from this site, however, have been published only selectively [Ilinskaya 1960].

At the Malopolovetske-3 cemetery, ^{14}C determinations were obtained for grave 83 (Table 6:42, 45-47, 58; sum of probability distributions — 1400-1260 BC) [Lysenko 2001b]. The grave pit was rectangular with its longer side oriented along the east-west axis; its dimensions were 1.8 x 1.3 m (Fig. 23). Along its edges lay burnt logs. Dismembered bones of an adult had been put at the southern side of the pit in three clusters. The grave goods included: a cup (Fig. 23:1, 2), a spindle bob/whorl (Fig. 23:3) and a miniature, "bulbous" vessel (Fig. 23:4). Four to five meters north and south from the burial, outside of the mound limits, 0.45-0.50 m below the ground, fragments of a bowl decorated with appliqué bosses were found (Fig. 23:5). Materials found in the grave were used in six radiocarbon measurements made on burnt human bones (2) and burnt wood (4) (Table 6:42, 44-47, 58). One of them, made on burnt bones, (Table 6:58), is too late. When the other radiocarbon measurements are taken into account, the feature may be dated between 1400-1250 BC.

On the basis of abave mentioned informations, MP-IV horizon of the Kiev--Cherkasy group may be dated between 1400 and 1200 BC.

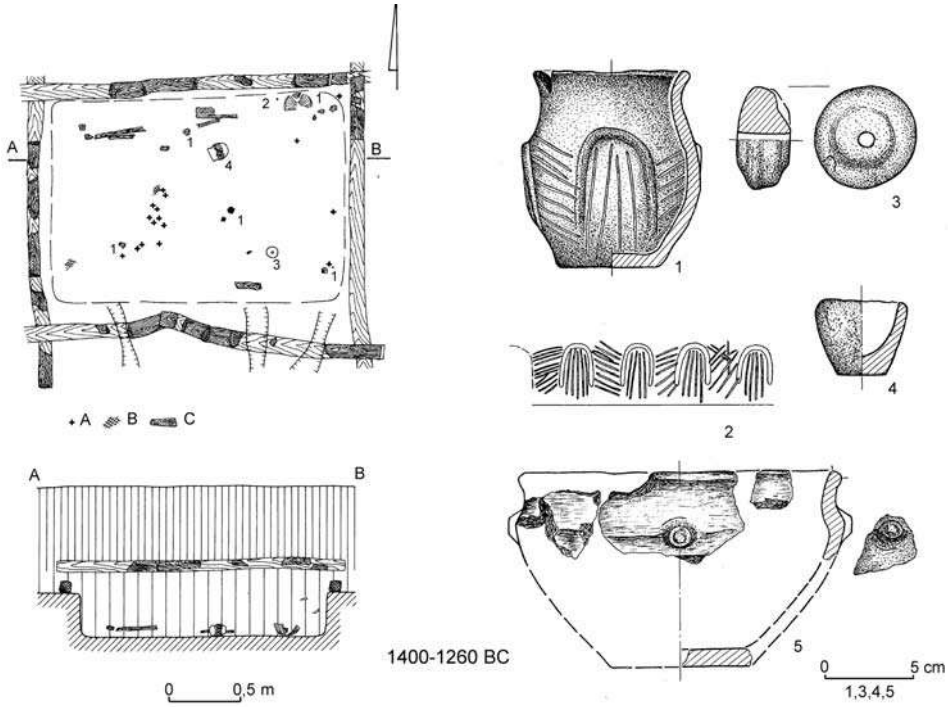

Fig. 23. Malopolovetske-3, Middle Dnieper area. Grave 83 and artefacts from the grave. 1-5 - clay. Legend: 1 - fragment of a skull; 2 - stone; 3 - spindle whorl; 4 - pottery. A - calcified bones ; B - burnt soil; C - log. After Lysenko 2001b

Horizon MP-V (Bilogrudovka horizon)

The ^{14}C method was used to date settlements at Obukhov, Malopolovetske-2A, Subotov and graves 5 and 13 at the cemetery in Verguny (Table 6:40, 41, 48-51, 53-56, 59, 60).

At the settlement in Obukhov (Podgorodishche Woods), E.A. Petrovskaya explored a sunken floor house in 1973-1974. Wood from its fill was dated in the Kiev laboratory (1440-1260 BC, Table 6:41) [Telegin *et al.* 1981:82].

At site 2A in Malopolovetske, in horizon MP-V one can include feature 1, a house (Fig. 24A and C) and feature 2, a hearth (Fig. 24B and C) [Lysenko 2001b]. The sunken floor house is a semi-dugout 3.15 m in length, 2.6 m in width and 1.02 m deep measuring from the present ground surface. The floor level in its western part was higher than in the eastern part by 0.17 m. In the centre of the western part a cluster of pottery was found. Six vessels were reconstructed: upper and bottom parts of large tulip-shaped pots (Fig. 24:2, 3, 7), a small tulip-shaped pot and three large bowls with their rims turned inwards (Fig. 24:4-6). The fill also

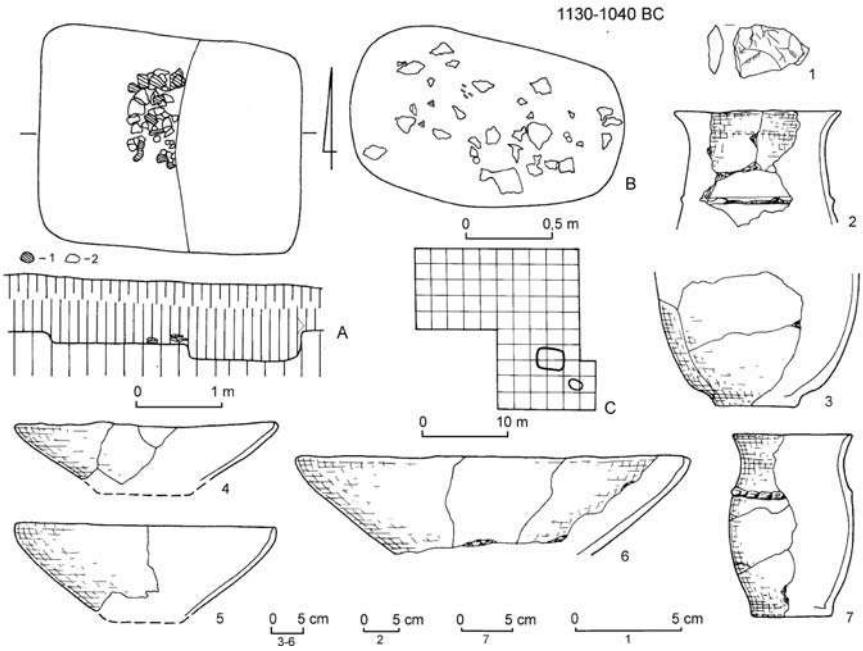

Fig. 24. Malopolovetske-2A, Middle Dnieper area. A - house; B - hearth. Legend: 1 - shard; 2 - burnt stone; C - planigraphy of features (house and hearth). 1-7 - artefacts from the house. 1 - flint; 2-7 clay. After Lysenko 2001b

yielded up a fragment of a flint sickle of the "Bilogrudovka" type (Fig. 24:1). Next to the house, a hearth was discovered consisting of a cluster of burnt stones and earth about 1 sq m in size (Fig. 24B). The date obtained for the dwelling feature (Table 6:55) [Kovalyukh *et al.* 1998b:140] is consistent with the typological-stylistic assessment of the materials.

S.S. Berezanskaya [1985:503] classifies seven dugouts excavated by A.I. Terenozhkin in Subotov as belonging to the Bilogrudovka culture. The ^{14}C method was used to date house 4 from the Subotov settlement and a grave discovered there (Table 6:40, 48-51, 53, 54, 56) [Klochko *et al.* 1998:667-673].

Considering the funerary ritual and finds, one may also assign to this horizon the cemetery at Verguny near Cherkasy explored by M.P. Sivolap in 1995-1996. Of the greatest interest there are mass graves 5 and 13 (Fig. 25) [Lysenko 2001b]. Rectangular pits contained five non-anatomically arranged (dismembered) bodies each. Grave 13 (Fig. 25A) yielded up a short fragment of copper wire (Fig. 25:3). Grave goods found in grave 5 (Fig. 25B) included four copper ornaments: two fragments of a wire coil and two tutulus-beads, of which the larger one was decorated with the motif of concentric circles (Fig. 25:1, 2, 4, 5). ^{14}C determina-

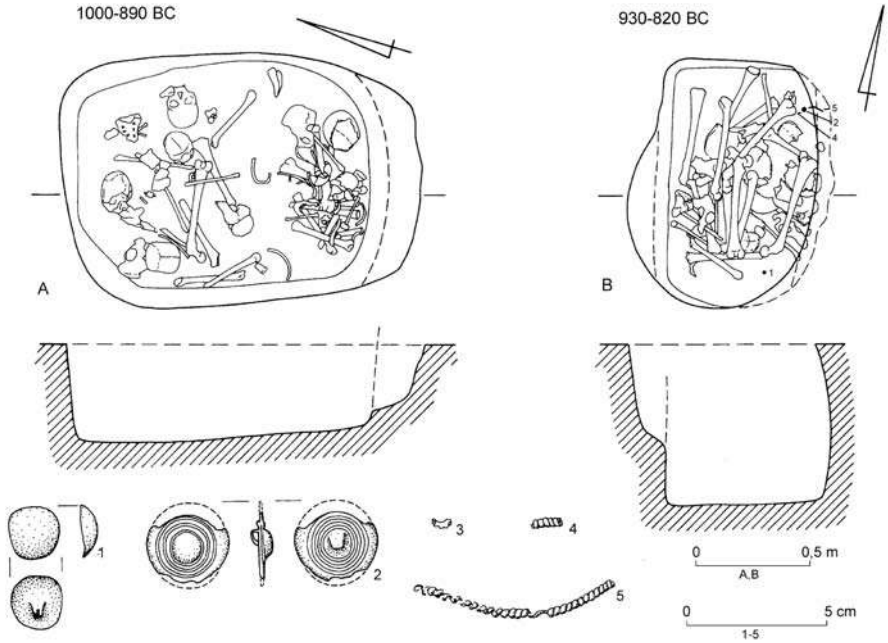

Fig. 25. Verguny, Middle Dnieper area. A - grave 13; B - grave 5. Bronze artefacts from the graves. 1, 2, 4, 5 - grave 5; 3 - grave 13. After Lysenko 2001b

tions concerning both graves (Table 6:59, 60) seem to be much later than expected. The dismemberment ritual, prevailing at the cemetery in Verguny (including mass graves), finds direct analogies in horizons MP-II, MP-III and MP-IV in Malopolovetske and in TCC assemblages in Poland [Rybakov 1981:252; Kłosińska 1987:Fig. 4; Grygiel 1987:Fig. 5, 8; Matoga 1987:Fig. 2, 3; Makarowicz 2000a:Fig. 35; 2000c].

Horizon MP-V of the Kiev-Cherkasy group may be dated between 1200-1000 BC. Whereas in the eastern subcircle of the TCC, Bilogrudovka pottery is related to the later development stages of the Trzciniec ceramic tradition, in the western subcircle of the TCC similar pottery is found in an earlier period, specifically in younger assemblages of TH 1 and TH 3 in Kujawy (1650-1500 BC) [Czebreszuk 1996:190; Makarowicz 1998a:97, ryc. 38] and in A1-A3 assemblages in Małopolska [Górski 1998a; 1998b], hence, in the time when Babino type pottery (mnogovalikovoy) still dominated in the Middle Dnieper area. The explanation of this phenomenon goes beyond the scope of this paper.

Summing up, we believe that the Kiev-Cherkasy group of the TCC should be dated between 1800/1700 and 1000 BC.

The chronology of the eastern subcircle of the TCC covers the period of 1800/1700-1000 BC. Assemblages combining traits of the MPC and TC appeared in the period of 1800-1600 BC, while "purely" Trzciniec assemblages emerged ca. 1650-1600 BC. The lower chronological limit of the Trzciniec development trend of the eastern subcircle of the TCC is marked by the life of the Middle Dnieper culture, i.e. 1700 BC. Thus, the formation of TCC groups in Belarussian and Ukrainian Polissya may be dated at the beginning of the 17th century BC. Dates for the Kiev-Zhitomir and Sosnitsa groups of the TCC fit into the interval of 1600-1200 BC. However, in the Middle Dnieper and Desna basins, these groups (Lebedovka/late Sosnitsa assemblages) survived until ca. 1000 BC.

To be able to determine the absolute chronology of the assemblages of the Komarov and Volhynia groups of the TCC, there are too few dates. It can be said, however, that after 1300 BC, in the Dnieper area, the Komarov group of the TCC was gradually superseded by the NC.

On the Southern Bug, a benchmark for dating the Hordeevka-Bilogrudovka group is the cemetery in Hordeevka, the chronology of which may be set at 1500-1000 BC. Horizon Hordeevka I must have been preceded by a pre-Bilogrudovka horizon — the time when the TCC spread from the Dniester area to the Southern Bug.

In the Middle Dnieper area, the formation of the Kiev-Cherkasy group of the TCC may be synchronized with horizon MP-I (mnogovalikovoy), i.e. 1800/1700--1600 BC. It is also in this period that early forms of the Malopolovetske type pottery appear and co-occur with late Babino pottery (mnogovalikovoy). Bilogrudovka type assemblages forming horizon MP-V in the Middle Dnieper area mark the upper limit of the Kiev-Cherkasy group. They are dated there between 1200 and 1000 BC.

4. CONCLUSIONS

Conclusions concerning the absolute dating of both TCC subcircles and individual regions discussed here using the radiocarbon method may be set out as follows:

1. Taking into account exclusively the sum of probability distributions, the life of the TCC in the western province should be dated between 1900 and 1400 BC, i.e. earlier than in the eastern province where it seems to have lasted from 1640 to 1420 BC. This estimate does not take into account dates for "transition" assemblages from the IC to the TH in the lower Vistula drainage and from the MPC to the TC in the Dnieper drainage.

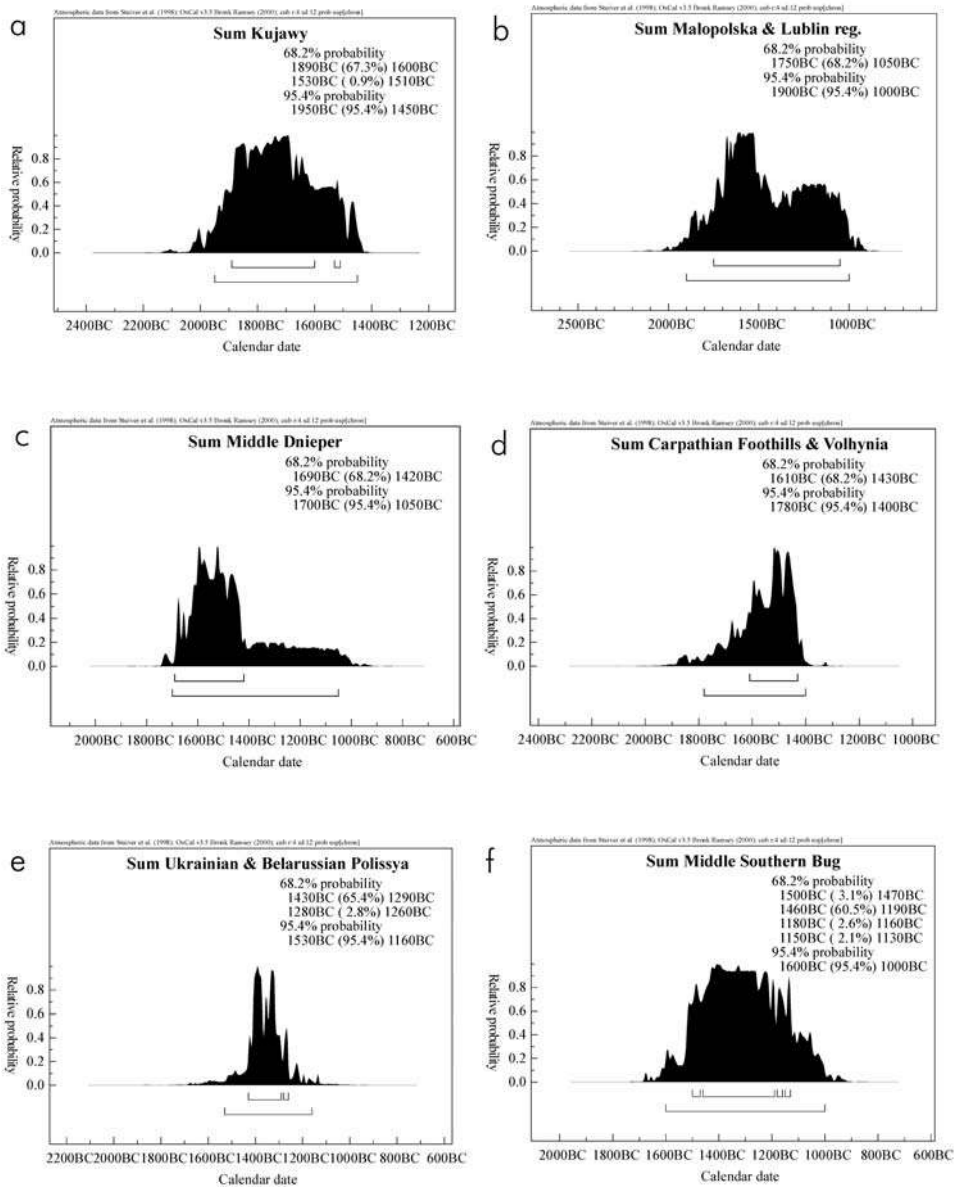

Fig. 26. The sum of probability distributions for Kujawy (a); Małopolska & Lublin area (b); Middle Dnieper (c); Carpathian Foothills & Volhynia (d); Ukrainian & Belarussian Polissya (e); Middle Southern Bug (f)

2. The comparison of the sum of probability distributions in individual regions where the TCC formed (Fig. 26a-f) shows the movement of Trzciniec structures ("migration of Trzciniec stylistics") from the northwest (Kujawy, 1890-1600 BC) and doubtless the northeast (Mazowsze, specifically the Warsaw Basin, no ^{14}C dates) to the southeast (Małopolska and Lublin area, 1750-1050 BC) and the east (Middle Dnieper drainage, 1690-1420 BC). The chronology of regional TCC varieties in the Carpathian Foothills and Volhynia (1540-1430 BC), Belarussian and Ukrainian Polissya (1430-1290 BC) and the Middle Southern Bug drainage (1460-1190 BC), due to the scarcity or low representativeness of dates obtained so far, may only suggest that these varieties formed later. For a more comprehensive assessment of the chronological position of the Trzciniec complex in the said regions we should wait until a longer series of dates is available.

3. Taking into consideration all the reliable dates, we can fit the TCC chronology in the Vistula drainage into the period of 1900-1200 BC in the north and 1700-1100 in the south. Transition assemblages from the IC to the TH should be placed between 2000 and 1900 BC. If the same criteria are applied, the life of the eastern TCC subcircle may be dated between 1650/1600 and 1000 BC, while transition assemblages from the MPC to the TC (mnogovalikovoy horizon) may be dated between 1800 and 1600 BC.

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 307-335
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF MONUMENTS OF THE BEREZHNOVKA-MAEVKA SRUBNAYA CULTURE NEAR THE TOWN OF ORDZHONIKIDZE

The Berezhnovka-Maevka Srubnaya culture was distinguished from the general massif of the monuments of the Srubnaya culture relatively not so long ago [Otroshchenko 1994; 2001]. The radiocarbon dating of monuments of that culture at the contemporary level has not been done until now.

This article discusses newly received radiocarbon dates for a group of monuments of the second period of that culture [calibration after Kovalyukh, Nazarov 1999].

Table 1

Ordzhonikidze, Dnipropetrovsk Region. Dates for samples of bones from graves of the Srubnaya culture (calibration after Weninger 1993)

Lab. No.	Kurgan/grave	BP	BC
Ki-9633	16/1	3215±80	1468±90
Ki-9626	16/2	3100±80	1335±98
Ki-9627	17/1	2980±80	1175±122
Ki-9628	18/20	3270±80	1524±88
Ki-9629	23/1	3190±80	1436±91
Ki-9630	23/2	3010±80	1227±121
Ki-9631	24/1	3920±80	2360±114
Ki-9632	24/4	3770±80	2158±127

The traditional dates attributed to objects of the second period of the Berezhnovka-Maevka Srubnaya culture by various researchers coincides at the level of necessary inclusion of the 13th century BC — from the 13th century to the first half of the 12th century BC [Otroshchenko 1981:17], the end of the 14th century — 12th century BC [Sharafutdinova 1982:153-156], 14th-13th century BC [Litvinenko

1994:14-15], the second half of the 14th-13th century BC [Otroshchenko 2001:19]. There are good reasons for synchronizing rhis with the BD period of the Carpathian basin. These dates were first presented to Ukrainian archeologists by A. I. Terenozhkin [Terenozhkin 1965:63-85], and since then arguments in favour of those dates have only increased in number.

1. RECORD OF RADIOCARBON DATED GRAVES

In 1999 and 2001, the Ordzhonikidze expedition of the Institute of Archaeology of the National Academy of Sciences of Ukraine, led by S.V. Polin, did preservation research of the burial mounds in the area of three grave sites at the town of Ordzhonikidze, the Dnipropetrovsk Region (Fig. 1). As a result of the archaeological works in 1999 and 2001, 24 burial mounds were investigated, and five of them (numbers 16, 17, 18, 23, 24) contained graves of the Berezhnovka-Maevka Srubnaya culture that are the topic of this article. In four of the burial mounds (numbers 16, 17, 23, 24) the main graves were found [Polin, Chernych, Kupriy 2001; 2002]. Let us discuss these complexes in more detail.

Burial mound 16 belonged to the mound group "Malaya Laurka" (Fig. 1, 2:B). The burial mound contained two graves of the Berezhnovka-Maevka Srubnaya culture, located at the central part of the excavated area.

Grave 1 (Fig. 3) was located practically at the conventional center of the mound shape. The burial construction represented a rectangular pit, covered with a stone "ceiling". The foundation of the "ceiling" was a rather massive flat stone made of roughly processed shell rock with concave long sides, 0.98 m x 0.54-0.7 m, 0.3 m thick, covering the pit along its long axis. Along the long walls of the pit, the stone was supported with six smaller broken shell rock and granite stones.

The rectangular grave pit was oriented along the long axis from West to East. The bottom of the pit at the level of 1.1 m from the day-time surface was deepened to the main soil to a level of 0.5 m. The pit was 0.94 x 0.63 m at the bottom level. At the bottom of the pit there were remains of an adolescent skeleton. Most of the bones of the proximities and the pelvis of the skeleton had been ruined by rodents. Judging by the remains, left *in situ*, the buried body had been put into the pit in a tightly curbed position on the right side, head to the East.

At the eastern wall of the pit, next to the head of the buried body, there had been a vessel — a clay pot with a wide neck, a slightly outward-bound rounded rim, high shoulders, flat bottom, emphasised with a minor edge (not preserved). The vessel was 11.3 cm high, the diameter of the rim was 12.4 cm, and the diameter

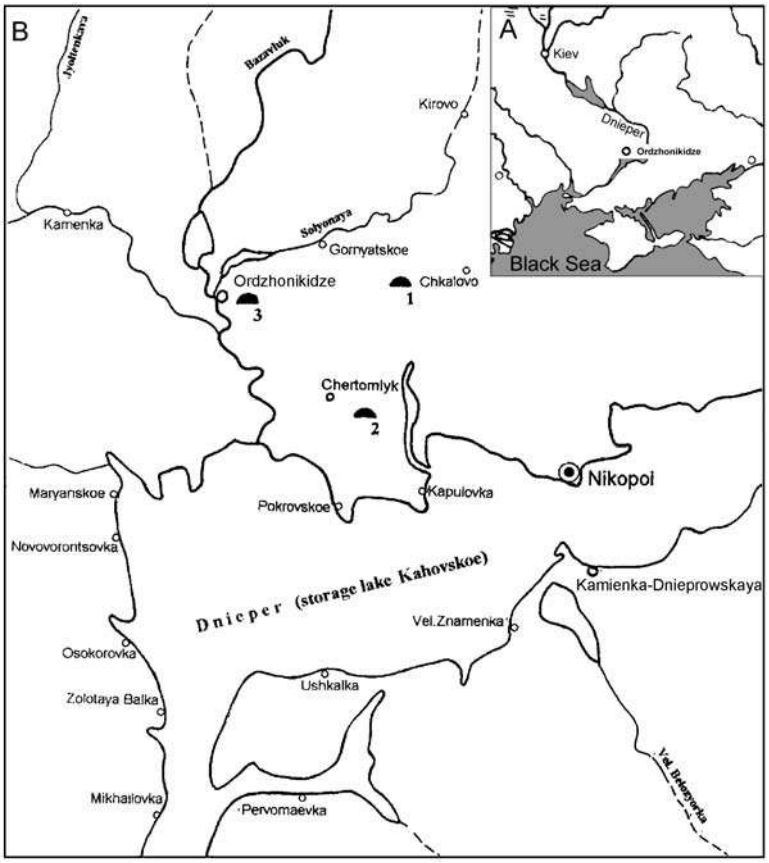

Fig. 1. Location of groups of burial mounds near the town of Ordzhonikidze: 1 - Malaya Laurka burial mound group; 2 - burial mound group in the Ozera ravine (the Pokrovskiy quarry); 3 - "Svynareva Mohyla" burial mound group

of the bottom was 9.5 cm. The vessel was burnt unevenly — from dark-grey to a red colour. The shoulders were decorated with an ornament of a finely drawn broken line with sharp corners. The space between the corners was filled with vertical strokes — from 3 to 5 in each of the groups. In one place the corners were supplemented with lines that formed three rhombs.

Grave 2 (Fig. 4:1) was found in 0.5 m to the North-West from grave 1. The pit was of rectangular shape with strongly rounded corners, and was oriented along the long axis from South-West to North-East. The bottom of the pit lay at the level of 0.92 m from the daytime level, and was deepened in the main soil to a level of 0.3 m. The pit widened towards the bottom; its dimensions at the upper edge were 1.24 m x 0.9-0,7 m, and at the bottom — 1.3 x 0.98-0.82 m. At the bottom of the

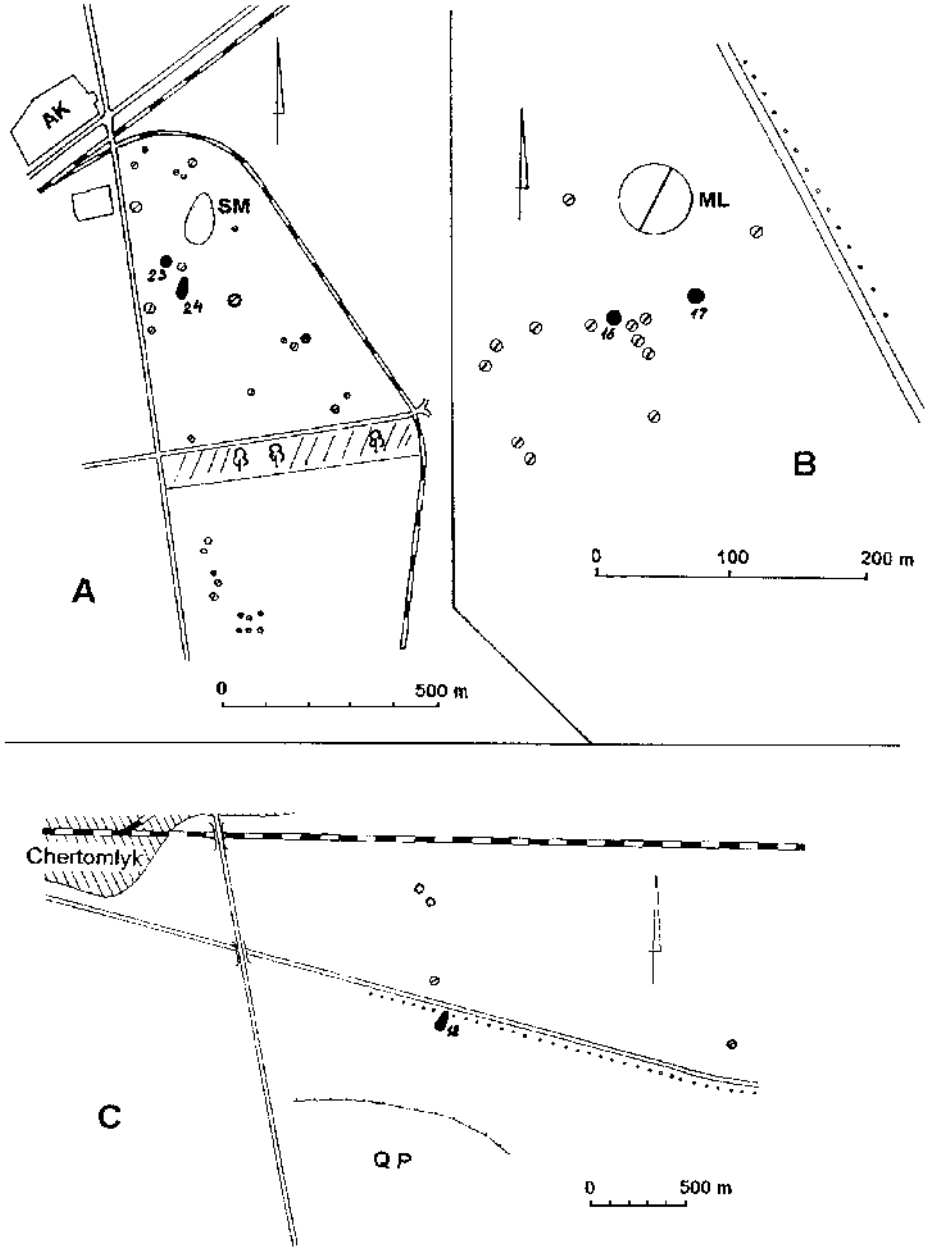

Fig. 2. Schemes of location of the burial mound groups: A - "Svynareva Mohyla" group; B - "Malaya Laurka" group; C - burial mounds at the "Pokrovskiy quarry" (Ozera ravine). Key: AK - autocade; SM - "Svynareva Mohyla"; ML - "Malaya Laurka"; QP - "Pokrovskiy quarry"; ○ - unexcavated burial mounds; ⊘ - excavated burial mounds and burial sites; ● - excavated burial mounds containing graves of the Berezhnovka-Maevka Srubnaya culture

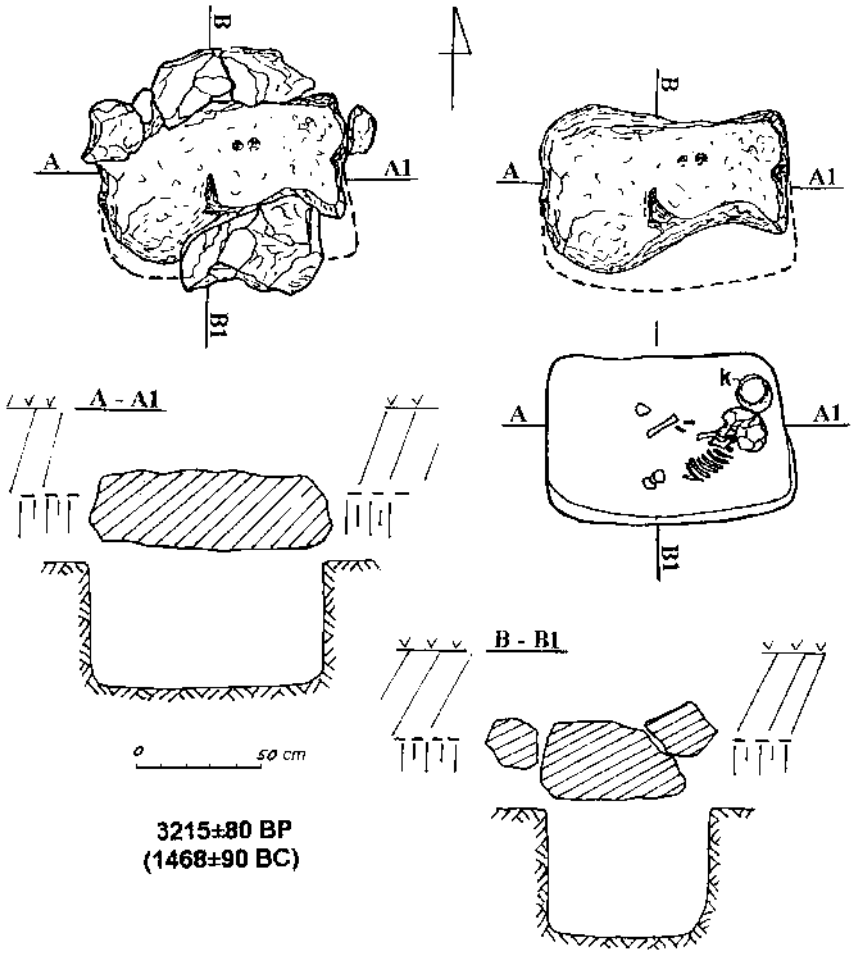

Fig. 3. Malaya Laurka group, burial mound 16, grave 1

pit there was a skeleton of an adult man — on the left side, curled up, head to the North-East - East. Opposite the northern corner of the pit, behind the skull there was a moulded flat-bottomed pot with a wide neck, the rim, slightly bent to the outside, weakly pronounced sagging of the neck and high shoulders. The vessel was ornamented at the upper part with thick drawn lines that formed a "belt" of

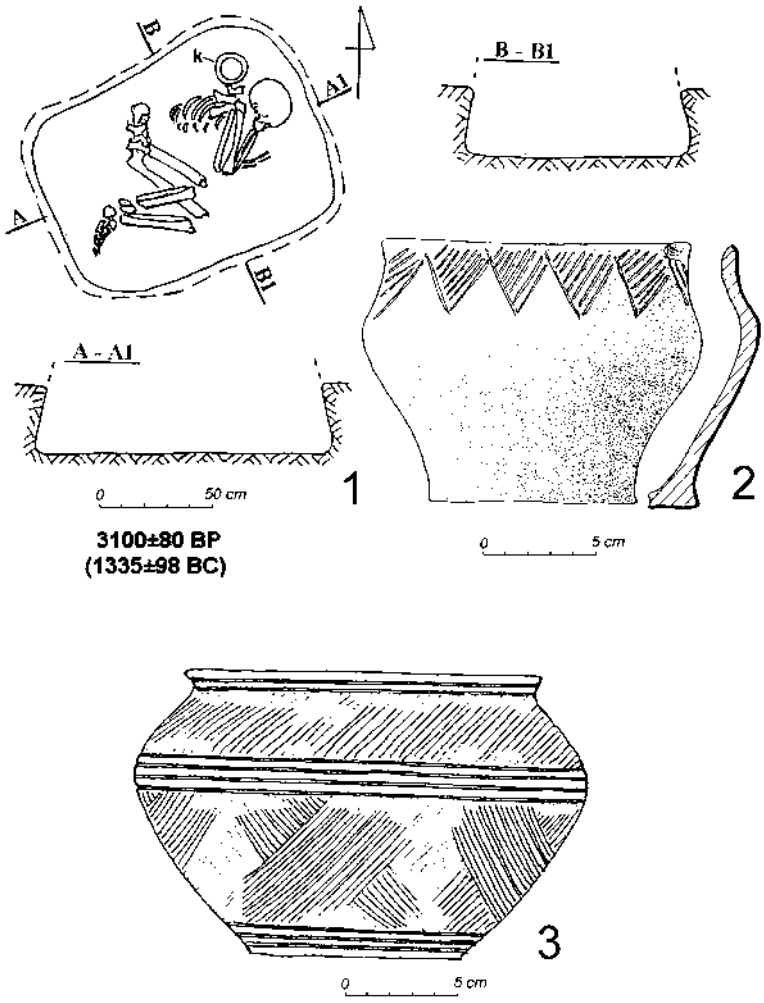

Fig. 4. Malaya Laurka group, burial mound 16: 1 - grave 2; 2 - vessel from grave 2. Burial mound 17: 3 - vessel from grave 1

triangles pointing with their tops down. The gray outer surface was well-finished. The diameter of the rim was 12.8 cm, the size of the shoulders — 14 cm, of the bottom — 8 cm, and the height of the vessel was 11 cm (Fig. 4:2).

Burial mound 17 also belonged to the "Malaya Laurka" group (Fig. 2:B).

Grave 1 (Fig. 5) was practically in the middle of the excavated area. The burial

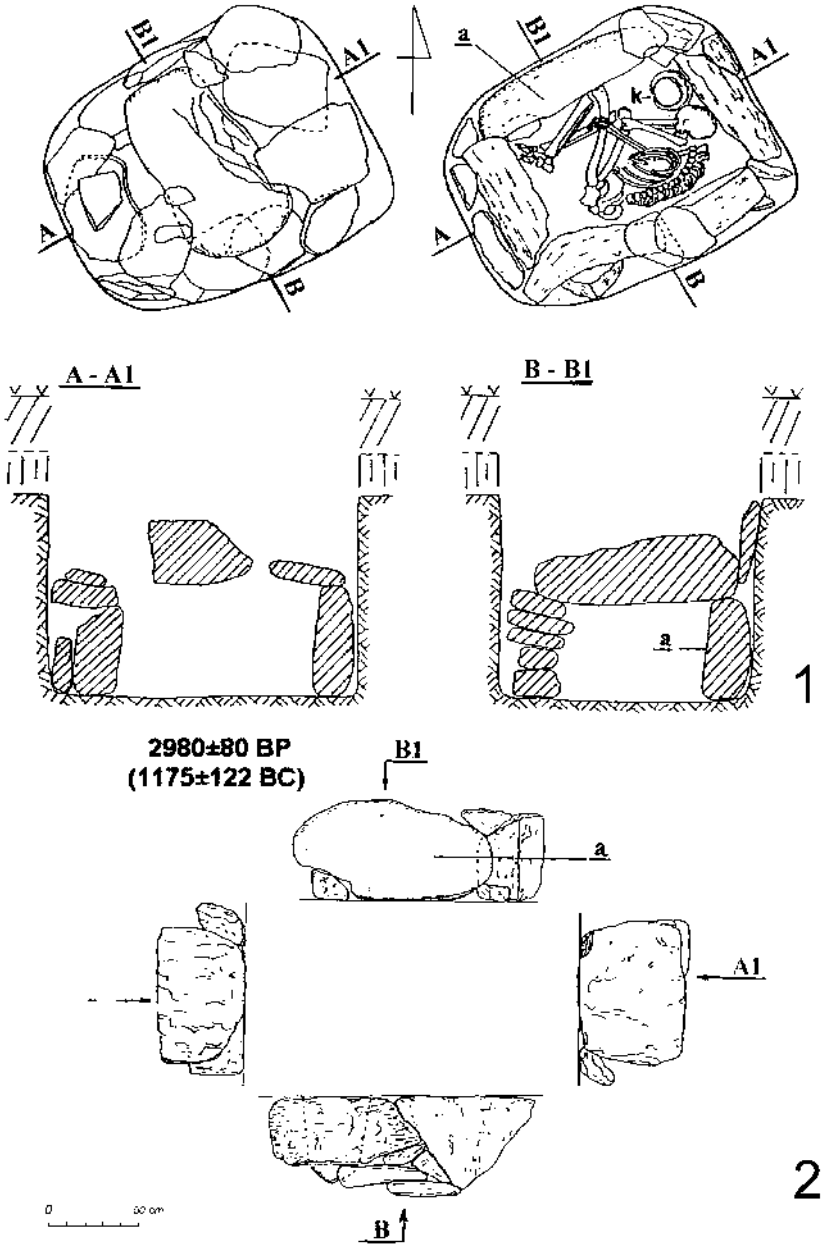

Fig. 5. Malaya Laurka group, burial mound 17, grave 1. 1- layout and sections of the stone grave; 2 - facing of the inner walls of the grave; a - granite slab

construction represented a grave pit deepened to the main soil to a level of 1.1 m; at the bottom of the pit there was a stone box with a "cover". The pit was rectangular, with strongly rounded edges and steep walls, oriented along the long axis from the South-West to North-East. The length of the pit was 1.7 m; its width at the North-Eastern part was 1.36 m, narrowing to 0.8 m at the south-western wall. The bottom at the level of 1.65 m. From the level of 0.53-0.75 m from the level of daytime surface the pit was blocked with stones of the "ceiling".

The "ceiling" and the "walls" of the pit consisted of large flat pieces of lime--stone of different sizes and shapes, with non-processed surfaces. Small stones filled the gaps between stone pieces, as well as between the flat stones and the walls of a burial pit. The base of the "ceiling" was a massive rectangular stone with rounded corners, 1.04 m long, 0.54 m wide, and 0.4-0.26 m thick. It lay in the middle across the box, with its edges supported by the opposite walls. From the two sizes, there were smaller flat stones (0.1-0.14 m) that rested on the central part of the "ceiling" and the side walls of the box. The base of the walls of the box consisted of massive thick slabs placed on their butt-ends along the entire perimeter of the pit. The slabs formed the rectangular grave. The inner dimensions of the box were as follows: length — 1.02 m, width — 0.74 m, height — up to 0.58 m.

A special element of the construction of the box was a stone slab that formed the north-western (long) wall of the grave (Fig. 5:1a, 2a). It was the most massive one among the slabs that formed the walls of the box and the only granite wall in its construction. The slab was 1.08 m long, 0.54 m wide (at the central part) and up to 0.28 m thick. Unlike the other slabs of the box, this one had a smooth polished surface. It had the shape of an elongated oval in cross-section, slightly wider at the eastern side. At the western butt-end of the slab there was a step-like extension. One of its wide sides, turned inside the box, was flat; the opposite side and two narrow sides were smoothly rounded.

