

**THE FOUNDATIONS OF RADIOCARBON
CHRONOLOGY OF CULTURES BETWEEN
THE VISTULA AND DNIEPER:
3150-1850 BC**

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BALTIC-PONTIC STUDIES

V O L U M E 7 • 1999

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INSTITUTE OF EASTERN STUDIES
INSTITUTE OF PREHISTORY
Poznań 1999
ISBN 83-86094-06-0
ISSN 1231-0344

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Cover Design: Eugeniusz Skorwider

Lingvistic consultation: John Comber

Printed in Poland

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

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Editor's Foreword

This volume of the *Baltic Pontic Studies* focuses on the results of the research carried out so far into the absolute (radiocarbon) chronology of the area lying between the Vistula and Dnieper or the bio-cultural borderland between the West and East of Europe. Absolute chronology is treated here both as a research goal and fundamental premise in the broader studies of the chronometric and development synchronization of “borderland” cultural systems. In a series of articles devoted to individual taxa a considerable number of new ^{14}C dates have been compared. The dates concern source materials that have been chosen from the point of view of their representativeness and chronometric value (“short-lived” materials were preferred to minimize a potential error). The vast majority of analyses were purposefully made in the same ^{14}C laboratory of the *State Scientific Center of Environmental Radiogeochemistry of Ukrainian Academy of Sciences* in Kiev taking advantage of funds generously provided by the *Polish Committee for Scientific Research*.

The volume devoted to the “dark” section of the “borderland” history (3150-1850 BC) is the first but not the last publication on the broader issues mentioned above that we intend to present in the near future.

Editorial comment

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

Viktor I. Klochko, Aleksander Koško, Marzena Szmyt

PROBLEM OF TAXONOMIC LIMITATIONS IN THE SYNTHESIS OF THE HISTORY OF BALTIC-PONTIC BORDERLAND IN 3150-1850 BC

In the time interval mentioned in the title, in the physiographic borderland between the East and West of Europe, a cycle of cultural changes took place. One of their consequences was the disintegration of distinct ties joining the societies living in the drainage basins of the Baltic and Black Seas. The cycle was initiated by the disintegration of the great Eneolithic systems of the Funnel Beaker culture (FBC) and Tripolye culture (TC) of common Balkan origin. The territorial successor of the former was the Globular Amphora culture (GAC) and Corded Ware culture (CWC), while the latter was succeeded by the Yamnaya culture (YC), which was foreign to the mentioned tradition [Gimbutas 1956; 1991; Danilenko 1974; Koško 1985; Mallory 1989; - see there for more literature; cf. a different view in Videiko 1994]. The synchronization of the development of the CWC and YC, and later the assessment of genetic relationships between them - a key issue of the European prehistory of the Early Metal Age - is made considerably more difficult. In the areas of old highlands, on the forest-steppe (the most culturally creative), between the upper part of the Dniester's drainage ("limes" of Złota Lipa) [Machnik 1979b:52ff] and the Dnieper basin, a taxonomic "no-man's land" appears, i.e. an area lacking any complexes of sources that could reveal the forms of ties between characteristics of both circles - the CWC and YC. Only in its borderlands - the northern, forest one and the southern, steppe one - do we find poorly explored manifestations of the synthesis of both circles (within the Middle Dnieper culture (MDC) and the Budzhak group of the YC) [Artemenko 1967; 1985; Yarovoy 1985]. A less acute case of the situation can also be found in the relationships holding between the GAC and YC [Szmyt 1996b; 1999b].

It is hard to determine now to what extent this picture is real, i.e. how serious is the deformation caused by the current state of research. Taking notice of the urgent need to verify this doubt, it must be said that the state of "disintegration of ties" should be perceived for the time being as an assessment of a real difficulty in the systematization of the cultural phenomena between the Vistula and Dnieper.

The best way to clear up the doubt would be to undertake field explorations in selected test areas located in the zone under discussion, for instance, in the vicinity of Zhytomyr.

The process continues after the decline of the “proper” CWC and YC, at the stage of late or epi-corded cultures and the Catacomb culture (CC). Its end is ushered only by the emergence of cultures related to the Trzciniec horizon and the Mnogovalikovoi Pottery culture (MPC) [Koško, Klochko 1998; Czebreszuk 1998].

With respect to the period from 3150 to 1850 BC, archaeology based on typochronology experiences a state of “analytical atrophy” between the Vistula and Dnieper. Systems of taxa in the basin of the Baltic and Black Seas are synchronized with respect to one another with little accuracy (“roughly”) making it impossible to place them in the sequences of historical events. This is why even when one records, for instance, “pit-grave” (YC) or “catacomb” traits in the Vistula drainage, it is difficult to venture to assess in greater detail their taxonomic position, not speaking of the qualification of their historical purport.

In consequence of this, several negative attitudes can be observed. One of them is avoiding “inconvenient” issues, another one is interpreting “contrariwise”, i.e. reversing the directions in the circulation of specific patterns (cf. the problem of the origins of Małopolska catacomb graves [Klejn 1964]).

1. THE MOTIVATION AND METHODOLOGICAL ASSUMPTIONS OF THE RESEARCH PROGRAM INTO THE COMPARATIVE CHRONOLOGY OF THE AREA BETWEEN THE VISTULA AND DNIEPER FROM 3150 TO 1850 BC

Drafted several years ago, the program of research into the comparative chronology of the area between the Vistula and Dnieper between 3150 and 1850 BC took for granted the results of many years' work on the absolute dating of prehistoric cultural structures in the said area carried out earlier. These studies were conducted by many scholars in several academic centers [cf. e.g. aspect summaries by Dolukhanov, Timofeev 1972; Mallory 1977; Telegin 1977; 1985; Patokova et al. 1989; Wechler 1994]. Apart from clear advantages like, in the first place, the very fact of gradual building the foundations of the absolute chronology, the efforts also brought about effects that were not entirely satisfying and - in many instances - that were not expected by the scholars.

a. A major shortcoming was an asystematic choice of samples:

- joint discussion of datings referring to different regions of the oecumene, often entirely dissimilar as far as autogenesis is concerned, of a given cultural unit in the study of the radiocarbon dating chronology, and
- a lack of series of datings for sites with a well preserved stratigraphy, of which

there are quite a few in this part of Europe (e.g. *kurgans* with a stratigraphic arrangement of burials belonging to different archaeological cultures).

As a result, the grid of comparative chronology built in this way gave rise to numerous interpretation disputes making obvious the need for organizational work using the so-called microgeographic method [Cofta-Broniewska 1989, see there for older literature], i.e. choosing:

- diagnostic surfaces representative of individual taxa, i.e. regions of a specific position (within the current synthesis) in the history of development of individual societies, and
- source data relating to these analytical units, i.e. records of taxonomically valuable assemblages for which there would be organic materials suitable from the point of view of the ^{14}C method.

Created along these assumptions, the outline of potential openings for a systematic study of the chronometry between the Vistula and Dnieper was a new quality being, however, only a point of departure. We were aware that taking advantage of them in a methodologically satisfying manner called for coordinated field work (cf. the above-mentioned question of the “noman’s land” or areas deprived of any significant sets of chronologically valuable assemblage series [e.g. area of the Budzhak group of the YC - Yarovoy 1985]).

b. Doubts were also raised by the preferences shown in the ^{14}C dating of charcoal and wood, i.e.

- sending for radiocarbon analyses so-called long-lived materials, which could (and in many instances, did!) cause interpretation complications, and
- frequent dating taxonomically dubious sources by this method, if one considers the fact that charcoals are often elements of the natural contents of layers/filling material of features or cultural material older than the investigated feature (effect of digging-in into an older set of sources).

c. It is worth mentioning about incomplete publications of the source contexts of dated samples or even about failures to report information on more detailed taxonomic identifications. Moreover, the available literature provided us with the picture of comparative chronology based on datings made from various materials, at different times and with the use of different technologies of radiocarbon chronometry.

All these reasons (and many other less important but troublesome ones) have given rise to the situation which may be perceived as chaotic: hundreds of datings have been made but there are no satisfactory absolute chronologies in respect of both individual cultures and regions. There are also clear data gaps, e.g. a virtual lack of datings for the GAC [see Szmyt 1996b] and MDC.

The situation presented above was a point of departure for a program of research coordinated by a Polish-Ukrainian research team of scholars from the Adam Mickiewicz University in Poznań (Institute of Prehistory and Institute of Eastern Studies) and the Ukrainian Academy of Sciences in Kiev (Institute of Archaeology

and State Scientific Center of Environmental Radiogeochemistry). The financing for the program was generously provided, for the most part, by the Polish Committee for Scientific Research in a number of individual grants.

The program is based on the following principles:

- most of the radiocarbon analyses are performed in the ^{14}C laboratory of the State Scientific Center of Environmental Radiogeochemistry of the Ukrainian Academy of Sciences in Kiev with the results being randomly verified in other laboratories by “cross-dating” [see Kovalyukh, Nazarov, Radiocarbon. . . ; Skripkin, Kovalyukh, Radiocarbon. . . , in this volume];
- analyses are primarily made of samples of bones or other short-lived materials (e.g. reeds, etc.) and only when these cannot be found, charcoal and wood are used; in this way we avoid undue controversies connected with the “old-wood effect”.
- priority is given to these samples which come from features with preserved stratigraphy; thus it is possible to verify an obtained series with independent data;
- the archaeological context of each dating should be clear; it should be published first in the *Baltic-Pontic Studies* or in another scholarly journal; in this way we avoid “empty” datings, the interpretation of which is practically impossible.

The implementation of these principles has encountered certain complications. We are fully aware of the controversies that may be aroused by the first principle. It has been adopted, nevertheless, as a consequence of the chosen organizational and financial structure. Significant effects are brought about by the choice of bones as the basic material for radiocarbon analyses [cf. methodological problems: Skripkin, Kovalyukh, Radiocarbon. . . , in this volume]. The interpretation of datings of burnt bones, which were the main material for the analyses in the case of the Sofievka group of the TC, presents a particular difficulty [Kovalyukh, Videiko, Skripkin 1995]. Furthermore, in certain situations, as for instance in the dating of materials from old archaeological excavations, it was not always possible to determine with certainty the archaeological context of the sample (the case of several datings for stage CII of the TC and GAC). The use of such uncertain sources, as far as their informative value is concerned, has been forced upon us because of the limited scope of exploration works carried out in Ukraine at present [see also Szmyt, Chernyakov, Radiocarbon. . . , in this volume].

Taking into account all pros and cons, we believe that our approach has turned out to be highly effective. So far, as a result of the program, radiocarbon dates have been obtained in respect of cultural units from Belarus, Poland and Ukraine. The program enlisted the cooperation of a number of people whose earlier contributions to the taxonomic exploration of the area between the Vistula and Dnieper together with collections of sources currently at their disposal guaranteed a high quality of cooperation results. New series of datings, meeting current methodological require-

ments, have been obtained for the following cultures: TC, stage CII (35 datings), MDC (17 datings), YC (45 datings), Kemi-Oba (5 datings), and - for the first time in the literature - for the eastern group of the GAC (12 datings) [see Kadrow, Szmyt 1996b], the CWC with references to the MDC (5 datings), the Kujawy groups of the FBC and CWC (or possibly from the “borderland” of the FBC and the CWC) with “eastern” traits (4 datings), as well as the GAC in Kujawy with “eastern” elements (7 datings). Additionally, in respect of younger cultural groups (the Trzciniec Horizon culture and MPC) samples were examined which were presented in one of the earlier volumes of the *Baltic-Pontic Studies* [Makarowicz 1998; Kovalyukh et al. 1998]. It is worth mentioning that a methodologically similar program was independently implemented also in respect of the CC (24 datings) [Kaiser, Radiocarbon. . . ; Nikolova, Radiocarbon dating. . . , in this volume].

Geographically speaking, the discussed sources come from the right-bank (i.e. western) part of the Middle Dnieper area, the Lower Dniester, Volhynia, Podolia, Małopolska and Kujawy.

2. RESEARCH POTENTIAL

The obtained body of data makes it possible to analyze from various aspects the chronological and cultural situation between the Vistula and Dnieper from 3150 to 1850 BC. In the conclusion of the present volume [Klochko, Koško, Szmyt, A Comparative. . . , in this volume], we outline two aspects of the situation. One of them is the chronology of selected cultural units in different zones of the territory they occupy. This, in turn, allows us to trace out the current foundations of the comparative chronology in the overall “interfluvial” territory.

At the same time, we regard this state of exploration as a register of future research tasks. One of the issues which still remains unclear is the polylinearism of development of cultural systems which for the time being are treated as “blocks”. Similarly inspiring is the verification of the principle of “peripheral survivals” [cf. e.g. the chronology of the decline of the TC Sofievka group: Kovalyukh, Videiko, Skripkin 1995]. The borderland of the East and West of Europe in the said period when agrarian and “pastoral” cultures met continues to be one of the most important research areas in the building of a synthesis of European prehistory.

Any further research shall be recorded in the next volumes of the *Baltic-Pontic Studies*.

Translated by Piotr T. Żebrowski

Nikolay N. Kovalyukh, Sergey V. Nazarov

RADIOCARBON DATING CALIBRATION IN ARCHEOLOGICAL STUDIES

Reliable radiocarbon dating, which displays real historical events, is a top, which all geochronologists with archeologists are striving to. The ^{14}C dating due to the intricate work made by representatives of radiocarbon has nearly been idealized in recent years by raising it in the “absolute” rank. These successes were reached at the improvement (refinement) account of the calibration curves by radiocarbon, which were checked against dendrochronological dating. Building of lengths of sub-calibration curves had exactly reproduced a temporal interval of historical events under study. These studies in separate events have made it possible to receive radiocarbon dating, which had $\pm 10\text{-}20$ years’ mistake.

These successes have forced to take a look in a different way at the chronology and life period of many cultures, which lived on the Eastern European territory during the Ages of Copper and Bronze. Many cultures had had a rather complex way from their spring up to the stopping the existence. Several cultures, which had much in common, now and then, were in contact and lived in parallel over a course of prolonged period. Subsequently they were transformed into a new united culture.

All these stages of separate culture development are possible to be study when leaning upon the exact, reliable radiocarbon dating.

Authors of given article are the representatives of an isotopic geochronology and they have their own sight for ^{14}C dating improvement.

It is necessary to pass a long devious road from a selected by archeologists sample to a radiocarbon dating to be get. And such a road cannot be always finished by the aim achievement. Only the implementation of serious statistics, ^{14}C dating seriated obtained, make it possible to consider realistically one or another chronological length for the culture under study.

A validity degree of radiocarbon dating, obtained from different materials has been considered in this article. Improvement of BP dating calibration programs and a comparison between them by data obtained allows eliminating such kinds of

mistakes, which would disturb subsequently to produce correlation of radiocarbon dating that had been obtained by cultures from different regions.

Finally, the control between laboratories is precisely this one which allows to exclude all doubts and to refer with confidence to radiocarbon dating obtained, which occasionally can make a revolution in archeologists' opinions and which force to take a new glance for the history of our distant ancestors existence.

1. METHODOLOGY OF RADIOCARBON DATING CALIBRATION

Radiocarbon method was based on the suggestion of ^{14}C -isotope concentration constancy in the atmosphere. However, atmospheric radiocarbon concentration depends on the tension and directivities of the earth's magnetic field, cosmic factors and solar activity. The international project on calibration curve building by annual tree rings was created for the reason to fix these change.

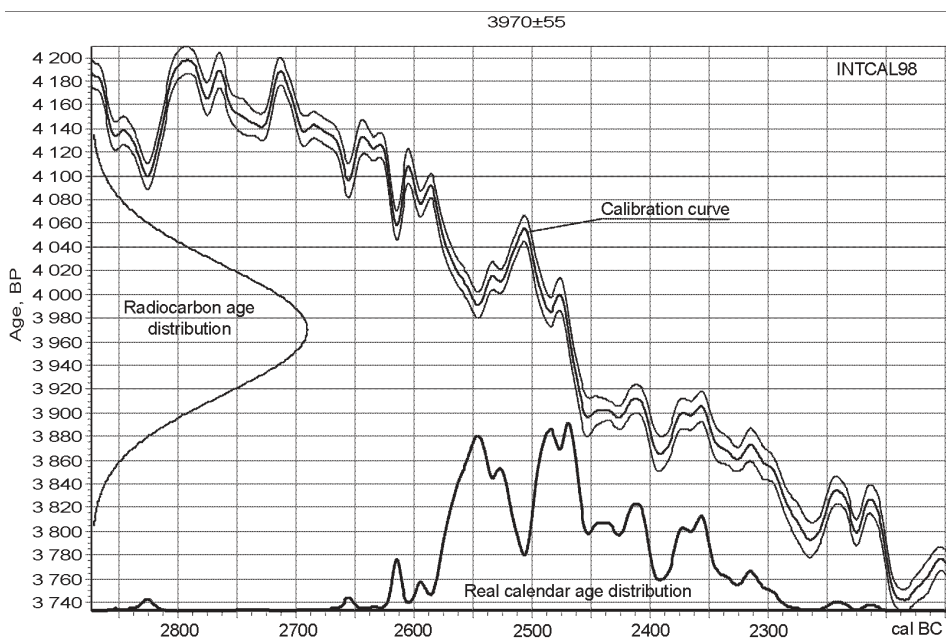


Fig. 1. Graphical presentation of calibration (Ki-6719)

Several unique buried trunks were selected with this aim to calculate the age by their well-saved annual rings. The concentrations of ^{14}C in separate annual tree rings and corals were determined, and the calibration curve up to 24 000 years (INTCAL98) was built [Stuiver, van der Plicht 1998].

The results of calibration are most are presented in the manner of intervals set that had been grouped for 1σ , 2σ and 3σ with corresponding dating probabilities of 63%, 95% and 99% within. Such kind of approach allows being orientated towards the real historical limits of dating. However, the application of intervals complicates understanding of results and does not present with a possibility for their statistical and chronological processing. That is why the necessity appeared of rounding off the calibration results and to present them in a dotted dating manner.

Graphical presentation of calibration is shown on the Fig. 1. Radiocarbon age Gaussian distribution when crossing with calibration curve forms a real historical age. It is possible to define probability of dating to be get in one or another interval by the given distribution - it will correspond to a figure area, which will be cut off by this interval. However an estimate of such probability is sufficiently complex computing process, so it would be simplest to calculate probability of getting a result into the forehand interval, and then to define subsequently this interval only. It was counted that probability of one mistake ($\pm\sigma$) to be brought into the interval is 63%, of duplicated mistake ($\pm 2\sigma$) - 95%, a tripled mistake ($\pm 3\sigma$) intervals are used more rarely, probability of finding wherein forms 99%. The employment of duplicated mistake intervals in practice may be sufficiently.

Principles of historical age determination are shown on the Fig. 2.

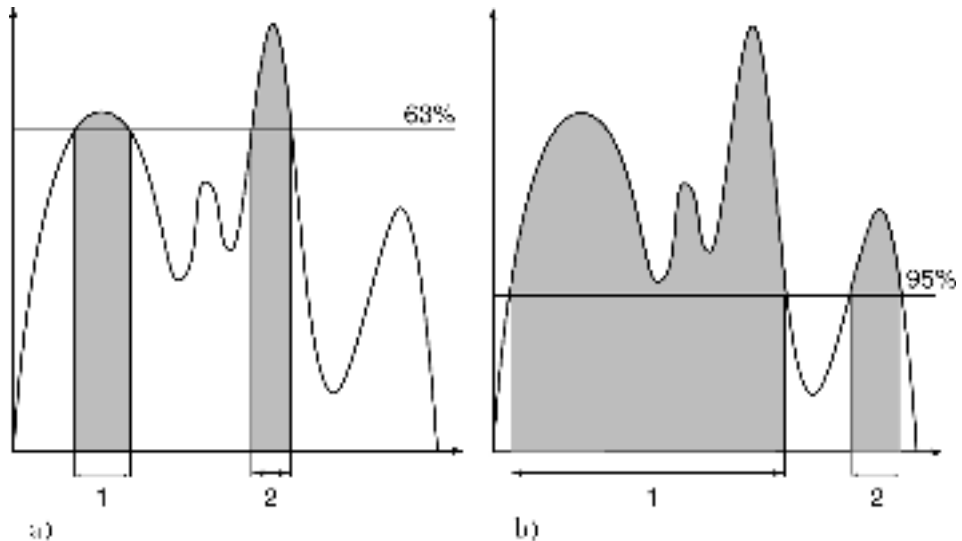


Fig. 2. Determination of calibration intervals: a) for 1σ , b) for 2σ

Calibration curve, as well as radiocarbon age has a measurement mistake. So, it is necessary at intersections of radiocarbon age distribution with calibration curve to take these mistakes into account. The variants of taking measurement mistake into account (σ dating) and the calibration curve mistakes (σ curve) are shown on the Fig. 3 [van der Plicht, Mook, Hasper 1987].