At the bottom of the pit, along its long axis, there was a skeleton of an adult man in a tightly curved position, on the right side, head to the North-East — i.e., the buried body had been put in the pit vis-a-vis the granite stone. The right hand was slightly bent into the shoulder and placed so that the arm touched the middle of the thigh bone. The left hand was strongly bent into the shoulder, with the hand under the skull. The skeleton filled the small space at the bottom of the pit almost entirely, pressed to the walls with the skull, the left knee and both of the feet.

Under the North-Eastern wall of the box, to the right from the skull of the buried body, immediately next to its forehead bone, there was a vessel — a short wide-necked pot, with the rim bent to the outside, a short neck and wide rounded shoulders. The ornament on the pit was made of fine drawn lines: two parallel horizontal lines went round the neck under the rim, four lines of the same kind went round the shoulders, and three lines went round the lower part of the body at the bottom of the pot. The surface between the horizontal lines from the rim to the

shoulders was filled with frequent parallel slantwise strokes. The surface between the shoulders and the bottom was covered with figures in the form of intersecting bunches made of several rows of thin slantwise strokes (possibly, with a comb-like cliché). The clay of the vessel easily crumbled and in many places the upper surface peeled off in thin scales (Fig. 4:3).

Burial mound 18 belonged to the "Pokrovskiy quarry" group of burial mounds at the far eastern end of the village of Chertomlyk (Fig. 1:2; 2:C) and to the type of so-called "long mounds". The total length of the mound was about 80 m, and the height of the burial mound was up to 30 m. Twenty two graves were studied in the burial mound (Fig. 6). Among them there were two Eneolithic graves (Nos. 11 and 16); six graves of the Yamnaya culture (Nos. 10, 12, 14, 15, 19, 22); four graves of the Catacomb culture (Nos. 3, 8, 17, 18); two graves of the Mnogovalikovoy Pottery culture (Nos. 2, 4); five graves of the Berezhnovka-Maevka Srubnaya culture (Nos. 1, 5, 6, 20, 21); two graves of the Bronze Age (Nos. 7, 9); and one unidentified grave (No. 13). The graves of the Berezhnovka-Maevka Srubnaya culture were preceded with a long stage of co-existence of two closely located burial mounds — the southern one and the northern one. Probably, the southern burial mound over the Eneolithic graves (0.5 m high, 11-13 m in diameter) was made first. During the Early Bronze Age the burial mound had been made higher at least three times over the graves of the Yamnaya culture, and had grown in diameter. The graves of the Catacomb culture were "dropped" into the existing fourth layer of the southern burial mound without any additional soil put on top of the mound. The time of emergence of the northern burial mound is not clear enough. The primary mound (0.6 m high, 12 x 16 m in diameter) had been made over an unexplored grave that was later found under a telephone pole. A Yamnaya culture grave (No. 14) was "dropped" into the northern side of the mound. That grave was accompanied with making the second layer of the burial mound (1.3 m high, about 17 m in diameter). After the fourth layer of the southern mound and the first layer of the northern mound were made, the sides of the mounds closed up. More detailed information about early graves in the Dovha Mohyla are discussed separately [Polin, Chernych, Kupriy 2001:28-33; Rassamakin, Kupriy 2001:35-42].

Grave 20 (Fig. 7:1), the only dated grave of the Berezhnovka-Maevka Srubnaya culture graves in that burial mound, is linked to the second increase of the northern mound. The rectangular pit was 1.7 x 1.35 m in size and oriented from east to west with slight deviation. The vertical walls of the pit displayed traces of a chisel-like digging tool. At 1.03 m from the level of the buried black earth there is a layer of a wooden "cover", worn out under the weight of the soil, covered with a layer of white ashes with remainders of herbal fiber. The bottom of the pit was down at 1.25 m from the buried black earth. The skeleton of the buried body lay curled up on the left side, head to the east. The right hand was bent in the elbow, with the hand put in front of the face. The left hand, slightly bent in the elbow, was put so that

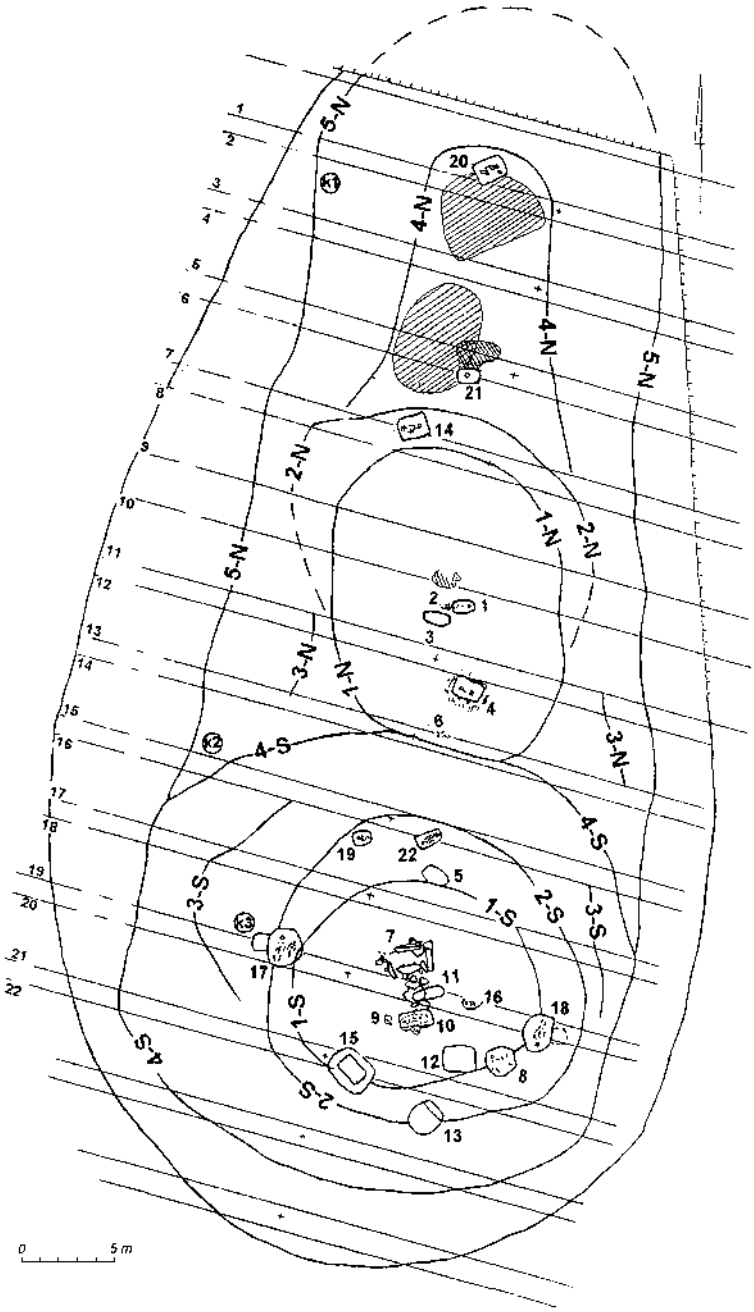

Fig. 6. Pokrovskiy quarry. General layout of the burial mound 18 (Dovha Mohyla). Legend: k1-k3 - finds of ceramics from funeral feasts; N - initial mound; S - additional layers of soil; 1-22 - numbers of graves; 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16, 17-18, 19-20, 21-22 - sections of borders

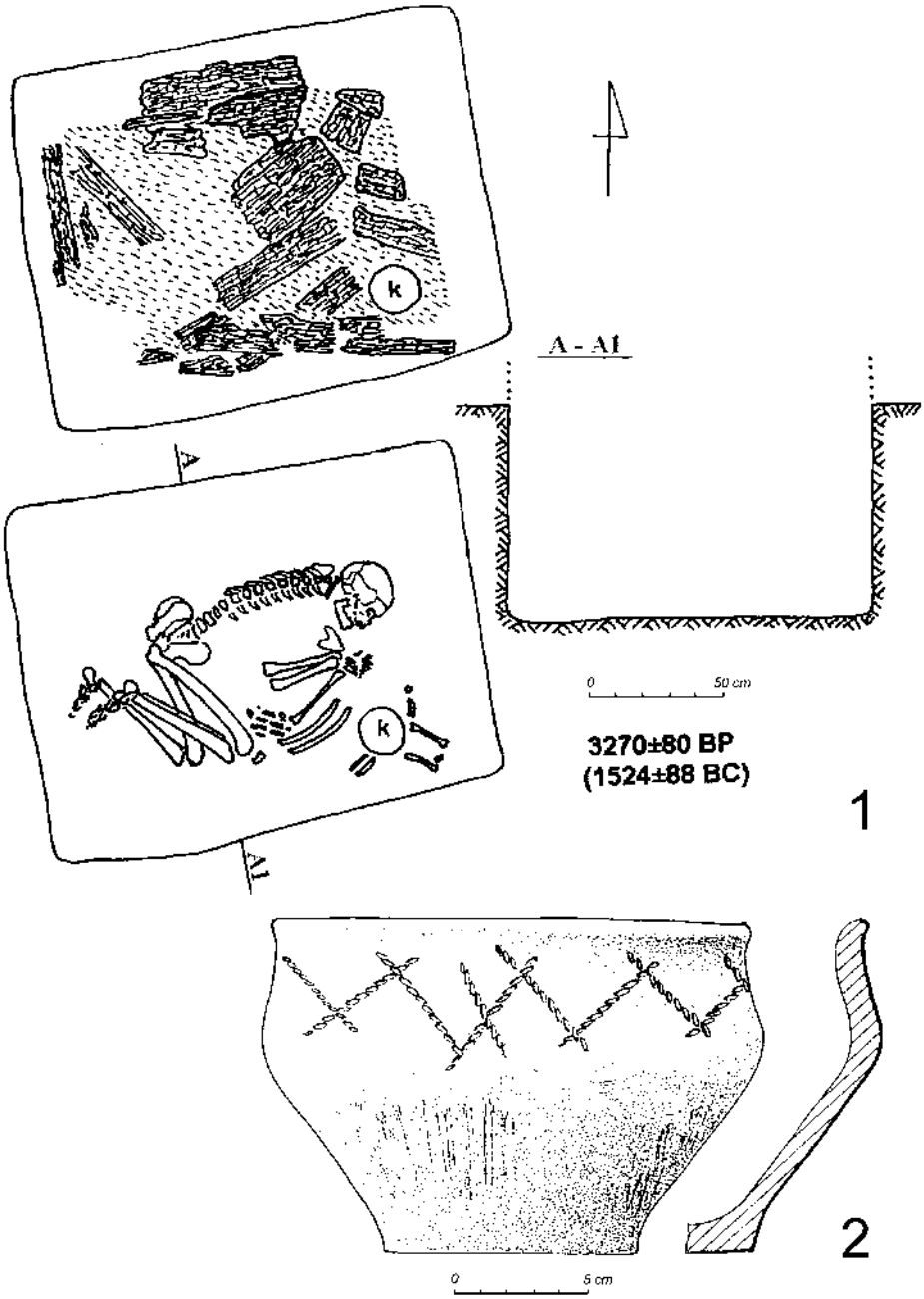

Fig. 7. Pokrovskiy quarry. Burial mound 18, grave 20: 1 - plans and section; 2 - vessel

the hand was at the knees. In front of the face, closer to the south-eastern corner, there was a wide-necked pot with a slightly turned outward rim, high shoulders and the body narrowed to the bottom. Between the rim and the shoulders there was an ornamental frieze that consisted of impressions of a cord in the shape of slantwise crosses. Below the shoulders the surface of the pit was covered with irregular vertical scratches made by a fine sharp comb (Fig. 7:2). Behind the vessel there were bones of a leg of a smaller domestic animal (possibly, a sheep or a goat). Between the vessel and the left hand of the skeleton there were two cow ribs.

Burial mound 23. Burial mounds Nos. 23 and 24 belonged to the "Svynareva Mohyla" mound group (Fig. 2:A). The burial mound 23 contained two graves of the Berezhnovka-Maevka Srubnaya culture, as well as two alter pits and fragments of pottery in the soil of the hill (Fig. 8).

Grave 1 (Fig. 9:1) was located at 6.5 m to the south from the imaginary center of the burial mound. The grave had been ruined by subsequent diggings that had completely destroyed the original shape of the burial construction. Its dimensions at the upper edge were: length — 2.12 m, maximum width at the eastern part — 1.56 m. The bottom of the pit lay at 1.99 m from the level of the daytime surface. The dimensions at the bottom were 1.52 m x 0.9 m; it was oriented from west to east. The filling of the pit consisted mainly from loose black earth in which, at different levels there were small fragments of human bones and pottery. All in all, 22 fragments of a moulded ceramic vessel were found, 4 cm x 5 cm and smaller. Among the fragments there were two pieces of a rim with sharpened outer edge and remainders of ornamentation made of shallow drawn lines that had created a corner; the same ornament was made on two fragments of the walls (Fig. 9:2). The dough and the surface of the vessel were black. The filling, under the south-western wall of the pit, at 0.55 m from the level of the bottom, contained a thigh and tibial human bones.

Grave 2 (Fig. 10) was located under the imaginary center of the burial mound. The burial construction was a large pit with broad steps along its perimeter. In the center of the steps there was a burial chamber with a stone box. The entrance was round in section, with a smooth and levelled north-eastern wall and a salient edge towards the north. The pit was slightly narrower at the bottom, its dimensions at the upper edge of fixation were 3.92 m (along the north-south axis) x 3.76 m (along the east-west axis); and the dimensions at the bottom were 3.76 m x 3.64 m, respectively. The bottom of the entrance pit at the base of the walls lay at the depth of 1.4 m (1.3 m from the day-time surface); to the center of the pit the bottom level went down by 0.07-0.08 m. The width of the shoulders was from 0.22 m in the north-eastern part of the pit to 1.1 m in the south-eastern side. In some places at the shoulders there were smears of white ashes from a woven grass mat.

The burial chamber, made in the center of the entrance pit, was rectangular with a slightly curved northern wall, oriented by its length from west to east, with

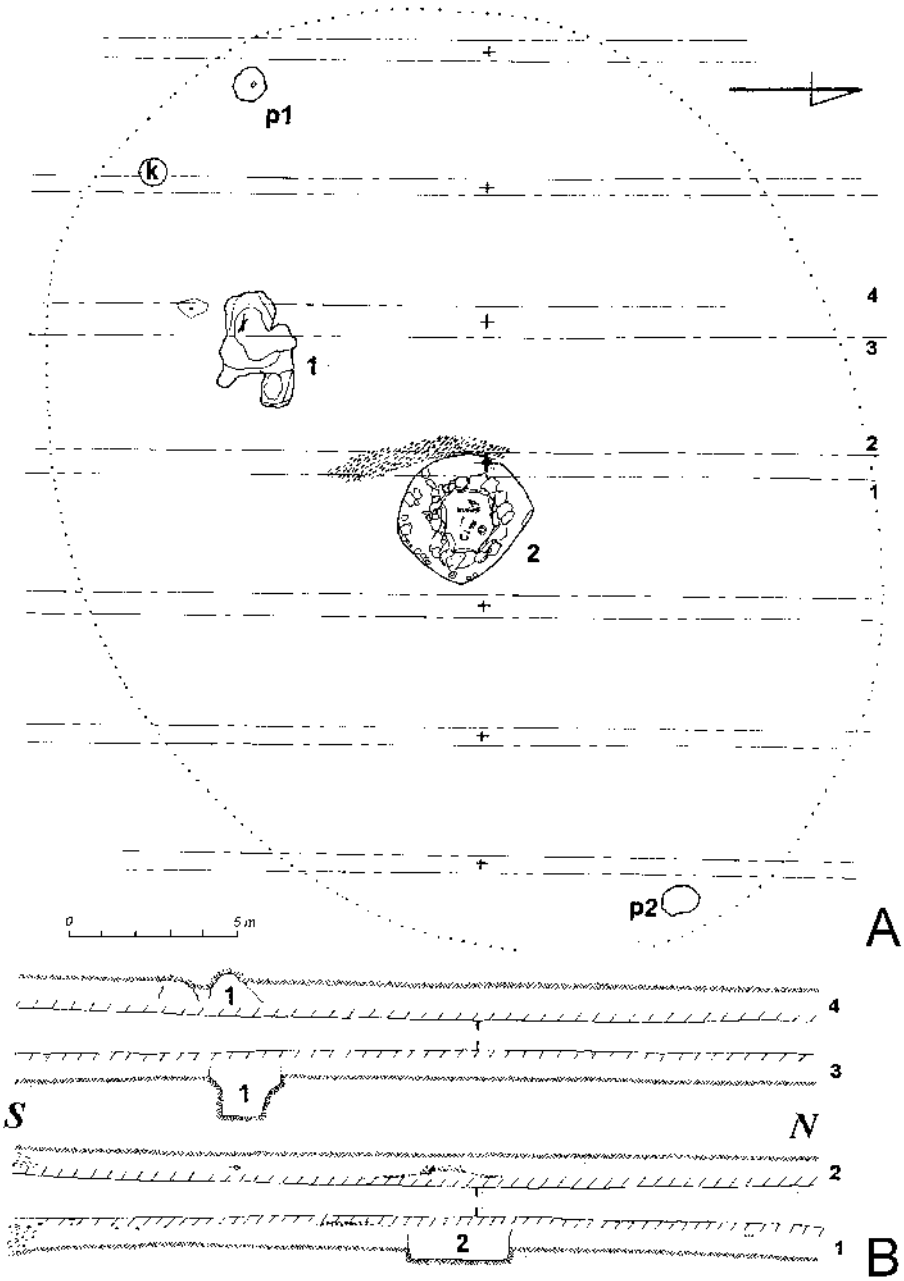

Fig. 8. “Svynareva Mohyla” group. Burial mound 23: A - general layout, B - sections 1-2, 3-4. Legend: k - ceramics in the mound; P1, P2 - ritual pits related to grave 2

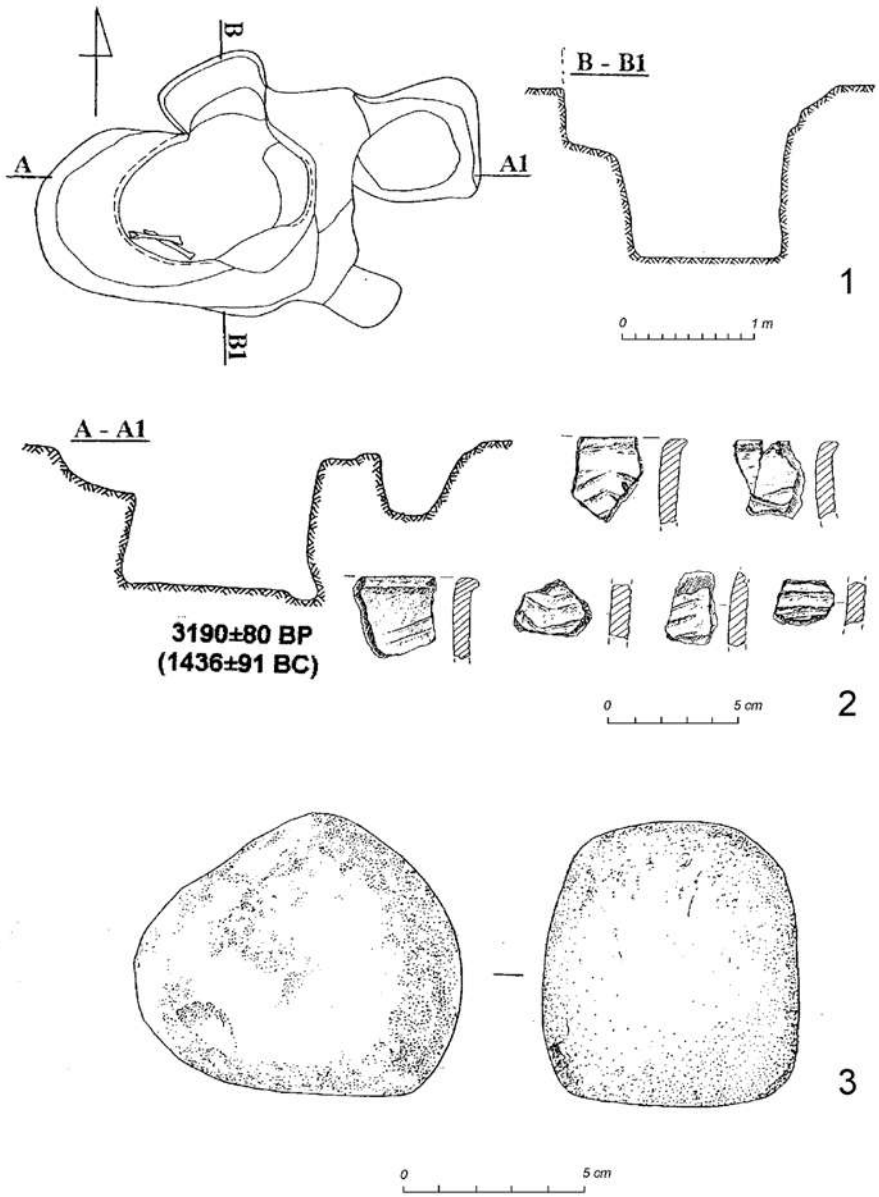

Fig. 9 "Svynareva Mohyla" group. Burial mound 23, grave 1: 1 - plan and sections, 2 - fragments of the vessel; 3 - finished stone from the ritual pit 1

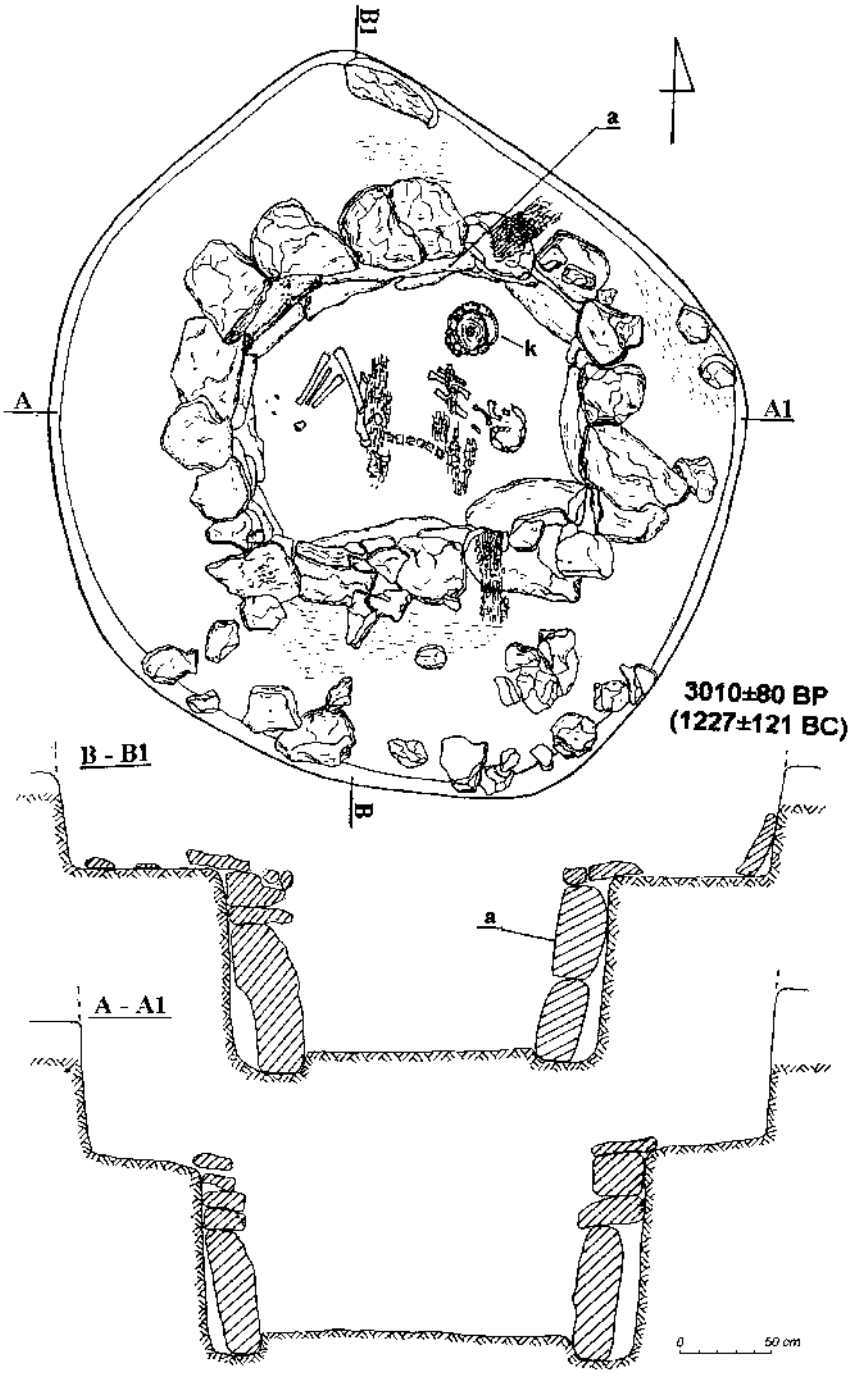

Fig. 10. "Svynareva Mohyla" group. Burial mound 23, grave 2: plan and sections

a slight deviation towards the north-east — south-west axis. The floor of the burial chamber lay at 0.96-1.0 m below the steps. The chamber became slightly narrower towards the floor: its dimensions at the upper edge were 2.3 m x 1.94 m, and 2.18 m x 1.54 m at the bottom. The perimeter of the walls at the bottom of the pit was marked with a small ditch (0.22-0.3 m wide, 0.1-0.14 m deep) — for placing stone walls of the box.

The base of the walls of the box consisted of 12 massive stone slabs placed on their butt-ends along the walls of the pit. Above those slabs the walls of the box were covered with flatly placed smaller stone slabs up to the upper edge of the burial chamber: 2-4 layers over the eastern wall, 3-4 layers over the southern wall, 3 layers over the western wall and 1 layer over the northern wall. The upper layer of the slabs covered the edge of the burial chamber along its perimeter at the level of the steps. In two places the upper slabs of the walling wore traces of rotten wooden "scaffolds". Apparently, the box had had a wooden cover, over which there had been slabs similar to those used for the walling; a large number of the cover slabs were found at the southern side of the steps and in the bottom filling of the southern part of the entrance pit. Two small stones were found under the eastern corner of the entrance pit; one large disk-shaped stone rested on the northern corner of the entrance pit. It is possible that the cover had been taken apart by grave robbers who had also ruined grave No.1. Eleven of the stone slabs that had made the walls of the box were roughly processed, flattened shell-rock slabs. Seven such slabs, placed on their butt-ends at the bottom of the small ditch, comprised the foundation of three walls of the box — the eastern, southern and western ones (Fig. 11:1).

The northern wall was distinct in the construction of the box — it consisted of five massive slabs placed on their butt-ends in two layers. In the lower row, at the bottom of the small ditch, there were three slabs of shell-stone. The upper row consisted of two slabs, of which one (eastern) was the largest and the only granite slab in the box. It represented a "gravestone", close in shape and size to the granite "gravestone" in grave No.1 of burial mound 17. The shape was oval in section, with a rounded eastern end and a small rounded salience in the upper part of the western end. The "gravestone" was semi-oval in section: the side facing the inner part of the grave was flat, while the side facing the wall of the chamber and the other facets were rounded. The surface of the granite slab was smoother — probably, it had been processed more diligently than the shell-rock slabs. Its dimensions were as follows: maximum length — 1.1 m, height (width) — 0.48-0.52 m; thickness — 0.2 m at the butt-ends and 0.28 m in the center (Fig. 11:a).

The inner dimensions of the grave at the bottom of the pit were 1.64 m x 1.3 m. At the bottom of the pit in the central part of the grave there was a heavily decayed skeleton of an adult man — curled on the right side, head to the east. The arms were bent in elbows under acute angle; the hands were stretched to the chin. The legs were bent under an obtuse angle at the coxal joints, and under an acute

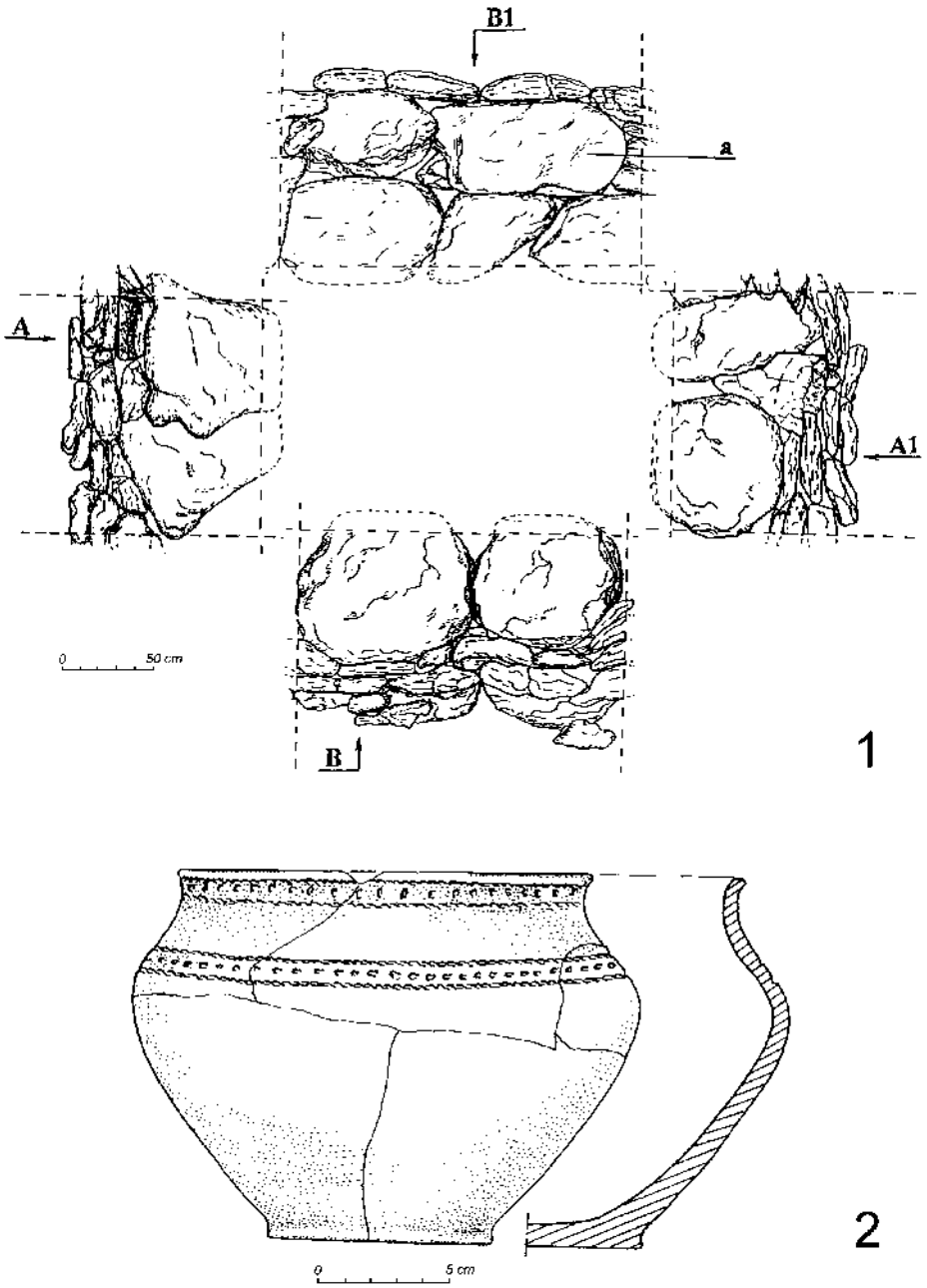

Fig. 11. "Svynareva Mohyla" group. Burial mound 23: grave 2: 1 - facing of the inner walls of the grave, 2 - vessel, a - granite slab

angle in the knees. Most of the bones of the feet were not intact; hands and ribs were practically missing. On the bones of the upper part of the skeleton and the pelvis there were pieces of wooden planks of the cover that had worn into the pit.

Between the skeleton and the northern wall of the box, in front of the hands — 0.1 m to the north of them — there was a ceramic pot — destroyed by pressure — with a slightly turned-out rim, a short neck, high rounded shoulders and the body that was narrowed to the bottom. The neck under the rim was decorated with a narrow "ribbon" of ornament of two parallel lines of ordinary cord between which there was a row of small impressions made with a sharp tool. Another ribbon of ornament of the same kind went round the shoulders. The vessel was 14 cm high, with the neck of 15.2-15.5 cm in diameter at the rim, and the bottom 8.3 cm in diameter. The dough and the surface of the vessel were black (Fig. 11:2). The whole floor of the chamber was covered with dark-brown dust from a decayed organic mat.

Probably, the construction of the main grave No. 2 was related to the remainders of the burial feast — fragments of moulded ceramics and two offering pits that marked the edges of the initial mound.

A collection of seven small fragments of ceramics was found at 13 m to the south-west from the imaginary center of the burial mound, practically the layer of a ploughed field: from 0.2 m to 0.27 m from the daytime surface (Fig. 8:k). All fragments had "aged" edges; their sizes were from 1.2 cm x 1.5 cm to 2.5 cm x 3.5 cm. All of them were the fragments of a single vessel: five of them were collected in a larger fragment of the wall. Such ceramics were typical for vessels of the Late Bronze Age: thick black dough without noticeable admixtures, the smooth black outer surface and light-brown inner surface.

The offering pits were at about the same distance from the grave 2 at the opposite sides of it. The first one was located in 11.8 m to the south-west from it; the second one was located in 11 m to the north-east from the grave. The offering pits lay at the same line with the grave, oriented from south-west to north-east (Fig. 8).

Pit No. 1 (south-western) was almost circular in shape with uneven edges, 0.95-1.0 m in diameter at the upper edge of fixation (at the surface of the layer of mainland clay). The bottom was semi-spherical, maximum 0.43 m down from the level of fixation and 1 m from the daytime surface level. At the bottom of the pit there was a fragment of tubular bones of the extremities of an ox, a horse tooth and a stone tool in the form of a triangular grinder made of line-stone, with rounded edges and one of the facets, flat base and finished surface. The tool was 7 cm tall; the length of the sides of the base was 7.7 – 7 – 6 cm and 8.5 – 7 – 7 cm (Fig. 9:3).

Pit No. 2 (north-eastern) was 0.75 m – 1.1 m in diameter at the upper edge of fixation, with the semi-spherical bottom at the maximum of 0.3 m deep from the mainland surface and 0.97 m deep from the daytime surface level. At the bottom of the offering pit there were several fragments of animal bones.

Burial mound 24 also belonged to the "Svynareva Mohyla" mound group (Fig. 2 A). The mound was 46 m x 25 m large. Under the mound there were four graves: graves 1 and 3 belonged to the Berezhnovka-Maevka Srubnaya culture, grave 2 belonged to the Cimmerian type, and grave 4 was of an unidentified kind (Fig. 12).

The main grave of the burial mound was grave 3, dropped from the surface of the ancient strata. Fragments of a moulded vessel with aged fractures were found near it. After the restoration works is became clear that the vessel had been a thick-walled flat-bottomed jar typical for the Berezhnovka-Maevka Srubnaya culture. At the outer side of the neck there was a row of oblique cuts. The bottom had a minor salience. The dough of the jar was black and did not contain visible admixtures. The outer surface of the jar was dark-grey, roughly smoothed. The vessel was 12 cm tall, with the bottom of 11 cm in diameter (Fig. 13:3).

Grave 1 was found at 14 m to the north from the imaginary center of the burial mound at 0.58 m down from the daytime surface (Fig. 13:1). The burial pit was not traced. The skeleton (possibly, of an adolescent ?) was represented only by remainders of the skull, fragments of bones of the forearm with four fingers, and fragments of long leg (possibly, thigh) bones. Judging from the location of the bones, the buried body had been placed curled on the right side, head to the north-east. The legs, probably, were bent at the knee under the right angle in the hip joints; the arms were bent in the elbows with the hands placed in front of the face. Behind the skull, almost touching the occiput bone, there was a crushed ceramic vessel — a pot with a flatly cut rim, a short neck and a rounded, narrowed to the bottom, body. The whole surface of the vessel was decorated with a geometrical ornament made of drawn lines: two parallel horizontal lines going round the base of the neck and the body at the maximum width of the shoulders framing a zone of triangular shapes, aiming with their tops up or down, drawn with two lines or, in one place, with four lines. The triangles with their tops up were painted with horizontal strokes. The triangles with their tops down were not filled with strokes except one triangle that formed a parallelogram with a stroked top-up triangle next to it. The lower part of the body of the vessel — from the maximum width of the shoulders to the bottom — was decorated with a broken line made of tripple zig-zag that formed corners and covered the body in three spiral rounds. The dough and the surface of the vessel were black, the outer surface was well smoothed and polished. The vessel was 15 cm tall, and the other dimensions were as follows: diameter of the rim — 14.9 cm, diameter of the shoulders — 16 cm, diameter of the bottom — 7.5 cm (Fig. 13:2-2a).