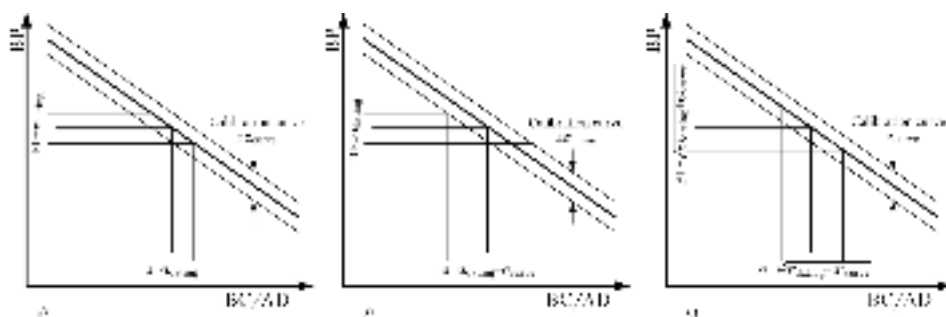


Fig. 3. Variants of taking measurement mistake into account and of calibration curve

The variant 1a does not take a calibration curve mistake into account that gives smaller sizes of calibration intervals as a result. The variant 1b does take both mistakes into account by their addition - it gives a maximum plausible calibration result at the big intervals of calibration. And finally, the variant 1c is the most correct consideration of mistake from the mathematical standpoint. If a calibration curve were presented as a direct line, the variant 1c would be ideal, however a calibration curve is not as such, so each of the presented method of mistakes consideration is meaningful in one or another situations.

Complexities of calibration interval results implementation for the chronological and statistical works have required an alternative view of these results. Certainly, the most demonstrative and suitable can be such a presentation of results as a dotted dating.

2. DOTTED DATING: ADVANTAGES AND DEFECTS

Bernhard Weninger was the first to come forward for this problem decision. He had elaborated a program that presents a result in one interval form; a probability of dating finding out in which is sufficiently great.

The difference between the concepts “dotted dating” and “single dating” if not great, and yet exists. Dotted dating characterizes a concrete dotted value of real

calendar age with a divergence. Thus, it is possible to confirm that the most probable value of real historical age can form just the value of this dot. The age presentation in a single dating form is expressible by a dotted value with a divergence, however this dot is not the most probable value of real historical age. Historical age distribution is shown on the drawing 6 for Ki-7124 dating, the corresponding dotted dating presented by the “Ages” program, and the single dating obtained by the “CalPal” program.

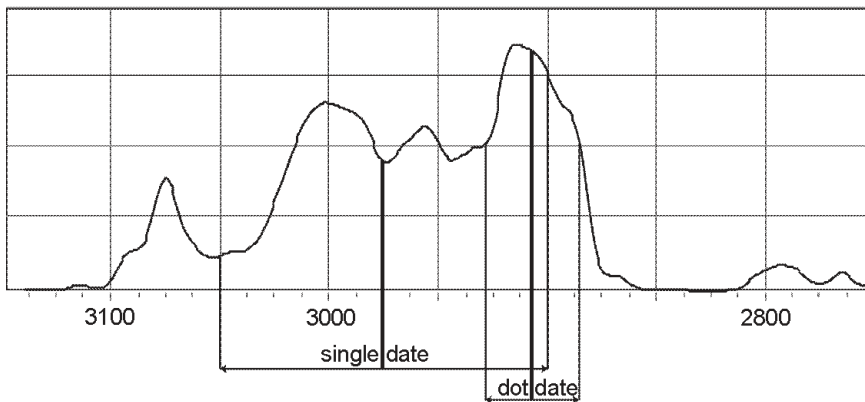


Fig. 4. Comparison between dotted and single dating

Each presentation has its own field of use - a single dating defines a range of dating coming, and it can be used for orientating within its staying limits; a dotted dating characterizes the most probable and narrow sufficiently interval of dating finding out.

Main defect of single dating is a possibility to define broad limits of result - they exceed as a rule the radiocarbon age initial divergences. Different probability of result for dating group is a defect of dotted dating.

3. MATERIALS FOR DATING AND RELIABILITY OF RADIOCARBON DATING OBTAINED

Materials for dating purpose within the range of reliability degree by the radiocarbon dating obtained can be aligned in the following sequence: large fossil bones → wood → organic remains of grasses → large coal → fossil soils → fine charcoal → small fossil bones → clamshells.

Bone material has the major use since it is the very reliable and numerous one when archeological excavations carried out under studies for dating. Calogen of fossil bones is subjected sometimes to a bacterial processing, and the isotopic age obtained under investigation of samples can be distorted as a result of biological fractionation. A correction for fractionation $\delta^{13}\text{C}$, which can be obtained by mass-spectrometric method, must be input for each sample with the goal of all distortions consideration for the age obtained.

The most reliable for radiocarbon dating are tubular bones of normal density, the least suitable are considered friable bones and brainpans which had been built from fine bone plates with friable and porous surface, as a rule.

Wood follows fossil bones within the range of materials safety. The mentioned one is often met at excavations. The reliable radiocarbon dating can be get from the wood samples when correct chemical training had been carried out. However the fact can be taken into consideration that the wood while keeping in the soil is subjected to decomposition, and in the most cases we can deal with the samples presenting a central part of a tree. In these cases dating are to be aged artificially for 50-150 years.

The examples of radiocarbon dating of Yamnaya culture (YC) monuments obtained from different material (tree, fossil bones) are presented in Tables 1 and 2.

Table 1

The results of the Yamnaya culture samples radiocarbon dating (fossil tree) of the Ukrainian territory

No.	Tie			Lab. Number	Age BP
	Location	Sample	Presented by		
1	Vidradne, Novyi Buh Distr., Mykolaiv Region	barrow 1, burial 21	O.G. Shaposhnikova	Ki-7070	3890 \pm 65
2	Vishneve, Tatarbunary Distr., Odesa Region	barrow 17, burial 38	L.V. Subbotin	Ki-7126	4105 \pm 65
3	Novoselitsa, Tatarbunary Distr., Odesa Region	barrow 19, burial 19	L.V. Subbotin	Ki-7127	4055 \pm 60
4	Novoselitsa, Tatarbunary Distr., Odesa Region	barrow 20, burial 8	L.V. Subbotin	Ki-7128	4005 \pm 50
5	Vinogradne, Tomakivka Distr., Zaporizhzhia Region	barrow 15, burial 5	V.V. Otroshchenko	Ki-7129	4145 \pm 55
6	Kremniivka, Volodarske Distr., Donetsk Region	barrow 6, burial 6	S.M. Bratchenko	Ki-7124	4325 \pm 60
7	Kremniivka, Volodarske Distr., Donetsk Region	barrow 6, burial 7	S.M. Bratchenko	Ki-7125	4365 \pm 55

Table 2

The results of Yamnaya culture samples radiocarbon dating (fossil bones) of Ukrainian territory

No.	Tie		Lab. Number	Age BP
	Location	Sample		
1	Ordzhonikidze - 1997	b. 11, g. 90	Ki-6571a	4035±50
2	Ordzhonikidze - 1997	b. 11, g. 11	Ki-6572a	4005±55
3	Golovkovka	b. 6, g. 8	Ki-6719	3970±55
4	Golovkovka	b. 7, g. 4	Ki-6722	3980±60
5	Golovkovka	b. 11, g. 5	Ki-6723	4030±60
6	Golovkovka	b. 12, g. 3	Ki-6724	3950±50
7	Golovkovka	b. 5, g. 3	Ki-6730a	3925±55
8	Golovkovka	b. 5, g. 5	Ki-6731	4005±55
9	Protopopovka	b. 2, g. 2	Ki-6733	3945±50
10	Protopopovka	b. 2, g. 3	Ki-6734	3925±55

Diagram of comparison for calibrated radiocarbon dating obtained by wood and fossil bones (Table 1 and Table 2) is shown on the Fig. 5. From the data obtained one can see that radiocarbon dating presented by wood are more ancient. The earlier dating has been obtained, according to the diagram, for the «Kremniovka» monument - about 3 thousand BC years. However, one important point should be remembered, that we used to compare different monuments of YC, which are situated in different regions of Ukraine. That is why, this question requires an extended discussions for the final conclusions.

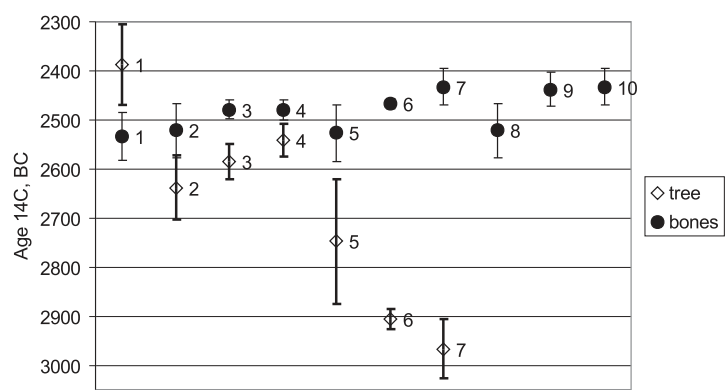


Fig. 5. Comparison of calibrated radiocarbon dating

Table 3

The results of interlaboratory control

No.	Sample	Kiev radiocarbon laboratory		Oxford radiocarbon laboratory	
		Lab. Number	Age ^{14}C , BP	Lab. Number	Age ^{14}C , BP
1	Nikolsky, grave 125	Ki-6603	6160 \pm 70	OXA-5029	6300 \pm 80
2	Yasinovatka, grave 45	Ki-6791	6305 \pm 80	OXA-6164	6360 \pm 75
3	Yasinovatka, grave 19	Ki-6788	6310 \pm 85	OXA-6165	6370 \pm 60
4	Vasilievka 5, grave 29	Ki-6776	6220 \pm 60	OXA-6198	6298 \pm 70
5	Vasilievka 5, grave 8	Ki-6777	6430 \pm 50	OXA-6171	6470 \pm 70
6	Marievka 5, grave 10	Ki-6781	7585 \pm 80	OXA-6200	7620 \pm 100
7	Marievka 5, grave 14	Ki-6780	7600 \pm 100	OXA-6269	7630 \pm 110

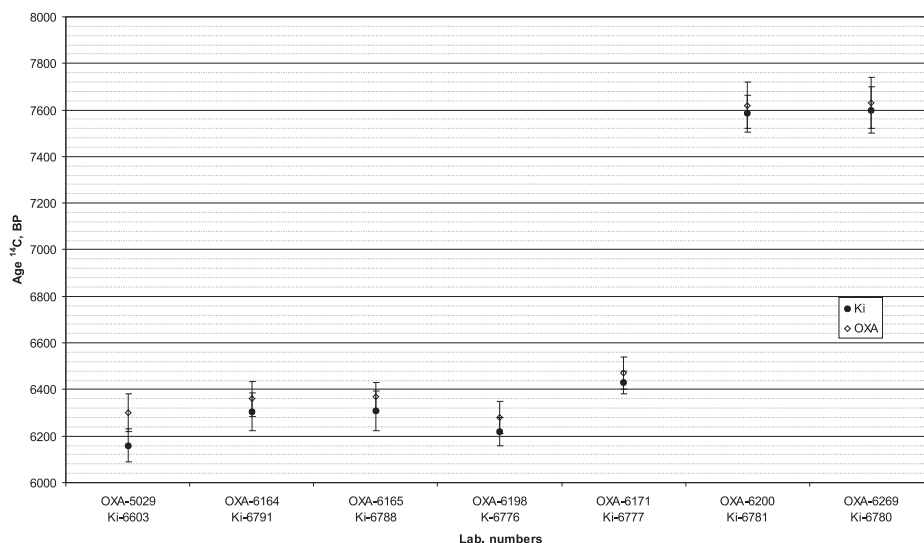


Fig. 6. Radiocarbon dating comparison

It is necessary also to consider a reliability degree of radiocarbon dating obtained by fine fragmental charcoal. As often happens, the archeologists at excavations find a body of fine fragmental charcoal in a cultural layer, which differs in later age from the monuments studied. Such kind of bodies are formed, as a rule, after large fires at the sacrifice of filling rodents and insects burrows with light charcoal transferred by winds and floods. So, it is preferable to use charred wood fragments when getting radiocarbon dating.

Interlaboratory control is one of number reliability and validity criteria for radiocarbon dating obtained as well. Laboratories participating in such a kind of control with a purpose of isotopic dating makes use samples with practically equal radiocarbon contents. There were presented fragments of men skeleton skulls for comparison by radiocarbon between laboratories. Materials for dating had been taken from the different Neolithic burial-mounds, situated through the Ukrainian territory. These materials have been presented to Kiev and Oxford radiocarbon laboratories by prof. D.Y. Telegin. Results of radiocarbon dating are shown in the Table 3. The analysis of resulting data exhibited in the Fig. 6, points to the fact of good coordination between dating obtained by precisely these samples in different laboratories.

4. COMPUTER-AIDED MANUFACTURING OF CALIBRATION

There are some programs for radiocarbon dating calibration. A more widespread amongst them are the following: Groningen radiocarbon calibration program ("Cal25") designed by Johannes van der Plicht at the Center of Isotopic Studies of Groningen University [van der Plicht 1993], Oxford calibration program ("OxCal") designed by Christopher B. Ramsey at Radiocarbon Department of Oxford University [Ramsey 1995] and "CalPal" calibration program of Bernhard Weninger developed in the radiocarbon laboratory of Cologne University [Weninger 1986].

Radiocarbon dating calibration can also be executed by Kiev radiocarbon calibration program "Ages", designed in the radiocarbon laboratory at the State Scientific Center of Environmental Radiogeochemistry of NAN of Ukraine [Nazarov, Kovalyukh 1999]. The program is functioning by IBM PC joint computers under MS Windows 95 operating system management. Main advantages of the program are convenient way in use, interface for lots of languages and possibility for calibration results to be exported in the most widespread graphic formats of files.

The "Ages" program had been written on C++ language and was executed in accordance with Windows 95 standards. All the program functions provided are available through the main menu, but the most abundant ones have been brought to the panel of quick access.

For purpose of dating calibration it is necessary and sufficiently to indicate its radiocarbon age in $BP \pm \sigma$ form. The program allows if needed to add some additional information of dating laboratory number, tie, owner of sample etc. When creating a list of samples it is possible to indicate the sample's name and author. All the data input are stored in the file, which will also be available for a further use on any computer, where the "Ages" program is installed.

Inasmuch as there is sufficiently great amount of calibration curves up to the present day, the program gives a chance to choose one of the curves represented in the form of separate files.

Calibration curve, practically, is presented by a set of dots put down 10-20 years distant of time lapse from one dot to another. Cubic interpolation is used in the program for the curve presentation as uninterrupted curve. Function form between two dots is determined by four dots around ones [Reinsch 1967]. The estimation of radiocarbon age Gaussian distribution is executed within 3σ limits.

There were four programs to be used in order to compare the calibration results: "Cal25", "OxCal", "CalPal" and "Ages". The parameters of primary importance comparison are certainly the results of calibration. The programs "Cal25" and "OxCal" present the results in an interval type, the single dating program is a result of "CalPal" calibration program, the "Ages" program presents a results just as in an interval so in a dotted dating. The calibration results are provided in the Table 4.

Table 4

The results of radiocarbon dating calibration

Lab. number	Cal25	OxCal	CalPal	Ages	
				dot	intervals
Ki-7070	1 σ 2465-2289	1 σ 2470-2280	2355 \pm 95	2388 \pm 82	1 σ 2470-2306
	2 σ 2559-2535	2 σ 2560-2520			2 σ 2572-2515
	2531-2523	2500-2190			2500-2271
	2495-2197	2170-2140			2257-2227
	2163-2145				2223-2204
Ki-7126	1 σ 2861-2811	1 σ 2860-2810	2700 \pm 120	2638 \pm 65	1 σ 2862-2808
	2755-2723	2760-2720			2777-2773
	2701-2575	2700-2570			2758-2720
	2511-2505	2510-2500			2704-2573
	2 σ 2877-2555	2 σ 2880-2490			2514-2501
Ki-7127	2539-2495				2 σ 2880-2471
	1 σ 2835-2817	1 σ 2840-2810	2640 \pm 130	2586 \pm 36	1 σ 2832-2820
	2663-2647	2670-2470			2661-2650
	2625-2487	2 σ 2870-2460			2623-2550
	2485-2471				2542-2491
	2 σ 2865-2807				2479-2474
Ki-7128	2781-2771		2530 \pm 60	2542 \pm 34	2 σ 2863-2807
	2759-2717				2779-2771
	2707-2463				2759-2719
					2706-2464
Ki-7128	1 σ 2575-2511	1 σ 2580-2460	2530 \pm 60	2542 \pm 34	1 σ 2576-2508

Lab. number	Cal25	OxCal	CalPal	Ages	
				dot	intervals
	2505-2467 2 σ 2835-2817 2663-2649 2625-2401 2379-2349	2 σ 2840-2810 2670-2400 2380-2340			2504-2468 2 σ 2828-2823 2658-2652 2622-2607 2602-2458 2419-2406 2358-2356
Ki-7129	1 σ 2869-2831 2821-2805 2783-2769 2761-2717 2709-2661 2651-2623 2605-2603 2 σ 2881-2617 2613-2577	1 σ 2870-2600 2 σ 2880-2570	2730 \pm 100	2748 \pm 127	1 σ 2876-2621 2608-2599 2587-2585 2 σ 2883-2571 2516-2500
Ki-7124	1 σ 3019-2977 2971-2945 2939-2885 2 σ 3261-3243 3099-2865 2807-2781 2771-2761 2719-2707	1 σ 3020-2880 2 σ 3300-2700	2975 \pm 75	2906 \pm 20	1 σ 3014-2981 2963-2951 2927-2886 2 σ 3094-2878
Ki-7125	1 σ 3081-3069 3027-2909 2 σ 3307-3291 3289-3271 3265-3239 3169-3161 3101-2883	1 σ 3080-3060 3030-2900 2 σ 3310-3230 3110-2880	3010 \pm 80	2967 \pm 60	1 σ 3081-3068 3028-2907 2 σ 3260-3241 3099-2884
Ki-6571a	1 σ 2619-2609 2597-2591 2583-2487 2485-2471 2 σ 2857-2813 2735-2725 2697-2463	1 σ 2620-2470 2 σ 2860-2810 2750-2720 2700-2460	2580 \pm 80	2534 \pm 48	1 σ 2619-2610 2597-2590 2582-2486 2484-2472 2 σ 2854-2851 2841-2816 2671-2464
Ki-6572a	1 σ 2617-2613 2579-2465 2 σ 2853-2849 2841-2815 2669-2397 2385-2345	1 σ 2620-2610 2580-2460 2 σ 2900-2800 2700-2300	2540 \pm 70	2522 \pm 55	1 σ 2616-2614 2577-2467 2 σ 2832-2820 2661-2650 2623-2403 2376-2352

Lab. number	Cal25	OxCal	CalPal	Ages	
				dot	intervals
Ki-6719	1 σ 2573-2515 2501-2455 2447-2433 2423-2403 2373-2371 2363-2353 2 σ 2621-2609 2597-2589 2583-2297	1 σ 2580-2400 2380-2350 2 σ 2620-2290	2475 \pm 85	2479 \pm 19	1 σ 2566-2520 2498-2460 2 σ 2619-2611 2596-2592 2581-2306
Ki-6722	1 σ 2577-2455 2445-2435 2421-2403 2363-2353 2 σ 2833-2819 2661-2649 2623-2293	1 σ 2580-2400 2370-2350 2 σ 2850-2800 2700-2250	2490 \pm 90	2480 \pm 20	1 σ 2572-2515 2500-2461 2 σ 2826-2826 2657-2653 2621-2608 2601-2306
Ki-6723	1 σ 2657-2653 2621-2607 2601-2467 2 σ 2861-2811 2755-2721 2703-2455 2449-2431 2423-2403 2375-2369 2365-2353	1 σ 2660-2650 2630-2460 2 σ 2900-2350	2590 \pm 100	2527 \pm 57	1 σ 2620-2609 2598-2588 2584-2470 2 σ 2858-2812 2744-2724 2698-2459 2416-2409
Ki-6724	1 σ 2557-2537 2527-2525 2495-2401 2379-2349 2 σ 2575-2511 2503-2295	1 σ 2560-2520 2500-2400 2380-2340 2 σ 2580-2290	2450 \pm 90	2466 \pm 10	1 σ 2551-2541 2491-2478 2475-2456 2447-2433 2421-2404 2362-2353 2 σ 2575-2511 2503-2295
Ki-6730a	1 σ 2471-2331 2323-2309 2 σ 2571-2517 2499-2281 2251-2233 2219-2207	1 σ 2480-2300 2 σ 2580-2200	2410 \pm 80	2433 \pm 37	1 σ 2470-2396 2386-2339 2318-2312 2 σ 2570-2517 2499-2280 2251-2231 2219-2207
Ki-6731	1 σ 2617-2613 2579-2465 2 σ 2853-2849	1 σ 2620-2610 2580-2460 2 σ 2900-2800	2540 \pm 70	2522 \pm 55	1 σ 2616-2614 2577-2467 2 σ 2832-2820