Grave 3 (the main one) lay in the center of the burial mound (Fig.14:1). The grave pit was trapeze in shape and up to 1.3 m deep from the daytime surface. The pit was oriented along the long axis from east to west; its walls were slightly narrower towards the bottom. The size of the pit at the upper edge was as follows: length — 1.62 m, width under the eastern wall — 1.26 m, width under the western wall —

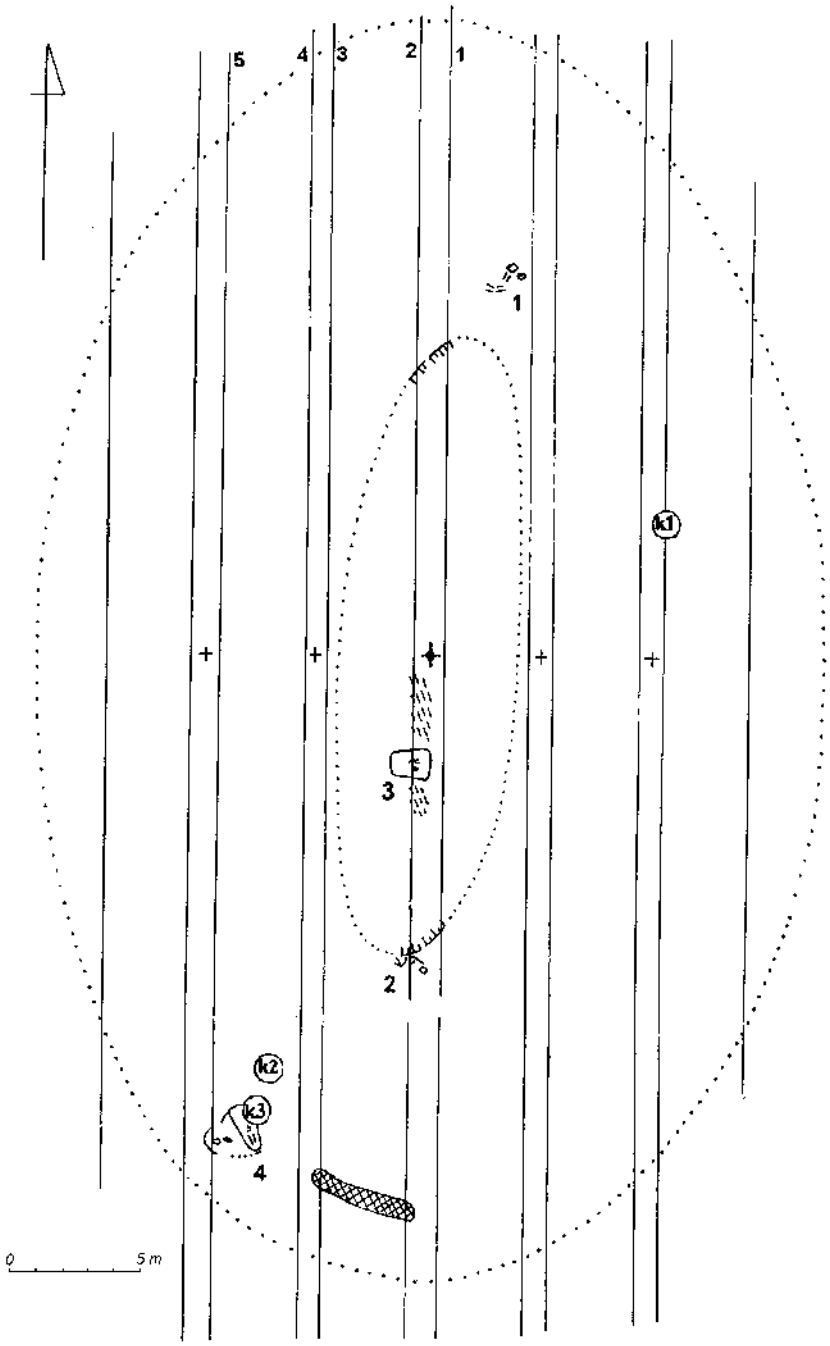

Fig. 12. "Svynareva Mohyla" group. Burial mound 24: general layout. Legend: k - ceramics in the mound

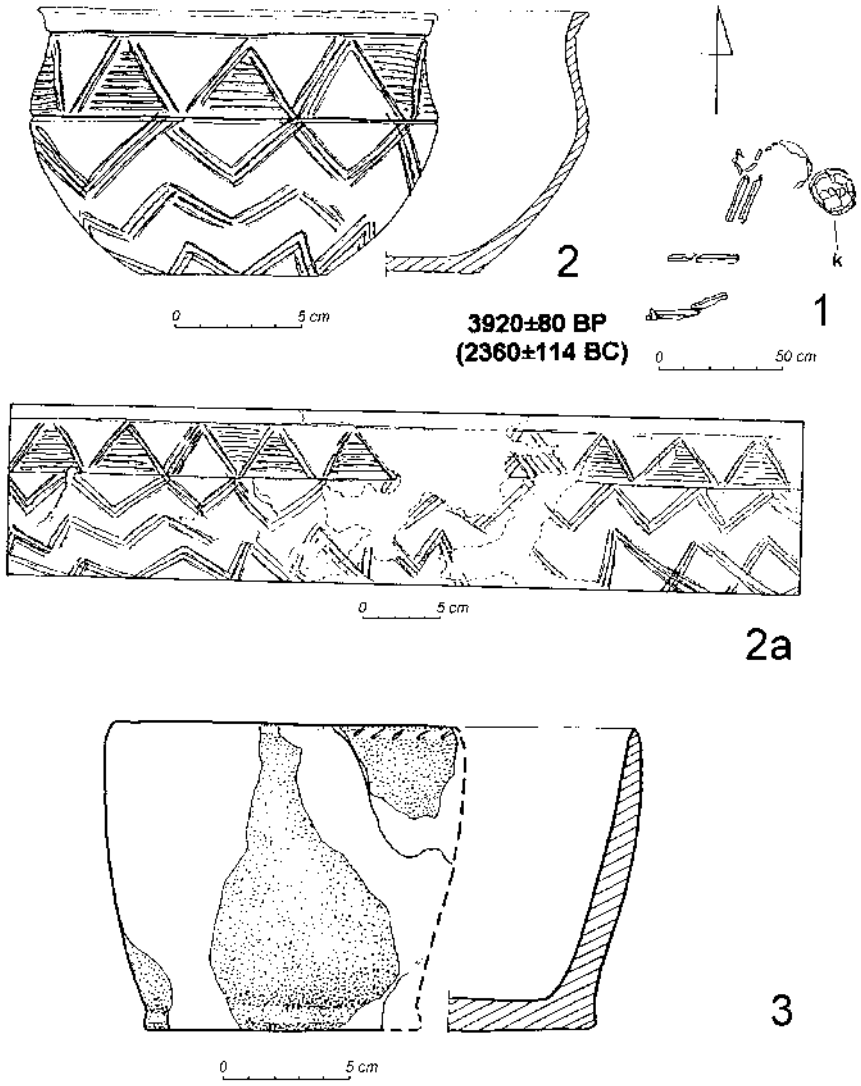

Fig. 13. "Svynareva Mohyla" group. Burial mound 24, grave 1: 1 - plan, 2 - vessel, 2a - spread-sheet of ornament on the vessel; 3 - vessel from the mound

1.02 m; the dimensions at the bottom were 1.52 m, 1.14 m and 0.96 m, respectively. The burial right was cremation: at the bottom of the pit, in 0.3 m from the eastern wall there was a compact collection of calcinated bones arranged in a narrow stripe (0.4 m long, 0.06-0.12 m wide) — along the central axis of the pit in its eastern half. Among small fragments of the bones there were large melted green fragments

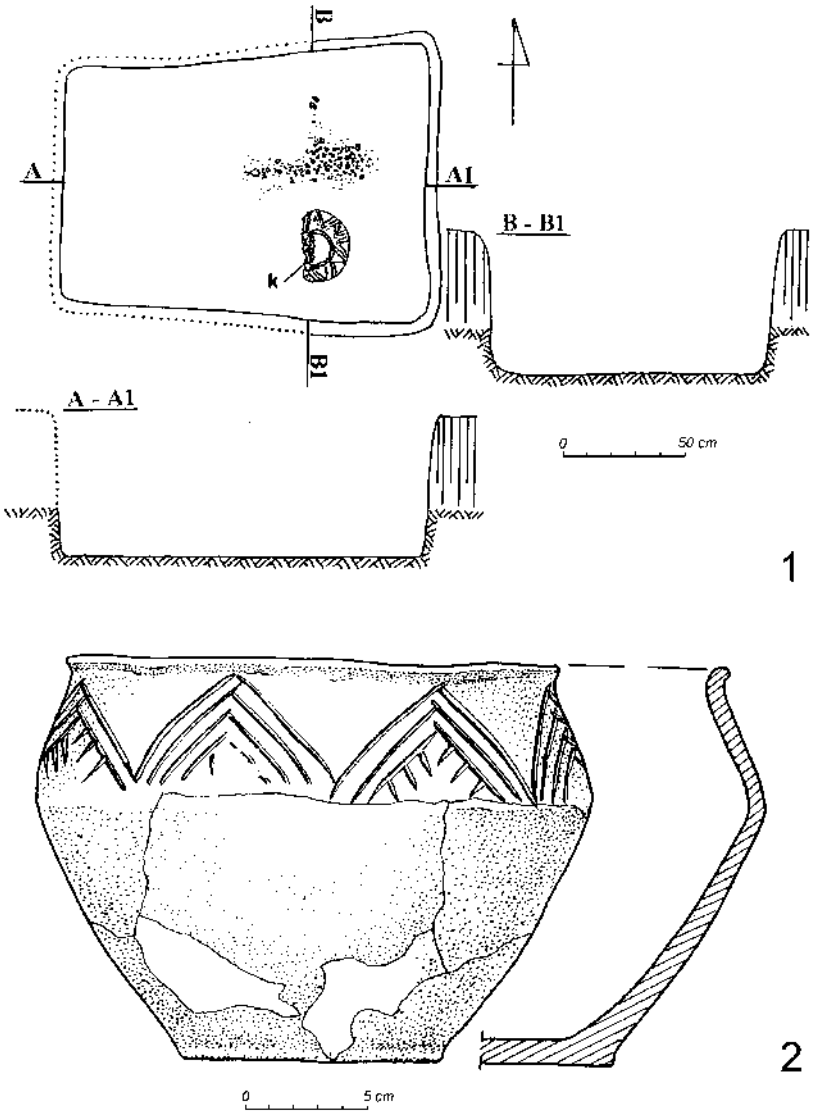

Fig. 14. "Svynareva Mohyla" group. Burial mound 24, grave 3: 1 - plan and sections, 2 - vessel

(about 5-8 cm in diameter). In 12 cm to the south from the collection of calcinated fragments, in the eastern half of the pit there was a ceramic vessel — a wide-necked pot with a flatly cut, slightly turned-out rim, a bi-conical body and the bottom with a slightly pronounced edge. Above the rib on the shoulders the vessel was decorated

with a zone of triangular shapes with their tops up, drawn with three or four lines. The inside parts of the shapes were covered with cuts going from the drawn lines to the rib of the vessel. The dough of the vessel was black and porous. The inner surface of the vessel was black, the outer surface was burnt to an orange colour. The vessel was 16.8 cm tall, with the shoulders 10.5 cm tall, the diameter of the rim at 20.5-21 cm, and the diameter of the bottom at 11 cm (Fig. 14:2). At the floor of the pit there were slight traces of yellowish and brown dust from the mat.

Grave 4 (dropped-in, unidentified) was found at 18.7 m to the south-west from the imagined center of the burial mound (Fig. 15). The burial construction was a catacomb or a pit with a shelf. At the bottom of the entrance pit and partly, probably, in the filling of the burial chamber, located to the east of the entrance pit, there were remainders of a stone cover — two shell-rock stones, obviously displaced from their initial positions. The burial chamber, probably, was oval, stretched along the long axis from north-north-west to south-south-east. The chamber was about 2.14 m long and 1.50 m wide at the center. At the bottom, in the southern part of the chamber, there were remainders of a human skeleton. Two hip bones lay parallel to the long axis of the pit. From the northern side, from the knee joints to the middle of the pit, in compact form lay a group of different bones of the skeleton: a foot bone, seven ribs, a radius bone of the forearm, a shoulder-blade and two fragments of shoulder bones. Judging from the location of the human bones (preserved *in situ* hip-bones with knee cups and talon bones at the southern but-end of the chamber), the body had been buried in a stretched position (?) with his head towards the north-west. There were no ritual objects. Probably, the grave had been damaged with later diggings.

2. ABSOLUTE CHRONOLOGY OF THE BEREZHNOVKA-MAEVKA SRUBNAYA CULTURE

The published materials provide us with a representative group of twelve graves of the Late Bronze Age that require a summarized description. Five of them were dropped into an earlier burial mound; they form one row of graves along the long axis of the burial mound (burial mound 18). The burial pits are located across that axis with their long sides parallel to each other, forming a single cemetery. The other seven graves were found in "their own" burial mounds of the Late Bronze Age. In two cases (burial mounds 16, 23) the graves formed pairs and then they can be seen as principle ones. Only in burial mound 24 is there an unquestionable dropped-in grave (1) in the burial mound of the Late Bronze Age. Stratigraphical observations were done also in burial mound 18, where graves 21

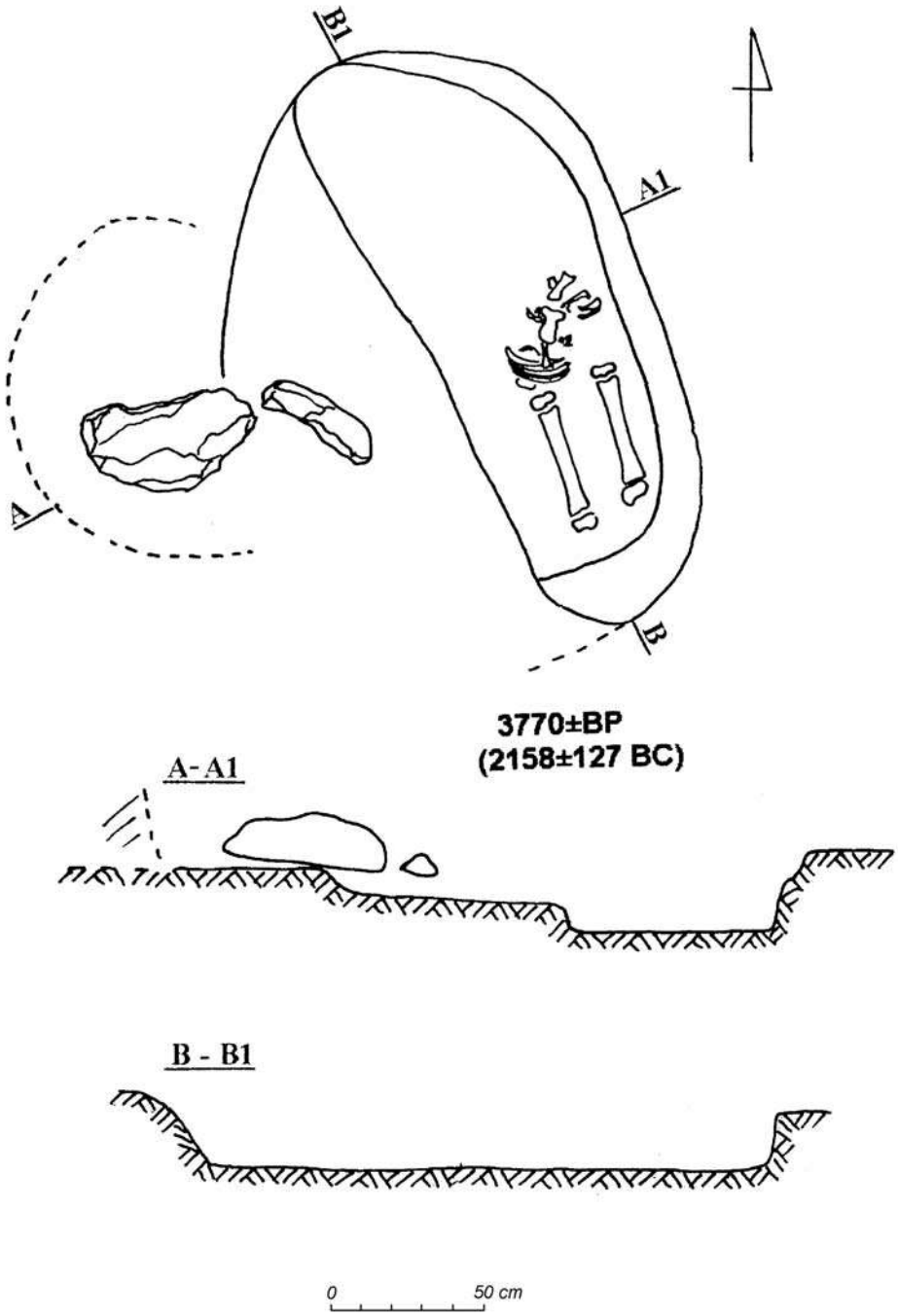

Fig. 15. "Svynareva Mohyla" group. Burial mound 24, grave 4: plan and sections of the "shelf"

and 20 (Late Bronze Age, connected to the mounds 4 and 5) followed grave 4 (the Mnogovalikovoy Pottery culture), covered with a third layer of soil ("bridge"). The latter contained dropped-in graves 1, 5, 6 (Late Bronze Age). Summing up the observations, the stratigraphically earlier group may include principle graves in burial mounds 16, 17, 23, 24 and graves 21, 20 in burial mound 18, linked to the additional layers of soil put on the mounds. The dropped-in graves, 1, 5, 6 in burial mound 18 and grave 1 in burial mound 24 are distinctly smaller in size of the burial constructions and represent more modest rituals. Hence, it is possible to assume that the stratigraphical observations here reflect, most probably, not a real difference in dates of the burial complexes but social phenomena. Unfortunately, samples of the bone material for absolute date calibration (with one exception) were taken from better preserved graves of an earlier stratigraphical group, which does not allow verification of our hypothesis. Moreover, the only date available for a group of dropped-in graves proved to be much more recent than originally believed (burial mound 24 / grave 1: 2360±114 BC).

The lack of principle differences in rites allow us to give a general description of the published group of graves. All of them are linked to long burial mounds of the second (burial mound 18) and third (burial mounds 23, 24) types [Otroshchenko 1976a:16-18]. In two other cases the mounds were ploughed down to the base and, therefore, their shapes could not be identified. All graves were made in rectangular burial pits, oriented along the north-south line. One of the pits had a broad "shelf" along the perimeter (burial mound 23 / grave 2). The presence of the "shelf" could be predicted also in grave 1 of burial mound 16, as suggested by the location of the stones of the "ceiling" below the level of buried black earth. The "ceiling" (stone, wooden, combined) was usually made inside the pit. In two cases at the bottom of the pit there was a stone box made of shell-rock slabs but with a granite "gravestone" included into the northern wall (burial mound 17 / grave 1; burial mound 23 / grave 2). The third slab of the shell-rock covered the pit and served as the base for the stone "ceiling" (burial mound 16 / grave 1).

Ten graves followed the rite of inhumation of the bodies in curved position; two graves displayed the rite of outside cremation (burial mound 18 / grave 21; burial mound 24 / grave 3). In grave 1 of burial mound 16 there were remains of two bodies (an adolescent and a child). Other graves were individual. In five graves the skeletons lay on the right side; in four graves on the left side. The orientation of the buried remains was to the east, with deviation to the north or south within 25 degrees. The hands of the buried bodies were placed in front of the faces, more rarely — in different directions. In three cases on the floor of the pits there were traces of organic mats. Accompanying objects found in the graves were ceramic vessels (absent only in one case: burial mound 18 / grave 6). The vessels were put in front of the body at the head or the waist, and only in one case at the back of the head. The vessels, with a certain degree of conditionality, may

be classed into three types: jar-like (three objects), low ribbed vessels (six objects) and pots (three objects). All the pottery can be regarded as tableware. The rich ornamental compositions and techniques of ornamentation (drawn, impressions of cord, stroked surface, cuts)were typical for ribbed vessels. Smaller pots were more modestly decorated (draft ornament, cord, cuts, pricks) and only one of three jars was decorated with cuts at the rim. The favourite zone of ornamentation is the neck, less frequently — the rim of a pot or a jar. On two of the ribbed vessels the ornament also covers the lower part of the body. The ornamental compositions consist of combinations of zig-zags, triangles and horizontal circular lines, oblique crosses and rhombes.

A specific feature of this group of graves is the presence of three "gravestones" — diligently processed slabs of granite or shell-rock without any anthropomorphic features. One of the "gravestones" served as the "ceiling" to the burial pit (burial mound 16 / grave 1). In that context the "gravestones" were found in a burial mound of the Late Bronze Age near the village of Kapustino of the Mykolaiv Region [Symonovich 1954:81-84] and in a burial mound with a labyrinth near the village Luhove in the Crimea [Koltuchov, Kisliy, Toshchev 1994:81-82, Fig. 41:1-4). Even more interesting is the context of finding the "gravestones" that had been built into the wall of a stone box (burial mound 17 / grave 1; burial mound 23 / grave 2). Such cases were found in the village of Pryshyb of the Zaporizhya Region, burial mound 1 / grave 3 [Rassamakin, Kolosov 1992:30, Fig. 3:1) and in burial mound 1 at the village of Rusyn Jar in the Donetsk Region [Polidovich, Tsimidanov 1996:100-05]. The available material, now from four burial sites, allows making some conclusions. The "gravestone" was built into the wall of the box taking into account the position of the body so that it could be in front of the face. When the body was put on the left side, the slab was built into the southern wall, and when the body was put on the right side, the slab was built into the northern wall (like in burial mounds near Ordzhonikidze). The body was arranged in the position of adoration. Therefore, the wall of the grave to which the face of the buried body was turned could be regarded as an altar. In all of the cases the accompanying objects were put in front of that wall.

Identification of the cultural affiliation of the discussed graves, while seemingly obvious, has some specific details. Accoridng to I.N. Sharafutdinova, those could be "Srubnaya graves of pre-Sabatinovka and Sabatinovka time" [Sharafutdinova 1982:61, Fig. 20]. V.V. Otroshchenko earlier referred complexes of that kind to older and earlier Sabatinovka stages of the Lower Dnieper version of the Srubnaya culture [Otroshchenko 1981:17]. There is a third opinion about the stone box graves of the Sabatinovka culture [Klyushentsev 1994:250-254]. However, looking at the east, we find similar complexes in the second and third stratigraphical horizons of the Srubnaya culture of the Eastern Upper Azov Region [Litvinenko 1999:20, Fig. 13] and the Siversky Donets basin [Litvinenko 1994:21, Fig. 1]. V.V. Otro-

shchenko, having reviewed materials from the Srubnaya community graves at the territory from the Southern Trans-Urals to the Upper Northern Pontic Region, was decided that it was necessary to divide them into two archeological cultures within the Srubnaya community — the Pokrovsk and the Berezhnovka-Maevka [Otroshchenko 1994:150-53; 2002:13-19]. In Ukraine, the monuments of the Pokrovsk Srubnaya culture correspond with the early stratigraphical horizon of the Srubnaya culture, according to P.A. Litvinenko [1994]. Monuments of subsequent horizons (second and third) are included into the Berezhnovka-Maevka Srubnaya culture. Its source was found in the steppe area between the rivers Dnieper and Siversky Donets, and its western border was the river Inhulets. Hence, the burial monuments of the Late Bronze Age of the Dnieper-Inhulets river area belong to the area of the Berezhnovka-Maevka Srubnaya culture. The basic principles for such identification are the presence of long burial mounds, box-like containers in elite graves, stone figures, rectangular pits, "ceilings" inside the graves, predominant eastward orientation of the buried bodies, the presence of ceramic vessels in the graves, and cremations.

An important task is to clarify the chronological position of the described group of graves in the system of monuments of the Berezhnovka-Maevka Srubnaya culture. The line between the first and the second periods is not very clear and is determined in accordance with a tendency, with predominance of earlier or later features. The earlier features include the presence of "srubs", ceramic forms with distinct "ribs", bronze knives, decorations. The late features include stone burial boxes, particularly the graves made with the use of horizontal walling; the higher proportion of cremations and cases of a right-side position of the buried body and the absence or minimum of dropped-in graves in the burial mounds of the Berezhnovka-Maevka Srubnaya culture. The comparison of features verified on dozens of stratified burial mounds shows that the Ordzhonikidze graves belong to the second period of the Berezhnovka-Maevka Srubnaya culture. We would like to speficically emphasise the unusually high occurrence of the right-side position of the buried body (50% instead of statistical average of 11.2%) and cremations (16.6% instead of statistical average of 4.1%. The absence of narrowly dated objects is embarrassing; however, here we may use materials of burial mounds with stone boxes in pits found in the lower Inhulets with the collection of bronze tools (needle — awl) [Klyushentsev 1994:252-253, Fig. 2:2; 4:2-3]. Such a combination of tools is conducive for date-setting graves of the second period of the Berezhnovka-Maevka Srubnaya culture in its entire area.

Hence, the package of eight ^{14}C dates obtained through analysis of the bone material from the graves of the discussed group is of particular interest (Table 1). The date-setting was performed at the Kiev Radiocarbon Laboratory of the Institute of Environmental Geochemistry of the National Academy of Sciences of Ukraine (head of the laboratory — N.N. Kovalyukh). As it has been already mentioned, samples of the bone material were taken from six complexes of the first stratigraphical

group (except cremations), one of the second group and one of the unidentified grave (burial mound 24 / grave 3). The six dates, on average, are grouped within the time period between 1524-1175 BC. The two dates from graves 1 (2360±114 BC) and 4 (2158±127 BC) of burial mound 24 (objectively the latest in the sample) were included in the 3000 BC set and should be recognized as incorrect.

Therefore, the main package of dates represents only the graves of the early stratigraphical group that were spread rather evenly at the time line of 350 years (Table 1). In fact, the obtained data are broader in archaeological date-setting, for they cover not only the second period but also the entire range of the Berezhnovka--Maevka Srubnaya culture within the 15th — 12th centuries BC. Taking into account the entire possible collection of the dates, the range becomes even broader — from the 17th century BC to 10th century BC. It is interesting to compare two pairs of dates received from two pairs of presumably main graves in burial mounds 16 and 23. In the first case graves 1 and 2, made next to each other, are divided by 133 years (1468±90 and 1335±98 BC), while in the second case the time between graves 1 and 2 is 209 years (1436±91 BC and 1227±121 BC). It should be noted that the earlier date is produced by the peripheral (accompanying, logically) grave 1. It is also noteworthy that the latest dates on the list were the results received from the complexes in stone boxes: burial mound 17 / grave 1 (1175±122 BC); burial mound 23 (1227±121 BC). There were "gravestones" in them, built into the walls of the graves. Grave 1 in burial mound 16, covered with a slab, produced a noticeably earlier date (1468±90 BC).

Recently, the Kiev laboratory has produced two representative packages of dates for monuments of the Late Bronze Age in Ukraine. The graves of the Malopolovetske cemetery near the town of Fastiv in the Kiev Region produced a series of dates within the period of 1600-1400 BC [Kovalyukh *et al.* 1998:130-140]. That cemetery contains materials of the Trzciniec and the Berezhnovka-Maevka Srubnaya cultures. The settlement of Hlyboke Ozero at the Siversky Donets river in the Donetsk Region (that can be referred to the second period of the Berezhnovka-Maevka Srubnaya culture) produced a series of eleven dates ranging from the 14th century to 12th century BC [Gershkovich 1998:86-88, Table 1]. In general, the dates from Malopolovetske and most of the dates from Ordzhonikidze appear to be somewhat lower than they really are. Dates ^{14}C from the Hlyboke Ozero are the most consistent with the archaeological dates. However, one should agree with the conclusion made by Y.P. Gershkovich about effectiveness of radiocarbon dates for the Late Bronze Age: "At best, (...) we have a proof of archaeological dates but they remain "floating" within wide ranges, largely exceeding those we would like to get" [Gershkovich 1998:87]. V.I. Besedin is even more skeptical in his assessment of real acheivements of radiocarbon date-setting for monuments of the 2000 BC: "... there is nothing more relative than absolute dates. (...) Absolute dates in Eastern European archaeology have never been determinant. Moreover, their interpretation has

always depended on archaeological data themselves, stratigraphy of the complexes and types of objects found in them" [Besedin 1999:191,194-195]. Obviously, specialists in absolute date-setting will have a lot to do to regain the trust of thoughtful archaeologists.

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 336-364
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE BILOZERKA CULTURE — BASED ON BARROWS NEAR THE VILLAGE OF ZAPOVITNE (THE "STEPNOY" CEMENTERY)

In 1972, the Zaporizhzhia expedition of the Institute of Archaeology of the Academy of Sciences of Ukraine excavated the largest barrow cemetery of the Bilozerka culture on the land of the former Soviet farm "Stepnoy" near the village of Zapovitne, Kamenka-Dniprovska District of the Zaporizhzhia Region (Fig. 1). The publication itself, of selected materials of the excavation [Otroshchenko 1975], provoked substantial resonance in academic circles and stimulated the process of identification of the Bilozerka culture [Otroshchenko 1986]. At that time the radiocarbon dating of samples from the cemetery was performed (Table 1).

Table 1

Zapovitne, Kamenka-Dniprovska District, Zaporizhzhia Region. Old ^{14}C datings for graves of the "Stepnoy" cemetery

Lab. No.	Barrow / grave	BP	BC
Ki-575	9/1	3050±70	1293±98
Ki-889	11/3	2850±40	977±60
Ki-885	3/1	2805±55	921±71
Ki-887	2/1	2700±45	839±41
Ki-886	15/2 *	2690±50	837±42

Note: * – or barrow 14 / grave 2.

A general description of the published barrows was done shortly after the excavation [Otroshchenko 1975:193-206]. Subsequently, the first set of dates for the "Stepnoy" was published [Otroshchenko 1981:17]. Materials of the cemetery were used for the first identification and description of the Bilozerka culture [Otrosh-

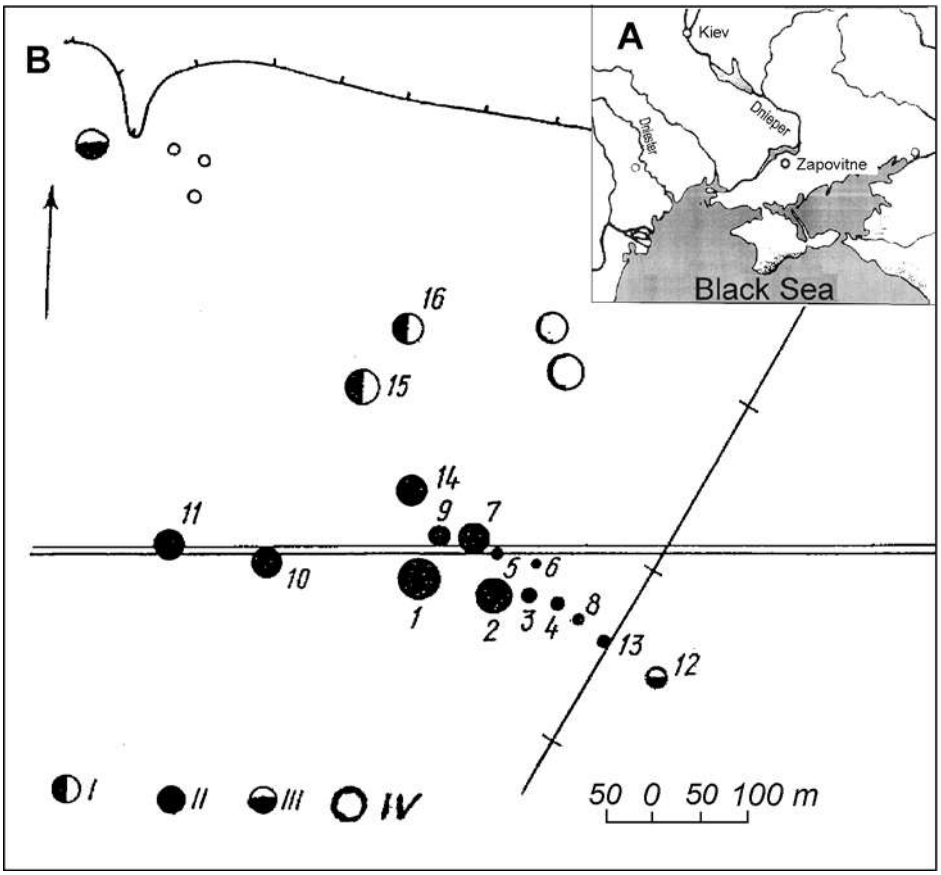

Fig. 1. Location (A) and plan of the barrow group (B) near the village of Zapovitne, Kamenka--Dniprovska District, Zaporizhzhia Region. Key: I – barrows of the Mnogovalikovoy Pottery culture; II – barrows of the Bilozerka culture (the "Stepnoy" cemetery); III – Scythian barrows; IV – unresearched barrows

Table 2

Zapovitne, Kamenka-Dniprovska District, Zaporizhzhia Region. New ^{14}C datings for graves of the "Stepnoy" cemetery

Lab. No.	Barrow / grave	BP	BC
Ki-9823	15/2 *	2920±50	1092±83
Ki-9596	3/1	2915±45	1087±78
Ki-9820	9/1	2880±55	1016±89
Ki-9821	11/3	2830±55	962±76
Ki-9822	2/1	2780±55	895±64

Note: * – or barrow 14 / grave 2.

chenko 1985]. The complex of grave 1 of barrow 3 with a sub-Mycenae fibula was published one year later [Otroshchenko 1986], and barrow 9 was not published until recently [Otroshchenko 2001]. The new dates we have obtained allow us to return to the analysis of materials of the excavation near Zapovitne.

1. RECORD OF RADIOCARBON DATED COMPLEXES

Let us consider complexes that have been dated with the use of ^{14}C methodology and those of non-dated complexes that contain typical archaeological materials.
Barrow 2 was 2.8 m high and 24 m in diameter (Fig. 1:2)
Grave 1 was located 1 m to the south of the 0 point. The soil, dug out when the pit had been made, was placed in the shape of a horseshoe along the western, northern and eastern walls (Fig. 2). The entrance to the pit, located at the southern wall (not shielded by the soil) was covered with a fine (up to 0.02 m) layer of reed. The pit was covered with a solid transversal cover made of oak planks of the total size of 5.4 x 4.4 m. The planks were 0.27 m wide and 0.06-0.07 m thick (Fig. 3:1). They rested on the edges of the pit and on two lengthwise beams fastened along the western and eastern walls. Like the planks, the beams were placed crosswise on the pit, but were noticeably shorter than the planks and fully fitted into the opening of the pit. The burial pit — rectangular, with rounded corners — was made 1.9 m deep. The dimensions of the pit were 3.65 m x 3.2 m; it was oriented from north to south. Along the perimeter of the pit, under the wall there was a trench (0.09 — 0.13 m wide, 0.1 m deep). The lower edges of the planks of the wall coating were hammered down 0.15 m to the bottom of the trench. The planks of the wall coating were carefully smoothed and tightly fitted to each other. The location of the planks at the walls was as follows: southern — length 3.15 m, 14 planks; northern — length 3.1 m, 15 planks; western — length 3.35 m, 15 planks; eastern — length 3.65 m, 19 planks (Fig. 3:2-5).

Altogether, 66 planks were used to coat the walls of the burial pit. The side trenches shaped the floor of the pit as a platform (3.45 m x 2.95 m). Its central part was occupied by a rectangle (2.5 m x 2.1 m), limited with four round cylinder holes (Fig. 3:1).

The grave had been robbed. The cleaning of the worn-in cover in the southern part of the pit, at the depth of 1.35 m from the level of buried black soil, displayed a human skull; fragments of a horse skull were found at 1.6 m. Some animal bones were found at the north-western hole. Two bone cylinder-shaped beads (8 mm long, 5 mm in diameter) were found on the wooden planks of the floor that had served as a podium for the dead body (Fig. 2:2).

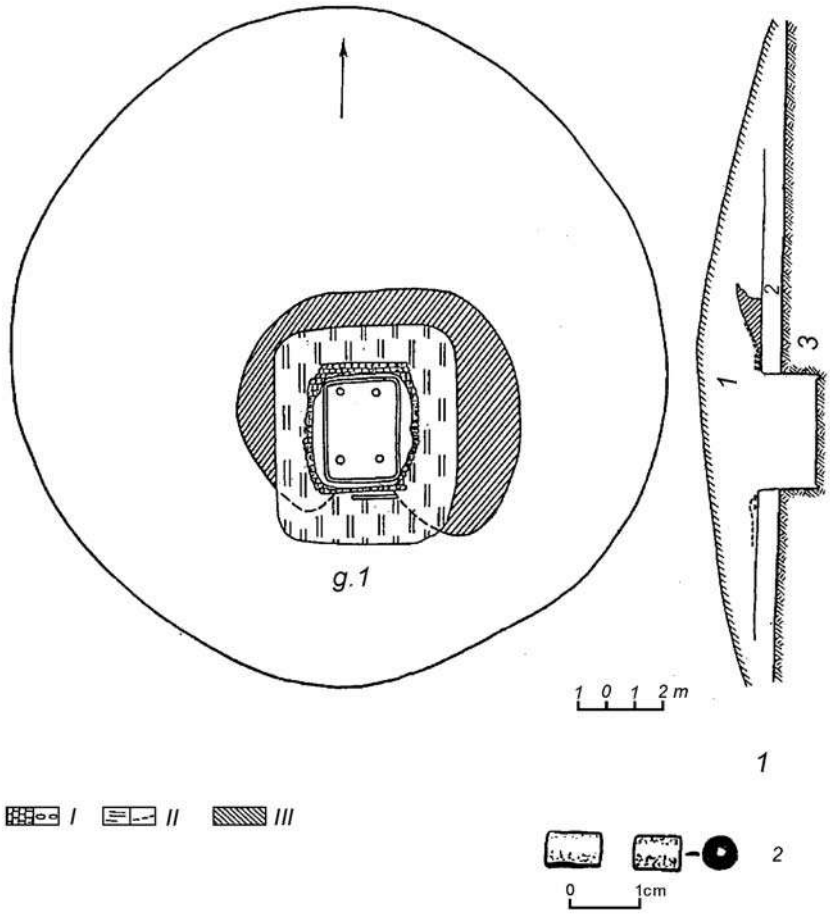

Fig. 2. Barrow 2 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the barrow; 2 – bone beads from grave 1. Key: *I* – wood; *II* – reed; *III* – soil excavated when the grave was dug

^{14}C dates based on samples of wood were Ki-887: 839±41 BC (old), and Ki-9822: 895±64 BC (new).

Barrow 3 was found in 14 m to the east of barrow 2 (Fig. 1). The barrow was 0.4 m high and 22 m in diameter (Fig. 4).

Grave 1 was found in the centre of the barrow. The square pit with rounded corners was 2.4 m x 2.2 m in size, 1.6 m deep. At the level of 1.5 m there were traces of a worn-in cover that had been made of poplar beams and planks. In the trenches

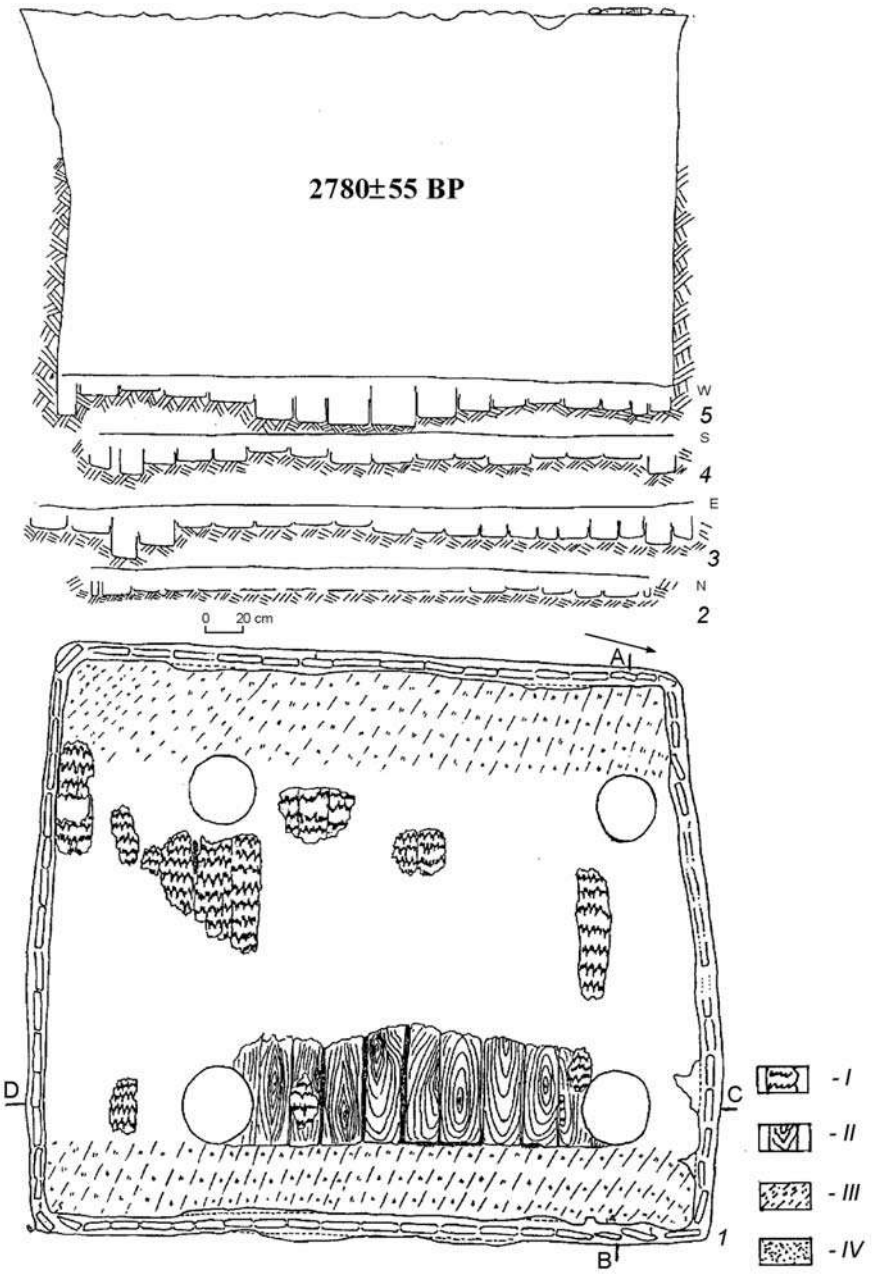

Fig. 3. Barrow 2 near Zapovitne, Zaporizhzhia Region: 1 – plan of grave 1; 2-4 – sections of the northern, eastern and southern trenches; 5 – section along the western wall of the pit. Key: *I* – planks; *II* – imprints of the planks on the floor of the pit; *III* – herbal mat; *IV* – ochre

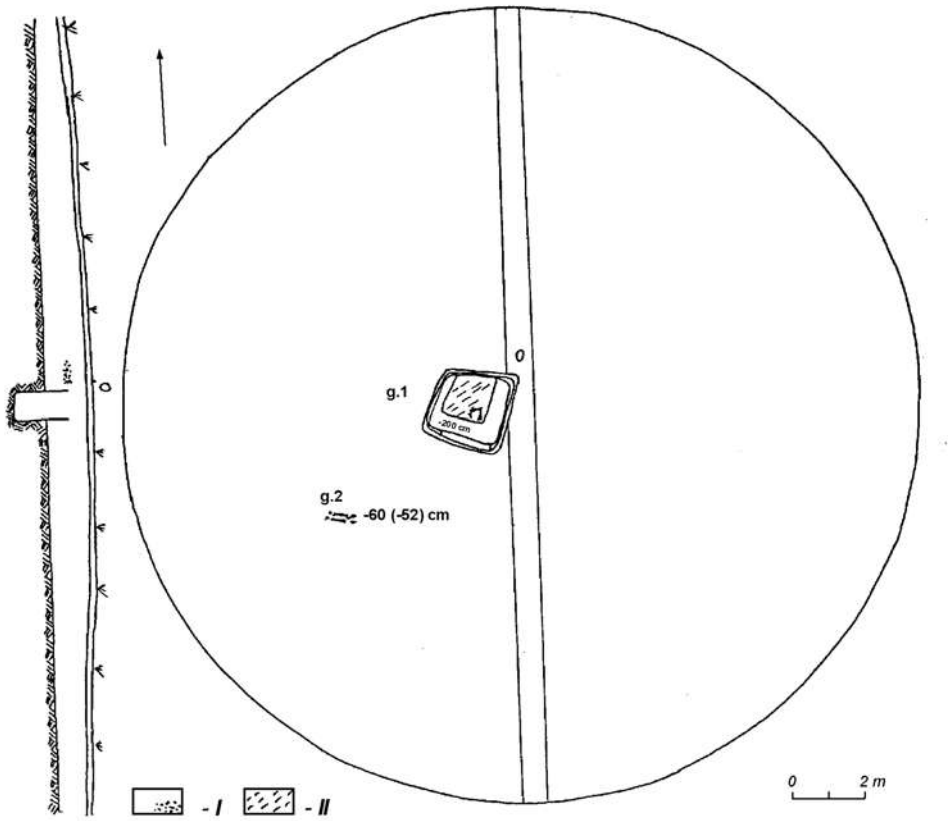

Fig. 4. Plan and section of barrow 3 near Zapovitne, Zaporizhzhia Region. Key: *I* – soil, excavated from the burial pit; *II* – herbal mat

along the perimeter of the pit there were poles that had served as supports for the beams of the cover. The construction of the cover most closely resembles a shed. One of the lengthwise planks was burned from beneath. The presence of the trenches made the bottom of the pit look like a couch or a stepped terrace. A skeleton of a man (aged 20-30 at the time of death; anthropological identification was performed by S.I. Kruts) lay on the eminence in a tightly curved position on the left side, head to the south-west. The skull and leg bones below the knees displayed traces of dark-red paint (Fig. 5:1). In the north-eastern corner of the pit, under a ledge and behind the skull there was a small goblet (1). Under the right knee-cup there was a bronze fibula (2). Behind the pelvic bones there was a round ceramic weaving-stone (3); there were eight glass beads (4) and one amber bead (5) at the

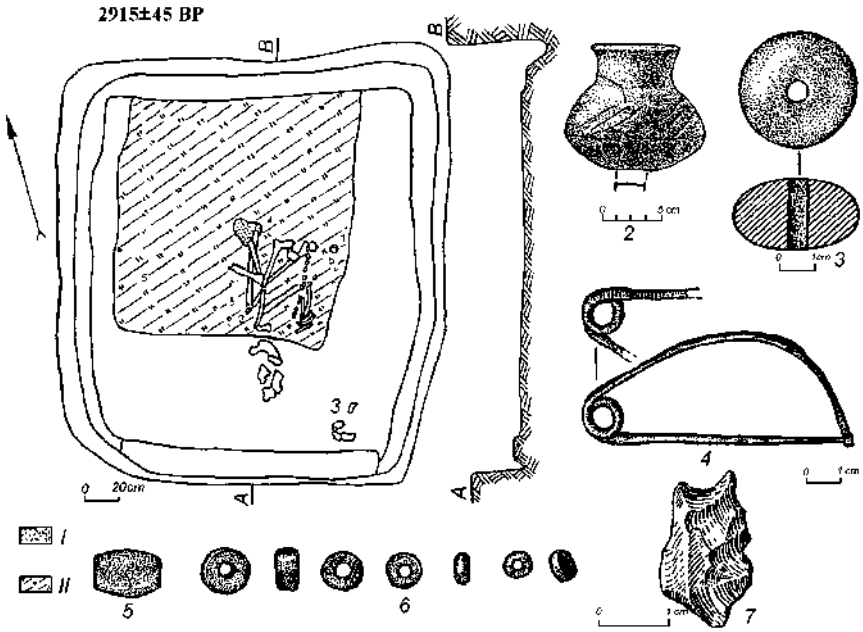

Fig. 5. Barrow 3 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of grave 1; 2-3 – ceramics; 4 – bronze; 5 – amber; 6 – glass; 7 – flint. Key: *I* – ochre; *II* – herbal mat

chest and the skull. At the western edge of the mat, opposite the knees, there was a flint splinter (6).