Lab. number	Cal25	OxCal	CalPal	Ages	
				dot	intervals
	2841-2815 2669-2397 2385-2345	2700-2300			2661-2650 2623-2403 2376-2352
Ki-6733	1 σ 2555-2539 2495-2399 2381-2347 2 σ 2575-2513 2503-2293	1 σ 2560-2530 2500-2340 2 σ 2580-2290	2445 \pm 85	2438 \pm 35	1 σ 2549-2543 2490-2480 2473-2403 2376-2352 2 σ 2574-2513 2501-2293
Ki-6734	1 σ 2471-2331 2323-2309 2 σ 2571-2517 2499-2281 2251-2233 2219-2207	1 σ 2480-2300 2 σ 2580-2200	2410 \pm 80	2433 \pm 37	1 σ 2470-2396 2386-2339 2318-2312 2 σ 2570-2517 2499-2280 2251-2231 2219-2207

Just the same calibration curve - INTCAL98 was used when calibration. Discrepancy between these calibration results are explained by the accuracy of calculations applied in the program and, certainly, by the method of calibration curve and radiocarbon dating errors consideration [van der Plicht, Mook 1987].

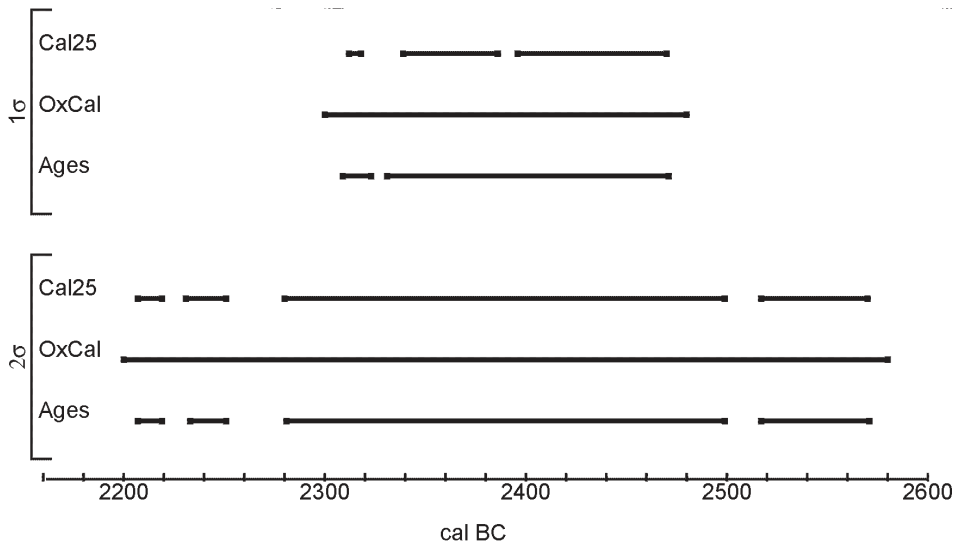


Fig. 7. The results of calibration graphic comparison (Ki-6734)

Fig. 7 illustrates a graphic comparison of calibration interval results for more pictorial visualization of the results.

Comparison of calibration results is the very important question when the programs are compared, however, a list of additional functions provided by the programs, comfort of input-output data, etc. are to be necessary taken into account. The programs "Cal25" and "CalPal" run on under MS DOS operating system, that is why an export of results to another applications is obstructed. "OxCal" and "Ages" are devoid such a defect - both of them run on under MS Windows operating system and have the export means of results.

There is more specific attention paid for exporting of graphical results to the vector formats in "Ages" program, that allows editing easy later on. Suitable print functions allow to make printout easily of both single dating calibration results and dating groups results tables.

5. CONTRIBUTION TO THE YAMNAYA CULTURE CHRONOLOGY

We used radiocarbon dating obtained as to YC of Ukrainian steppe and partially forest - steppe zones for chronological analysis. Full description of YC monuments pointed in the Table 1 and Table 2 is illustrated in the published work of D.Y. Telegin [Telegin 1977].

As for climate-chronological aspect the YC on the territory of Ukraine came into existence on the mark of Atlantic and Subboreal periods changing, about 3200-2900 years BC. Then more severe subboreal climate gave way to warm climate of Atlantic period. The "Kremniovka" monument (it was among those with dating carried out) which was existing in 2970-2900 years BC belongs, by isotopic data, to the monuments of Early YC. Almost without exception all the monuments with dating carried out refer to the Late YC age. A climatic optimum appears in that time (2800-2400 years BC), which promotes demography burst and blossoming forth of YC. Cold and humid climate of Early Subboreal gave way to warm and temperate dry climate - the optimum conditions for life appear - high grasses in steppes, broad-leaved forests in partially wooden steppe zone. A large number of radiocarbon dating, which characterize the main stage of the Late YC development within 2600-2400 years BC chronological limits.

We can conclude by isotopic chronological investigations that YC existed about one thousand years on the territory of Ukraine since the time of its incipience up to its change by Catacomb culture and other ones.

CONCLUSIONS

- a. Radiocarbon dating calibration is a complex mathematical process of natural changes and measurements faults consideration in radiocarbon age finding out, however this process is required for the real history age estimation. Ambiguous approach for these factors consideration explains a difference between calibration results obtained by different calibration programs.
- b. Dotted dating account applied in the program is not ideal, and it requires a further study.
- c. Dotted data obtained are appropriate in the case of using them in a chronological and a statistic information, however the employment of intervals which display all the possible confines of dating finding out would be more correctly for the sample historical age dating determination.
- d. Tubular fossil bones are the best archeological materials so that the plausible data can be obtained by radiocarbon.
- e. Essentially all radiocarbon dating presented of YC through the territory of Ukraine are within the subboreal climatic optimum (4200-3900 BP).

Translated by authors

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RADIOCARBON LS DATING OF BONE MICRO-SAMPLES

Samples of bones from archeological excavations are reliable and often exclusive material for radiocarbon dating. At the same time radiocarbon dating of fossil bones is associated with some difficulties. Porous structure of bones when being in ground absorbs water soluble organic substances, which have age different from collagen of bones. Besides, bone collagen when being in ground is subjected to bacteria and micro-fungus destroying influence. Micro-biota influence leads to breaking of carbon isotopes primary correlation, so called "isotopic fractionating".

The factors mentioned above have an influence particularly on the bone micro-samples dating, in which carbon total contents does not exceed one gram. Micro-samples form not less than 50% in a whole archeological material available for radiocarbon dating. Micro-samples of bone material are the only possible objects in determination of absolute age by isotopic methods for many archeological monuments. It should be given the special attention for primary chemical processing of samples under investigation. An important and inconsistent problem is decided on this stage: as much as possible full removing of introduced organic substances and bad admixtures with keeping simultaneously as much as possible amount of bone collagen, and of bone coal - for burnt bones. It is important for the samples with significant biological destroying of collagen (more than 50%), that stable carbon isotopes correlation with subsequent correcting of radiocarbon age should be defined by masses-spectrometric method.

Methods and strategies. A new complex technology is designed in our laboratory of bone micro-samples primary chemical processing and subsequent carbon dating fractions deposition in a kind of benzene.

Primary processing. Traditional strategy of bone samples primary processing comprises a stage of collagen deposition in a pure substance type [Arslanov 1987]. For this aim the sample reduced to fragments is processed by 0.5% - 2% solution of hydrochloric acid at room temperature. Mineral part of bone consisting of phosphates and calcium and magnesium carbonates is dissolved in hydrochloric acid,

but collagen stays as a jelly-like material. It is important to note that a certain portion of the bone organic material is also dissolved and, moreover, it disappears forever. Subsequent processing of collagen is impeded and requires much time. Hydrated form of collagen is extremely uncomfortable for washing, centrifugation and drying. A great amount of phosphorus and sulphur compounds is abundant in the end product - dry collagen. Phosphorus and sulphur are the most harmful admixtures in lithium carbide producing, and that is why it is necessary to oxidize a collagen beforehand till carbon dioxide with subsequent gas purifying. Multi-stage of traditional technology leads to inevitable losses of carbonaceous substances, that is undesirable particularly for micro-samples. It is impossible at all to select a dating carbon fraction from some types of bone material by traditional technology. So for instance burnt bones contain semi-destroyed collagen and fine-dispersed bone coal. Both components are completely available for the purpose of undistorted radiocarbon age determination, but semi-destroyed collagen is practically completely dissolved in acids, and fine-dispersed bone coal can be deposited only with the help of super-speed and lowefficient centrifugal machines.

Technology developed makes possible lithium carbide production from collagen or bone coal without preliminary deposition of them in a pure kind [Skripkin, Kovalyukh 1998]. The bones for this purpose are reduced to fragments, and after washing with trisodium phosphate solution they are processed by 1-3% hydrofluoric acid. This acid transforms carbonate and partly calcium phosphate into fluoride. Calcium fluoride does not dissolved practically in weak acids, but change of CO_3^{-2} and PO_4^{-3} volumetric anions for compact F leads to genesis of mineral matrix which is porous and cleaned from organic-silicate complex. Collagen in this case exists in semi-bound nonhydrated state. Essential advantage of hydrofluoric acid is its ability to dissolve silicates and humic acids as well as products of bacteria vital activity absorbed on them. It make it possible to remove introduced organic substances and carbonic carbon, to wash and dry the processed sample easy and qualitatively. The losses of bone organic substances or bone coal are minimum under such processing [Kovalyukh, Skripkin, Sobotovich 1996].

The sample subsequently is reduced to fragments and mixed with manganese dioxide for lithium carbide production by technology of "vacuum pyrolysis" (*the direct chemisorption into a lithium alloy of carbonaceous gases produced by the controlled thermal degradation of organic materials under vacuum*).