Description of the finds:

1. A molded goblet with a cylinder-shaped neck and a concave bottom. The vessel was covered with black polish and decorated with a pair of circular and four groups of inclined cannelures. Each of the groups had three parallel cuts. The vessel was 9 cm high, with the rim of 6.5 cm in diameter; the diameter of the body was 10.5 cm, and the diameter of the bottom was 2.5 cm (Fig. 5:2).

2. A fibula with an arch-shaped back was made out of a piece of bronze wire with a sharpened end of a pin and a narrow stop, hammered flat. The surface of the pin displayed slight faceting; there was also an ornament of crosswise cuts at the place where the back of the fibula transformed into the pin. The length of the pin of the fibula was 7.8 cm, the height of the curve was 3 cm, the diameter of the spring was 1.3 cm, the section of the curve was 0.4 cm, and the section of the needle was 0.2-0.3 cm (Fig. 5:4).

3. A round ceramic weaving-stone with a round hole in the middle. One of the

sides of the hole was framed with two short cuts placed opposite each other. The diameter of the weaving-stone was 3.5 cm, the diameter of the hole was 0.6 cm, and its height was 2.2 cm (Fig. 5:3).

4. Glass beads differed in colour and shape (Fig. 5:6). They included: one dark blue elongated bead (D – 0.6 cm, h – 0.4 cm); seven round beads, including one red (D – 0.6 cm, h – 0.4 cm), two green (D – 0.5 cm, h – 0.35 cm), one yellow (D – 0.4 cm, h – 0.3 cm), three light-brown (D – 0.8 cm, 0.6 cm and 0.45 cm, h – 0.3 cm, 0.2 cm and 0.2 cm).

5. A bi-conical amber bead: h – 1 cm, D at the edges – 0.5 cm, D at the rib – 0.7 cm (Fig. 5:5).

6. A flint splinter in the shape of a short plate with one-sided oblique chops-off, measuring 2.4 cm x 1.3 cm x 0.4 cm (Fig. 5:7).

The ^{14}C date taken from a wood sample was Ki-885: 921±71 BC (old), and Ki-9823: 1087±78 BC (new).

Barrow 4 was located 62 m to the east of barrow 2 (Fig. 1). It was 0.35 m high and 18 m in diameter. The mound of the barrow contained fragments of a Polovets statue. The main grave of the barrow was grave 2; there were also 'dropped-in' Scythian (3) and Polovets (1) graves (Fig. 6).

Grave 2 lay 0.8 m to the southeast from the center. The northern part of the burial pit was ruined with the Polovets grave 1. The square burial pit (1.8 m x 1.9 m) had rounded corners. The black soil filling of the pit was filled with fragments of wood from the ruined cover. The bottom of the pit had a complex profile and construction. A "couch" for the dead body (1.0 m wide) was cut 1.2 m deep in the main soil at the centre of the pit along the north-west — south-east axis. To the west and the east from the "couch" there were side trenches (0.5 m and 0.45 m wide and 0.22 m and 0.3 m deep from the level of the grave, respectively). In each of the trenches there were two large round holes that contained think wooden poles (D – 0.08 m).

Along the perimeter of the pit there were 15 additional small round holes (D – 10 15 cm, up to 10 cm deep), probably for coating the walls of the burial construction. A skeleton of a man aged 25-30 at the time of his death was placed on the "couch" within the square formed by the large holes, in the curved position of the left side, his head to the south. Because the lower part of the skeleton was ruined, it was impossible to identify the positions of the arms and legs. Along the southern edge of the "couch" immediately at the hopes of the coating, there was a wooden plank. Another plank was found behind the back of the skeleton along the eastern edge of the "couch". The bottom of the "couch" was covered with a herbal rug (Fig. 7:1). Under the southern wall of the pit, opposite the back of the skull there was a moulded goblet (1). Next to it there was a lower jaw of an animal. There were two beads behind the back (2).

Description of the finds:

1. A goblet — thin-walled, with polished grey-cream surface. The vessel was 12.4

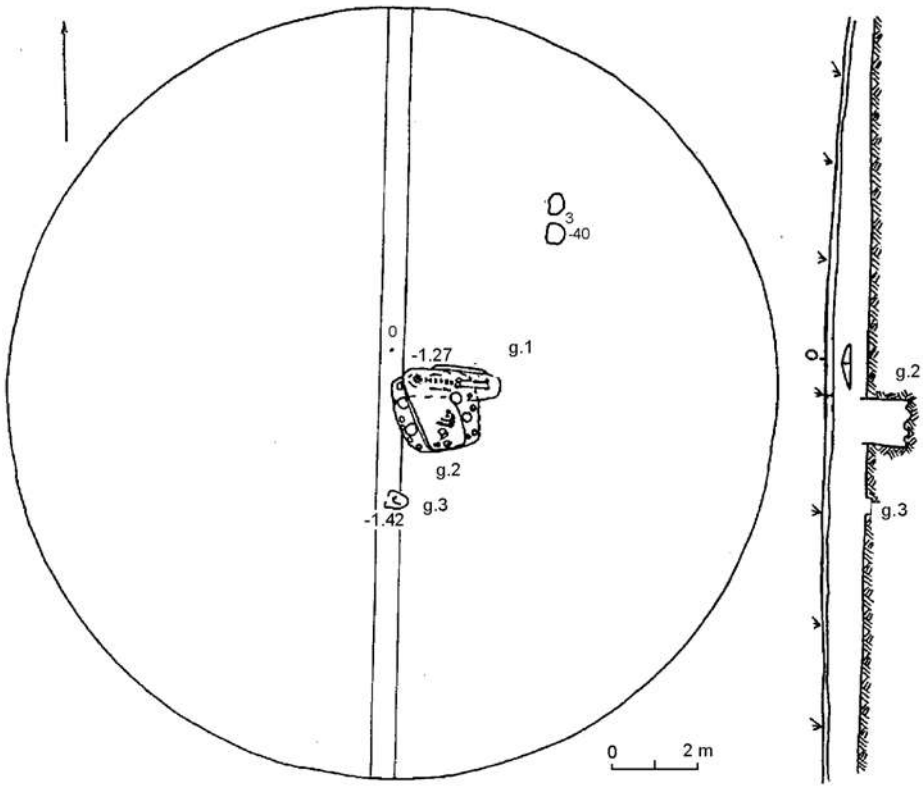

Fig. 6. Plan and section of barrow 4 near Zapovitne, Zaporizhzhia Region

cm high, 7.5 cm in diameter at the rim, 15 cm in diameter at the body and 2.5 cm in diameter at the bottom (Fig. 7:2).

2. Long cylinder-shaped beads (made of bone and amber) — 1 cm long, 0.5 cm in diameter (Fig. 7:3-4).

Barrow 5 was located in the northern row in 25 km to the northeast of barrow 2 (Fig. 1). The barrow was 0.65 m high and 24 m in diameter. That barrow alone contained two main graves of the Bilozerka culture (Fig. 8).

Grave 1 was located 1.15 m to the south from the centre. The rectangular pit with rounded corners was 2.1 m x 1.6 m in size, and 0.9 m deep. The black soil filling of the pit contained traces of a vertical coating of the walls, made of thin wooden poles. The polls served as supports for thin wooden crosswise planks. The cover was made inside the pit. The filling of the pit contained occasional pieces of charcoal and fragments of the rim and walls of a polished black goblet with a cylinder-shaped

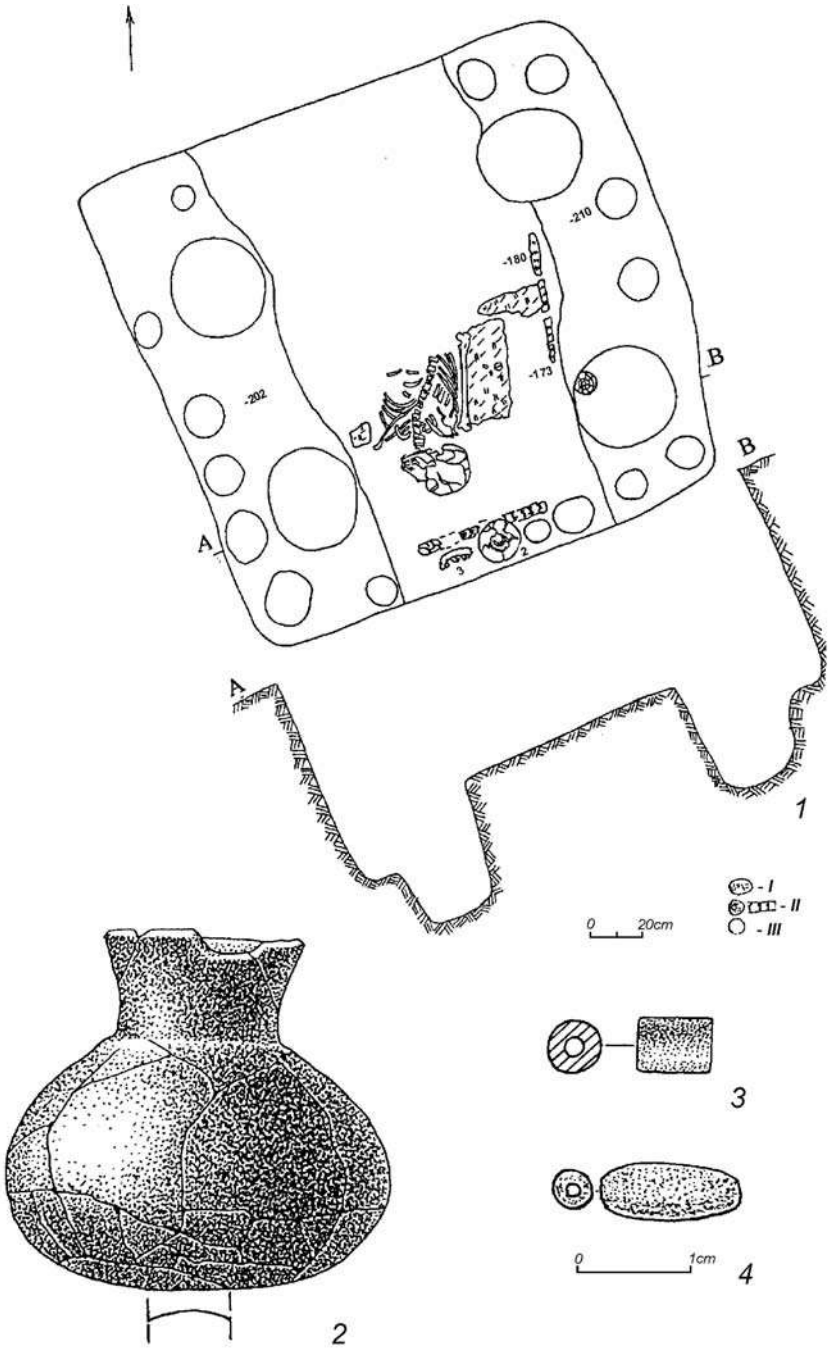

Fig. 7. Barrow 4 near Zapovitne, Zaporizhzhia Region: 1 - plan and section of grave 2; 2 – ceramics; 3 – bone bead; 4 – amber bead. Key: *I* – herbal mat; *II* – wood; *III* – pole hole

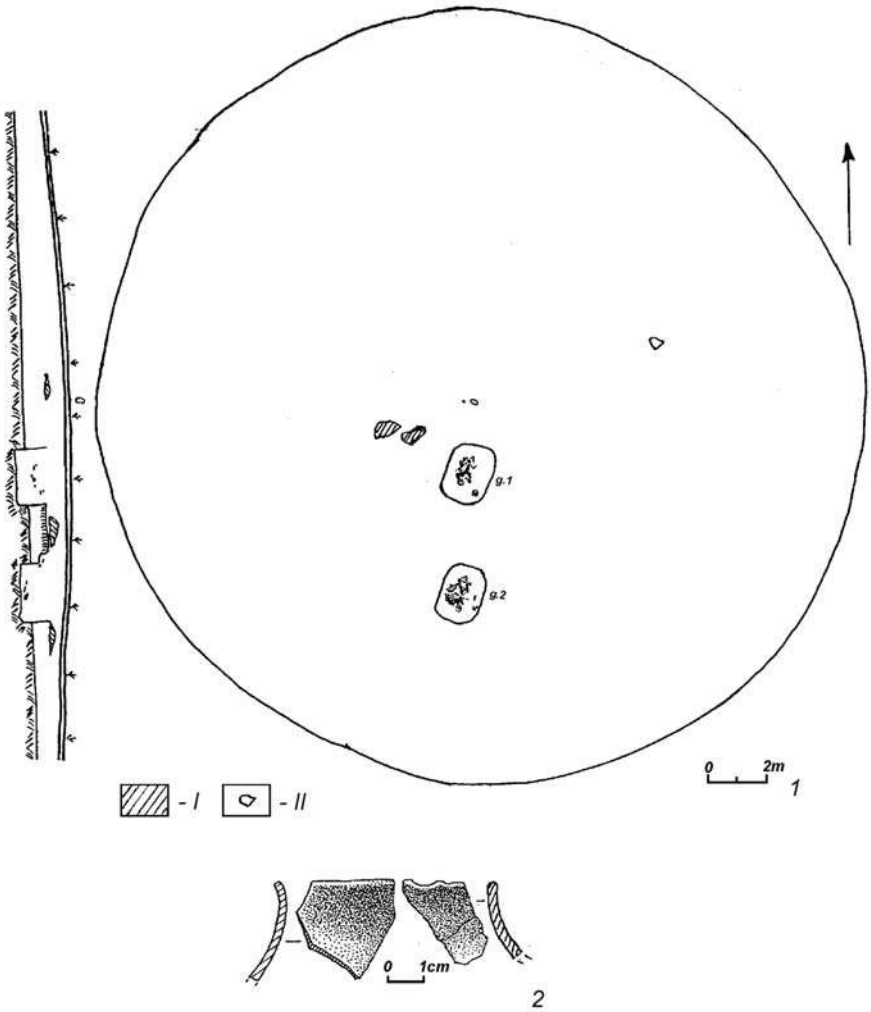

Fig. 8. Barrow 5 near Zapovitne, Zaporizhzhia Region: 1 - plan and section of the barrow; 2 – fragments of ceramics from the filling of the pit of grave 1. Key: *I* – soil excavated when the grave was dug; *II* – fragments of stones in the mound

neck (Fig. 8:2). The dead body had been placed on some chalk sprinkled on the floor at the centre of the pit in a tightly curved position on the left side (Fig. 9:1). There were small crumbles of ochre on the herbal rug that served as a cover to the dead body. In the south-eastern corner of the pit there was a moulded vessel (1). In front of the chest of the dead man there was a glass bead (2); behind the back there was a bunch of bronze rattling pendants (3).

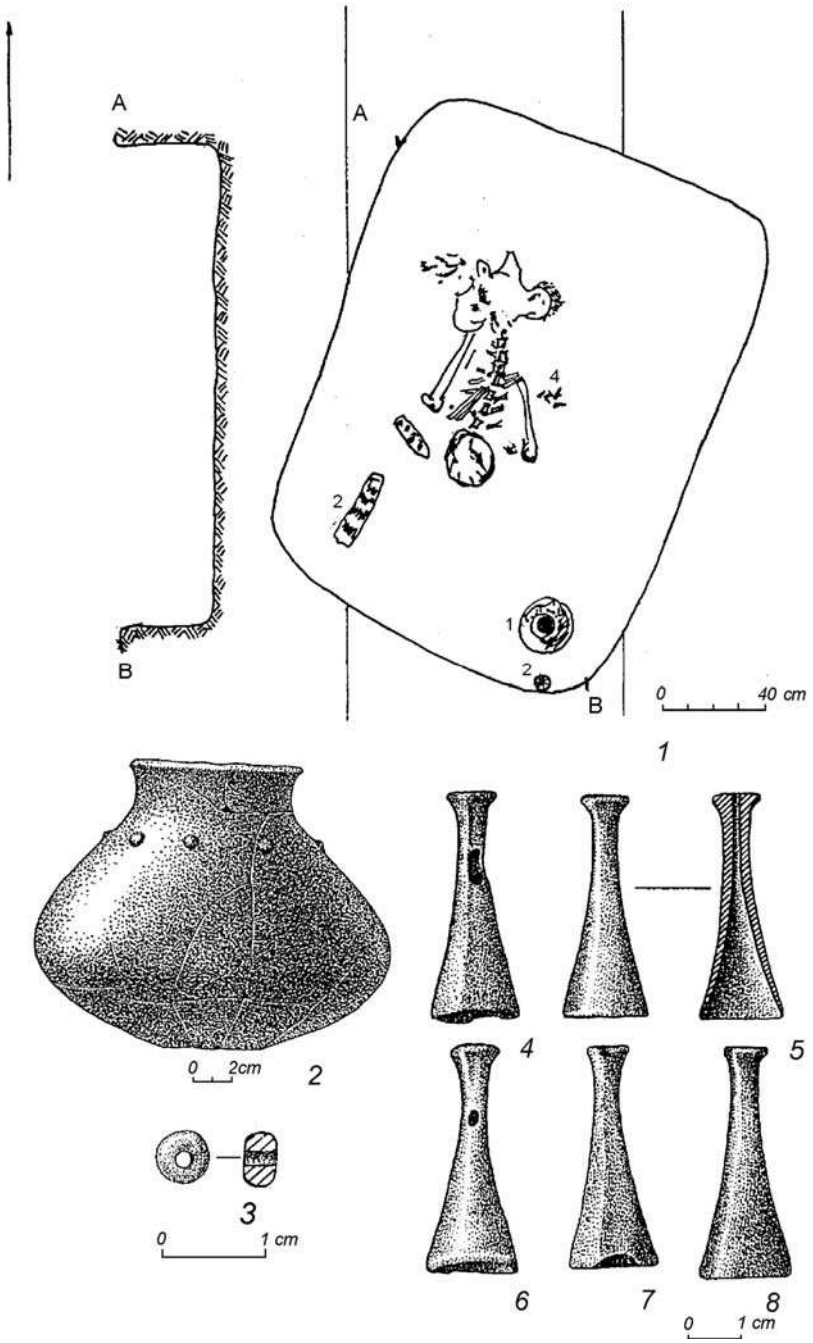

Fig. 9. Complex of grave 1 in barrow 5 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the grave; 2– ceramics; 3 – glass; 4-8 – bronze

Description of the finds:
1. The vessel — a polished dark-grey earthenware pot. The shoulders of the pot were decorated with seven nipple-like protuberances positioned in a line. The vessel was 21.5 cm high, 9.5 cm in diameter at the rim, 18.5 cm in diameter at the body, and 5 cm in diameter at the bottom (Fig. 9:2).
2. A round glass bead — D – 0.5 cm, h – 0.3 cm (Fig. 9:3).
3. Bell-shaped pendants (5 items). Inside some of the pendants, at the hole, there were remainders of threads and a leather ribbon tight in a knot. Each of the pendants was 4.4 cm high, 0.8 cm in diameter at the head, 0.5 cm in diameter at the neck; the size of the opening was 1.8 cm x 1.1 cm (Fig. 9:4-8).
Grave 2 was located in 4.7 m to the south from the centre (Fig. 8:1; 10:1). The rectangular pit with rounded corners was 1.8 m x 1.25 m in size and 0.9 m deep. Pieces of wood occurred frequently in the black soil filling of the pit — positioned vertically under the walls and horizontally across the pit. Therefore, one may assume that there had been a crosswise cover that had rested on the edges of the pit and the lengthwise beams, as well as of vertical coating of the walls with poles. A youth (?) aged under 20 had been put on the floor sprinkled with chalk in a curved position on the right side, his head to the south. In front of his face, at the eastern wall of the pit there was a moulded goblet placed on the side (1); 13 cm to the north of the goblet there was a bi-metallic dagger (2). On the left hand of the skeleton there was a bracelet (3); there was a pin (4) and a eye-like bead (5) beneath. Two more small beads were found at the back of the skull (6).
Description of the finds:
1. A goblet with grey polished surface and ornament on the shoulders: three groups of vertical smoothed grooves (four grooves in each of the groups). The vessel was 15.5 cm high, 10 cm in diameter at the rim, 17 cm in diameter at the body, and 6 cm in diameter at the bottom (Fig. 10:2).
2. A dagger with a bronze handle and an iron blade. The dimensions of the artifact were as follows: length — 12 cm, length of the iron part — 5.2 cm, length of the bronze part — 6.8 cm, length of the shaft — 3.6 cm, diameter of the stop — 1.6 cm, diameter of the neck — 0.8 cm, width of the blade — 2.3 cm, thickness of the blade — 0.5 cm (Fig. 10:7).
3. A bronze bracelet with overlapping ends, oval in section. The diameter of the bracelet was 5.2 cm, the section of the rod was 0.3 cm x 0.5 cm (Fig. 10:3).
4. A bronze pin, shaped like a shaft made of wire, round in section, with a head that had been hammered flat and then turned into a pipe. The dimensions of the pin were as follows: length – 11.0 cm, diameter of the head – 0.6 cm, section of the rod – 0.35 cm (Fig. 10:6).
5. A large round bead made of blue glass, with four circular protuberances ("eyes") and a wide white belt. The dimensions of the bead were as follows: diameter 1.2 cm, height – 0.9 cm (Fig. 10:4).

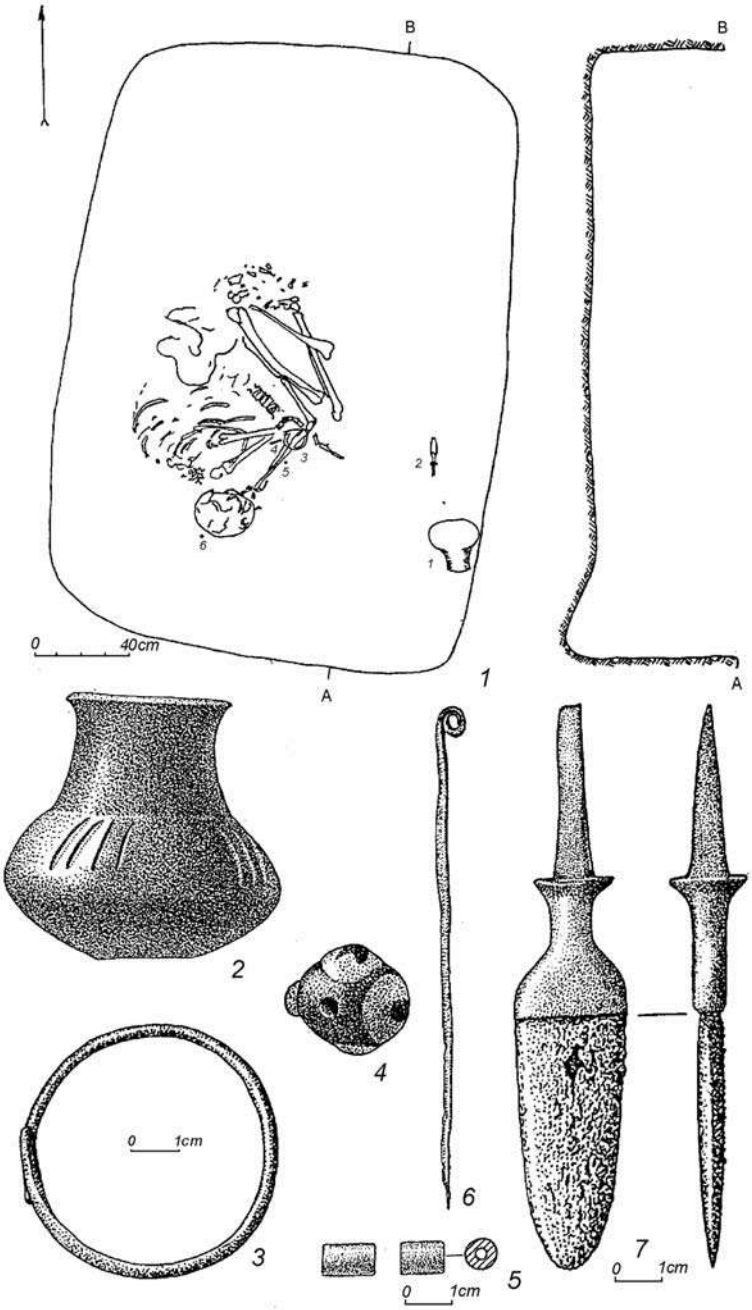

Fig. 10. Complex of grave 2 in barrow 5 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the grave; 2 – ceramics; 3,6 – bronze; 4 – glass; 5 – bone; 7 – bronze and iron

6. Bone beads (2 items) were cylinder in shape, 0.7 cm long and 0.5 cm in diameter (Fig. 10:5).

Barrow 6 was located in the northern row 50 m to the northeast of the barrow 2 (Fig. 1). The height of the barrow was 0.2 m, its diameter was 13 m. (Fig. 11:1).

Grave 1 was located in the middle of the barrow. The rectangular burial pit (1.7 m x 1.35 m) was 1.65 m deep. The black soil filling of the pit contained remainders of a reed cover at the level of 1.25 m. A skeleton of a man aged 50-60 at the time of death was placed on a reed rug in a curved position on the right side, head to the south, and covered with another herbal rug. The legs and feet were intensively covered with ochre (Fig. 11:2). At the feet there were animal bones; there was a sharpening stone at the left knee cap (1). The filling of the pit contained a fragment of a moulded vessel (2).

Description of the finds:

1. A bar-shaped sharpening stone with a broken lower edge. The length of the preserved part of the sharpening stone was 6.0 cm, the section was 2.5 cm x 1.0 cm, and the diameter of the hole was 0.2 cm (Fig. 11:4).

2. A fragment of the body and a flat bottom of a pot without traces of polish, with admixtures of mica and ground ceramics in the dough. The preserved part of the vessel was 6.0 cm high, the diameter of the bottom was 7 cm (Fig. 11:3).

Barrow 8 was located 125 m to the southeast — east of barrow 2 (Fig. 1). The mould was completely ploughed-down. The diameter of the remaining smear was 10 m; a grave of the Bilozerka culture was found in the centre of it (Fig. 12:1).

Grave 1 was made in a rectangular pit (2.5 m x 1.9 m), dug 2.15 m deep. A man (?) aged 40-50 at the time of death had been buried in a curved position on the left side, head to the south-west. Leg bones were preserved *in situ*. When the grave had been buried, the skull had been thrown back to the eastern wall and the chest had been turned across the pit (Fig. 12:2). At the initial position of the head there was a set of beads (1); there was a pendant under the chest (2), and a fragment of a bone plate in the filling of the pit (3).

Description of the finds:

1. Round beads (6 items), carved from an *Unio* shell. Their dimensions were as follows: diameter – 0.6 cm, height – 0.2 cm (Fig. 12:5-7).

2. A pendant of irregular oval shape with a small eye, made of a slice of sandstone. The dimensions were as follows: height – 2.1 cm, width – 1.7 cm, thickness – 0.9 cm, diameter of the eye – 0.2 cm (Fig. 12:3).

3. A fragment of a bone moon-shaped plate. The convex surface of the plate was decorated with an ornament of three double concentric circles with a point in the middle. The fragment was 3.8 cm long, 1.0 cm wide and 0.5 cm think (Fig. 12:4).

Barrow 9 was located in the northern row in 20 m to the northeast of barrow 1 (Fig. 1). The barrow was 0.9 m high and 20 m in diameter. The barrow was made over

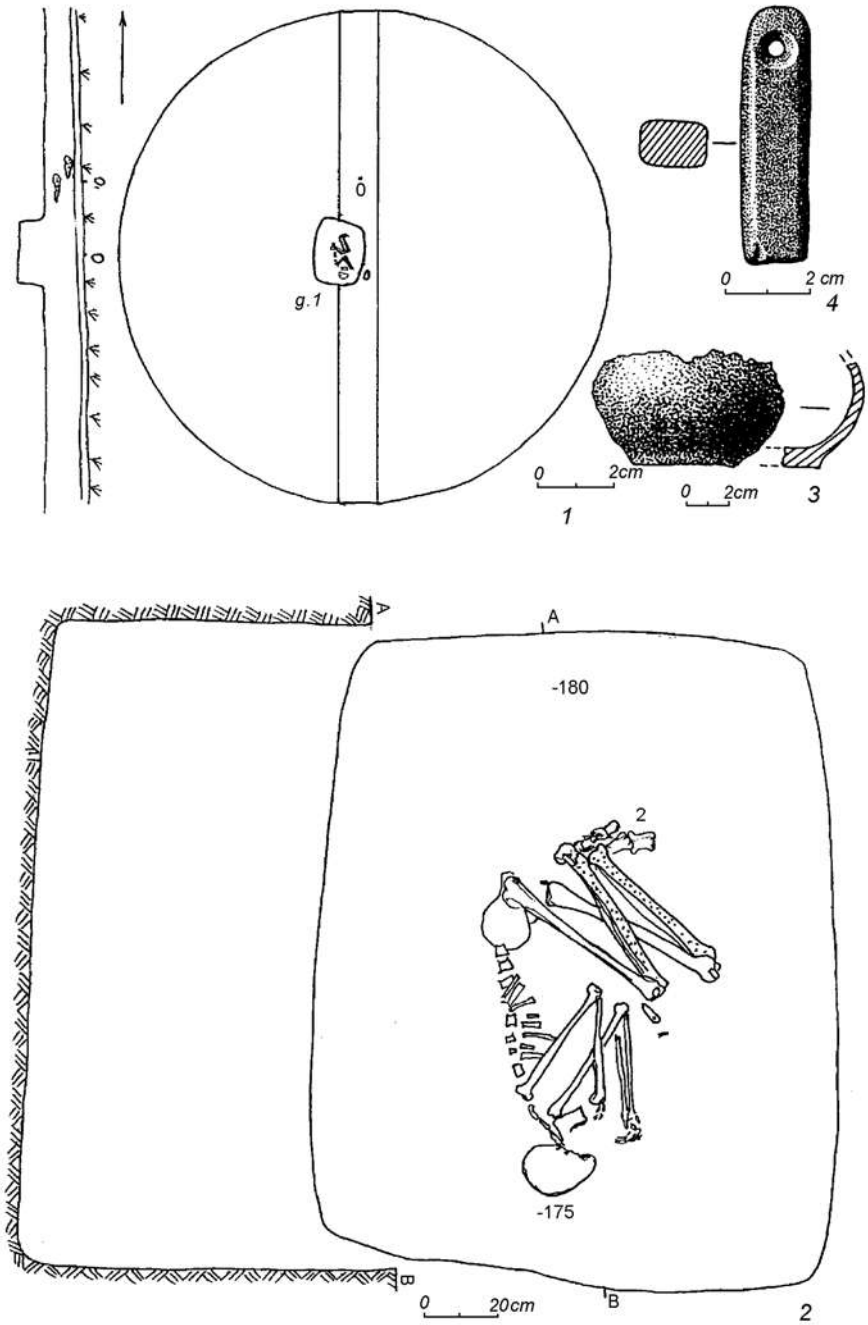

Fig. 11. Barrow 6 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of barrow; 2 – plan and section of the grave; 3 – ceramics; 4 – stone

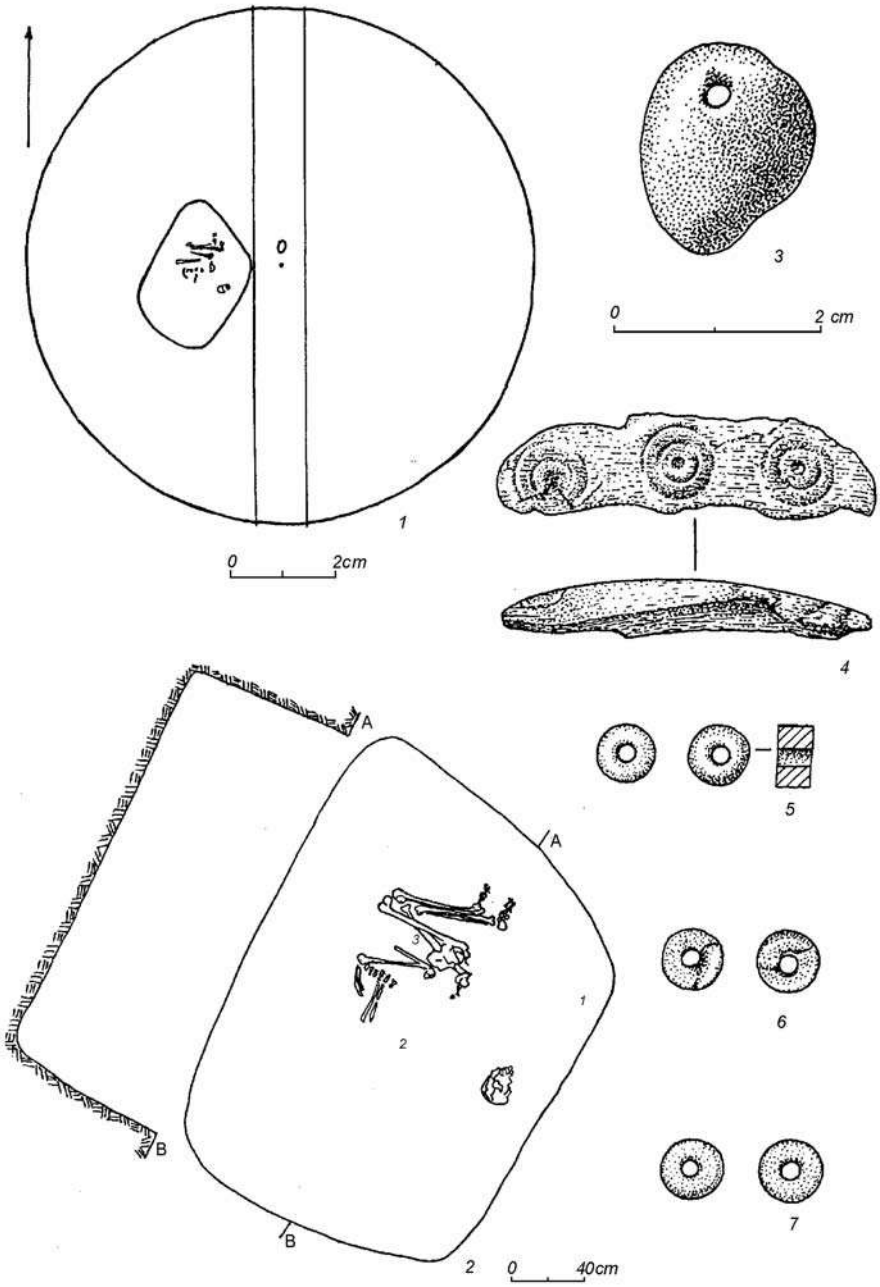

Fig. 12. Barrow 8 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the barrow; 2 – plan and section of the grave; 3 – stone; 4 – bone; 5-7 – beads made of an *Unio* shell

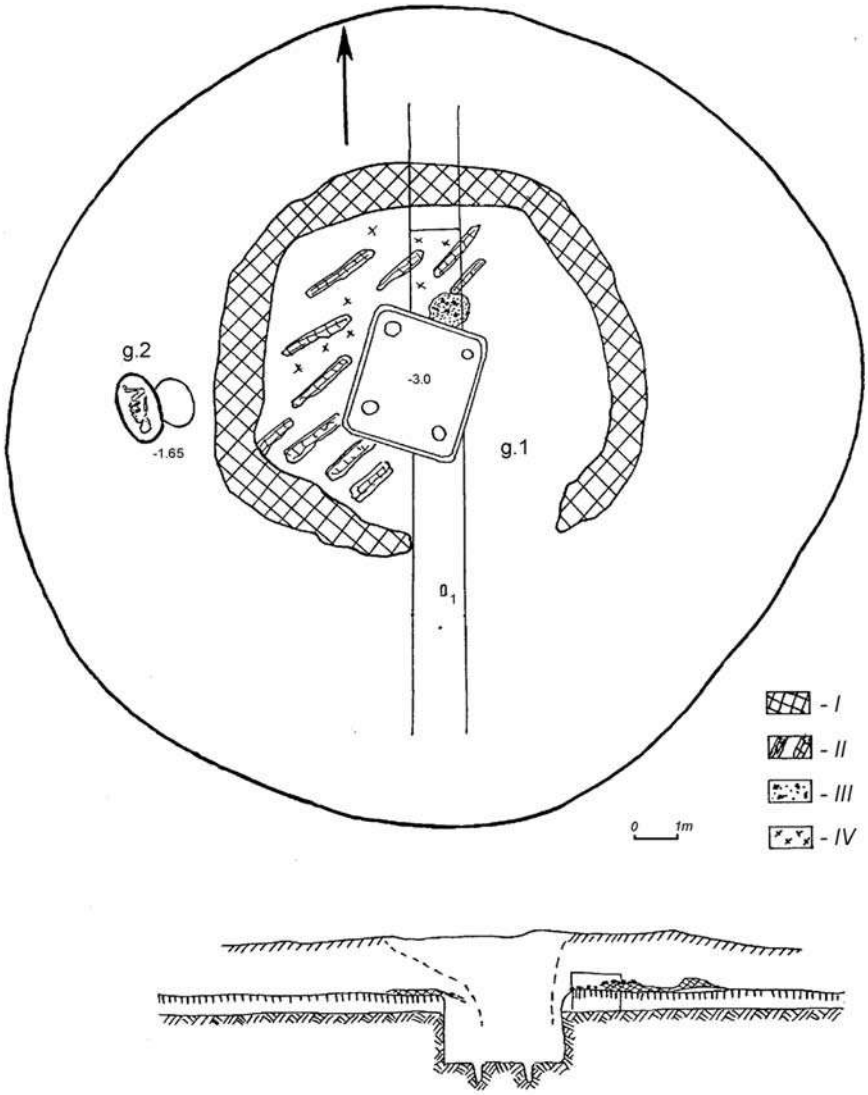

Fig. 13. Plan and section of barrow 9 near Zapovitne, Zaporizhzhia Region. Key: *I* – soil excavated when the grave was dug; *II* – wood; III – traces of a fire; *IV* – mat

grave 1 (the Bilozerka culture); grave 2 (the Chorna Hora type of the Cimmerian culture) was a 'dropped-in' grave (Fig. 13).

Grave 1 was made in the central part of the barrow. Before the construction of the burial pit was started, a fire had been made at the level of buried black soil; the

fire had left a piece of burnt soil and a pile of charcoal and ashes. The diameter of the fire-bed was 1.0 m. A rectangular pit (2.95 m x 2.65 m) was dug 1.7 m deep. The excavated soil was arranged in the shape of a horseshoe with an opening at the southern part. The pit and the surrounding surface in the radius of 2 m from the edges of the pit were covered with a shield of wooden planks, oriented from northeast to south-west. The planks had been placed irregularly, with gaps of about 0.3-0.5 m between them. It could be seen that the planks were worn-in in the central part of the pit. Under the planks there was a thin layer of herbal origin (a rug) that served as the lower component of the cover. The robbery of the grave that had been made from the southern side made it impossible to identify the exact construction of the shield. The construction of the shed inside the pit and the wooden coating of the walls were also ruined. The best preserved was the vertical coating of the eastern wall. The walls of the pit were covered with wooden planks that could be traced at the eastern wall to the height of up to 0.9 m from the level of the bottom of the pit. That wall was coated with 22 planks, each about 10 cm wide. For better fastening of the coating, a trench about 10 cm wide and deep was made along the perimeter of the pit. The bottom of the trench, rising by 0.1 m from north to south, was covered with fine planks and a herbal rug. There were several small lumps of ochre on the rug. Round holes were made opposite each of the corners of the pit (Fig. 14:1). The filling of the holes contained remainders of the poles. At the bottom of the pit there were beads (1); the filling of the south-eastern hole contained a weaving-stone (2).