This technology is based on combination of two processes: thermal breakdown of organic sample and chemical absorption of gaseous products by lithium. Reactor construction and elements of technology are shown on the figure 1. Synthesis is carried out within the reactor made of stainless steel with metallic lithium placed on the bottom, but the sample is seated inside the titanium glass. The glass with the sample is held at the optimum height in the tubular holder, which directs a gas flow for the melted lithium. Such location of lithium and carbonized sample permits

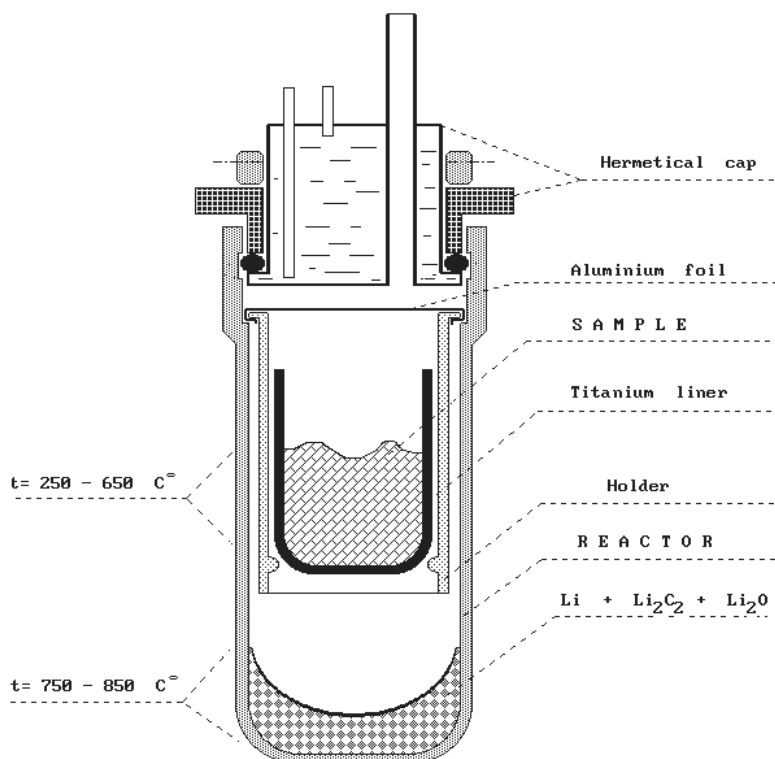


Fig. 1. Reactor construction and elements of technology

temperature regulation to be made within the area of thermal breakdown (and consequently gassing velocity) without temperature changing within the melted lithium area. Reactor is inserted into the stove at optimum depth, and is fixed in such a position. When temperature conditions are properly chosen a velocity of chemical absorption of thermal breakdown gaseous products by metallic lithium slightly exceeds a sample thermal breakdown velocity. The reactor pressure is stabilized at 0.1-0.2 atm. This promotes raising of thermal breakdown light - volatile products gassing and prevents condensation of these materials for reactor walls.

As a result of running processes the collagen is converted into a volatile organic combinations and into a bone coal. Addition of manganese dioxide plays an important role. When the temperature is above 550°C the manganese dioxide disintegrates with active oxygen liberation all over the volume of mixture. Oxygen liberation runs quietly, under the broad range of temperatures ($550-940^{\circ}\text{C}$). Fine-dispersed bone coal therewith is oxidized till carbon oxide and dioxide, and in such a kind it is absorbed by melted metallic lithium. An essential feature of manganese oxides is

their ability to link phosphorus and sulphur in thermal stable combinations. This allows getting lithium carbide of high quality, and what is more - practically from the whole carbon content of bone organic substances. Formation of lithium carbide runs without complications with high output. Lithium oxide, hydride and nitride are also formed in parallels with carbide. Lithium hydride and nitride are completely destroyed under short reaction volume vacuuming at the end of process. The reactor of reduced volume (400 ml³) was designed for fossil bones micro-samples that has made it possible to reduce greatly the losses on this stage.

Lithium carbide is subjected to hydrolysis, and gassing acetylene is converted into benzene on vanadium catalyst. Vacuum system for benzene syntheses is made from materials, which adsorb not at all acetylene and benzene. Internal volume of vacuum line has its minimum possible meaning. Constructive particularities mentioned above allow to reach 95-97% benzene output to the total exclusion of the memory effect. As a result of summation of new complex technology advantages the possibility appears for bone samples dating carrying-out with collagen total contents up to 250-300 mg.

The complex chemical technology of lithium carbide production from fossil bones samples had been tested comprehensively. The samples of different type bones as well as of their different preservation after their reducing to fragments and quartering were processed in parallels by both traditional and new methods. The results obtained were compared and analyzed. The samples age in parallel series coincided within the limits of instrumental error under measurement practically in overwhelming majority of cases. Moreover there was a success in dating some tests by only new method of chemical bones processing application. Samples with obviously denominated rejuvenating influence of humic acids were equally well cleaned from the last ones both by washingout with alkali or trisodium phosphate and by the action of hydrofluoric acid. Laborious process of the new complex approach and a temporal period spent for it was found 5-10 times less than for the traditional method of bone material radiocarbon analysis. The most typical results of two methods comparisons are shown in the Table 1.

Traditional technology of collagen deposition stipulates humic substances removing by 0.1% NaOH solution processing. As a rule, humic substances are of younger age with respect to collagen, and they are present within the bone samples in a kind of silicon oxide and soil organic material re-precipitated conglomerate. If used new technology the humic substances are removed from the bone samples together with silicates at the processing stage by hydrofluoric acid. Silicon oxide is completely dissolved in hydrofluoric acid solution, and humic substances precipitated on silicates form pseudo-solution.

One can see from comparative experiments carried out that new technology completely satisfies requirements for the samples purification from humic substances. Comparison was carried out for the samples of different preservation and ar-

Table 1

Comparative dating of fossil bone samples by the traditional technology and by "vacuum pyrolysis" method

No.	Sample		Lab. numb	Age ¹⁴ C, BP
1	Ordzhonikidze (excavations 1997), b.11, g.8	Traditional method	Ki-6827a	3890±50
		Vacuum pyrolysis	Ki-6827b	3910±45
2	Golovkovka, b.3, g.1	Traditional method	Ki-6718a	3905±55
		Vacuum pyrolysis	Ki-6718b	3920±60
3	Ordzhonikidze (excavations 1980), gr. Chorna Mogila, b.3, g.17	Traditional method	Ki-6553a	3710±60
		Vacuum pyrolysis	Ki-6553b	3745±50
4	Semionovka (excavations 1990-91), b.1	Traditional method	Ki-6688a	6800±60
		Vacuum pyrolysis	Ki-6688b	6980±65
5	O. Surskoy b.II (excavations 1946), sq.7	Traditional method	Ki-6691a	7230±55
		Vacuum pyrolysis	Ki-6691b	7245±60
6	Solonoe Ozero IV (excavations 1990)	Traditional method	Ki-6202a	12805±95
		Vacuum pyrolysis	Ki-6202b	12890±100
7	Novovladimirovka II	Traditional method	Ki-6203a	19290±85
		Vacuum pyrolysis	Ki-6203b	19340±95
8	Dmitrievka, Upper late Paleolithic layer of seat	Traditional method	Ki-5826a	16495±100
		Vacuum pyrolysis	Ki-5826b	16520±95

cheological age. If the samples come under the age period of 12-19 th. BP, «vacuum pyrolysis» method gives even more ancient results, that points to the fact of more complete and selective removing of introduced organic substances. The collagen losses are likely be reduced considerably when humic substances removing technology by hydrofluoric method of organo-silicate component dissolving is in use.

Measurement of benzene micro-samples is carried out into the specially developed micro-vials with the help of "Quantulus" - low-background spectrometer [Buzinny, Skripkin 1995]. Micro-vials are made of high pressure non-porous teflon. Holders for micro-vials are made of high purity titanium, and they are provided with by the screen to prevent "cross-talk" effect. Constructive particularities as well as the chosen materials enable high counting features to be get (Table 2).

As a result of biological processes, which have been going on within the system bone - soil microorganisms, the natural relation between three main carbon isotopes (^{12}C , ^{13}C and ^{14}C) experiences certain changes. These changes can be increased additionally during the process of carbon collagen form chemical transformations into benzene one.

Table 2

Counting features

Vial volume (ml)	Benzene loss per 24 hour (mg)	Bg (cmp)	^{14}C efficiency (%)	FM	FM (E2/BG)	t_{max} (year)	t_{max} (year)
0.85	less than 0.10	0.11	82	23.2	61127	48050	80

Table 3

Comparative dating of fossil bones samples macro and micro increments (Yamnaya culture)

No.	Sample		Lab. numb	Age ^{14}C , BP
9	Protopopovka, b.1, g.4	Macro	Ki-6733a	3945 ± 50
		Micro	Ki-7130	3920 ± 70
10	Protopopovka, b.2, g.3	Macro	Ki-6734a	3925 ± 55
		Micro	Ki-7131	3910 ± 60
11	Ordzhonikidze (excavations 1997), Shakhta 22, b.2 g.6	Macro	Ki-6833	3900 ± 55
		Micro	Ki-7132	3930 ± 70
12	Golovkovka, b.6, g.8	Macro	Ki-6719	3970 ± 55
		Micro	Ki-7133	3960 ± 60
13	Golovkovka, b.11, g.5.	Macro	Ki-6723a	4030 ± 60
		Micro	Ki-7134	4035 ± 60
14	Golovkovka, b.5, g.5	Macro	Ki-6731	4005 ± 55
		Micro	Ki-7135	4020 ± 70
15	Golovkovka, b.7, g.4	Macro	Ki-6722	3980 ± 60
		Micro	Ki-7136	3940 ± 70

In evaluating radiocarbon age the correction is being taken in account for biological isotopic fractionation. Undertaking such an operation is possible due to welldefined relationship between the deflection of ^{13}C isotope concentration and the degree of 14 isotope fractionation. Practically $\Delta^{14}\text{C} = (\delta^{13}\text{C})^2$ equality is persisting. For this aim the determination is made on variation in concentrations of ^{13}C isotope in the ready benzene by mass-spectrometric method. This factor usually falls within the limits $-18.5 < \delta^{13}\text{C} < d^{13}\text{C} < -20.7$ promille. For such kind of samples, which had been under considerable effect of soil microorganisms, this factor can reach - 16 promiles, whereas together with chemical fractionation it may

even come to 14 promile. It means in practice that samples misrepresentation by age in something like BP=5000 years can reach 250 years. Correction entering for the isotopic fractionation is currently central for micro-samples, since such samples have as a rule a fine bone layer, being easy permeable for natural destroying agents.

The work carried out in our laboratory on Yamnaya culture archeological monuments dating is an inherent example of radiocarbon method applying for fossil bones micro-samples.

As one can see from the data mentioned above in the Table 3 the ages of the bones micro-samples derived are coincided within the limits of error in measurement with those ages derived from the same samples, taken in macro amounts. Small rejuvenation for the micro-tests is caused by comparatively most background effect stipulated by the cosmic radiation. These deviations can be taken into account subsequent to the complex comparative checking, including mathematical statistics are carried out.

Conclusions. Complex technology has been designed with the purpose of fossil bones micro-samples dating, which has shown reliability of high degree for resulting dating. All the stage of new technology had passed all-round inspection for the convergence of results with respect to the traditional methods. Represented technology allows getting reliable results for those kinds of samples, which could be not dated earlier by traditional method.

Translated by authors

Mihailo Y. Videiko

RADIOCARBON DATING CHRONOLOGY OF THE LATE TRIPOLYE CULTURE*

This article is dedicated to the radiocarbon chronology of the late period of the Tripolye culture (TC) (Tripolye-CII, according to the period division of T. S. Passek [1949]). The development of this topic is important for the reconstruction of the ethnic cultural situation on the territory of south-eastern Europe in the second half of the 4th - first half of the 3rd millennium (BC), in other words, at the end of the Neolithic Age and the beginning of the Bronze Age.

For the creation of the isotope chronology of the late TC, we currently possess a set of 35** ¹⁴C dates deriving from 12 monuments of the C-II stage (Tables 1-12). These represent all the major territorial groups of TC, including the Dniester, the Northern Pontic area, Volhynia, and the basins of the Southern Bug and the Middle Dnieper rivers (Fig. 1).

Here we will speak about the following groups of the late TC: Gorodsk - Troyaniv, Sofievka, and Usatovo. For a long time, this period has been dated according to 10 dates obtained essentially for Usatovo type complexes. Seven of these dates were defined for Mayaki settlement and one for each of Gorodsk settlement, and the Usatovo and Danku II cemeteries.

Thus, it was hardly possible to date all the local variants of the late TC. It is also worth noting that nowadays the term "TC CII", for the naming of the cultural complexes in the region of the Prut and the Dnieper river basins, is used in deference to tradition. In reality, there existed archaeological cultures, still referred to in literature as local types or variants of the TC, that had been formed under the strong influence of the cultures of central and southern Europe.

The 25 new dates obtained in Kiev laboratory allow us to date those cultural types. Eight dates published in the *Baltic - Pontic Studies* were for cemeteries of the Sofievka type [Kovalyukh, Videiko, Skripkin 1995: 135-140; Kadrow 1995: 141-147].

* Project was financed in part with grant no. 1H01G01810 provided by the Polish Committee for Scientific Research in 1996-1998.

** The paper ignores a series of dates (11) from the Akkimbekskiy kurgan concerning the Usatovo group of the TC [Szmyt, Chernyakov, Radiocarbon. . . , in this volume] - editor's note.

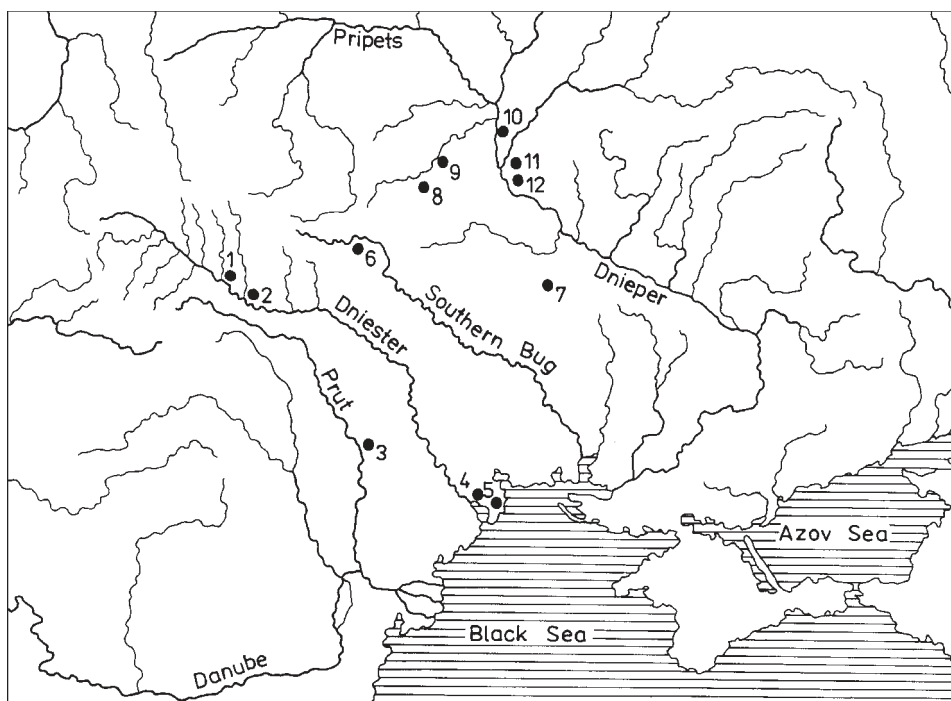


Fig. 1. Location of ^{14}C dated sites of the late Tripolye culture (phase CII).

1 - Zhvaniets; 2 - Tsviklovtsy; 3 - Danku II; 4 - Mayaki; 5 - Usatovo; 6 - Sandraki; 7 - Vilkhovets (Olkhovets); 8 - Trojaniv; 9 - Gorodsk; 10 - Zavalovka; 11 - Krasny Khutor; 12 - Sofievka.

A number of dating for cemeteries of the Usatovo type were published in articles included in this volume. Seventeen datings and the corresponding materials for them, deriving from late TC settlements, are published below. The samples for dating were mostly selected from the materials stored in scientific collections of the Institute of Archeology of the National Academy of Sciences of Ukraine (Sandraki, Trojaniv, Zhvaniets) or of the National Historical Museum (Zhvaniets, Tsviklovtsy, Trojaniv). In the latter case, it was not always possible to identify accurately the source of samples from particular complexes. Four samples deriving from Vilkhovets settlement were examined by the author of this article in 1993 [Videiko 1994:25-26, Fig.15].

The article comprises a short description of the dated complexes from 12 late TC sites (settlements and cemeteries); an analysis of the results obtained; an essay on the isotope chronology of the late period of TC, containing a historical-geographical review of the issue; and relative and absolute chronologies of the TC CII.

1. DESCRIPTION OF THE DATED COMPLEXES

1.1. SANDRAKI

Table 1

Sandraki - the dated complexes

Settlement	Complex - material	Stage	index	BP	BC
Sandraki	sq.3-7, hearth - bones	TC, C-II	Ki-6746	4175±50	2270±92
Sandraki	sq.3-7, hollow - bones	TC, C-II	Ki-6747	4210±45	2790±81

The settlement is situated near the village of Sandraki in the Khmilnyk District of Vinnitsia Region (Fig. 1). In 1949-1950, it was explored by an Southern Bug archaeological expedition under the supervision of O.F. Lagodovska [Lagodovska 1956:118-129]. The materials are stored in the scientific collections of the Institute of Archeology (Kiev). The finds from this settlement illustrated the multi-level character of the monument. The settlement is situated beyond the eastern border of Sandraki village, on the high cape dune presently known as Pagurok. Pagurok faces a streamlet valley with steep slopes, difficult for climbing. Above the streamlet valley, the site rises to 20-22 metres. Its upper ground has an oval form, extended in a western direction, 90 metres long, 50 metres wide. Its area is 0.4 hectares. From the field on the eastern side of Pagurok, there is an easily-distinguishable bank and ditch, and a further bank and ditch which are almost impossible to make out. Remains from three epochs were discovered in the cross-section: 17th-18th Century, Bronze Age, and TC CII. The samples for dating were selected from among the materials obtained during excavations of the overland dwelling of 50 m². This had a long rectangular shape, extended in a north-east - south-west direction. The remains of the building consisted of burnt clay of a red-and-yellow and reddish colour, lying on one level 0.08 - 0.15 m wide.

After sorting these remains, it was detected that under it, in the loam, there was a further cultural layer, represented by fragments of late TC ceramics, animal bones etc. These finds were lying in a spread and fragmented way and did not form any concentrations. The majority of the finds were ceramics, found in a very fragmented condition.

In the opinion of the researcher, two major groups were of ceramics: ceramics with an admixture of mica and sand; and painted ceramics with no admixture. The first group, decorated with engraved or cord-patterned ornamentation, represents 86% of the ceramics found (Fig. 2). Those with rope ornamentation essentially consist of cups and wide-mouthed vessels, kitchen pots etc. Semi-spherical vessels with

a slightly internally-curved upper brim are very typical. The vessel brim is often typically obliquely cut towards the middle. The ornamentation is usually found on the external under-edge of the cup and on its edge cut aslant to the middle. Fragments of cups decorated internally occur only rarely; the ornamentation consisting of “caterpillars” or small curved sickles. Occasionally, there appears a scheme of a horizontal row of cords, alternated with a similar vertical row (Fig. 3). A fragment of the lower part of a cup with the image of a cross in its centre is of special interest. Here, in the technique of cord pressing, an ornament typical of painted Usatovo vessels is repeated. The cord ornamentation of the pot-like vessels, similar to Usatovo ones, is also especially worth noting.

The ceramics with a herbal admixture constitutes a separate group and is represented by a small quantity of fragments. The general character of ceramics with a deep ornament is similar to that of the late TC settlements of Gorodsk, Raiki, Nova Chortorya etc.

The other group of ceramics (Fig. 4), comprising 14% of the total find, is characterised by highly-purified clay of a ceramic paste with no admixture or with a large amount of very small-grained sand. The colour of the ceramics is light pink and yellow, sporadically turning into red. The painting was done in dark brown or black paint, often mixed with red. The following forms occur: large two-handled vessels with high shoulders, pot-shaped vessels, wide-mouthed vessels with bulbous handles; middle-sized wide-mouthed vessels with short, slightly narrowed necks; cups; platters etc. Such ceramic shapes are typical for ornamented ceramics of late TC complexes. The ornamentation consists of straight lines, curved lines, nets and other elements. One distinctive pattern is an ornamentation of wide plaited strips, consisting of multiple parallel lines, densely covering the surface of the vessel.