Description of the finds:

1. Bone cylinder-shaped beads (3 items) differed in length. Two of them were 0.4 cm long, while the third one was 0.6 cm long; the diameter of all the there beads was the same: 0.5 cm (Fig. 14:2).
2. A round ceramic weaving-stone was 2.9 cm in diameter, the diameter of the hole was 0.5 cm, and its height was 2, 0 cm (Fig. 14:3).

The ^{14}C dates based on the samples of wood were identified as Ki-575: 1293±98 BC (old), and Ki-9820: 1016±89 BC (new). The geo-magnetic date for the fire-bed at the level of the buried black soil was identified as 1000 BC (responsible for performing the date-setting: H.F. Zahniy).

Barrow 10 was located 125 m to the north-west-west of barrow 1 (Fig. 1). The barrow was 1.65 m high and 40 m in diameter. The main grave in the barrow was grave 2 (the Bilozerka culture); there were also 'dropped-in' graves 1 and 3 (Fig. 15).

Grave 2. The square burial pit (2.3 m x 2.4 m) was 1.95 m deep. The soil, excavated when the pit was made, was moved away from the edges of the pit to the distance of 1.2 m – 1.5 m. (Fig. 15:1; 16:1). The pit, the adjacent surface and the internal sides of the soil wall were covered with a thin layer of reed. Under the reed there was a shield made of firmly fitted wooden planks (Fig. 15:3). The southern edge of the

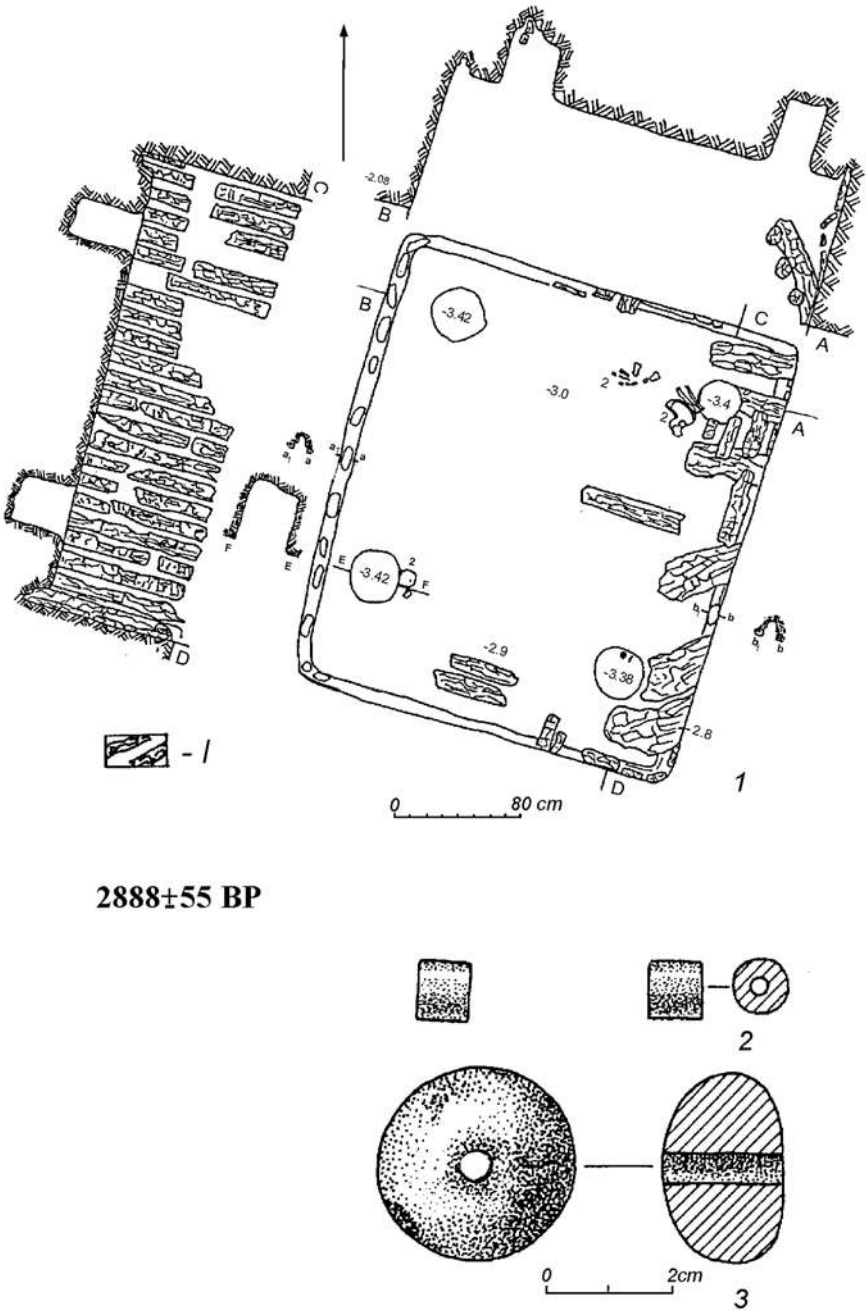

Fig. 14. Grave 1 of barrow 9 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the grave; 2 – bone beads; 3 – ceramic weaving-stone. Key: *I* – wood

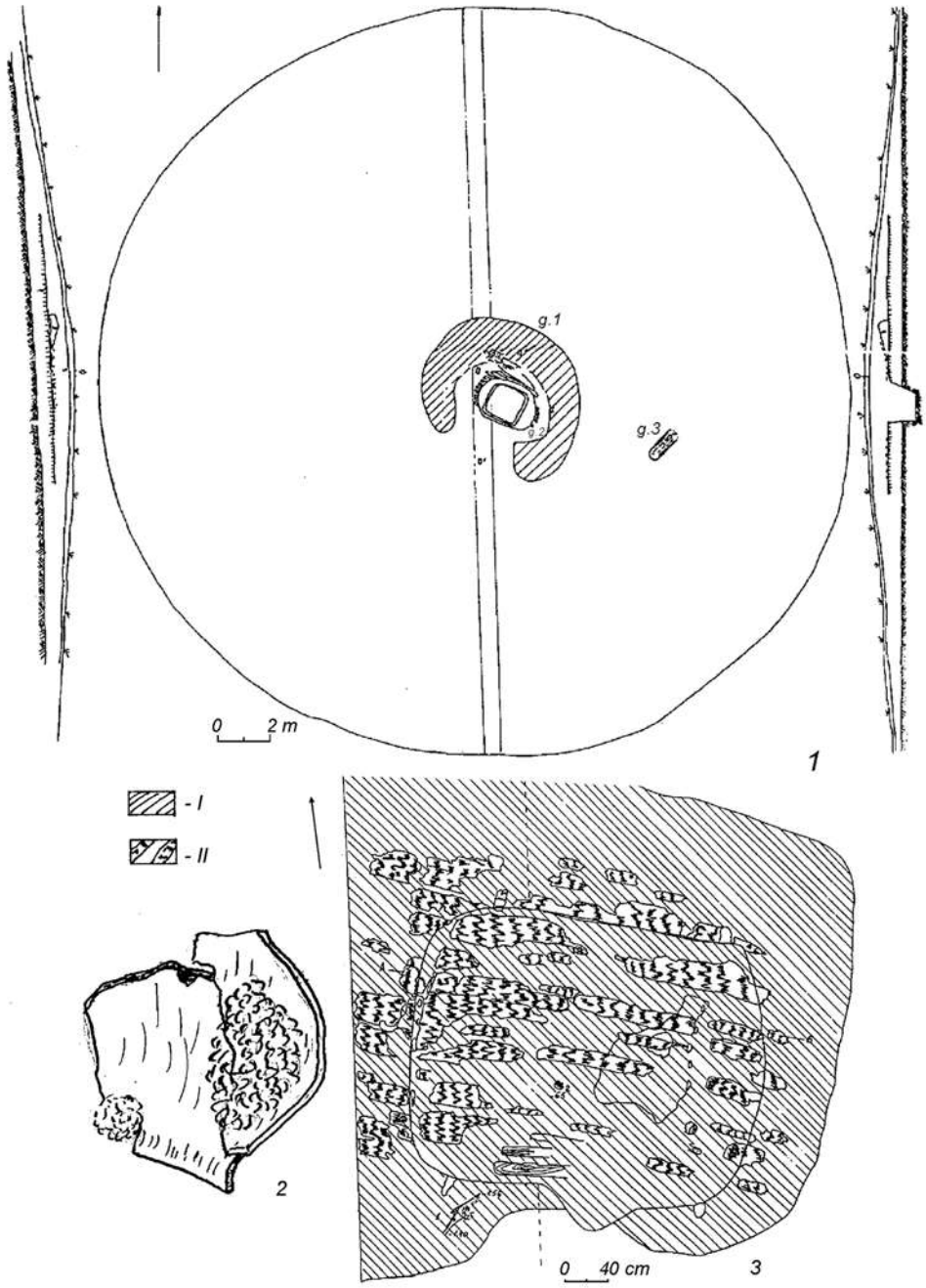

Fig. 15. Barrow 10 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the barrow; 2 – brazier made of a pot wall; 3 – plan of cover over the grave. Key: *I* – soil excavated when the grave was dug; *II* – wood

shield had been ruined by robbers who had penetrated the grave before the planks collapsed. The planks of the shield rested not only on the edges of the pit but also on two crosswise beams (10 cm in diameter). The beams were oriented along the north-south line and fastened in special grooves at the northern and southern edges of the pit by the western and southern walls.

At the centre of the worn-in shield at the depth of 0.65 m there was a brazier that had initially stood on the shield (Fig. 15:2). The northern wall of the pit (1.45 m high from the bottom level) had traces of planks of the vertical coating of the pit walls. The butt-ends of the planks were hammered into the bottom of the groove (8-16 cm wide, 14-19 cm deep), dug along the perimeter of the pit. The floor of the pit, limited by grooves, was covered with thin planks positioned along the north-west-west — south-east-east axis. On lengthwise planks at the western and eastern walls of the pit there were two crosswise planks (Fig. 16:1). At the bottom of the pit there were seven beads: 4 glass beads and three bone beads.

Description of the finds:

1. A brazier was made out of a wall of a large moulded pot and filled with pieces of charcoal. The vessel had a slightly flattened and turned-out rim, a well-pronounced neck that smoothly transformed into a rounded body. The part between the neck and the body was emphasized with a thin plastered-on rolled "cord", triangular in section. The "cord" was decorated with cuts that formed a zigzag. The surface of the pot was finished with scratches made with a fine-teethed cliché. The reconstructable diameter of the rim was 33 cm, the preserved height of the vessel was 23 cm (Fig. 15:2; 16:5).
2. Three beads were made of light blue-green glass (diameter – 0.5 cm, height – 0.3 cm). The fourth one, a large "eyed" bead made of green glass, was crushed (Fig. 16:3, 4).
3. Cylinder bone beads: two of them were 0.7 cm long, while the third one was 0.5 cm long; the diameter of each of the beads was 0.5 cm (Fig. 16:2).

Barrow 11 was located 65 m to the west of barrow 10 and was the last one in the southern row of mounds from the west (Fig. 1). The barrow was 1.2 m high and 40 m in diameter. The barrow was made over grave 3 (the Bilozerka culture). There were two Polovets graves (1 and 2) dropped into the mound (Fig. 17).

Grave 3 was located in the centre of the barrow. The rectangular burial pit with rounded corners (2.8 m x 2.55 m) was dug 1.55 m deep. In 0.2 m from the southern edge of the pit at the ancient horizon a fire had been made; the remaining fire-bed (1.0 m in diameter) left burnt soil of terracotta colour, ashes and charcoal. Probably, that fire had been the first to be lit in the rite of burning down the burial construction that had burnt down completely. Reconstruction of the burial rite is prevented by the robbery of the barrow. The robbers entered the barrow having partially ruined the southern wall and the fire-bed. The inner coating of the walls and the floor of the pit with wooden planks was burnt down (Fig. 17:2).

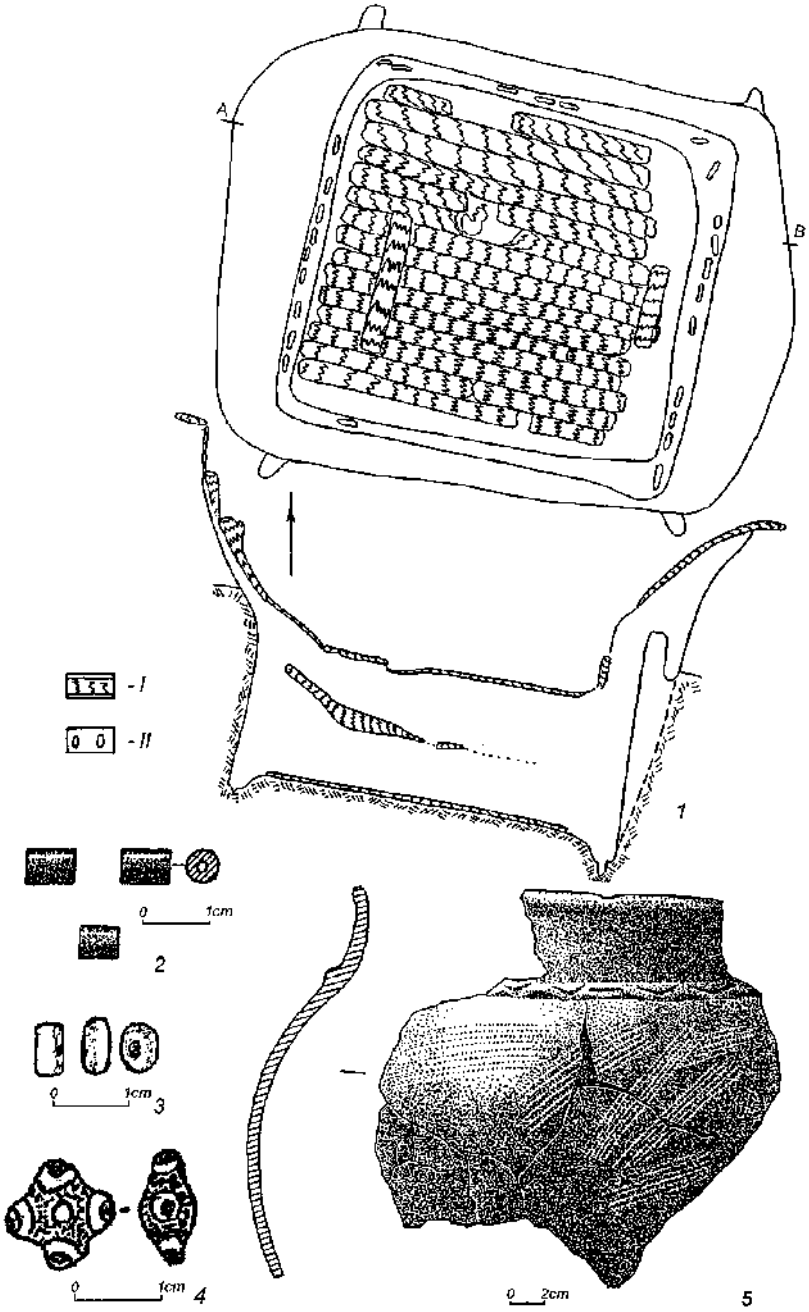

Fig. 16. Grave 2 in barrow 10 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the grave; 2 – bone beads; 3,4 – glass beads; 5 – fragment of a ceramic pot – brazier. Key: *I* – planks; *II* – imprints of the planks on the bottom of the trench

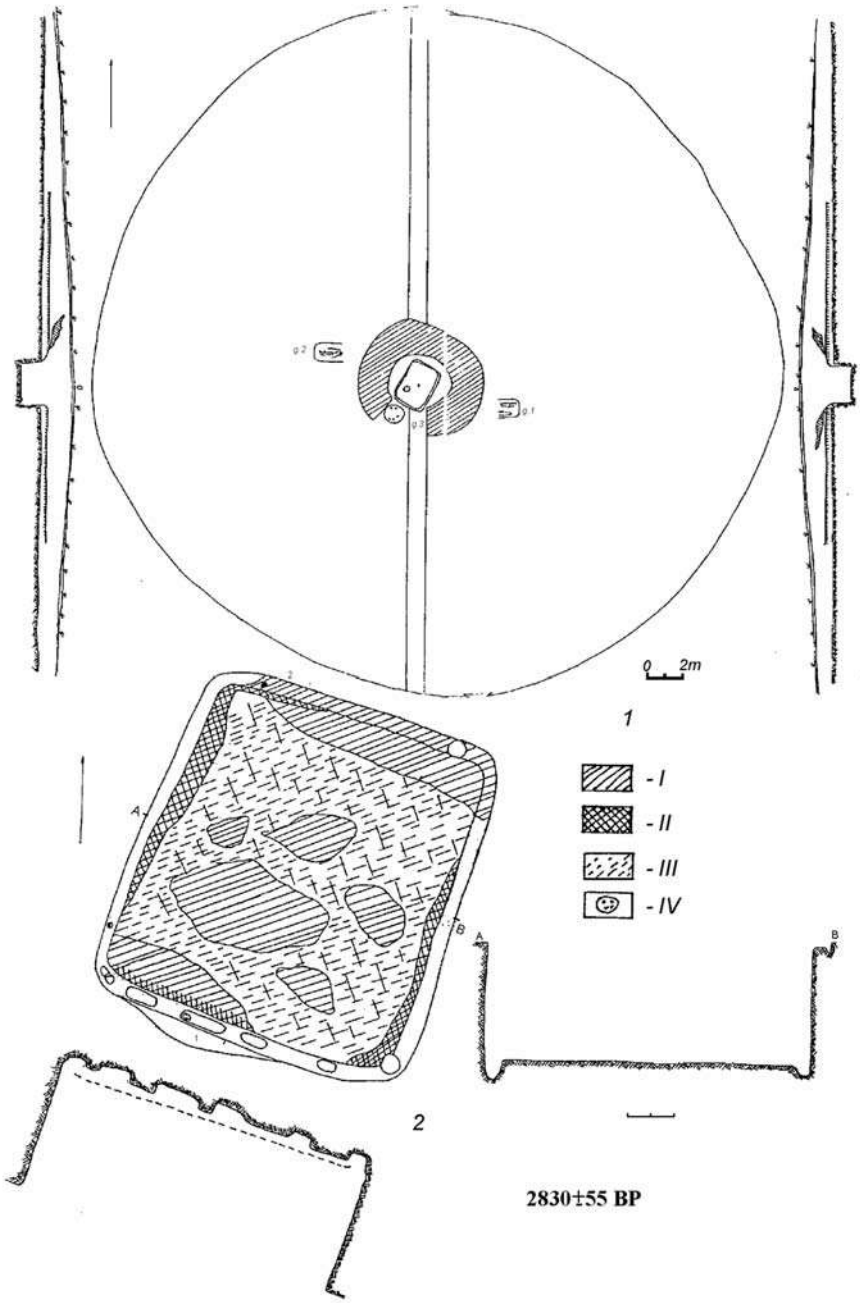

Fig. 17. Barrow 11 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the barrow; 2 – plan and section of grave 3. Key: *I* – burnt soil; *II* – coals; *III* – mixture of coal with burnt soil; *IV* – traces of a fire

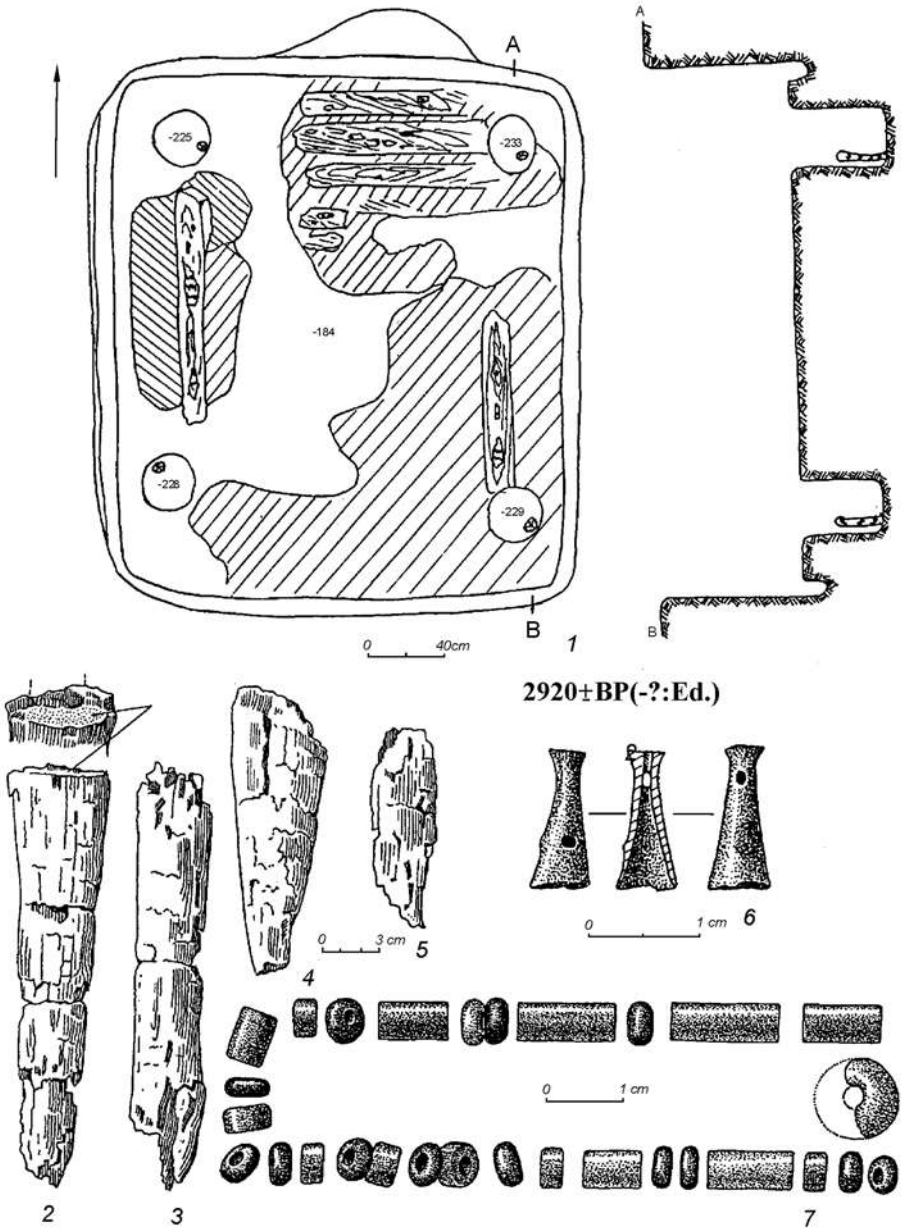

Fig. 18. Grave in barrow 14 near Zapovitne, Zaporizhzhia Region: 1 – plan and section of the grave; 2-5 – remainders of wooden poles; 6 – bronze pendant; 7 – bone and glass beads. Note: Most probably, the sample originated from barrow 14, grave 2 (Ed.)

The ^{14}C dates, made of the charcoal samples, were as follows: Ki-889: 977±60 BC (old); Ki-9821: 962±76 BC (new).

Barrow 14 was located 55 m to the north of barrow 1 (Fig. 1). The height of the barrow was 2.4 m, the mound was 32 m x 26 m.

Grave 1 was located 8.8 m from the centre. The rectangular burial pit with rounded corners (2.95 m x 2.65 m) was dug 1.85 m deep (Fig. 18:1). Along the perimeter the pit, the floor was limited with a groove (about 10 cm wide, up to 15 cm deep). The part of the floor, limited by the grooves, was covered with a reed rug. There were two pole holes in the bottom of the pit. Each of the pits contained remainders of a sharpened butt-end of a thin pole placed vertically in the hole (Fig. 18:2-5).

The human remains found in the grave had been moved by the robbers to the north-eastern pole hole. While investigating the bones, the researchers found a bell-like pendant (1) and a pile of glass (2) and bone (3) beads. Some of the beads were scattered on the cover.

Description of the finds:

1. A bell-like bronze pendant with a nail-shaped head and a hollow body. The height of the item was 2.8 cm, the diameter of the head was 0.8 cm (Fig. 18:6).
2. 18 round glass beads a various colours — dark-blue to light-green (0.5-0.6 cm in diameter, 0.2-0.3 cm high) and one round grey-blue bead of porous glass mass (diameter – 1.1 cm, height – 0.7 cm (Fig. 18:7).
3. Cylindrical bone beads (7 items), 0.4-0.5 cm in diameter and 0.7-1.4 cm high. A round bone bead – 1.1 cm in diameter and 0.7 cm high (Fig. 18:7).

Most probably, related to this grave are the dates marked as barrow 15/2 (see Table 1 and 2), i.e., the ^{14}C dates taken from charcoal samples Ki-886: 837±42 BC (old); Ki-9823: 1092±83 BC (new).

2. ABSOLUTE CHRONOLOGY OF THE BILOZERKA CULTURE

Materials of the "Stepnoy" cemetery play an important role in identifying more precise chronological limits of the Bilozerka culture along the line of stratigraphical observations, analogies and absolute dating. The pre-Bilozerka period is represented in that field by barrows 15 and 16 with the main graves of the Mnogovalikovoy Pottery culture and additional mounds of the Berezhnovka-Maevka Srubnaya culture [Otroshchenko 1976:175-177; Litvinenko 2002:143-144, Fig. 8, 2]. The Chorna Hora grave 2 was dropped into the Bilozerka barrow 9 [Goshko, Otroshchenko 1986:168-169, Fig. 1:1-2].

Some time ago a fibula from the "Stepnoy" was the third find of that kind from graves of the Bilozerka culture, but the number of such finds has tripled since. Eight fibulas were made of bronze wire and one of iron wire. Of these, five belonged to the Lukyanovka type (with two springs) and two to the Stepnoy type (with one spring). A fibula of the Stepnoy type was found in grave 2 of the Kazakliya cemetery [Agulnikov 1996:93, Fig. 5, 6]. V.P. Vanchugov proposed a one-spring version for reconstruction of a fragment of a fibula from Kochkovate [Vanchugov 1990:82, Fig. 35:13]. Let us assume that the partially preserved fibula from grave 55 of the Kazakliya cemetery could have had two springs, although it was reconstructed in the publication as having one [Agulnikov 1996:107, Fig. 19:4]. Given the reconstructions mentioned above, we have six two-spring fibulas and three one-spring items. A typical feature of fibulas of the Bilozerka culture is the presence of salient backs. The attempt of G.N. Toshchev [1984] to class a find from the Strumok as a fibula of the bow type was recognized to be incorrect. Its shape was clarified [Vanchugov 1990:82 Fig. 35:11], and it can only be compared with fibulas of the Lukyanovka type [Otroshchenko 1998:356, Tab. 3:1, 1a, 2]. After that clarification it should be admitted that bow fibulas are not represented in complexes of the Bilozerka culture, and researchers should refrain from referring the culture to an earlier period (XIII century BC), thus, making it older. Additional analogues to the Bilozerka fibulas confirmed the dates we had proposed before (XI-X century BC) [Smirnova 1985:42-45, Fig. 5].

Bell-like pendants were found in two complexes of the "Stepnoy" (barrow 5, grave 1 and barrow 14). As the fibulas, such pendants were made by Bilozerka craftsmen, as proved by finds of moulds for making those decorations on matrixes of the Lower Dnieper area [Gershkovich, Klochko 1987] and the Donets area [Tatarinov 1979]. To date, 10 cases of finding such pendants in graves of the Bilozerka culture at the left-bank Dnieper area and the area between the Dniester and the Prut rivers. Single analogues to the bell-like pendants originate from treasures of the Cincu-Suseni horizon in Transylvania, dated to the HaA1 period or the XII century BC [Petrescu-Dimbovita 1977: Tab. 165:33, 246:17].

Glass-eyed beads from the "Stepnoy" belong to the oldest in Europe. Finds of analogues items in south-eastern France are referred to the XI century BC [Henderson 1988:441, Tab. 1]. Analogues to other beads from the "Stepnoy" originate from the Dridu treasure that was found in a hut of a settlement that belonged to the second period of the Babadag culture at the Lower Danube (about X century BC). Among 352 objects of the treasure there is a fibula of the Lukyanovka type, knife-shaped plates, a grooved chisel and temple rings of the Bilozerka kind [Enăchiuc 1987: 72-91, Fig. I:7; III:18-21; VII:87-89; XII:145-146]. G.I. Smirnova referred the Babadag II to the second part of the X century or the IX century BC [Smirnova 1986:43, Fig. 4]; this fact should be taken into account when dating the "Stepnoy" complexes.

The "Stepnoy" is the most dated among burial monuments of the Bilozerka culture, as far as the use of the ^{14}C methodology is concerned. Availability of two generations of radiocarbon dates, obtained from samples of wood and charcoal at the Kiev laboratory in the second half of 1970s and in 2002, allows some observations and certain suggestions. In the first series of dates, the earliest was barrow 9 in the northern row (Ki-575: 1100±70BC). Barrows of the southern row were made from west to east: barrow 11 (Ki-889: 900±40 BC); barrow 1 (Ki-885: 855±55 BC); barrow 2 (Ki-887: 750±45 BC) [Otroshchenko 1981:17]. The straight sequence of the first series of dates was broken by a wood sample from grave 2 of barrow 15 that belongs to the first period of the Berezhnovka-Maevka Srubnaya culture [Otroshchenko 1976: 174-177, Fig. 2g; 2a; 3:1]. Barrow 15 was made over graves of the Mnogovalikovoy Pottery culture; and grave 2 (archeologically dating back to the XV-XIV century BC) was dropped in its southern side and accompanied by am addition to the mound. Therefore the given complex stood away from the Bilozerka cemetery and had no connection to it. A sample of wood from grave 2 was accidentally included among packages with wood samples from graves of the Bilozerka culture. Possibly, that is why it appeared to be about 700 years younger (Ki-886: 740±50 BC). A subsequent dating of the wood from grave 2 of barrow 15 reduced that difference by half (Ki-9823: 1092±83 BC). However, the new date was also noticeably younger than the real archaeological age of the complex in question1. The regretful mistake was made because analysts did not verify samples against the field report documentation.

The second generation of dates for the Bilozerka complexes of the "Stepnoy" was more compact, but an earlier age of barrows of the northern row no longer looks so evident. The initial date of grave 1 of barrow 9 (Ki-575: 1100±70 BC) moved towards a more recent period (Ki-9820: 1016±89 BC) and approximated a geo-magnetic date of the fire-bed at the edge of the burial pit (X century BC). The earliest then was barrow 3 from the southern row (Ki-9823: 1087±78 BC). It was located next to barrow 2, the last one according to the ^{14}C dates. The initial age of barrow 2 (Ki-887: 750±45 years BC) was increased substantially during the second dating (Ki-9822: 895±64 years BC). The most accurate were definitions of age of wood from grave 3 of barrow 11 (Ki-889: 900±40 BC (old) and Ki-9821: 962±76 BC (new). The clarified and calibrated dates for the "Stepnoy" cemetery define its service time as 1150-850 BC. The same time range includes four ^{14}C dates for graves of the Hordeevka cemetery at the Southern Bug in the Vinnytsia Region, referred to the Bilogrudovka culture — 1125-920 BC [Klochko 1996:131].

The age of the "Stepnoy" corresponds with the dating of grave 1 of barrow 32 of the Kochkovate cemetery — Ki-1714: 930±45 BC [Vanchugov 1990:119]. Close dates exist for a settlement of the mountain Crimean version of the Bilozerka culture Tau-Kipchak [Kolotukhin 1996:23] and for the lower layer of a settlement of the Koba culture Serzhen-Yurt in Ichkeria [Kozenkova 1977]. It is worth noting that

the old dates for the Tau-Kipchak and the Serzhen-Yurt give a somewhat larger difference in time, and so does the first series of the "Stepnoy". As a result, for the Bilozerka culture and the final bronze age in general, a rare correspondence of archaeological and radiocarbon dates has been achieved — which can only be seen as a reason for satisfaction.

CONCLUSION

Due to the obtained results, the issue of reducing the age of the chronological framework of the Bilozerka culture by about 50 years comes on the agenda. The actual age of the culture — instead of 1200 — 1000 BC, as assumed before [Otroshchenko 1981:17; 1986:148-150; Bochkarev 1982:21; Vanchugov 1990:110-123, Fig. 44] — is in the period of the second half of the 12th century BC — first half of the 9th century BC, or 1150-850 BC. While for the lower date that adjustment fully coincides with views of a number of prominent researchers [Terenozhkin 1976:196-197; Smirnova 1985:42-45, Fig. 4-5], the X century BC as the upper edge causes no doubt among researchers of the Bilozerka culture. However, even partial synchronization of complexes of the "Stepnoy" with the Babadag II culture that dates back to the 9th century BC involves raising the upper limit of the Bilozerka culture to the first half of the 9th century BC. Neither old nor new radiocarbon dates contradict such an assumption.

Translated by Inna Pidluska

Baltic-Pontic Studies
vol. 12: 2003, 365-381
PL ISSN 1231-0344

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RADIOCARBON CHRONOLOGY OF THE "HORDEEVKA TYPE"

The discovery of a tumulus cemetery near Hordeevka (Gordievka), in the Trostyanets District, the Vinnytsia Region (Fig.1), is a turning point in the process of analysing the pace of cultural changes on the borderland of the steppe and the forest-steppe of the northern Pontic area in the late Bronze Age. Although this

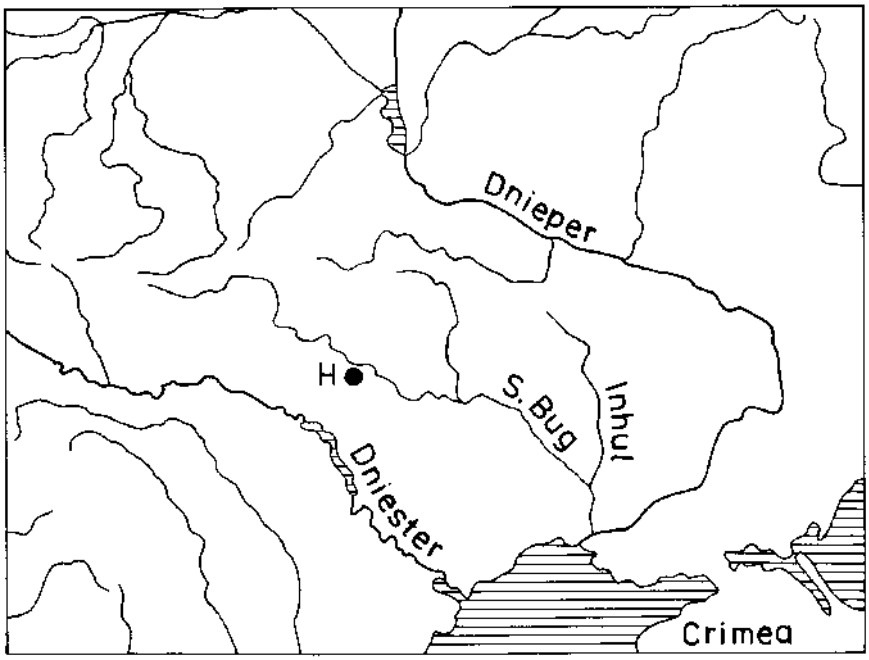

Fig. 1. Hordeevka, Trostyanets District, Vinnytsia Region. Location of the site

site has already been extensively described in the relevant literature, its ^{14}C datings available at present are still rare. Hence, specifying the culture and time in which it functioned arouses controversies.

Basically, there are two approaches concerning the Hordeevka cemetery itself and the related terminology. In the first one, it is treated as an isolated phenomenon that occurred within local or immigration cultural groups (cf. chapter I). In the other approach, L.I. Krushelnitska referred to this site as to a taxonomic unit, introducing the term **"Hordeevka type"** to denote a "late Bronze Age Middle Dniester culture". According to L.I. Krushelnitska, this culture differed from the Bilozerka or Bilogrudovka cultures [Krushelnitska 1998:196]. In line with this approach, V.I. Klochko [2001:157] pointed to the emergence of a new culture, manifested by the Hordeevka cemetery.

In this article the author aims at establishing the chronology of the Hordeevka site on the strength of the radiocarbon datings and, indirectly, attempts at determining the place of the **"Hordeevka type"** in the cultural setting of the right-bank Ukraine.

I. HOW HAS THE "HORDEEVKA TYPE" BEEN REPRESENTED CULTURALLY AND GENETICALLY TO DATE?

The cemetery is situated on a flat high ground, covering an area of approximately 3 square km (2.0 by 1.5 km), between two right tributaries of the Southern Bug River — the Bityug and Trostyanchyk rivers. This area features 45 low, roughly round mounds. In 40 of them there were burials. Most probably, the tumuli appeared in a larger number, however, some of them had been completely destroyed by ploughing [Berezanskaya, Lobay 1994:148]. The site in question was discovered in 1986 in the course of land improvement works and its excavation proceeded until 1989. In the first season the investigation was directed by B.T. Lobay of the Regional Museum in Vinnytsia. However, owing to the unique nature of the discovered finds, the direction in the subsequent three seasons was taken over by S.S. Berezanskaya who was assisted by the team composed of: V.I. Klochko, B.T. Lobay, Y.S. Machostych and O. Vangorodskaya.

Since 1994 when the research began, the basic problem to solve has been to determine the chronology of the cemetery and the culture it belonged to, as well as the role and nature of the central-European influences. The authors of the initially determined taxonomy maintain that the Hordeevka cemetery reflects a considerable influence of the central-European tumulus cultures, resulting from eastward migration from the west [Berezanskaya, Lobay 1994:152]. Supposedly, this was the

burial place of the elite representatives of a single wide territorial unit. This hypothesis can be further supported by the lack of any neighbouring and coexisting settlement. Featuring hardly any weapons but containing instead rich sets of ornaments, the site was believed by some to be a female necropolis [Berezanskaya, Lobay 1994:153] of an easternmost group, so far unknown, of the tumulus groups. Such assumption was supposedly based on the finds of tulip-shaped jars, vases and cups, bronze bracers and spiral-plate rings, as well as single-edged knives. The question of chronology was settled by making a comparative analysis of the Hordeevka metals and central-European materials. Consequently, the cemetery was dated between the 14th and the early 10th century BC, BC-HaA2 according to Reinecke [Berezanskaya, Lobay 1994:153]. Due to differences found in the analysed material (mainly in pottery), the authors of the study suggested distinguishing two phases of the use of this necropolis: phase 1 — connected with the Komarov and Trzciniec cultures and phase 2 — connected with the Bilozerka, Vysotsko and Bilogrudovka cultures, as well as the Tarnobrzeg group of the Lusatian culture [Berezanskaya, Lobay 1994:153].

The opinion on the connection of the Hordeevka cemetery with the tumulus circles was further popularised in S.S. Berezanskaya and V.I. Klochko's monograph of the site [1998]. The authors extended the previous division by another two phases, following the comparison of metals (mainly knives), pottery and harnesses with materials from the Carpathian and east Mediterranean areas. This chronology, according to the authors, was supported by five non-calibrated ^{14}C datings (cf. chapter II). Phase I was dated at 1500-1300 BC (BB-BD), phase II — 1300-1200 BC (BD-HaA1), phase III — 1200-1100 BC (HaA2) and phase IV — 1100-1000 BC (HaA-B) [Berezanskaya, Klochko 1998:19-20].

In contrast to the above considerations, L.I. Krushelnitska challenged the thesis that the discussed cemetery belonged to the "tumulus" groups. She argued that there were no grounds to establish the formal identity of the vessel forms found in Hordeevka with those in the Tumulus/pre-Lusatian assemblages. L.I. Krushelnitska pointed out that similar pottery traditions were widely cultivated by groups inhabiting south-western Ukraine. She criticised the assumption — made after analysing only some of the metal objects, including tanged arrowheads, spiral temple circlets [of the Bilozerka type] — that the assemblage was of an allochthonous origin and claimed that these artifacts appeared in the right-bank Ukraine already in the "Late Sabatinovka" level. L.I. Krushelnitska observed that the Hordeevka metal objects are most analogous to artifacts found in assemblages of the Vysotsko culture, however, in her opinion, the analogies resulted from reciprocal contacts. What is more, she maintained that the state of culture in Hordeevka makes one believe that in the "Middle Dniester" area (i.e. area between the Middle Dniester and Southern Bug rivers) there appeared syncretic groups that could have contributed to the formation of the Chornoles culture in this area. L.I. Krushelnitska claimed that the

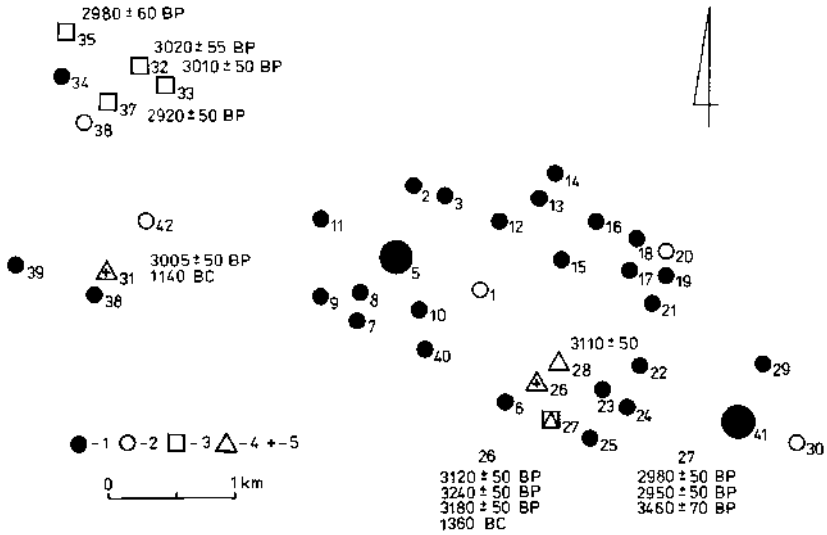

Fig. 2. Hordeevka, Trostyanets District, Vinnytsia Region. Layout of the location of the barrows. Key: 1 – conventionally dated barrows, 2 – natural mound, 3 – first stage of radiocarbon dating, 4 – second stage of radiocarbon dating, 5 – supercalibration

cemetery's magnitude, abundance of its inventory, the complexity and uniformity of rituals, but most of all the long time of functioning induce one to treat it as a centre of rituals and ceremonies. In her work she agreed with the dates proposed by S.S. Berezanskaya and B.I. Lobay [Krushelnitska 1998:193-197].

The view that the cemetery is autochthonous, as a result of merging forest-steppe [the Bilogrudovka and Chornoles cultures] and steppe [the Balty group of the Bilozerka culture] patterns in the late the Bronze Age and in the early Iron Age, is also advanced in the present author's studies to date. A detailed analysis of the grave goods and characteristics of burial rituals, as well as calibrated ^{14}C datings served as a basis for establishing a new chronology of the assemblage. Accordingly, the Hordeevka cemetery was dated between 1400 and 1000 BC [Ślusarska 2003].

II. DESCRIPTION OF SOURCE ASSEMBLAGES FOR WHICH RADIOCARBON DATES WERE OBTAINED

The construction of the absolute chronology of the Hordeevka cemetery on the basis of radiocarbon dating is marked by two stages of research. The first one, connected with the monograph of the site, contains dates of five tumuli (cf. Fig. 2).

The second one started with dates obtained for four tumuli. The studies constituted a part of a research project concerning relative chronology of the area between the Vistula and Dnieper rivers. The project was conducted by the Institute of Prehistory at Adam Mickiewicz University, Poznań, with the co-operation of the Institute of Archaeology of the Ukraine Academy of Science and the State Scientific Centre of Environmental Radiogeochemistry in Kiev.

II.1. HORDEEVKA IN LIGHT OF THE RADIOCARBON DATINGS MADE SO FAR

The cemetery's monograph contained ^{14}C dates from five tumuli: 27, 32/2, 33, 35, 37. The Authors' thesis was that the dates referred both to the earliest (27) and to the latest phase of the cemetery (cf. Table 1). These dates, assumed conventionally, without calibration, corroborated the chronological brackets of the cemetery established on the basis of typology [Berezanskaya, Kločko 1998]. Likewise, the radiocarbon dates and conventional dates "complement" the typochronology in later literature [cf. Berezanskaya 1998:325-341; Kločko 1998:343-351].

Table 1

Hordeevka, Trostyanets District, Vinnytsia Region. The basic radiocarbon chronology of the cemetery by Berezanskaya and Klochko [1998]

Lab. No.	Grave No.	Material	Date BP	Conv. bc	Date BC [Calpal 2001]
Ki-5080	27	bone	3460±70	1510±70	1780±90
Ki-5079	32/2	bone	3020±55	1070±70	1260±90
Ki-5083	33	bone	3010±50	1060±50	1250±90
Ki-5081	35	bone	2980±60	1030±60	1200±100
Ki-5082	37	bone	2920±50	970±50	1120±90

With the adoption of conventional dates it was no longer necessary to criticise the single dating of tumulus 27 which in its calibrated version shifted the dates for this assemblage to the period between 1878 and 1682 BC. Otherwise, a possible solution of this situation would be to consider this dating as false and date the early level of the cemetery relying on typochronology [Ślusarska 2003:71-72].

Dates were determined for four grave assemblages, i.e. tumuli: 26, 27, 28 and 31. Their description provides only typochronologically relevant characteristics, namely the rituals and grave goods.

Tumulus 26 (Fig. 3). The grave pit was roughly square, 3.6 by 3.3 metres, and it was covered with timber. About 20-40 cm away from its walls there were boards forming a cist of a kind. Inside this cist there were 4 postholes probably supporting a canopy-shaped construction. The covering boards bore traces of fire, which induces one to assume that above the grave there was a ritual hearth. The skeleton was relocated; only teeth and humeri were left *in situ*. Other grave goods were discovered in the debris which was filling the shaft made by thieves. The inventory included: two gold and two silver pendants, a bronze knife with a solid handle, 10 amber beads and 2 resin discs. They were all found in the place where originally lay the corpse's head. However, fragments of a vessel and of a bronze pin were placed in the material filling the posthole in the SW part of the grave. The ^{14}C dates are as follows: 3180±50 (Ki-9252), 3240±50 (Ki-9253), 3120±50 (Ki-9254). One of the construction elements was supercalibrated. Consequently, it was possible to determine the date of cutting down the tree at 1360 BC.

Tumulus 27 (Fig. 4). The grave was surrounded by a patch of pale yellow clay thrown out of the excavation. Four metres S from the grave pit there were traces of a hearth. The grave pit was rectangular, measured 3.8 by 2.8 metres, and was covered with a wooden roof. The grave walls were grooved lengthways to fit in wooden boards. At the bottom of the grave pit there were 4 postholes. The grave's N part was destroyed by thieves digging into the grave. The skeleton had only the long bones left *in situ*. It was a flexed burial, with the head directed NE and hands put in front of the face. Below the skeleton there was an organic bed. Presumably, the inventory was originally placed near the corpse's head in the upper part of the body only to be relocated later. The grave goods featured: about 100 amber beads, a handleless, S-shaped cup, a bronze awl, fragments of two bronze ring-headed pins, one bronze needle, 3 ring-like gold pendants, a helix made of a strip (5 turns) and another one of gold wire (3 turns). The ^{14}C dates are as follows: 2980±50 (Ki-9255), 2950±50 (Ki-9256).

Tumulus 28 (Fig. 5). The rectangular grave pit (dimensions 3.4 by 2.8 metres) was covered with a board ceiling and shifted NE. On the bottom there were 4 postholes, i.e. the remnants of a structure supporting the roofing or a wooden platform. The skeleton was relocated; some of the bones were found in the debris filling the thief-made shaft which had destroyed the northern part of the grave. The skeleton probably lay on a reed bed (?), 1.5 by 1.8 meters in size, while the remaining part of the grave contained small slats. Both the bones and the covering wood bore

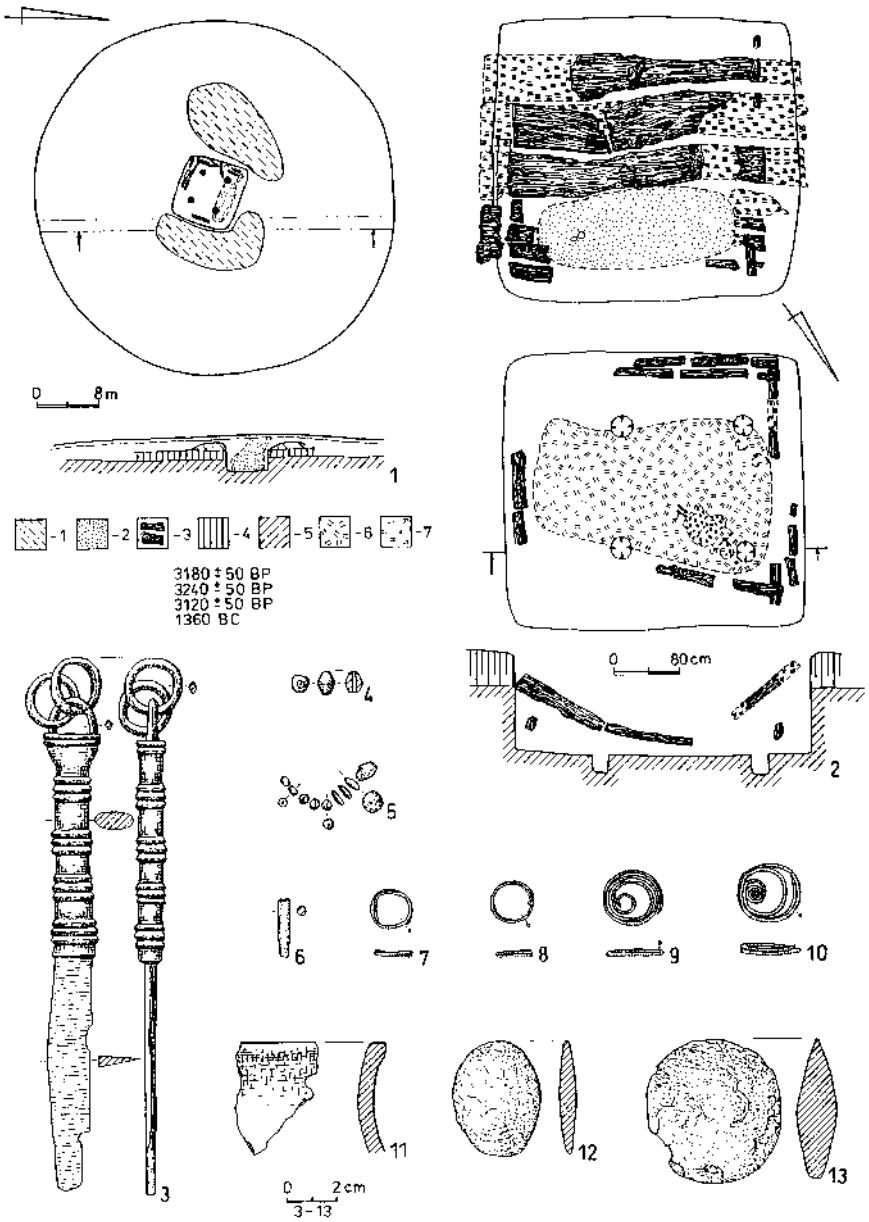

Fig. 3. Hordeevka, Trostyanets District, Vinnytsia Region. Barrow 26. 1 – plan and section of barrow, 2 – plan and section of grave, 3 – bronze knife, 4-5 – amber beads, 6 – fragment of bronze needle, 7-8 – golden rings, 9-10 – silver pedants, 11 – fragment of pottery, 12-13 – resin. Key: 1 – discharge, 2 – plunder diggings, 3 – wood, 4 – chernozem, 5 – rock-bed, 6 – remains of organic underlay, 7 – wood remains

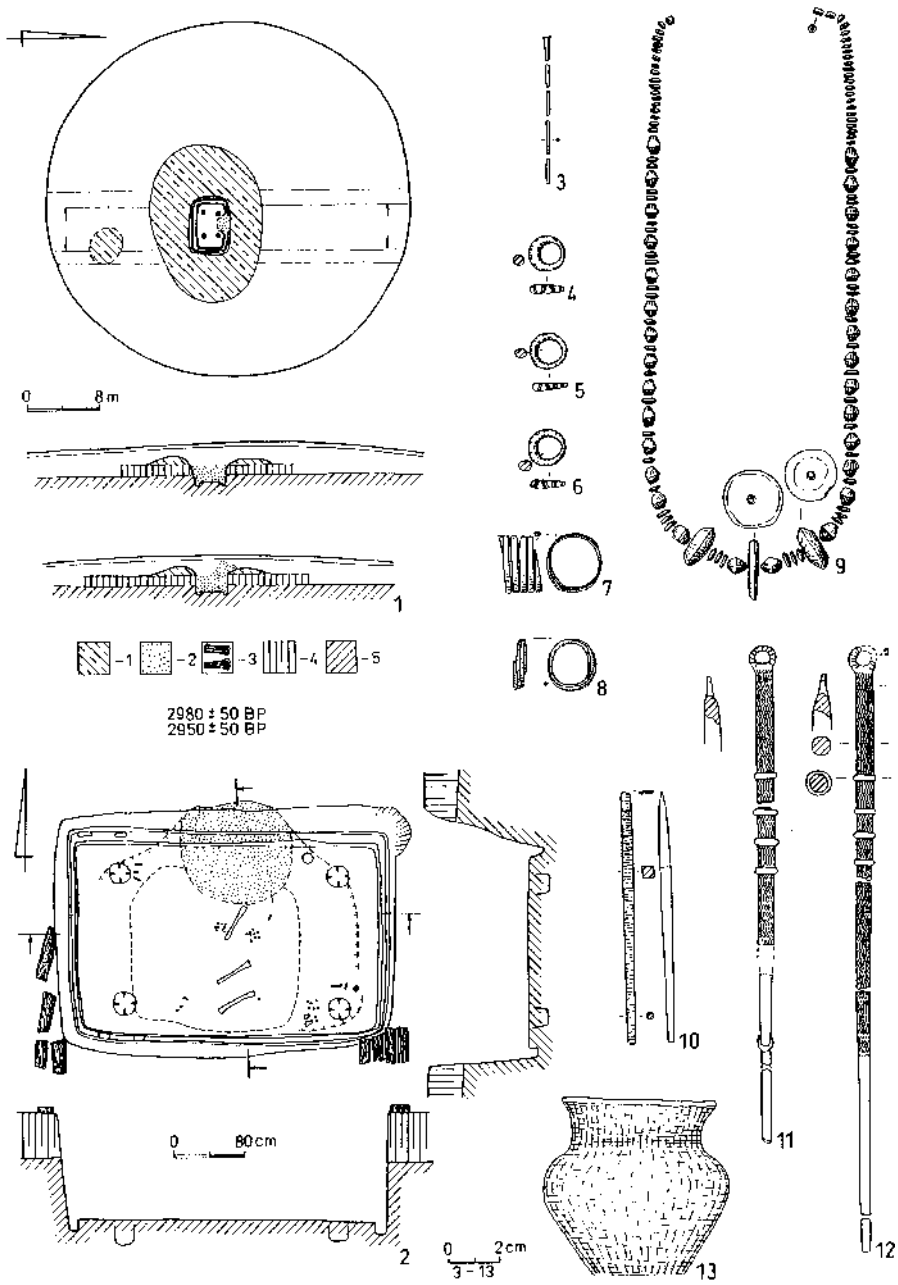

Fig. 4. Hordeevka, Trostyanets District, Vinnytsia Region. Barrow 27. 1 – plan and section of barrow, 2 – plan and section of grave, 3 – bronze needle, 4-8 – golden rings, 9 – amber beads, 10 – bronze awl, 11-12 – bronze pins, 13 – pottery. Key: 1 – discharge, 2 – plunder diggings, 3 – wood, 4 – chernozem, 5 – rock-bed

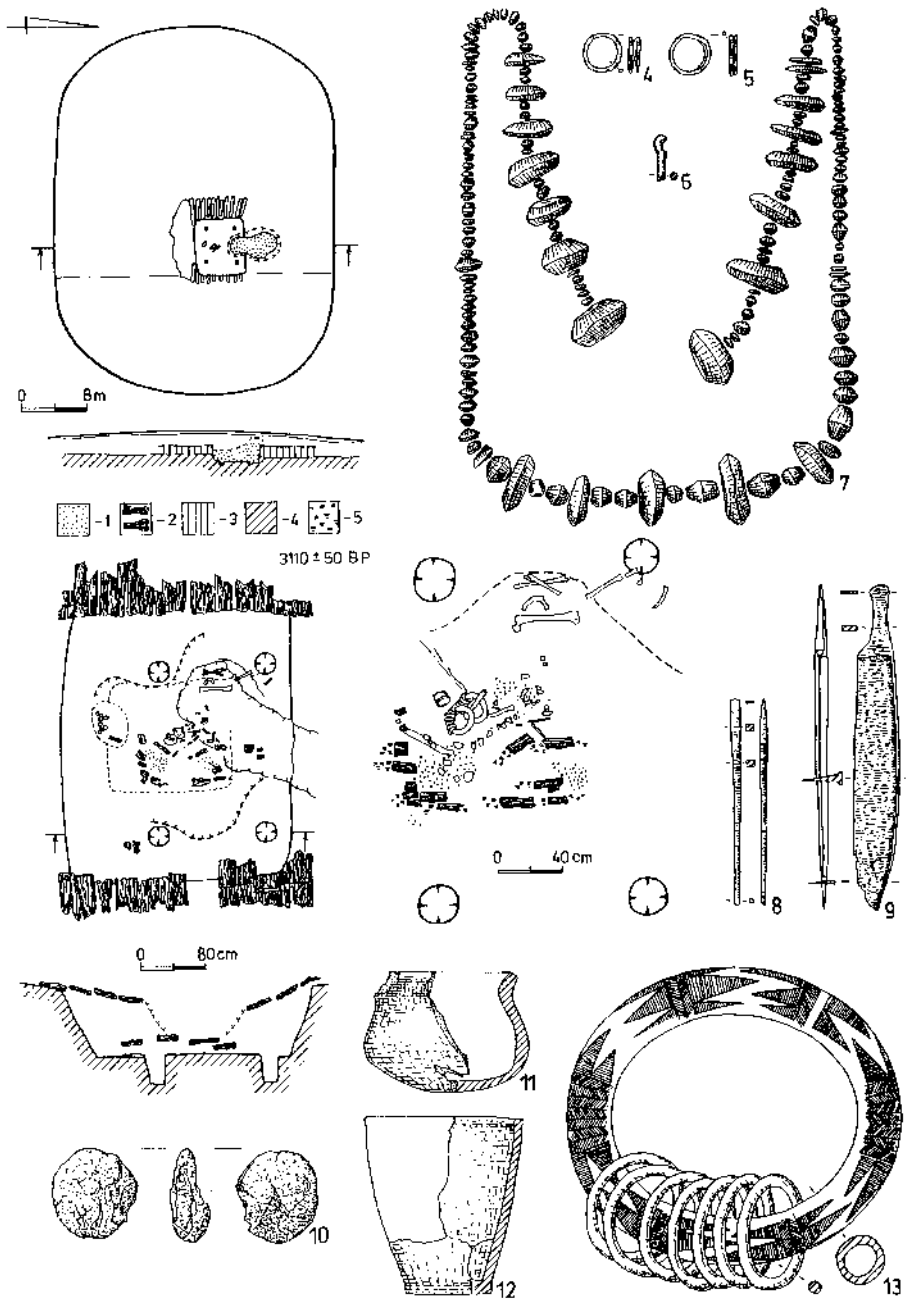

Fig. 5. Hordeevka, Trostyanets District, Vinnytsia Region. Barrow 28. 1 – plan and section of barrow, 2-3 – plan and section of grave, 4-5 – golden rings, 6 – fragment of bronze needle, 7 – amber beads, 8 – bronze awl, 9 – bronze knife, 10 – resin, 11-12 – pottery, 13 – bronze bracelet (?). Key: 1 – plunder diggings, 2 – wood, 3 – chernozem, 4 – rock-bed, 5 – remains of organic underlay

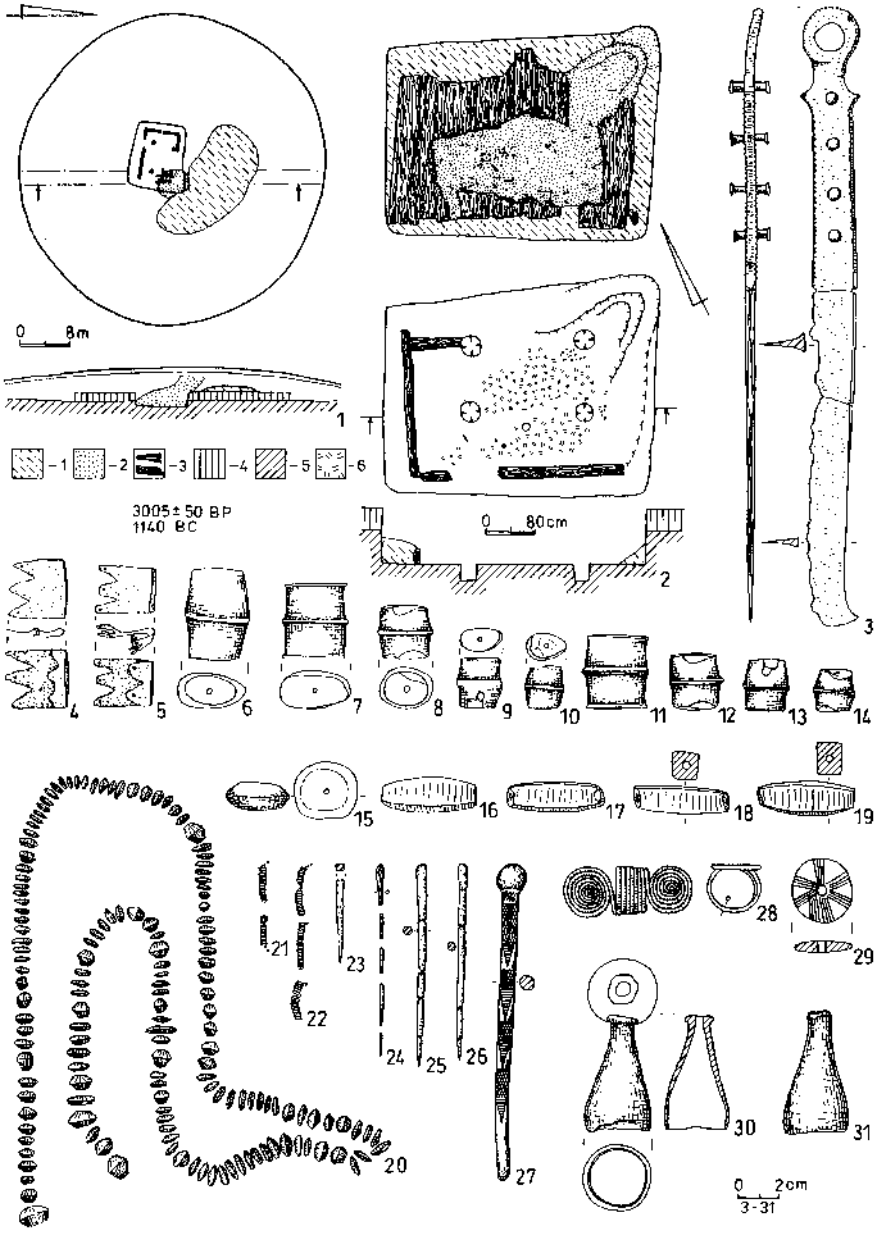

Fig. 6. Hordeevka, Trostyanets District, Vinnytsia Region. Barrow 31. 1 – plan and section of barrow, 2 – plan and section of grave, 3 – bronze knife, 4-20 – amber beads, 21- 22 – golden scrolls, 23 – bronze awl, 24 – bronze needle, 25-26 – bone needles, 27 – bronze pin, 28 – golden ring, 29 – amber pendant, 30-31 – bronze bell-shaped pendants. Key: 1 – discharge, 2 – plunder diggings, 3 – wood, 4 – chernozem, 5 – rock-bed, 6 – remains of organic underlay

traces of fire that might have been lit above the grave. Relying on the grave goods that were left intact, it may be assumed that in this flexed burial the corpse was laid on its right side with the head directed northwards. The hands, holding two bracelet-flappers, were raised and placed near the face. In the SE corner of the grave there were: a small vase, a bronze awl, as well as a fragment of a bulbous vessel and a knife. The latter two artifacts were found near the skeleton's legs. The other inventory consisted of about 100 bronze beads, a fragment of a pin with a globular head, 2 helixes of gold wire (1.5 turns) and a resin disc. The ^{14}C date is as follows: 3110±50 (Ki-9257).

Tumulus 31 (Fig. 6). The rectangular grave pit (dimensions 4.0 by 3.5 metres) was situated in the centre of the mound. Alongside the northern side of the pit, there was a layer of soil thrown out during the digging. The grave had a roof made of logs, which in the SE part bore traces of burning (probably remnants of a ritual hearth). Inside the grave pit, a "cist" made of wooden boards was found with four postholes within its perimeter. The northern part of the grave was destroyed by thieves who had dug a shaft, pulled out the corpse and scattered around the inventory: about 160 amber beads, 5 small gold wire helixes, 2 gold ferrules of a wooden vessel, a bronze knife, a fragment of an awl, a bronze disc-shaped pendant, one bronze and two bone needles, a bronze globular-headed pin, 2 bell-shaped pendants. The ^{14}C date is as follows: 3005±5 (Ki-9258). One of the structural elements was supercalibrated. Consequently, it was possible to determine the date of cutting down the tree at 1140 BC. The new dates are listed in table 2.

Table 2

Hordeevka, Trostyanets District, Vinnytsia Region. The radiocarbon dates obtained in the second phase of research into the cemetery's absolute chronology

Lab. No.	Grave No.	Material	Date BP	Date BC [Calpal 2001]
Ki-9252 [k. 26]	26	wood	3180±50	1450±50
Ki-9253 [k. 26]	26	wood	3240±50	1520±70
Ki-9254 [k. 26]	26	wood	3120±50	1380±60
supercalibration	26	wood		1360
Ki-9255 [k. 27]	27	wood	2980±50	1210±90
Ki-9256 [k. 27]	27	wood	2950±50	1160±90
Ki-9257 [k. 28]	28	wood	3110±50	1370±60
Ki-9258 [k. 31]	31	wood	3005±50	1240±90
supercalibration	31	wood		1140

III. THE TYPOCHRONOLOGY VERSUS THE RADIOCARBON CHRONOLOGY OF THE "HORDEEVKA TYPE"

III.1. TYPOCHRONOLOGY OF THE CHARACTERISTICS OF BURIAL RITUALS

This article describes only two most meaningful typochronological features: (a) structures within the grave pit and (b) traces of ritual behaviour.

a. In the Hordeevka cemetery one can distinguish two kinds of grave structures. In the first one, there were boards lining the grave pit walls covered by roofing made of logs split in halves. The simplest wooden grave structures, consisting only of pit coverings made of boards or logs split in halves appeared in the Pontic area as of the early Bronze Age. Although the custom of lining the grave pit walls with boards was recorded as early as in the burials of the Mnogovalikovoy Pottery culture, it become most widespread in the Bilozerka culture. In the graves of the latter taxon, the boards were placed along the walls both vertically and horizontally [Otroshchenko 1986:130]. It seems that the rectangular grave pits found in the Hordeevka cemetery roughly correspond to type 3, according to Vanchugov [1990:50].

In the other kind of wooden grave structures discovered in Hordeevka, there were cists or coffins with a log structure. Their analogous forms were found in the graves of the Chornoles culture (e.g. Gulay-Gorod, tumulus 52), including the Zhabotin phase (Nosachevo, Ryzhanovka) and both phases of the Cimmerian horizon. The above observations incline one to assume that the chronology of the graves containing cist-coffin structures, i.e. tumuli 26, 31, 32/2, 33, 34, 35 and 37 is relatively late. In line with this view, the authors of the monograph suggest that the structures be recognised as a local characteristic of the right-bank foreststeppe, typical of the Pre-Scythian period [Berezanskaya, Kločko 1998:7].

What is interesting about the interior design of the Hordeevka graves is the existence of postholes. The tumuli of the Bilozerka culture featured several postholes, the number ranging from two to over a dozen. However, in most cases there were four postholes. They are thought to be remnants of light roofing structures, yet there are reasons to believe that some postholes were not parts of any structure. The debris filling postholes in tumulus 4/2 of Glinnoe and 31/1 of Kochkovatoe contained fragments of vessels and bull bones. Likewise, in Hordeevka, a posthole in tumulus 34 contained a snaffle bit [Berezanskaya, Kločko 1998:table 64].

b. In the mound of tumulus 27, at the grave pit's southern border, there was a hearth. In tumulus 28 both the skeleton and the structure boards bore traces of charring. Furthermore, in the southern part of tumulus 31 traces of fire were also detectable, while around the grave in tumulus 5, there was a ring (diameter 21 by 18 metres; 5.0-6.0 metres wide; 1.5 metres thick) of burnt clay with a layer of ash and

charcoal. Consequently, it may be assumed that fire played a vital role in the burial ceremonies. The custom of fire-kindling over graves, evi- denced by the traces of ash and burnt clay in grave pit ceilings, also appeared in the burial ceremonies of the Bilozerka culture [Vanchugov 1990:51].

III.2. TYPOCHRONOLOGY OF GRAVE GOODS

The analysis of grave goods includes only the artifacts which are vital for typochronology: (a) elements of harness, (b) single-edged knives, (c) bronze ornaments, (d) amber beads, and (e) pottery forms.

a. Elements of harness were found in the graves of horizon II. Stirrup-type snaffle bits prevailed in the Chernogorovka phase on the Pontic steppes. Usually, such snaffle bits occurred together with bronze cheekpieces [Chochorowski 1994:48]. Surprisingly, one assemblage featured a bronze snaffle bit and a three-aperture cheekpiece, probably made from a wild boar tusk, with round apertures in the same plane. It is believed that this type is connected with steppe influences. According to Foltiny, its date falls on the 9th century BC [Foltiny 1967:30]. However, the above description concerns only the central-European materials. As concerns the steppe and forest-steppe of south-eastern Europe, the cheekpieces under consideration constitute prototypes of the Cimmerian cheekpieces of the Chernogorovka type. They first appeared in the late Bronze Age cultures of Ukraine, mainly in the Bilogrudovka, Bilozerka, Chornoles cultures, and continued occurring until late Chernogorovka phase. The closest analogous artifact to the find from tumulus 34 is the cheekpiece discovered in Sacharna (the Rezin region) [Terenozhkin 1976:Fig. 62, 15]. However, the fact that one assemblage contained both a bone cheekpiece and the discussed bronze snaffle bit does not necessarily reflect the manner in which bits made of the composite materials were used. As O. Terenozhkin (followed by J. Chochorowski) noticed, bronze snaffle bits were fit with bronze cheekpieces, while bone cheekpieces appeared together with flexible (leather-strapped) snaffle bits [Terenozhkin 1976:150]. The above considerations refer to grave deposits, therefore, in line with Chochorowski's observation, it may be assumed that the appearance of particular goods in graves was determined by symbolic rituals. If so, it is uncertain whether the fact that a only a snaffle bit or only cheekpieces were found in a grave reflects the manner of using a particular type of bit [Chochorowski 1994:42]. Still, when both artifacts appear in one assemblage there are grounds to consider its chronology. The bone cheekpieces with apertures in the same plane were recorded as early as the Bilozerka and Bilogrudovka cultures and they continued occurring until the Chernogorovka phase, i.e. from about the 10th till about the 9th/8th century

BC. Similarly, the stirrup-type snaffle bits appeared mainly in the Chernogorovka phase, i.e. from about the 10th to the first half of the 8th century and slightly into the 8th and 7th centuries BC. If this snaffle bit were to be considered as one of the oldest, according to the monograph authors, it cannot be dated earlier than at HaA2/HB.

The monograph describes an artifact from tumulus 37 as a snaffle bit. Its analogous forms were found in grave 5 of the Vaszar cemetery (western Hungary) that belonged to the younger phase of the Urnfield culture circles (HaB) [Berezanskaya, Kločko 1998:10]. Nevertheless, the discussed object, which is made of iron, is connected with "Thraco-Cimmerian" art [Stegmann-Rajtár 1992:83]. The present author believes that the artifact from tumulus 37 may be associated with the group of Smerekivka-type catches-connectors, even though it bears no stylistic traits that would suggest its connection with the Cimmerian horizon. Other pendants, similar but with different ends (either crescent-shaped or trapezoid-shaped on the outer rings), are known from the late Bronze Age assemblages of Transylvania and were dated at HaB [Chochorowski 1994:83]. The iron artifact found in Vaszar seems to play the same role. In accordance with J. Chochorowski's observations, it may be assumed that early Hallstatt artifacts served as prototypes that were later adapted and transformed in the Cimmerian traditions [Chochorowski 1994:85].

b. Artifacts analogous to single-edged bronze knives included in the Carpathian group can be found in the central-European cultures of the BD/HaA1 period [Berezanskaya, Kločko 1998:8; Ślusarska 2003]. L.I. Krushelnitska noticed that analogous types of knives occurred at the sites of the Vysotsko? culture (Zalozhtsy, Lisivtsy, Shumlyany) [Krushelnitska 1998:Fig. 111].

c. At the Hordeevka site there appeared two types of bell-shaped pendants. Tumulus 31 featured solid items found near the chest and the shoulders of the corpses. Artifacts of this kind, dated at HaA1, were relatively common in the burials of the Bilozerka culture and the Carpathian Basin cultures.

d. In terms of typochronology, the beads of the Tiryns and Allimuere types seem to be important. As a matter of fact, only those artifacts can be dated precisely: the 11th-9th century BC [LHIIIC and the Submycenaean period]. In Italy, the beads are found in the Proto-Villanovan contexts, while in Bosnia they are encountered in assemblages dated at HaA-B [Harding, Hughes-Brock 1974:155]. The fact that beads of these kinds occurred in Hordeevka means that there were ties between the Southern Bug and eastern Mediterranean areas. Besides, such an assumption leads to the possibility of dating the assemblages in which the beads were found, i.e. the late phase of the site's functioning, which corresponds to HaA-B.

e. In establishing the chronology of pottery assemblages, it is necessary to consider two graves containing scoops with loop-like handles. Scoops became widespread in the cultures of the transition period between the Bronze and the Iron ages, *inter alia* in the Bilogrudovka cultures, in which the scoops were the second, as

to the frequency of occurrence, group of table pottery, as well as in the Bilozerka culture. Various forms of scoops were also popular in the east-Balkan cultures of the Late Bronze Age [i.a. the Babadag culture] and Early Iron Age culture groups of the Dniester area: Chišinau-Corlăteni, Saharna-Solonceny or Neporotiv. One of the scoops found in Hordeevka has a disc-like bead at the top of a handle. This trait was very common in the Thracian Hallstatt groups on the Dniester: Chišinau-Corlăteni and Neporotiv.

To conclude, it may be said that typological analysis of the whole funerary rite, including grave goods, leads to distinguishing, within the cemetery, two groups of graves that may be associated with different stages of its evolution.

The first group of graves is characterised by grave pits without any wooden structures, covered only by a ceiling, alternatively with boards lining the walls. Inside, there were remnants of postholes. The grave inventory usually consisted of: 1-3 vessels from groups I, II, V, VIB2 and VII (i.e. vases, handleless cups, stem vessels, poorly profiled tulip-shaped pots and bulbous vessels), single-edged knives of the Carpathian and Mediterranean groups, a number of ornaments (bracelets, pins, pendants, elements of necklaces), including amber beads. These graves often contained also bronze awls and needles appearing together with single-edged knives. The following tumuli belong to this group: 2-22, 24-28, 30, 39 and 40. In many aspects, group I is analogous to the early assemblages of the Bilozerka and Bilogrudovka cultures, as well as to the Carpathian cultures of the BD/HaA1-HaA2 level.

The other group of graves incorporates tumuli with large grave pits (about 3.0 by 3.20 metres) fitted with complex wooden structures, i.e. cist-coffins. Occasionally, postholes were also recorded. The grave goods consisted mainly of 1-3 vessels from groups I, II, III, IV and VIB1 (i.e. vases, handleless cups, bowls, scoops and tulip-shaped pots), few ornaments (usually limited to small pendants made of gold wire, gold, glass and amber beads, including beads of the Tiryns and Allimuere types), iron artifacts (double-edged and bimetallic singleedged knives, an awl), bell-shaped pendants and elements of a horse harness. The following tumuli belong to this group: 5, 23, 31-38. Apart from the traits of the cultures mentioned above, in this group there were also characteristics of the earlier phase of the Cimmerian horizon, the Chornoles culture, as well as the Carpathian-Danube elements associated with the early groups of Thracian Hallstatt (HaA2-HaB).

The assemblages have some traits that are correlated with phase II of the Babadag culture evolution. Consequently, the present author suggests establishing for them a relatively late chronology, comparable with the late Bilozerka and Bilogrudovka cultures and the early Chornoles culture groups in the forest-steppe. On the basis of typochronology, the dates of the cemetery should be narrowed down to the BD/HaA1-HaB period (Table 3).

Table 3

Comparison of periodisation of the cemetery in the context of the Central-European periodisation of the Late Bronze and the Early Iron ages

Hordeevka, according to the present author	Hordeevka, according to V.I. Klochko [1998]	Central Europe
phase I	phases I and II	BD/HaA1-HaA2
phase II	phases III and IV	HaA2-HaB

III.3. THE "HORDEEVKA TYPE" IN LIGHT OF THE LATEST ^{14}C DATES

The series of seven new ^{14}C datings obtained from wooden elements of grave structures makes it possible to present a more accurate radiocarbon chronology of Hordeevka (cf. Table 2). Above all, it was possible to determine the time brackets for the initial group of burials and verify the contention about the sequence of the distinguished groups. Next, samples from tumulus 27 were taken and analysed again, which helped to verify its very early dates obtained before. The new dates range between 1250-1120 BC. The dates of the other two tumuli from group I (26 and 28) correspond to the period of 1420-1310 BC. Such time brackets for tumulus 26 are supported by the date obtained as a result of supercalibration, i.e. 1360 BC [Ślusarska 2002:184-185].

Considering typochronology and the radiocarbon dates, the first group of burials can be dated at the period between 1500/1400 and 1200 BC. The dates of the second group of burials, set in accordance with the previous datings at

1200 —1000 BC, were supported by the results of supercalibration of tumulus 31 (cf. Table 3).

CONCLUSIONS

The above findings can be concluded as follows:

1. According to two series of ^{14}C datings (cf. chapter II), the chronology of the Hordeevka cemetery should be established at the period between 1500/1400 and 1000 BC. Such chronological brackets do not contradict the typochronological findings.
2. The cemetery functioned approximately at the same time as the development of the Bilozerka culture and the early Chernogorovka phase of the Cimmerian

horizon in the steppe, as well as the Bilogrudovka and Chornoles cultures in the forest-steppe.

3. The joint appearance of steppe traditions (burial structures) and forest-steppe traditions (pottery), which is transparent at the Hordeevka site, seems to justify the hypothesis that in the area of the right-bank middle Southern Bug River there existed a new culture system, apart from the already known Balty group of the Bilozerka culture and the Bilogrudovka culture. However, the relationship of **"the Hordeevka type"** to the groups mentioned above or its supposed contribution to forming new cultural qualities [cf. Krushelnitska 1998:193-197; Klochko 2001:256-257, 276-279] require further study, including exploration of the settlement sites in the area between the middle Southern Bug and Dniester rivers.

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 382-395
PL ISSN 1231-0344

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THE RADIOCARBON CHRONOLOGY OF THE URNFIELD COMPLEX AND THE DATING OF CULTURAL PHENOMENA IN THE PONTIC AREA (LATE BRONZE AGE AND EARLY IRON AGE)

The study of development relationships — "contacts" between taxa generally associated with the Urnfield Complex (UC) and Pontic Area cultures — holding in the late Bronze Age and in the early Iron Age calls for — already in the initial stage — making the absolute chronology more accurate (Fig. 1).

At present, for the areas of interest to us here, there is a chance for developing an integrated periodization scheme supported by references to absolute dates and covering the Lusatian culture (LC) in the Baltic area and the Bilogrudovka (BgC), Chornoles (ChC) and Bilozerka (BzC) cultures in the Pontic area (Fig. 1). An obstacle in developing such a scheme is the "fragmentariness" of data coming from individual zones. This is particularly true for UC contact areas — its eastern frontiers and steppe and forest-steppe cultures of the Northern Pontic Area west of the Dnieper.

In the studies of the development relationships carried out so far, two branches can be distinguished: an "eastern" one and a "western" one. The "eastern" branch is concerned chiefly with pre-Scythian — read Cimmerian — influences on the cultures of the Carpathian Basin and the LC [cf. Bukowski 1976; Kossack 1980:109-143; Chochorowski 1992]; while in the "western" branch, the key issue is whether western or southwestern elements (Mediterranean) had a share in the origins of cultures of the western Dnieper drainage. As the groundwork for such studies served the "traditional", typochronological dating [cf. Otroshchenko, Radiocarbon..., in this volume, see there for further literature]. The prevailing view was that the presence of eastern — Scythian — traits and western — "Lusatian" — ones (mainly in weaponry) in cultures west of the Dnieper justified the formulating of hypotheses of *expansion* of the Scythian and Lusatian cultures in the

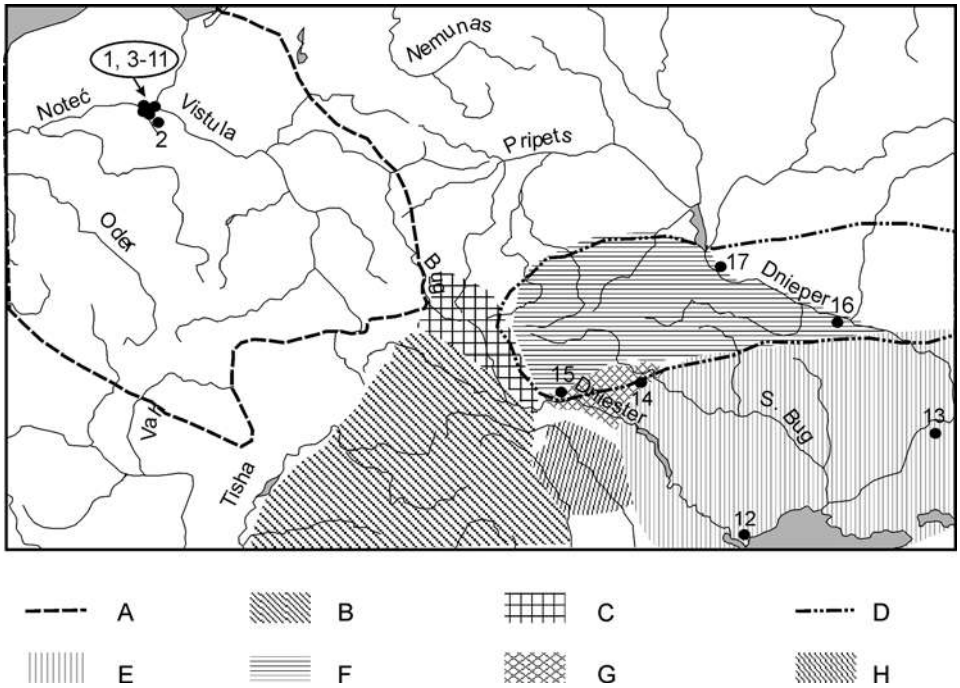

Fig. 1. The range of cultural units encountered in the area between the Baltic and Black seas in the late Bronze Age and early Iron Age. Culture groups: A - Lusatian culture, B - Gava-Goligrady culture, C- Vysotsko culture, D - Chornoles culture, E - Bilozerka culture, F - Bilogrudovka culture, G - Hordeevka type, H - Chišinau-Corlăteni; ^{14}C dated sites: 1 - Narkowo 9, 2 - Zgłowiączka 3, 3 - Sławsko Wielkie 12, 4 - Kuczkowo 5, 5 - Ciechrz 2, 6 - Bożejewice 22, 7 - Żegotki 3, 8 - Siniarzewo 1, 9 - Czerniak 3, 10 - Kruszwica 2/4, 11 - Radojewice, 12 - Kochkovatoe, 13 - Stepnoy, 14 - Hordeevka, 15 - Dnestrovka-Luka, 16 - Subotiv, 17 - Obukhiv

late Bronze Age and early Iron Age [Sulimirski 1936:40-54; Klochko 1992:183-190; 1993; 2001]. The studies cited seem to suggest a pulsative nature of information flow within the Baltic-Pontic ecological and cultural borderland. It has to be kept in mind, however, that the absence of consistent chronological scales may result in a false picture. Any further study of these matters must be preceded by an accurate dating of relevant cultural phenomena, i.e. taking into account radiocarbon dates. This task requires making a series of measurements for diagnostic assemblages to identify internal divisions of taxa. Settling this matter seems particularly interesting when viewed from the perspective of the subsequent cultural changes that affected central and eastern Europe in the decline of the Bronze Age and the dawn of the Iron Age, specifically, the substitution of UC traits by those of the Hallstatt culture and the appearance of nomads related to Cimmerians and Scythians on Pontic steppes.

The goal of this paper is to review briefly the state of radiocarbon exploration of the Urnfield Complex and to outline the plans for further necessary research. For the area of the UC (LC), the study relies on chronological determinations for the Polish Lowlands [chiefly Kujawy Uplands — see Ignaczak 2002:137-141], whereas for the Northern Pontic Area west of the Dnieper the same role is played by lands lying between the Dniester and Dnieper rivers (Fig. 1).

The point of departure for the discussion of absolute chronology is the classic typochronological periodization, therefore, it shall be a framework for our discussion here as well.

1. THE FOUNDATIONS OF ABSOLUTE CHRONOLOGY OF THE DIAGNOSTIC TRAITS OF THE URNFIELD COMPLEX. THE LUSATIAN CULTURE IN KUJAWY

The presented conclusions are selective and concern only a fragment of the UC oecumene, namely, the Polish Lowlands (Kujawy). According to a recently suggested taxonomic division, LC phenomena in Kujawy relating to the Bronze Age and the early Iron Age may be placed in five horizons dated using the radiocarbon method. The horizons cover the period of 1550-800/700 BC [Ignaczak 2002:87ff, see Fig. 1 and Tab. 1].

Two groups of artifact assemblages are the most interesting for the subject at hand. They are dated approximately at (a) the Bronze Age IV-V periods and (b) the Hallstatt C/D periods (according to classic periodizations by Montelius and Kostrzewski) for they make up a supraregional set of artifacts typical of the younger development phases of the LC.

a. A significant analytical advantage offered by the assemblages of the first group is the possibility of their synchronization with macrospatial identifiers of UC traditions such as socketed axeheads with loops, Reutlingen and Hemigkofen type swords and lancet spearheads. This set of traits is supplemented by the stylistics of ceramic goods featuring mainly ornaments of incised lines (Fig. 2). Absolute dating based on calibration using *wiggle matching* [Weninger 1986:38-40] permits us to place the assemblages in the interval from the beginning of the 14th until the end of the 11th century BC (cf. Table 1, lines 15-25).

b. In the case of the second group, an important characteristic is the possibility of synchronizing the artifacts with late Lusatian phenomena identified by their ornaments and pottery morphology. The chief reference is assemblages containing pottery decorated with pricks under the rim and incised lines (arranged in a traditional Lusatian way — horizontal lines enhanced by angular elements arranged horizontally as well — see Fig. 3). They are recorded throughout the oecumene of

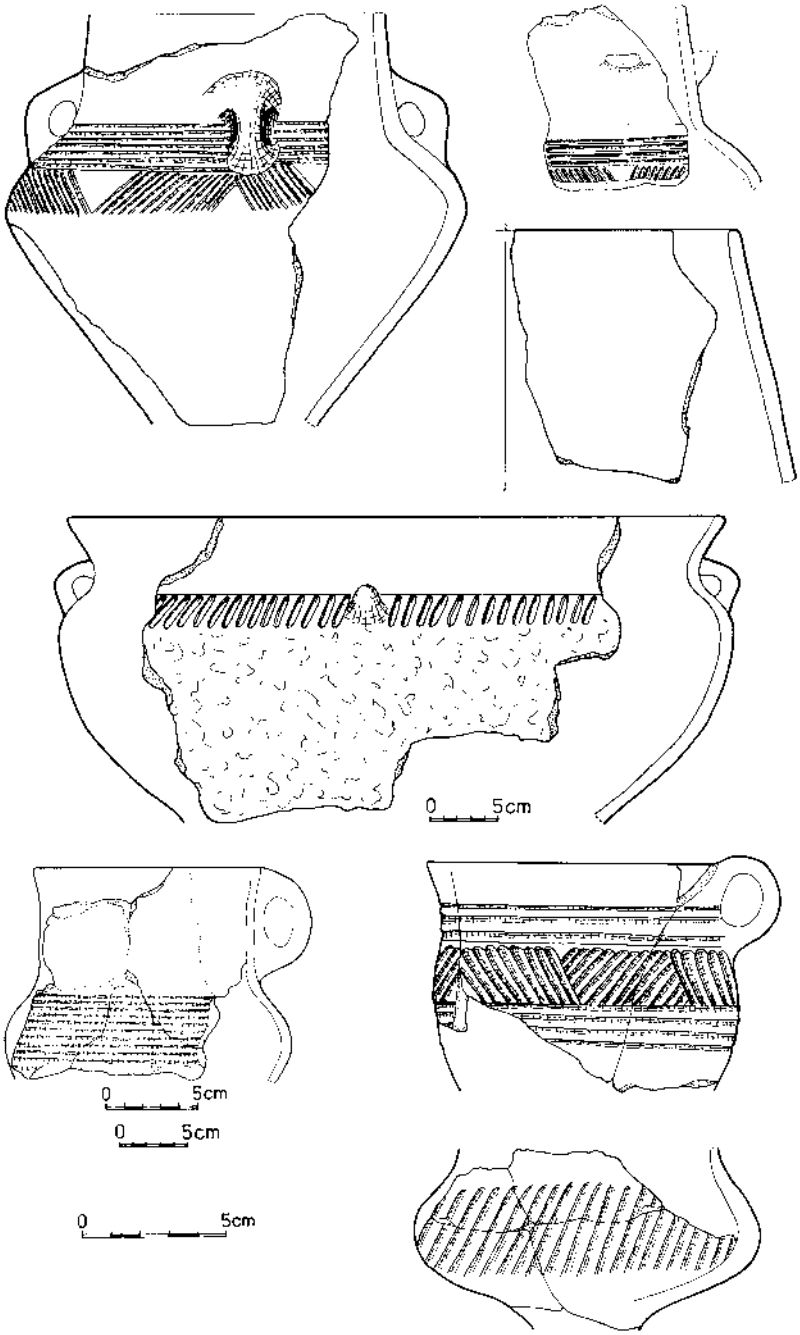

Fig. 2. A selection of ceramic forms of the Lusatian culture in Kujawy from the Bronze Age IV-V periods. Siniarzewo, site 1, Kujawy-Pomerania Province

Table 1

Absolute dating (^{14}C) of Lusatian culture assemblages from Kujawy

No	Site		Culture[a]	References	Material	Lab. No	Date		
	Location	Sample					Conv. BP	Cal BC (95,4%)[b]	Cal BC (68,2%)[c]
1	2	3	4	5	6	7	8	9	10
1.	Narkowo 9	pit 1	LC I	Czebreszuk, Ignaczak, Łoś 1987	charcoal	Gd-2288	3290±90	1780-1400	1690-1500
2.	Narkowo 9	pit 175	LC I	Czebreszuk, Ignaczak, Łoś 1987	charcoal	Gd-2619	2880±80	1400-800	1220-980
3.	Zgłowiączka 3	pit 3	LC IIa	Makarowicz 1998	bone	Ki-6886	3260±45	1680-1440	1620-1500
4.	Sławsko Wielkie 12	pit A84	LC IIa	Ignaczak, Szamałek, Głogowski 2003	bone	Ki-7821	3090±60	1520-1210	1440-1300
5.	Sławsko Wielkie 12	pit B31	LC IIa	Ignaczak, Szamałek, Głogowski 2003	bone	Ki-7822	3020±60	1430-1090	1400-1210
6.	Kuczkowo 5	pit C189	LC IIa	Ignaczak 2002, 2003	bone	Ki-7820	3010±60	1420-1060	1390-1200
7.	Ciechrz 2	pit A10	LC IIb	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-7817	2910±60	1310-920	1220-1020
8.	Ciechrz 2	pit A15	LC IIb	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-7818	2940±60	1320-990	1260-1050
9.	Ciechrz 2	pit B1	LC IIb	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-8907	2870±80	1290-830	1130-920
10.	Bożejewice 22/23	pit E19	LC II/III	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-7816	2845±60	1220-890	1100-920
11.	Żegotki 3	pit A95	LC II/III	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-7823	2890±50	1260-920	1160-1000
12.	Siniarzewo 1	pit H91	LC III	Ignaczak 2002, 2003	bone	Ki-6250	3160±40	1520-1390	1460-1415
13.	Siniarzewo 1	pit H91	LC III	Ignaczak 2002, 2003	bone	Ki-6251	3120±35	1510-1310	1440-1380
14.	Siniarzewo 1	pit H114	LC III	Ignaczak 2002, 2003	bone	Ki-6248	3080±40	1440-1260	1420-1310
15.	Siniarzewo 1	pit H80	LC IV	Ignaczak 2002, 2003	bone	Ki-6249	3070±40	1430-1250	1410-1310
16.	Siniarzewo 1	pit I95	LC IV	Ignaczak 2002, 2003	bone	Ki-6578	3025±40	1410-1200	1390-1250
17.	Siniarzewo 1	pit I320	LC IV	Ignaczak 2002, 2003	bone	Ki-6579	3010±35	1400-1130	1320-1250
18.	Siniarzewo 1	pit I392	LC IV	Ignaczak 2002, 2003	bone	Ki-6577	3040±40	1420-1210	1390-1260
19.	Siniarzewo 1	pit J103	LC IV	Ignaczak 2002, 2003	bone	Ki-6574	3065±35	1420-1260	1405-1310
20.	Siniarzewo 1	pit H54	LC V	Ignaczak 2002, 2003	bone	Ki-6580	2955±40	1320-1030	1270-1100
21.	Siniarzewo 1	pit I1	LC V	Ignaczak 2002, 2003	bone	Ki-6576	2970±35	1320-1060	1270-1120
22.	Siniarzewo 1	pit I282	LC V	Ignaczak 2002, 2003	bone	Ki-6581	2960±40	1320-1040	1270-1100

1	2	3	4	5	6	7	8	9	10
23.	Siniarzewo 1	pit J202	LC V	Ignaczak 2002; 2003	bone	Ki-6575	2925±40	1270-1000	1220-1060
24.	Siniarzewo 1	pit K164	LC V	Ignaczak 2002; 2003	bone	Ki-6573	2950±40	1310-1030	1260-1100
25.	Kuczkowo 1	pit A44	LC V	Ignaczak 2002; 2003	bone	Ki-7819	2930±50	1310-990	1220-1060
26.	Czerniak 3a	-	LC V	Ignaczak 2002	bone	Ki-6494	2820±35	1100-900	1010-920
27.	Czerniak 3a	-	LC V	Ignaczak 2002	bone	Ki-6495	2745±40	1000-820	930-835
28.	Kruszwica K-2/4	pit 48	LC V	Narożna-Szamałek 1987; Szamałek 1992.	charcoal	Gd-5047	2680±60	1000-760	865-795
29.	Kruszwica K-2/4	pit 46	LC V	Narożna-Szamałek 1987; Szamałek 1992.	charcoal	Gd-5046	2650±60	940-750	900-780
30.	Kruszwica K-2/4	pit 45	LC V	Narożna-Szamałek 1987; Szamałek 1992.	charcoal	Gd-3302	2460±60	770-400	760-680
31.	Żegotki 18	pit B11	LC V	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-8904	2680±80	1050-750	920-790
32.	Żegotki 18	pit C10	LC V	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-8905	2590±80	900-480	700-540
33.	Ciechrz 2	pit A12	LC V	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-8906	2550±70	830-480	700-520
34.	Bożejewice 28	pit A21	LC V	Szamałek, Głogowski, Ignaczak 2003	bone	Ki-8908	2540±70	810-480	710-520
35.	Radojewice 24	-	LC V	Ignaczak 2002	bone	Ki-6493	2510±35	800-520	640-540
36.	Radojewice 24	-	LC V	Ignaczak 2002	bone	Ki-6492	2470±40	780-410	770-520
37.	Sławsko Wielkie 12	pit A34	LC V	Ignaczak, Szamałek, Głogowski 2003	bone	Ki-8903	2800±70	1050-840	1160-810
38.	Sławsko Wielkie 12	pit A108	LC V	Ignaczak, Szamałek, Głogowski 2003	bone	Ki-8902	2390±70	760-690	770-380

[a] After Ignaczak 2002
[b] [c] OxCal 3.4.

the "eastern LC"[1] (the area east of the Noteć River line — see Fig. 1). A significant factor is certain spatial continuity of these traits in Kujawy [Ignaczak, Głogowski 2003] as well as in southeastern Poland [Czopek 1996, Fig. 11]. This group of cultural traits may be dated at the time interval from the middle of the 10th to the end of the 7th century BC (see Tab. 1, lines 31-38).

2. THE TYPOCHRONOLOGY OF "WESTERN" TRAITS IN THE NORTHERN PONTIC AREA WEST OF THE DNIEPER

It must be observed first that Ukraine west of the Dnieper was covered by two zones of east-west circulation of cultural information in the late Bronze Age and the early Iron Age. These were (a) Polesie-forest-steppe and (b) steppe zones.

a. The first zone was inhabited by the groups that had grown from the tradition of the Trzciniec Cultural Circle (TCC): the BgC and ChC, genetically related to the former and being its continuation, as well as the Vysotsko culture (VC, the question of its origin and the participation of TCC environment in it is debatable). Among "western" traits, associated chiefly with the LC, a number of metal goods are counted in this environment. They include weapons (socketed axeheads with loops, Reutlingen and Hemigkofen type swords and lancet spearheads) and ornaments. It is worth mentioning here that the origins of a certain group of ornaments demonstrating central European traits may be related to the genetic substratum of these cultures — the TCC environment. Furthermore, it was to the impact of western influences that cremations in vessels-urns was attributed. The range and dynamics of the spreading of these traits east are, however, a subject of discussion [cf. Berezanskaya 1982; Klochko 2001].

b. In the other — steppe — zone, BzC groups developed in the late Bronze Age and early Iron Age. They were related to the environment of the Srubnaya or Sabatinovka culture [cf. Otroshchenko 1986]. In the assemblages of this taxon, "western" traits — characteristic of the environment of Thracian Hallstatt — were treated as elements helpful in building chronologies. They were most readily observable in pottery assemblages, with ornamentation (fluting), surface treatment (burnishing) and morphology of vessels being the major tell-tale signs. Pottery showing "western" traits is found mainly in burials. Another element displaying "western" or "southwestern" characteristics in the contexts of the BzC is the bow-like fibula [see Otroshchenko, Radiocarbon..., in this volume].

It must stressed that the impact of the cultural centre related to the circle of Gava-Goligrady (and cliental cultures) is readily observable in both the steppe

[1] Identified by the absence of "boss style" in pottery [more on this issue — Ignaczak, Głogowski 2003].

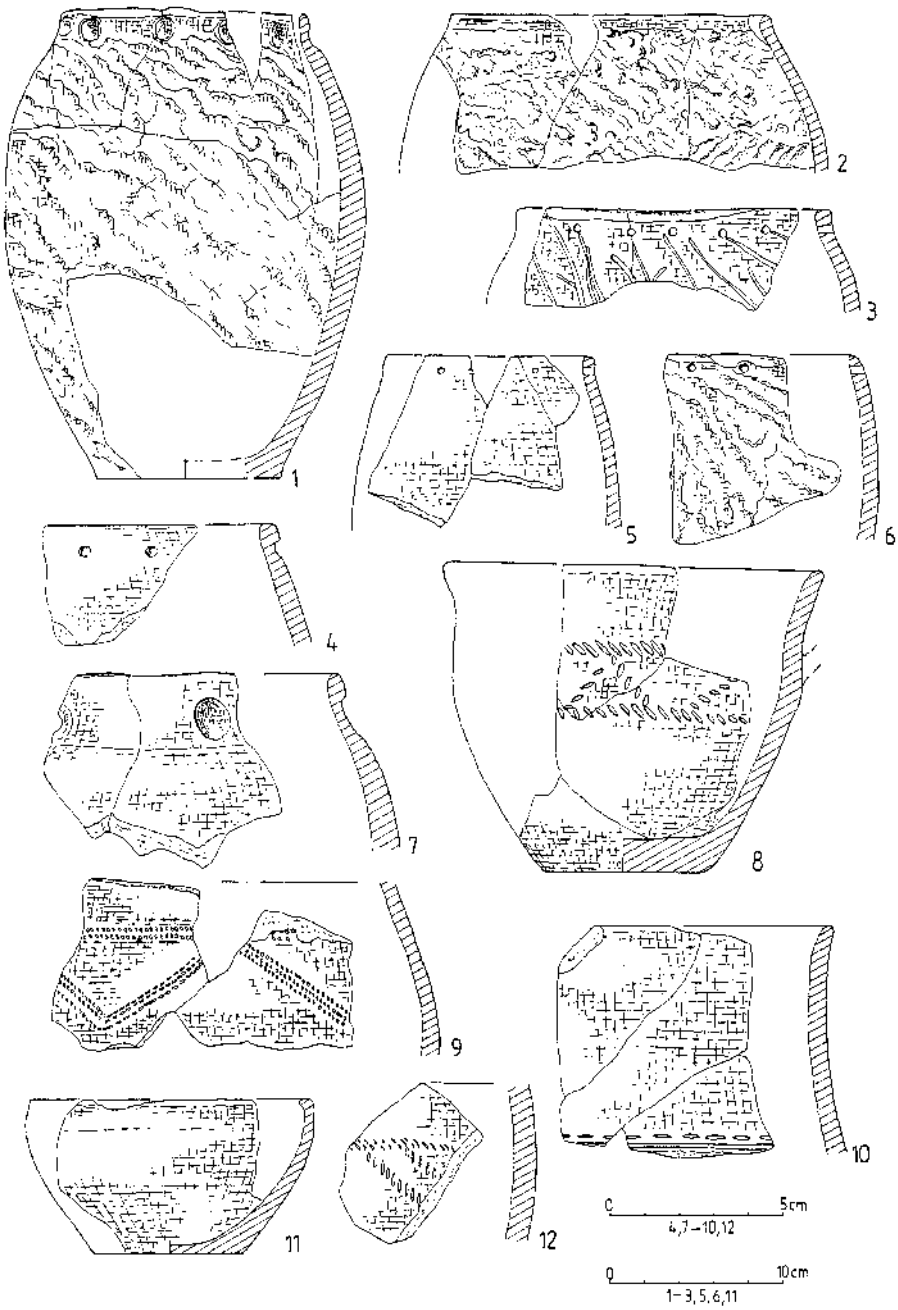

Fig. 3. A selection of ceramic forms (with eastern influences) of the Lusatian culture in Kujawy from the Hallstatt C/D periods. Piecki, site 8, Kujawy-Pomerania Province: 1-12

zone, Polesie-forest steppe zone of the Northern Pontic Area and southeastern Poland.

Furthermore, for the study of the spreading of cultural patterns, Pontic exchange trails, going along the Prut, Dniester, Boh and Dnieper rivers, are of considerable importance. Their significance, also for transcontinental exchanges, is supported by the case of the Hordeevka cemetery for one.

The chronological position of the taxa was determined relying mainly on stratigraphic data and the typochronology of metal goods. The stratigraphic observations of settlements related to the BgC set the position of this taxon between the eastern TH (Trzciniec-Komarów) and early Iron phenomena linked to the ChC. Taking the turn of the 12th century bc (i.e., on uncalibrated scale) to be the decline of Trzciniec groups, S.S. Berezanskaya determined the chronology of the taxon at the 11th-9th century bc. This chronology was supposedly supported by the appearance of pottery forms and metal goods from the Noua environment in BgC contexts [Berezanskaya 1982]. The concurrence of the set of metal goods in the context of the discussed taxon and BzC groups, as well as affinities with the products of the Krasniy Mayak metallurgical centre, were the reasons for moving the chronological brackets of the cultural system to 14th/13th-11th century bc [Chmykhov, Chernyakov 1988]. The final date of the functioning of BgC groups coincides with the appearance of ChC assemblages in the same area genetically related to the former culture. Until recently, this taxon has been dated to the period of 1050-725 bc [Illinskaya, Terenozhkin 1986]. This dating was corroborated by the analysis of ceramic assemblages featuring fluting and stamp ornaments showing affinities with Gava-Goligrady, Chišinau-Corlăteni i Saharna/Cozia assemblages. Besides pottery, evidence for building a ChC chronology was supplied by the presence of metals indicating Carpathian connections and, above all, objects related to the Cimmerian horizon.

Initially, BzC assemblages were taken to reflect the late phase of the Srubnaya culture. The traditional approach to their chronology was affected above all by stratigraphic observations. The assemblages occupied a place between the stratum of Sabatinovka and that of the Chernogorovka phase of the Cimmerian culture. O. T. Terenozhkin, relying on the presence of fibulae showing affinities with bow-type fibulae (Pantalica type) in the contexts of the BzC, dated this culture to 1150-900 bc [Terenozhkin 1965]. Of high importance for building the chronology were A. I. Meliukova's observations, who drew attention to the presence of traits from the circle of Thracian Hallstatt in ceramic and metal assemblages [Melyukova 1979]. Having distinguished Bilozerka-type phenomena as a separate archaeological culture, V.V. Otroshchenko suggested to date it at the interval of 12th-10th century bc [1981; 1985]. Such chronological brackets, synchronous with the BD/HaA1-HaA2/B1 period, have been maintained in V. P. Vanchugov's monograph [1990].

3. THE RADIOCARBON CHRONOLOGY OF "WESTERN" TRAITS IN THE NORTHERN PONTIC AREA WEST OF THE DNIEPER

In pursuance of the observations made above, the chronological schemes of Late Bronze and Early Iron taxa of Ukraine west of the Dnieper were developed for the most part relying on stratigraphic and typochronological findings. The growing number of ^{14}C measurements allows us to verify the assumed, "classic" chronological brackets (Fig. 1; Tab. 2).

The research has brought about a more accurate chronology of the BzC based on dates for the cemetery in Stepnoy. Relying on the obtained data, one can set the period when this cultural system functioned at the interval from the middle of the 12th to the middle of the 9th century BC [cf. Otroshchenko, Radiocarbon..., in this volume]. Such a late dating of this taxon corroborates the hypotheses about the independent development of Hordeevka-type complexes and their share in the formation of the BzC [Klochko 2001:256] and/or ChC [Krushelnitska 1998:193-197], which is suggested in the literature.

In respect of the BgC and ChC, we do not have a satisfactory number of measurements. A series of dates for the Subotiv site is an exception. An older stratum, which can be related to the decline stage of the BgC, has been dated at 1300-1200 BC, whereas strata corresponding to the ChC, in agreement with the obtained dates, match with the period of 1200-1000 BC.

A proposal to date earlier the onset of Cimmerian expansion into the Pontic Area, i.e. to the end of the 9th century BC, has a direct bearing on the discussion of cultural transformations at the threshold of the Iron Age [cf. Klochko, Kovaliukh, Skripkin, Motzenbecker 1998:667-673]. In respect of the ChC, there are available four measurements from the fortified settlement at Dniestrovka. They can be grouped into two chronological levels: 1300-1100 and 1000-800 BC, with older dates having been rejected as being too early [Smirnova 1986]. In the light of analyses made for the Subotiv site, it seems necessary to review the chronology of Dniester ChC complexes relying on the new series of dates.

The data available for building a radiocarbon chronology come for the most part from sites located in the Dnieper drainage, namely, Subotiv and Stepnoy. For any further studies, it seems necessary to obtain a series of dates from sites of the following cultures: Bilozerka, Bilogrudovka, Chornoles and Vysotsko. They are all located in the interfluvial area between the Dniester and Boh rivers, i.e. in the area where both "Lusatian" and "Gàva" influences are particularly clear.

Table 2

Absolute dating (^{14}C) assemblages from the Northern Pontic Area West of the Dnieper

No	Site		Culture	References*	Material	Lab. No	Date	
	Location	Sample					BP	BC
1	2	3	4	5	6	7	8	9
1.	Kochkovatoe, Odesa Region	barrow 32, grave 1	Bilozerka	Vanchugov 1990	?	Ki-1714	2880±45	1140-980
2.	Stepnoy, Zaporizhzhia Region	barrow 2 grave 1	Bilozerka	Otroshchenko 2003	wood	Ki-887	2700±45	900-820
3.	Stepnoy Zaporizhzhia Region	barrow 11 grave 3	Bilozerka	Otroshchenko 2003	charcoal	Ki-889	2850±40	1090-940
4.	Stepnoy Zaporizhzhia Region	barrow 9 grave 1	Bilozerka	Otroshchenko 2003	wood	Ki-575	3050±70	1390-1180
5.	Stepnoy Zaporizhzhia Region	barrow 3 grave 1	Bilozerka	Otroshchenko 2003	wood	Ki-885	2805±55	1030-880
6.	Stepnoy Zaporizhzhia Region	barrow 15 grave 2	Bilozerka	Otroshchenko 2003	charcoal	Ki-886	2690±50	900-815
7.	Stepnoy Zaporizhzhia Region	barrow 15 grave 2	Bilozerka	Otroshchenko 2003	charcoal	Ki-9823	2920±50	1210-1030
8.	Stepnoy Zaporizhzhia Region	barrow 3 grave 1	Bilozerka	Otroshchenko 2003	wood	Ki-9596	2915±45	1200-1030
9.	Stepnoy Zaporizhzhia Region	barrow 9 grave 1	Bilozerka	Otroshchenko 2003	wood	Ki-9820	2880±55	1160-970
10.	Stepnoy Zaporizhzhia Region	barrow 11 grave 3	Bilozerka	Otroshchenko 2003	charcoal	Ki-9821	2830±55	1080-910
11.	Stepnoy Zaporizhzhia Region	barrow 2 grave 1	Bilozerka	Otroshchenko 2003	wood	Ki-9822	2780±55	1000-850
12.	Hordeevka Vinnytsia Region	27	Type Hordeevka	Ślusarska-Michalik 2003	bone	Ki-5080	3460±70	1870-1680
13.	Hordeevka Vinnytsia Region	32/2	Type Hordeevka	Ślusarska-Michalik 2003	bone	Ki-5079	3020±55	1360-116
14.	Hordeevka Vinnytsia Region	33	Type Hordeevka	Ślusarska-Michalik 2003	bone	Ki-5083	3010±50	1350-1150
15.	Hordeevka Vinnytsia Region	35	Type Hordeevka	Ślusarska-Michalik 2003	bone	Ki-5081	2980±60	1310-1090
16.	Hordeevka Vinnytsia Region	37	Type Hordeevka	Ślusarska-Michalik 2003	bone	Ki-5082	2920±50	1210-1030
17.	Hordeevka Vinnytsia Region	26	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9252	3180±50	1505-1405
18.	Hordeevka Vinnytsia Region	26	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9253	3240±50	1590-1450
19.	Hordeevka Vinnytsia Region	26	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9254	3120±50	1440-1310
20.	Hordeevka Vinnytsia Region	27	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9255	2980±50	1300-1110
21.	Hordeevka Vinnytsia Region	27	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9256	2950±50	1250-1060
22.	Hordeevka Vinnytsia Region	28	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9257	3110±50	1430-1300
23.	Hordeevka Vinnytsia Region	31	Type Hordeevka	Ślusarska-Michalik 2003	wood	Ki-9258	3005±50	1340-1150
24.	Dnestrovka-Luka, Chernivtsy Region	pit 24	Chornoles	Smirnova 1986	charcoal	Le-2163	3010±40	1340-1170

1	2	3	4	5	6	7	8	9
25.	Dnestrovka-Luka, Chernivtsy Region	pit 5	Chornoles	Smirnova 1986	charcoal	Le-2161	2970±40	1270-1110
26.	Dnestrovka-Luka, Chernivtsy Region	pit 4	Chornoles	Smirnova 1986	charcoal	Le-2165	2800±40	995-890
27.	Dnestrovka-Luka, Chernivtsy Region	pit 5	Chornoles	Smirnova 1986	charcoal	Le-2164	2630±50	845-770
28.	Subotiv, Cherkasy Region	hut 4	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	charcoal	Ki-5505	3100±40	1410-1310
29.	Subotiv, Cherkasy Region	hut 4	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	charcoal	Ki-5502	3040±50	1370-1210
30.	Subotiv, Cherkasy Region	hut 4, pit 1	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	charcoal	Ki-5504	3030±60	1370-1170
31.	Subotiv, Cherkasy Region	hut 4	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5501	2950±45	1250-1070
32.	Subotiv, Cherkasy Region	hut 4	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5503	2980±50	1310-1090
33.	Subotiv, Cherkasy Region	hut 4	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5506	2940±50	1240-1050
34.	Subotiv, Cherkasy Region	hut 4	Bilogrudovka	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5507	2910±55	1210-1010
35.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5863	2935±40	1220-1050
36.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5859	2930±40	1210-1050
37.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	charcoal	Ki-5858	2910±35	1180-1030
38.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5862	2890±30	1090-960
39.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5869	2860±30	1090-960
40.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5861	2875±40	1120-980
41.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5865	2850±35	1080-940
42.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5860	2845±35	1070-940
43.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5866	2870±50	1130-960
44.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5864	2820±30	1005-925
45.	Subotiv, Cherkasy Region	“sq. 0-11”	Chornoles	Klochko, Kovaliukh, Motzenbecker 1998	bone	Ki-5868	2830±40	1040-920
46.	Obukhiv, Kiev Region	hut	Bilogrudovka	Otroshchenko 1986	wood	Ki-872	3090±70	1430-1240

* 2003 = . . . in this volume

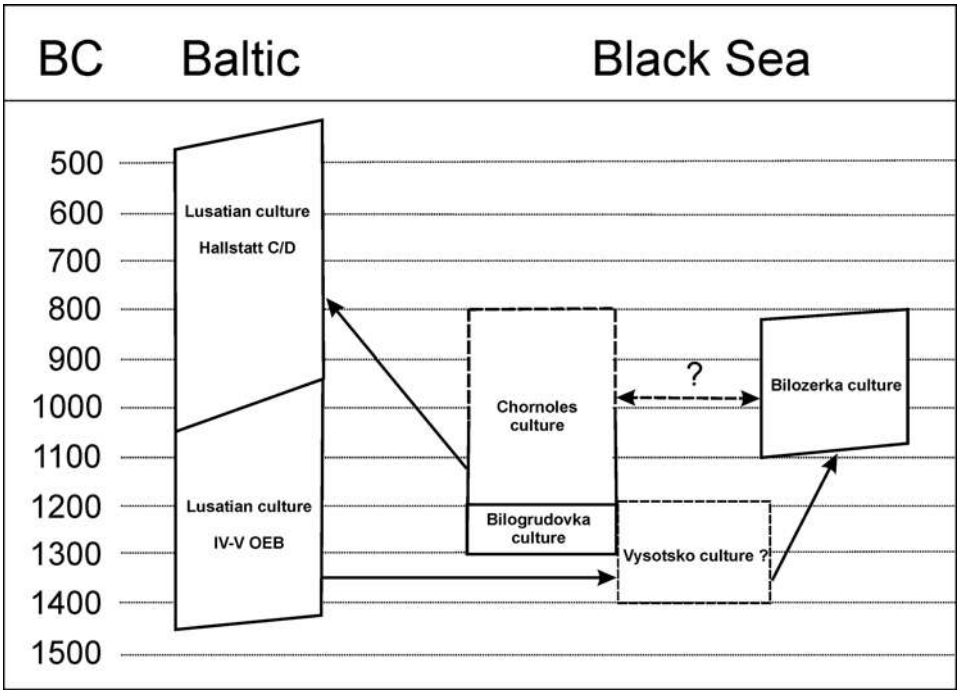

Fig. 4. A radiocarbon chronology scheme in the area between the Baltic and Black seas in the late Bronze Age and early Iron Age

CONCLUSIONS

Relying on the presented radiocarbon measurements concerning taxa found in the lands stretching between the Baltic and Black seas, specifically between the drainages of the Vistula and Dnieper rivers, one can venture to outline their development relationships. The outline should take into account the fact that the area in question witnessed multiple and multidirectional transmissions of cultural elements. The differences revealed in the dating of similar cultural elements in the areas under investigation permit us to surmise what the dynamic of cultural contacts looked like in the late Bronze Age and early Iron Age (see Fig. 4).

At present, one can discern two opposing trends in the transmission of cultural traits in the archaeological materials:

1. The first trend continued along the following path: the LC (late Bronze Age) → presumed VC (group) → the BzC (Fig. 4). An earlier appearance of the cultural patterns mentioned above in the LC setting justifies the view that the LC could be

the carrier of early Urnfield traits. We do not wish to deny a possibility, though, that the said cultures had other traits testifying to their separate genetic connotations.

2. The other trend of cultural transmissions should be placed in a spatially opposite direction of cultural contacts. The existence of such a direction is strongly suggested by the latest research into late (originating in the early Iron Age) LC assemblages in Kujawy [Ignaczak, Głogowski 2003 — cf. Fig. 3]. They are a record of a possibility that cultural traits infiltrated along the east-west line reflected by the following cultural trail: the Chornoles culture → Scythians → late LC groups (or, possibly, the Chornoles culture → Scythians → the Milograd culture → late LC groups). This transmission trail should be treated as opposite to that outlined under 1 above, both culturally and chronologically. Its substratum could have been a cultural element identified with nomadic Scythian populations. Materials exhibiting markers of this trend ("egg-shaped pots" with perforations under the rim, iron razors and nail-like earrings) have been identified so far in assemblages found in southeastern Poland [Lewandowski 1979:124-126] and Kujawy [Grygiel 1996; Ignaczak, Głogowski 2003].

The picture of cultural infiltration between the two seas briefly outlined above needs elaborating. The proposals presented here are, therefore, highly preliminary. A major shortcoming was an insufficient number of ^{14}C dates from the direct "contact zone" (eastern Poland and western Ukraine) and a narrow scope of reference of the chronology to the existing periodization schemes based, for the most part, on metal goods.

Translated by Piotr T. Żebrowski

Baltic-Pontic Studies
vol. 12: 2003, 396-414
PL ISSN 1231-0344

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A COMPARATIVE CHRONOLOGY OF THE PREHISTORY OF THE AREA BETWEEN THE VISTULA AND DNIEPER: 4000-1000 BC

The papers included in this volume of the *BPS* are a continuation of the subject that has already been addressed in our series, in particular in volume 7 [Kośko (ed.) 1999], namely, the study of comparative chronology of cultural phenomena in the borderland between eastern and western Europe. The present volume is, therefore, another step in the long-term project to build a scheme of comparative chronology relying on absolute (radiocarbon) dating [Klochko, Kośko, Szmyt 1999a:8-11]. In this case, however, the time brackets are broader to cover the period from the beginning of the 4th to the turn of the 2nd millennium BC. The discussion concerns the archaeological units that have been insufficiently or controversially treated in the studies carried out so far. In particular those of them which gave a chance of obtaining good quality samples (for ^{14}C measurements) or broadening the cultural background thus being an inspiration for further research. As previously, the papers focus on the presentation and interpretation of new series of radiocarbon dates. Use has been made of data collected in volumes 8 and 9 of the *BPS* [Szmyt 1999; Kośko (ed.) 2000].

In this summary we shall critically review the obtained results by concentrating on the identification of both undisputable achievements and the most controversial ("dark") issues. We shall also make another attempt to correlate cultural units distinguished between the Vistula and Dnieper in the 4th, 3rd and 2nd millennia BC, with the point of departure being the state diagnosed in 1999 [see earlier: Klochko, Kośko, Szmyt 1999b].

1. BALKAN CULTURAL CIRCLE IN THE NORTHERN PONTIC AREA

From a broad spectrum of issues relating to the communities of the Balkan cultural circle that can be identified in the Northern Pontic Area, new information concerns the absolute (radiocarbon) chronology of the following four units: (1.1.) Tripolye culture (TC), (1.2) Lublin-Volhynian culture (LVC), (1.3) Funnel Beaker culture (FBC) Volhynian concentration and (1.4) Globular Amphora culture (GAC) Moldavian (Siret) subgroup.

1.1. TRIPOLYE CULTURE

Earlier publications presented a long series of radiocarbon dates relating to the decline stage (CII) of the TC [Videiko 1999; Szmyt, Chernyakov 1999]. Their analysis allowed us to set absolute time brackets of the CII stage at ca. 3300-2700 BC. However, the youngest dates for the southwestern branch of the late TC indicated a possibility that it could have survived until the second half of the 3rd millennium BC (until 2400/2300 BC at the latest) [Klochko, Kośko, Szmyt 1999b:265-270].

In the present volume, an analysis of new dates was carried out for the TC of the following stages: BII-CI [Videiko, Radiocarbon..., in this volume; see also Burdo, Videiko 1998] and CII [see Videiko, Petrenko, Radiocarbon..., in this volume]. They concern the following groups/regions: (a) Middle Dnieper and (b) Usatovo.

a. New data concern two stages: (aa) BII and (ab) CI.

aa. Four new dates have been obtained for the Kaniv group (the Khatyshche settlement) that represents a version of the BII stage on the middle Dnieper. With high probability, all the four dates mark a single settlement phase lasting from ca. 3700 to 3400 BC (within this bracket, the most probable is the 3590-3520 BC interval). This dating marks the decline of the BII stage on the Dnieper, whereas its beginning is determined by the chronology of the settlement in Chapaevka connected with an earlier segment of the BII stage [Videiko, Radiocarbon..., in this volume]. Further research should necessarily focus on increasing the number of dates for the assemblages of the BII stage and confirming the dates obtained for Chapaevka with measurements made on short-lived materials, e.g. bones (Fig. 1).

ab. Seven new ^{14}C dates have been obtained for the Hryhorivka group (four for the settlement in Ihnatenkova Gora and three from the settlement in Khomyne), which is a local variety within the CI stage later than Lukashi type materials. The ^{14}C chronology of both source assemblages situates them in the period from ca. 3450 to 3000 BC; however, if narrowed down to 3400-3200 BC, the bracket would be more probable. An emerging sequence of sites of the middle Dnieper TC of the CI phase

(Evminka — Ihnatenkova Gora — Khomyne), nevertheless, needs corroborating by a larger number of dates (Fig. 1).
b. The dating was performed on a number of bone samples from five graves and one feature that had been identified as representing the Usatovo group [Videiko, Petrenko, Radiocarbon..., in this volume]. In several cases the obtained dates were too early and as such did not meet the expectations. Two of such dates concern grave 1/10 from Katarzhyno (Ki-9523) and grave 35 from Sadove (Ki-9529), dated at ca. 3700 BC, that can be hypothetically related to the period preceding the formation of the Usatovo group (i.e. the pre-Usatovo stage). Among the acceptable ^{14}C measurements, graves 22 and 35 from Oleksandrivka (Ki-9524 and Ki-9525) may be called early Usatovo, though they can just as well represent pre-Usatovo groups. It is to be regretted that it was not possible now to publish source materials accompanying the measurements. A date consistent with the expectations was obtained for feature 1/1990 from Mayaki (Ki-9527). The date fits into the series of measurements obtained so far for this site [Videiko 1999: Table 10]. Also, grave 17 from Oleksandrivka (Ki-9526) may represent a decline phase of the Usatovo group similarly to materials from the Akkembetskiy kurgan [Szmyt, Chernyakov 1999]. In sum, new ^{14}C dates seem to supply more information on the origins of the Usatovo group than on its absolute chronology (Fig. 1).

1.2. LUBLIN-VOLHYNIAN CULTURE

The latest studies of the LVC chronology [Kadrow, Zakościelna 2000; Bronicki, Kadrow, Zakościelna, Radiocarbon..., in this volume] place this unit of the Danube circle in the maximum period of 4200-3400 BC. However, a vast majority of late-phase (III) complexes survived only until 3600 BC. Notice must be taken of two important observations here. The first concerns a recessive and enclave character of the late phase of the LVC which developed alongside phases I and II of the FBC (see 1.3). The second is about superseding LVC settlements by those of the FBC ca. 3650 not only on the Vistula (example: Bronocice) but also on the Bug River (key sites: Gródek Nadbużny and Zimne) [Bronicki, Kadrow, Zakościelna, Radiocarbon..., in this volume] (Fig. 1)

1.3. FUNNEL BEAKER CULTURE

Presented in this volume, the re-analysis of ^{14}C dates for Gródek Nadbużny and the analysis of a series of 14 dates from the settlement in Zimne [Bronicki, Kadrow, Zakościelna, Radiocarbon..., in this volume] made it possible to introduce

substantial corrections to the existing chronological scheme of the southeastern group of the FBC or rather its "Pontic segment" connected to the West Volhynia Upland. On the West Volhynia Upland, the classic phase of the FBC can be dated at 3650 BC at the earliest. The same dividing line marks the beginning of large and long-lasting FBC settlements in Gródek Nadbużny and Zimne. In both cases, two phases can be justifiably distinguished: a classic one and a late one. The former should be dated in Gródek at 3650-3500 BC (Gródek I), while the latter has broad time brackets of 3500-2600 BC (Gródek II). In Zimne, the classic phase (Zimne I) is dated at 3650-3400 BC, while the late one (Zimne II) falls between 3050 and 2600 BC. It is unclear whether the gap between the two phases in Zimne merely reflects current research capability or mirrors an actual lack of continuity. It is worth paying attention to the high rank of the 3500 BC dividing line in the process of regionalization within the southeastern group of the FBC (Fig. 1).

1.4. GLOBULAR AMPHORA CULTURE

Series of ^{14}C dates for the features of the eastern group of the GAC [Kadrow, Szmyt 1996; Szmyt 1999] made it possible to determine the chronological brackets of GAC settlements in Volhynia and Podolia. In the case of the Volhynia subgroup the brackets fit into the period of 3000/2950-2400/2350 BC, while in the case of the Podolia subgroup they cover the period from 2900 to 2400 BC [Szmyt 1999: 68-82]. In this volume, the first dates are presented which refer to the third link of the eastern group of the GAC, namely, the Moldavian (Siret) subgroup. The series is made up of ^{14}C measurements made on samples of human bones coming from GAC graves in Basarabi, Bârgauani, Piatra Neamţ and from grave 2 in Dolheştii Mari. After rejecting two erroneous dates from the last mentioned feature, the three remaining ones were subjected to analysis. They fit into the period from 2995±25 BC (Basarabi) to 2717±43 BC (Piatra Neamţ). However, this is not a complete time bracket in which the Siret subgroup developed. There are grounds to believe that it declined in the middle of the 3rd millennium BC. The oldest quoted date (Basarabi) suggests also a possibility of correcting (making it older by moving until 3000 BC) the beginnings of GAC settlement in Podolia. To settle this issue, it is necessary to obtain more ^{14}C measurements (Fig. 1).

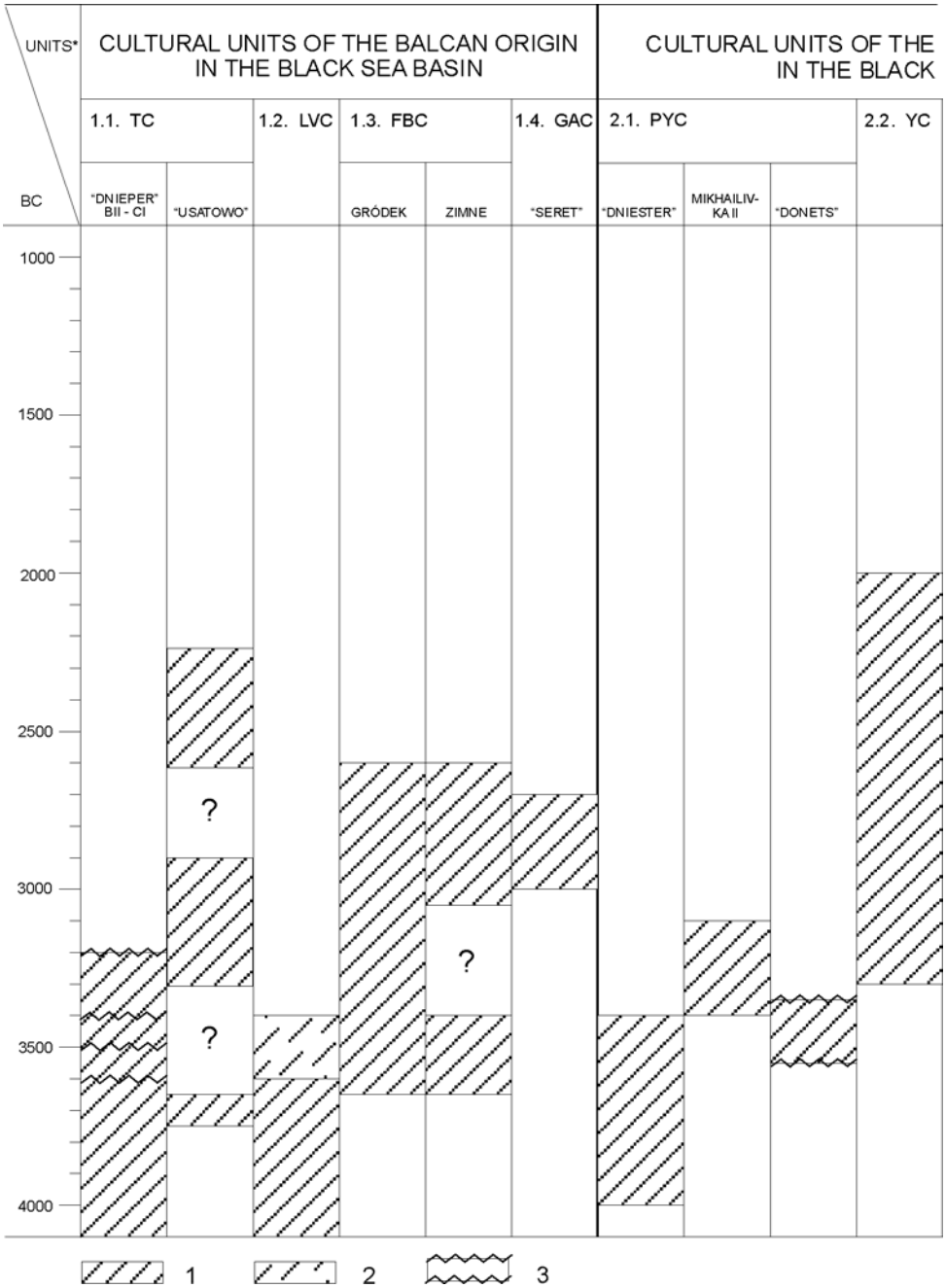
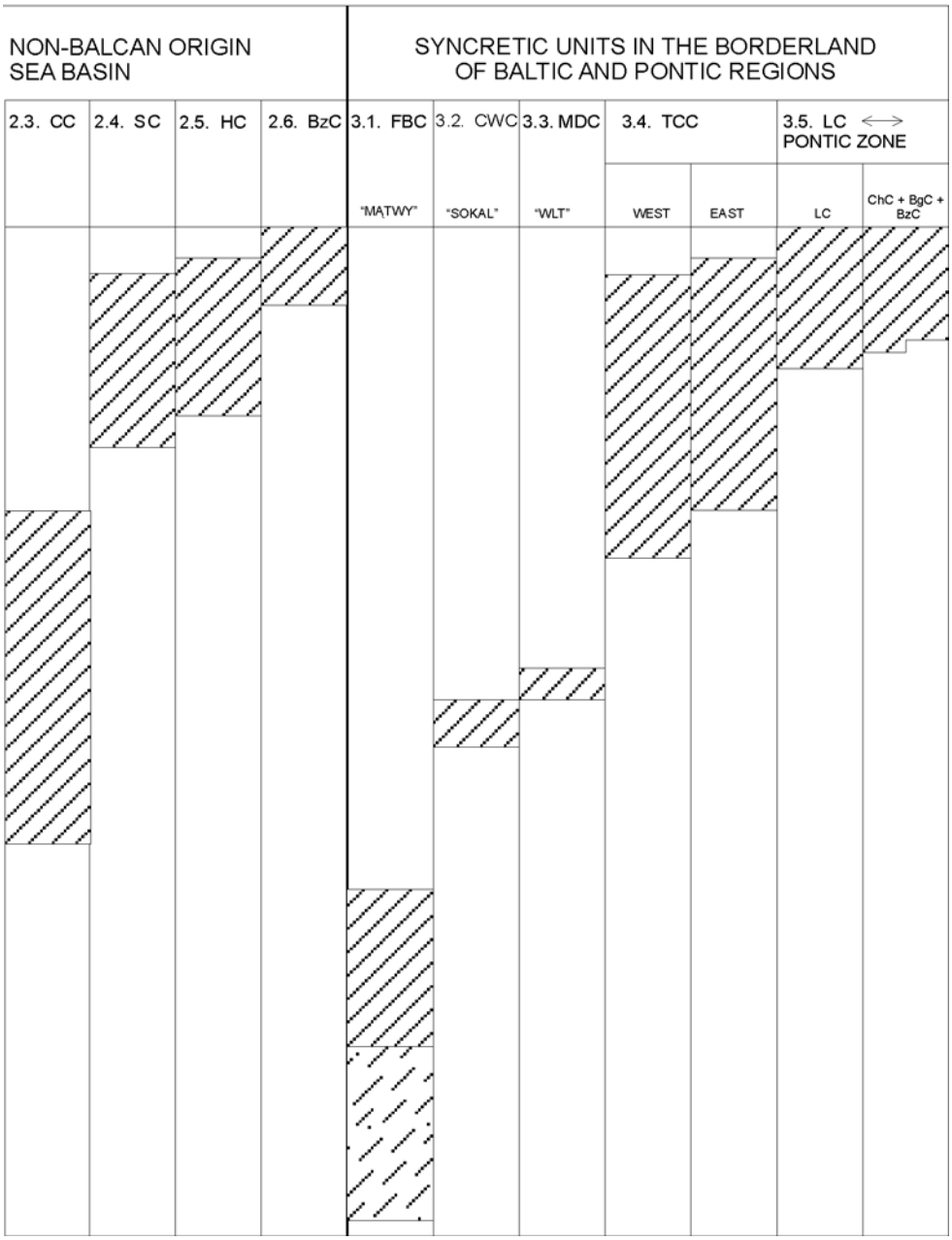


Fig. 1. Synchronization of cultural units between the Vistula nad Dnieper from 4000-1000 BC based on radiocarbon dates



* Abbreviations of culture names — see text. Key: 1 - ^{14}C chronology established, 2 - ^{14}C chronology unclear, 3 - single ^{14}C dating

2. ENDOGENOUS UNITS OF THE NORTHERN PONTIC AREA

The data gathered in this volume concern: (2.1) the so-called Eneolithic (Pre--Yamnaya) communities (PYC) from the steppe zone, (2.2) Yamnaya culture (YC), (2.3) Catacomb culture (CC), (2.4) Srubnaya culture (SC), (2.5) Hordeevka cemetery and (2.6) Bilozerka culture (BzC).

2.1. ENEOLITHIC (PRE-YAMNAYA) COMMUNITIES FROM THE STEPPE ZONE

The new data shed light on some aspects of the chronology of cultural phenomena preceding the formation of the YC on the steppes of eastern Europe [recently: Rassamakin 1999; Telegin 2001]. These phenomena are known by the names of steppe Eneolithic or Pre-Yamnaya groups. Until recently their chronology has almost exclusively been based on typochronological analyses, in particular, on references to the TC periodization. The radiocarbon dates included in this volume concern (a) the lower Dniester area, (b) the middle (II) stratum of an important site at Mikhailivka (so-called Mikhailivka II), and (c) the area of the Northern Donets (Fig.1).

a. The set of data from the mouth of the Dniester [Videiko, Petrenko, Radiocarbon..., in this volume] includes measurements made on bone samples collected in five graves in Koshary 1 and a grave in Khadzhider 1 as well as the already mentioned dates concerning graves originally associated with the Usatovo group (see 1.1. above): grave 35 in Sadove (Ki-9529) and graves 22 and 35 in Oleksandrivka (Ki-9524 and Ki-9525). It must be made clear, however, that the graves from Oleksandrivka may just as well represent the early Usatovo phase. Materials from Koshary and Khadzhider, distinguished as the Khadzhider type, may be dated at 4100-3300 BC, although owing to TC sources accompanying them and indicating to stages BII and CI, it seems to be more credible to narrow down the period when they were used to 4000-3400 BC [Videiko, Petrenko, Radiocarbon..., in this volume]. This interval encompasses the other, less certain dates as well (Fig. 1).

b. In light of the reanalysis of sources from the middle (II) layer of the Mikhailivka settlement [Kotova, Spitsyna, Radiocarbon..., in this volume], they should be treated as representing another cultural tradition than the contemporaneous phenomena of the Repin Khutor (Repin culture) type. It follows that combining materials from both sites is unfounded nor is it justified to call them by the common appellation of "early stage of the YC". Three measurements made on bones found in the lower horizon (Ki-8012) and in the upper horizon (Ki-8010 and Ki-8186) of

the middle layer set the interval of 3600-3050 BC. Using *wiggle matching*, we can narrow down the interval to 3400-3100 BC. Such a chronology together with the diagnosed uniformity of ceramic materials in the whole middle layer testify to the longevity of the cultural phenomenon. Identified in the sources from the middle layer, the traits of the Repin culture, the Maykop culture and the TC of the CI stage (and not, as it was believed until now, of the CII stage) support the suggested chronology.

The chronology of the middle layer of the Mikhailivka site has also far-reaching consequences for the time position of the lower layer at this site (so-called Mikhailivka I or Lower Mikhailivka) [Lagodovska, Shaposhnikova, Makarevich 1962]. For this level has to be older than the overlying middle layer, which means that its chronology would be earlier than 3600-3400 BC, whereas the dates that have been published so far — by the way controversial — for Mikhailivka I are much younger [Szmyt 1999:105]. To settle these controversies, it is necessary to expand the set of sources and process them well in terms of stratigraphy, taxonomy and radiocarbon dating (Fig. 1).

c. A single date was obtained for grave 12/1 in Svatove thanks to the re-dating of a series of wood samples from that cemetery [Bratchenko, Radiocarbon..., in this volume]. Regardless of methodological problems following from undertaking such a reanalysis (see part 2.3), it is worth mentioning that the new date (Ki-9856) fits into the interval of 3575-3375 BC, i.e. it matches the period when the Pre-Yamnaya horizon continued on the lower Dnieper and Dniester rivers (Fig. 1).

2.2. YAMNAYA CULTURE

One of the key issues of the archaeology of the borderland between western and eastern Europe is the chronology of the YC. This volume, besides (a) a review of the state of research [Telegin, Pustovalov, Kovalyukh, Relative..., in this volume] presents (b) new data from the Northern Donets region [Bratchenko, Radiocarbon..., in this volume; Klochko, Sanzharov, Radiocarbon..., in this volume].

a. A critical review of the studies of YC absolute chronology combined with a discussion of the strategy of further research into the subject seems to be absolutely necessary at the moment. The YC is, as it were, a textbook example of the fact that a large amount of data does not automatically push our knowledge forward. After all, this is a cultural unit for which we have the largest set of ^{14}C dates of all eastern European cultures [over 200 dates - see Telegin, Pustovalov, Kovalyukh, Relative..., Table 1]. However, to correctly analyze and credibly interpret them

is not easy, which is caused by a number of reasons. The most important are: selection of materials for dating (in most cases it was timber from grave structures and bones, however, much less frequently), low precision of a considerable number of dates (29% of BP dates have been made with a standard error of over 70 years), prevalence of single measurements (which prevents any control if they are correct using stratigraphy, for instance), and lastly but probably most importantly, a lack of full publications of dated assemblages. All this makes the work on the rich series of radiocarbon dates concerning the YC exceedingly difficult. In a paper included in this volume, D. Y. Telegin argues in favour of a return to the two-stage version of YC periodization. The older stage can be dated between 3300/3100 BC and 3000/2700 BC, whereas the younger stage can be assigned the period of 3000/2700-2100/2000 BC [see Telegin, Pustovalov, Kovalyukh, Relative..., in this volume]. The quoted author stresses the fact that YC societies subsisted in periods that differed widely from region to region. Specifically, the earliest YC assemblages are found on the northwestern coast of the Black Sea (already in ca. 3300-3100 BC), slightly later they are encountered on the Dnieper, the Sea of Azov and the Volga River, while on the steppes northwest of the Caspian Sea, the beginnings of the YC fall only after 2500 BC. It must be stressed that D. Y. Telegin, in his analysis of the oldest dates, uses new series of measurements obtained for sequences of grave assemblages, the stratigraphic relationships of which (i.e. relative chronology) are known (cf., for instance, dates for Kremnivka and Volonterivka).

b. Three new measurements of samples from Raygorodok, grave 1/10 i 1/9, and Krugloe fit into the maximum interval of 2550-2250 BC [Klochko, Sanzharov, Radiocarbon..., in this volume]. However, repeated ^{14}C measurements made on wood samples from Svatove yielded results between 2850 and 2500 BC [Bratchenko, Radiocarbon..., in this volume]. The dates are consistent with stratigraphic observations and general typological assessments. In both cases, we deal with materials representing a later development stage of the YC in its Don-Donets version. It is unclear, however, why both sets of dates differ. The differences may reflect dissimilarities in the dated material (bones / wood) but they may also be a manifestation of actual variations in chronological positions of the YC on a local scale.

2.3. CATACOMB CULTURE

This volume publishes (a) new results of analyses of a series of ^{14}C dates concerning the Eastern (Donets) Catacomb culture [Bratchenko, Radiocarbon..., in this volume; Klochko, Sanzharov, Radiocarbon..., in this volume] and (b) a reanalysis of typochronological and radiocarbon foundations of distinguishing between

the initial "stages" of the Pontic Bronze Age, namely, the Yamnaya and Catacomb stages [Telegin, Pustovalov, Kovalyukh, Relative..., in this volume].

a. All new ^{14}C dates come from the drainage of the northern Donets river (Luhansk region). Extending the research project to cover this area (i.e., enlarging the area studied in this volume) was justified by the topogenesis of some of the studied taxa.

A series of dates from the cemetery in Svatove [Bratchenko, Radiocarbon..., in this volume], made to verify earlier measurements from this site [see Telegin 1992], marks the interval of 2850-2250 BC. The interval matches typological assessments better according to which the graves in question date back to the middle phase of the Donets Catacomb culture.

We also have four new measurements from the "Luhansk region". After an obviously wrong date is eliminated (Ki-9513), they mark the interval of 2400-1825 BC [Klochko, Sanzharov, Radiocarbon..., in this volume]. Of particular importance seem to be three dates from the cemetery in Nevskoe related to the materials of the late phase of the Donets Catacomb culture that are dated between ca. 2135 and 1820 BP.

In sum, it can be thus concluded that the time bracket when the Eastern (Donets) Catacomb culture subsisted covered roughly the period of 2850-1820 BC, which is corroborated by S. Pustovalov's studies discussed below (Fig. 1).

b. The question of CC chronology is a key point of a broader discussion of the continuity of cultures of the Pontic Bronze Age in the steppe/forest-steppe zone, in this case the YC and CC. It is from this point of view that the problem was approached by S. Pustovalov [Telegin, Pustovalov, Kovayukh, Relative..., in this volume], who attempted to critically reanalyze an earlier "continuous chronometry" by A.V. Nikolova [Nikolova 1999a; 1999b]. The main contention of the cited paper can be summarized as follows: there are both ^{14}C dates referring to locations outside the area covered by A.V. Nikolova's investigations as well as a set of stratigraphic and typochronological observations that justify a counter-hypothesis about the parallel existence of the YC and CC in the period of 2850-2000 BC. Hence, S. Pustovalov suggests to move significantly backward the beginnings of the CC. Such a correction removes several contradictions in the picture of development relationships holding between the cultures of the east and west of Europe in the 3rd millennium BC. The most glaring contradiction concerned too early a chronology of niche graves of the Corded Ware culture (CWC) in Małopolska (dated between 2750 and 2200 BC [Włodarczak 1998:Fig.3]) in respect of the beginnings of occurrence of their assumed prototypes — i.e., catacomb graves — in the Pontic zone (in the previous approach: 2350/2250 BC [Nikolova 1999b:Fig. 11]). The contradiction has been exposed earlier making it an important research aim [Klochko, Kośko, Szmyt 1999:282].

2.4. SRUBNAYA CULTURE

The great range of the Srubnaya culture (SC) is inversely proportional to the number of ^{14}C dates available for it. In this volume, we present measurements for two varieties of the culture: (a) Pokrovsk SC and (b) Berezhnovka-Maevka SC.

a. Of the measurements made for the Luhansk region [Klochko, Sanzharov, Radiocarbon. . . ., in this volume], to the Pokrovsk SC refers a single date (Shmelevoe — Ki-9519), while the measurement results of the other samples are either wrong or attributable to other prehistoric societies. After calibration, the date fits between 1530 and 1380 BC, which is consistent with the chronology arrived at by comparative analyses (Fig. 1).

b. The series of dates for the Berezhnovka-Maevka SC is made up of six measurements made on bone samples from graves investigated in a cemetery in the vicinity of Ordzhonikidze [Chernykh, Polin, Otroshchenko, Radiocarbon. . . , in this volume]. They fit into (after eliminating two dates erroneously ascribed to the unit in hand - Ki-9631 i Ki-9632) the time interval of 1600-1050 BC (Fig. 1). In terms of typochronology, materials from the cemetery represent the middle (II) development stage of the unit in question. Unexpectedly late dates for two graves (Ki-9627 i Ki-9630) suggest a possibility that the cemetery may have continued to be used in the late phase. Keeping in mind that the dynamics of transformations of the Berezhnovka-Maevka SC has been explored only preliminarily, one cannot exclude a possibility that the foundations of its periodization are not known well enough yet. Attention must be drawn to yet two more issues: first, relatively high values of standard errors of the analyzed ^{14}C dates (a consequence of the poor state of preservation of bone sources at the site) and, second, some dates fell on a plateau of the calibration curve, which greatly restricted the possibilities of analysis. It is highly recommended that more intensive work be done on the absolute chronology of the SC.

2.5. HORDEEVKA CEMETERY

Since its discovery, the cemetery in Hordeevka, in the middle part of the Southern Bug basin, has been a key site for exploring far-reaching cultural relations in the borderland between the eastern European forest-steppe and steppe. Controversies have been aroused by the issues of its relation to the Tumulus culture circle and absolute chronology [e.g. Górski, Kadrow 2001:134]. Until now, chronological

assessments have relied on five ^{14}C measurements made on bone samples. In the present volume seven new dates, made on samples of wood from grave structures, are presented [Ślusarska-Michalik, Radiocarbon..., in this volume]. The new series has verified, among others, the controversial date. Worth mentioning is the subcalibration procedure (a variety of *wiggle matching*) applied to two features (tumuli nos. 26 and 31) and enabling a precise determination of their chronology [Kovalyukh, Nazarov 1999]. The analysis of both series of ^{14}C measurements, in the context of accompanying grave goods, led to a conclusion that distinguishing two phases of cemetery use was most reasonable at present. The older phase (I) covers the period of ca. 1500/1400-1200 BC, while the younger one (II) fits into the interval of 1200-1000 BC (Fig. 1).

2.6. BILOZERKA CULTURE

The Late Bronze Age Bilozerka culture (BzC) has few radiocarbon dates referring to it. Among the most important, one should count measurements made on the "Stepnoy" cemetery. The present volume provides [Otroshchenko, Radiocarbon..., in this volume] an analysis of new dates and a reanalysis of old measurements. In their light, it seems that the most credible BzC time brackets span the period from 1150 to 850 BC (Fig. 1). In its late stage of development, the culture smoothly transformed in the direction of a Cimmerian period culture.

3. SYNCRETIC UNITS IN THE BORDERLAND OF BALTIC AND PONTIC REGIONS

In light of information collected in this volume, it is possible to make the chronological positions of several units of a different taxonomic rank more precise. These are: (1) the Mątwy group of the Funnel Beaker culture (FBC), (2) the Sokal group of the Corded Ware culture (CWC), (3) the Middle Dnieper culture (MDC), (4) the Trzciniec cultural circle (TCC). Special attention was given to the problem of (5) time relationships of the Lusatian culture (LC) and BzC.

3.1. FUNNEL BEAKER CULTURE — THE MĄTWY GROUP

The Mątwy group was distinguished as a syncretic unit resulting from the adaptation of eastern European patterns, or rather those related to the borderland between the forest and forest-steppe zones, by the environment of the eastern group of the FBC. Now, its description and chronological position arouse controversy [Kośko 1981; 1988; Kukawka 1991; 2001; Daszkiewicz, Prinke 1999; 2001]. This volume of the *BPS* contains new sources for the study of the radiocarbon chronology of the Mątwy group (seven new measurements made on bone samples) and gives its current periodization [Kośko, Radiocarbon..., in this volume]. It consists in distinguishing three stages in the spread of "Mątwy" traits; the oldest (I) stage is dated at ca. 4050-3850 BC, the middle one (II) covers the period of 3500-3150 BC, while the late one (III) coincides with 3150-3000 BC (Fig. 1).

3.2. CORDED WARE COLTURE — THE SOKAL GROUP

Identifying evident ties of the "western" CWC and MDC, and distinguishing within the former the Sokal group, which is defined in taxonomic terms by the said ties [Machnik 1999], are some of the greatest new developments in the study of corded groups. In this volume, a series of sources concerning the Sokal group published earlier together with related radiocarbon dates [Machnik 1999] is supplemented by next grave assemblages [Machnik, An Interrupted Process..., in this volume]. Most importantly, however, the studies of the subject have resulted in the building of a periodization and the precise determining of the absolute chronology of the phenomenon in question [Machnik, An Interrupted Process..., in this volume; Kadrow, Absolute..., in this volume]. In light of the latest analyses, the Sokal group was a product of integration of MDC populations coming in from the northeast into the local population substrate, which represented a late version of the CWC. The group subsisted in the period of ca. 2540-2400 BC with the region of Grzęda Sokalska being infiltrated by MDC societies in the second half of the 26th century or at the turn of the same century BC (Fig. 1).

3.3. MIDDLE DNIEPER CULTURE

Published in 1999 [Kryvaltsevich, Kovalyukh 1999], the first series of ^{14}C measurements for MDC features from the region of the Middle Dnieper, Desna and Pripets rivers consisted of dates for 15 samples from graves and 2 samples from settlements. Considered jointly, they fit into the period of 2530-2790 BC. In this volume, we present two dates referring to hypothetically early traits of the western CWC, namely, the beaker with short-wave moulding from a settlement on site Prorva 4 [Yazepenka, Kośko, Radiocarbon..., in this volume]. The dated samples contained carbon deposit (organic substance) covering the surface of vessels (the already mentioned beaker and an MDC "settlement" vessel). Because of the kind of material and its small amount, ^{14}C measurements have high standard errors and set the interval of 2450-2100 BC. Since both vessels should refer to the same settlement episode, it is justified to narrow down the interval by jointly calibrating both dates. The result is ca. 2291 BC. All calibration results fit into the middle period of MDC populations subsisting on the middle Dnieper [Klochko, Kośko, Szmyt 1999b:276] and correspond to the late Corded Ware culture and the beginnings of epi-Corded groups (Mierzanowice culture) in the drainages of the Vistula and Oder rivers. The measurements make it possible to determine the chronology of infiltration of the "forest" environments of eastern Europe by western Corded Ware elements at ca. 2400-2300 BC.

3.4. TRZCINIEC CULTURAL CIRCLE

The issues related to the Trzciniec phenomenon have witnessed a true revival of interest in the last decades [see e.g. Czebreszuk, Kośko (ed.) 1998; Kośko (ed.) 1998]. In the aspects of chronological studies and comparative analyses of interest to us here, it is for phenomena known as Trzciniec (Trzciniec culture, Trzciniec horizon — TH or Trzciniec cultural circle — TCC) that we record the largest growth in the number of sources on the scale of the Bronze Age. In the case of ^{14}C dates the growth is rapid, indeed [e.g. Grossman 1998; Kovalyukh, Skripkin, Klochko, Lysenko 1998; Makarowicz 1998; Włodarczak 1998]. Consequently, the phenomenon is one of the best dated cultural phenomena of the Bronze Age.

The analysis of a rich series of ^{14}C measurements (almost 190 dates!) concerning Trzciniec features [Górski, Makarowicz, Lysenko, Radiocarbon..., in this volume] confirmed an earlier hypothesis about a gradual spreading of Trzciniec traits from the west toward the east and from the north to the south [Czebreszuk

1998]. The period when fully developed Trzciniec groups lived in the drainages of the Vistula and Oder rivers (so-called western province) can be set at 1900-1100 BC, whereas in the east (in the drainages of the Pripets, Southern Bug and middle Dnieper rivers as well as in Volhynia and Carpathian Foothills) it covers the period of 1650/1600-1000 BC. It must be noted, however, that there are no ^{14}C dates available for several regions playing a special role in the development of the Trzciniec phenomenon, including Mazowsze. Now, we shall focus on the most significant results of the new analyses concerning Trzciniec phenomena in individual regions: (a) on the Polish Lowlands, (b) on the uplands of southern Poland, (c) in Polesie, Volhynia and on the Dniester, (d) on the Southern Bug River and (e) on the middle Dnieper and Desna rivers.

a. On the Polish Lowlands, Kujawy is the most thoroughly investigated region [Makarowicz 1998]. A rich series of ^{14}C dates, critically commented in this volume [see Górski, Makarowicz, Lysenko, Radiocarbon..., in this volume], justifies placing the local version of the Trzciniec horizon between 1950/1800 and 1300/1200 BC. As the cited authors write, the transformation of Iwno structures into Trzciniec ones took place between 1950/1900 and 1800 BC, while the disintegration of the latter occurred in 1300-1200 BC.

b. On the uplands, Trzciniec phenomena developed along different lines in individual regions. On loess uplands of western Poland (Kraków region), Trzciniec traits appeared in the form of a fully developed Trzciniec culture about 1700-1600 BC (possibly a century earlier), while in the Lublin region they emerged much earlier. The decline of the culture in the Kraków region took place ca. 1300-1200 BC, and on Sandomierz loess soils it demised after 1050 BC.

c. Trzciniec circle groups in Polesie can be currently dated at 1700-1600 BC at the earliest, while their decline can be similarly dated at 1200 BC. In Volhynia a small number of ^{14}C dates prevents us from establishing the chronology of local Trzciniec structures with any greater precision (Komarov and Volhynia groups). The presented analyses suggest that after 1300 BC the Komarov group was replaced by the Noua culture on the Dniester.

d. The chronology of Trzciniec circle groups (the Komarov group) on the forest-steppe on the Southern Bug can be determined by referring to the cemetery in Hordeevka which is dated well at 1500/1400-1000 BC [Ślusarska-Michalik, Radiocarbon..., in this volume]; however, one should assume that Trzciniec structures appeared in this region slightly earlier.

e. Similarly, the period of development of Trzciniec structures on the middle Dnieper can be determined, relying on rich ^{14}C evidence from the Malopolovetske site, at 1800-1000 BC.

We attach great importance to the findings that in the western part of the Trzciniec circle, assemblages combining IC and TH traits appeared in 1950/1900-1800 BC, while "purely" Trzciniec ones started appearing ca. 1800 BC [see Czebreszuk

1998]. Meanwhile, in the eastern part of the TCC, assemblages combining Mnogovalikovoy Pottery cotlure and TCC traits may be dated to 1800-1600 BC, while "purely" Trzciniec assemblages began appearing there ca. 1650-1600 BC [Górski, Lysenko, Makarowicz, Radiocarbon..., in this volume] (Fig. 1).

3.5. THE LUSATIAN CULTURE AND THE NORTHERN PONTIC CULTURAL CIRCLE — A QUESTION OF TIME CORRELATION

The current efforts to revise the absolute chronology of the LC using radiocarbon dating methods [Ignaczak 2002] bring home a need to reanalyze the context of "neighbouring cultures". This especially applies to the Northern Pontic cultural circle. In this case (when the use of western Bronze "dating stamps" is restricted), ^{14}C dates lay the major ground for comparative analyses. Bringing alongside dates for the LC and such Pontic cultures as Bilogrudowka (BgC), Chornoles (ChC) and BzC sets the framework for the assessment of their mutual ties in the period from 1500 to 800 BC. More precisely, the research concentrates now on the chronological and cultural identification of "eastern traits" in the LC development, specifically in the Bronze Age IV and V and in Hallstatt C/D periods. Attention is drawn prompting to undertake a detailed research project by the evidence of the scale of pre-Scythian influence: the cycle of BgC → ChC [Ignaczak, Ślusarska-Michalik, Radiocarbon..., in this volume] (Fig.1).

4. CULTURAL UNITS IN THE AREA BETWEEN THE VISTULA AND DNIEPER: 4000-1000 BC. POSSIBILITIES OF HISTORICAL (CALENDAR) CORRELATION

Presented in BPS vols. 7 and 12, ^{14}C dates encourage to make a comparison of the "classic" periodization of the North Pontic Eneolithic and the Bronze Age from 4000 to 1000 BC. At present, the following chronological brackets can be adopted for its individual stages:

(MEA) Middle Eneolithic Age (TC - phase B) = 4500-3500 BC
(LEA) Late Eneolithic Age (TC - phase C) = 3600-2300 BC
(EBA) Early Bronze Age (YC, MDC...) = 3300-2000 BC
(MBA) Middle Bronze Age (CC...) = 2800-1600 BC
(LBA) Late Bronze Age (SC...) = 1600-850 BC

The analysis of the "radiocarbon" divisions brings corrections to the contention about the general northern Pontic dimension of the LEA/EBA/MBA stages

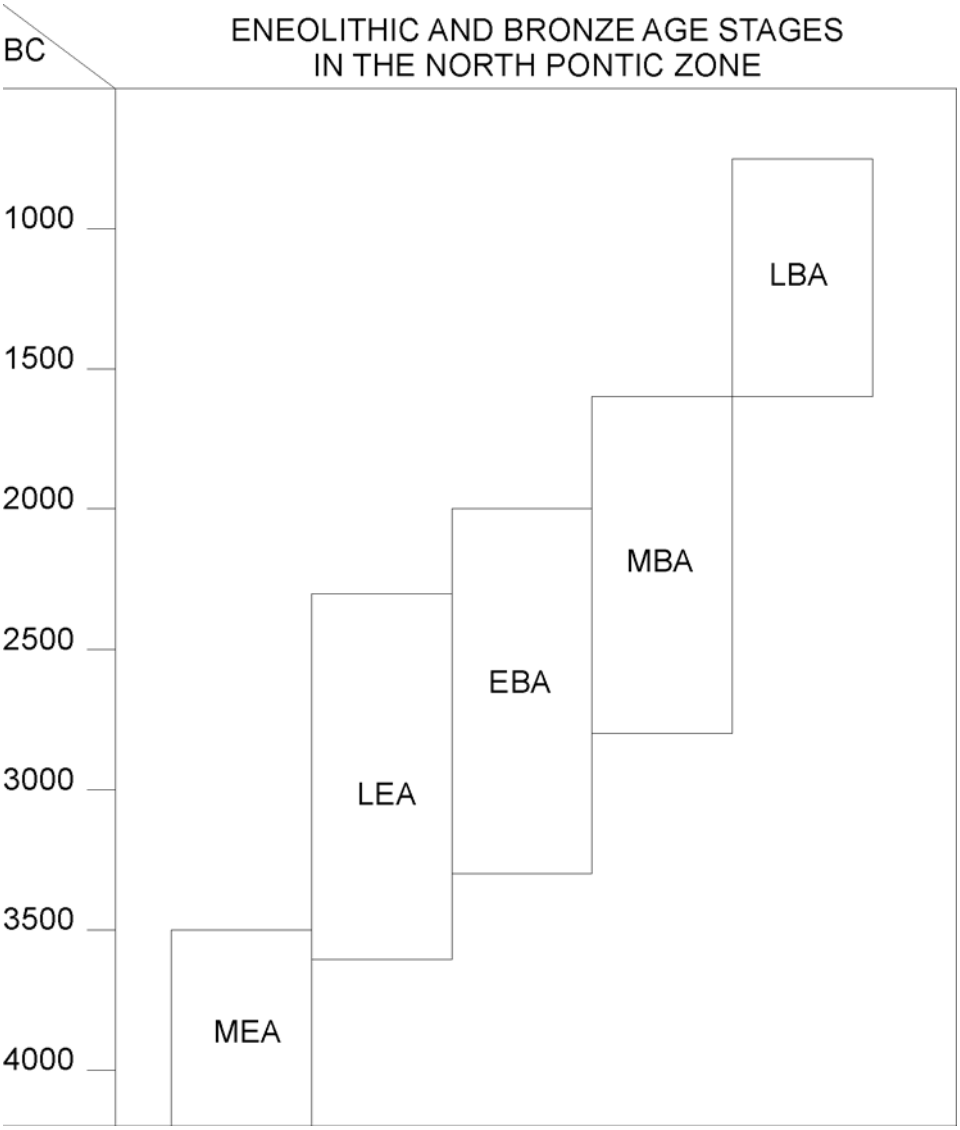


Fig. 2. Radiocarbon chronology of Eneolithic and Bronze Age stages in the North Pontic Zone

(3600-1600 BC), in the case of which we actually deal with three parallel and to some extent separate trends of cultural development (Fig. 2).

The tentative chronological scheme of the series of Pontic time divisions makes one revise their western references. This applies to the taxa in the Vistula drainage from the period of 4000-1000 BC having clear eastern connotations: LVC,

FBC, GAC, CWC, TCC i LC. The Baltic-Pontic development relationships in the 4000-1000 BC period can be now expressed as follows:

MEA (4100-3500 BC)

- Transmission of TC patterns ("Tripolization") to LVC [Bronicki, Kadrow, Zakościelna, Radiocarbon..., in this volume] and FBC environments = early (I) stage of the Mątwy cultural component [Kośko, Radiocarbon..., in this volume],
- Transmission of LVC patterns to the TC zone on the Dniester [Tkachuk 2000],

LEA (3600-2300 BC, TC trend)

- Transmission of TC patterns ("Tripolization") to FBC environments = classic (II) and late (III) stages of the Mątwy cultural component, phases I and II (or better: mainly II) of great settlements on the Bug River [Kośko, Radiocarbon..., in this volume; Bronicki, Kadrow, Zakościelna, Radiocarbon..., in this volume]

EBA (3300-2000 BC, YC-MDC trend)

- Migration of the societies of the central group of the GAC towards the drainage of the Black Sea = the eastern group of the GAC and the Budzhak group of the YC [Szmyt 1999]
- Migration of YC societies to the western CWC zone = phase I of the Wielkopolska-Kujawy group of the CWC [Kośko 1999].
- Migration of MDC societies to the western CWC zone = the Sokal group of the CWC [Machnik 1999; An Interrupted..., in this volume]
- Transmission of western CWC patterns (Wielkopolska-Kujawy group) to the MDC zone = late phase of the MDC [Yazepenka, Kośko, Radiocarbon..., in this volume]

MBA (2800-1600, CC trend)

- Migration of CC societies to the region of the western CWC = the niche-grave horizon of the Kraków-Sandomierz group of the CWC [Włodarczak 1998]
- Migration of the societies of the western branch of the TCC towards the Dnieper drainage = eastern branch of the TCC [Górski, Lysenko, Makarowicz, Radiocarbon..., in this volume]
- The beginnings of stabilization of interregional trails joining the Black Sea and the Baltic Sea [Kośko 2002]

LBA (1600-850 BC)

- Transmission of LC patterns toward the Black Sea drainage = Vysotsko culture, among others
- Transmission of ChC patterns to the LC zone [Ignaczak, Ślusarska-Michalik, Radiocarbon..., in this volume]

The above outline defines the limits of study of the cycle of Baltic-Pontic development relationships. Further research should make the above findings more specific by broadening their taxonomic record, chronology, topogenesis and historical interpretation.

Therefore, we recommend that continuity studies be carried on taking the experience of *BPS* vols 7 and 12 as an inspiration, but not relying on it directly, within the framework of five subprogrames outlined already earlier.

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 Środkowowschodniej, 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	–	Nauchniy 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
SlA	–	Slovenska Archeologia, Bratislava
SPA	–	Sprawozdania Archeologiczne, Kraków
WA	–	Wiadomości Archeologiczne, Warszawa

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The publication is carried out within the research project No. 5H01H02121 financed in the years 2001-2004 by Committee for Scientific Research and supplied with funds of Ministry of National Education and Sport (DWB'2003) and Adam Mickiewicz University Foundation.

ISBN 83-86094-11-7
ISSN 1231-0344