An examination of pottery from Sandraki settlement showed that included in the group of kitchen utensils was ceramic pottery with a polished surface, occasionally covered with red paint, analogous in production technology and in shape to those observed in Baden culture. On the brims of the pots, for example, there appear “stuck rolls” (separate rolls of clay stuck to the vessel before firing) with pinches, similar to the strongly contoured Baden “horn”-style, shoulder-placed handles.

The plastic arts are represented by fragments of figurines of women standing and figures of bulls.

The flint artefacts, bones, and clay fragments represent tools. The flint artefacts were made of half-nished products mostly of light and dark-grey flint of local origin. Artefacts of transparent flint of brownish tones were also found. There were the following types of products representing tools scrapers on blades, blade knives, axes, chisels, triangular arrowheads (with a straight base), as well as tools made from bone: a horn, strikers, tetrahedral awls, pressers, and mattocks. A find of eight large flakes (15 to 19 cm long), buried in loam under the floor of the dwelling, should also be mentioned. All the flakes were split from the same nucleus. Numerous ceramic

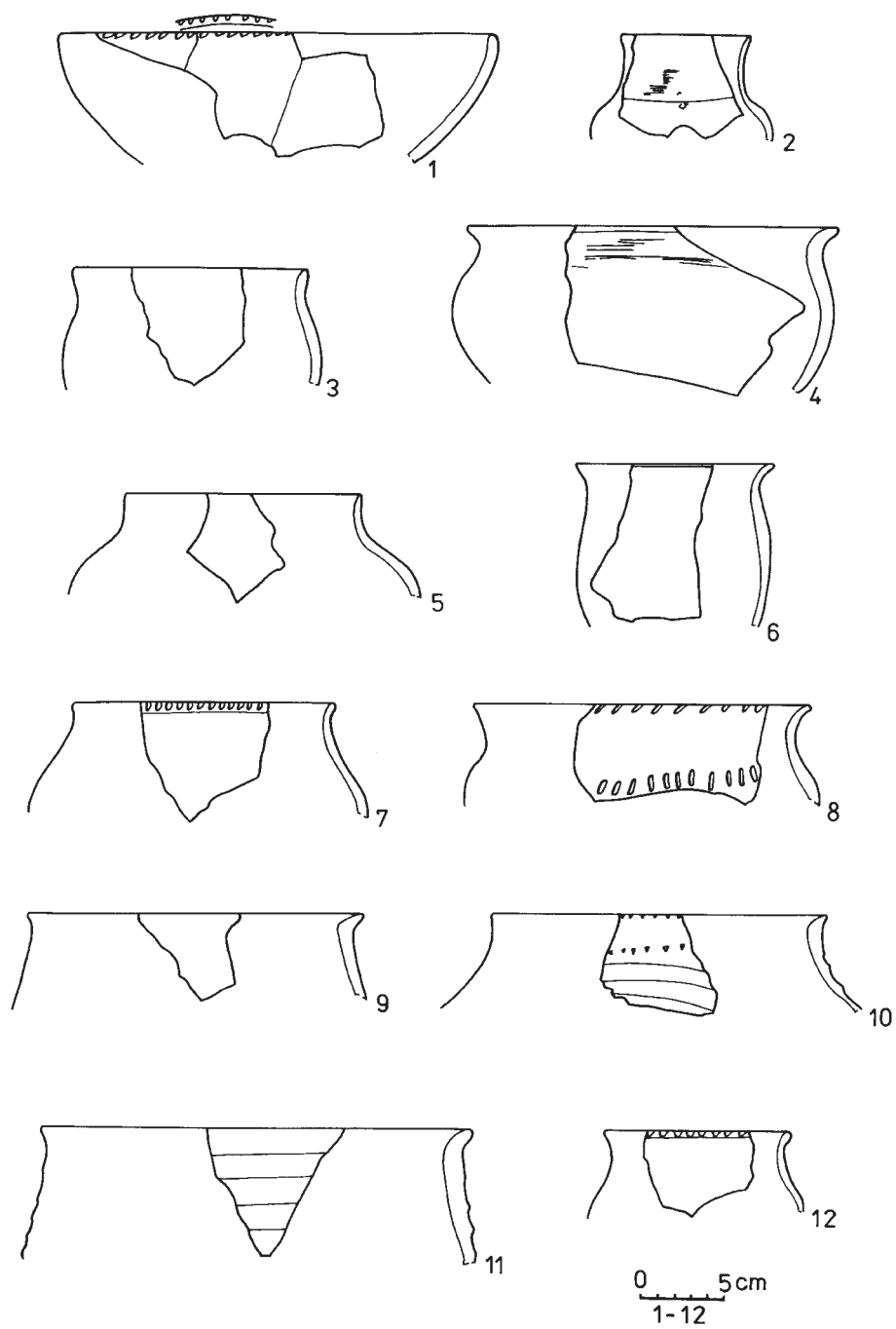


Fig. 2. Sandraki, Vinnitsia Region. "Kitchen" pottery

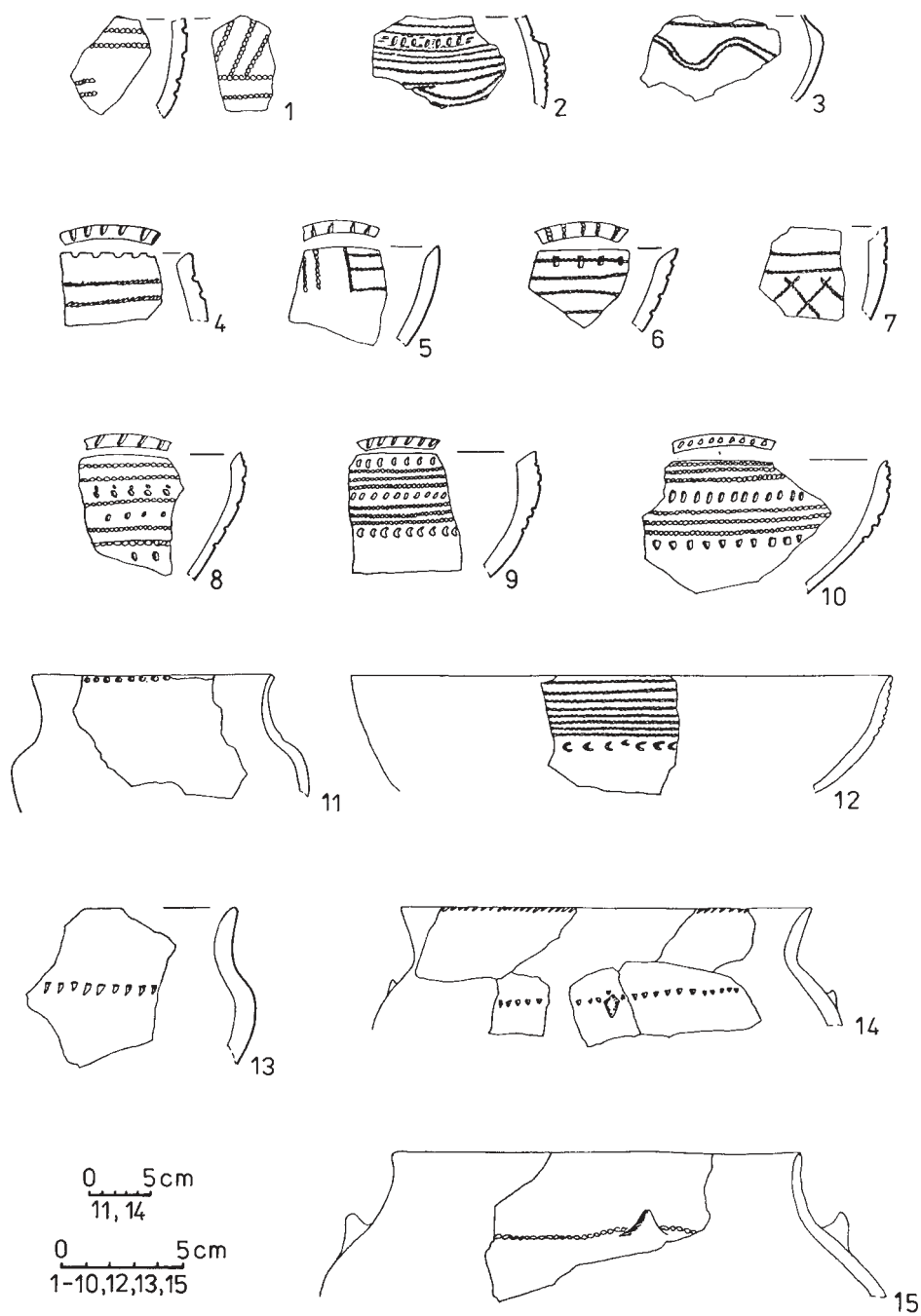


Fig. 3. Sandraki, Vinnitsia Region. Pottery with corded-stamp ornament

spinners decorated with incisions or engravings were discovered in Sandraki, too, along with clay weights for vertical looms, decorated with point-like die incisions and line engravings. Furthermore, in the dwelling, the bottoms of vessels with prints of textile set during pottery production were discovered [Lagodovska 1956:122-128].

1.2. ZHVANIETS, SHCHOVB SITE

Table 2

Zhvaniets, schovb site - the dated complexes

Settlement	Complex - material	Stage	index	BP	BC
Zhvaniets, Shchovb site	surface dwelling 2 - bones	TC, C-II	Ki-6743	4480±40	3209±106
Zhvaniets	dug-out 6 - bones	TC, C-II	Ki-6744	4355±60	2965±89
Zhvaniets, Shchovb site	dug-out 1 - bones	TC, C-II	Ki-6745	4530±50	3205±98
Zhvaniets, Shchovb site	embankment - charcoal	TC, C-II	Ki-6753	4290±55	2939±91
Zhvaniets, Shchovb site	? - charcoal	TC, C-II	Ki-6754	4380±60	2984±78

This late TC settlement is situated near the village of Zhvaniets in the Kamianets Podilskyi District of Khmelnytskyi Region. It is located on a high dune washed from three sides by the rivers Zhvanchyk and Karmelitka (Fig. 1). A part of the settlement was destroyed by quarrying, and a section of the TC level has shifted down from the dune. T.G. Movsha [1970; 1973] explored the settlement. The samples selected for dating are from the ground of surface dwelling 2, dug-outs 1 and 6 (animal bones), the embankment, and an unidentified complex (charcoal).

A protective bank and ditch fortified the settlement on the side of the field. The front of the earth bank and the ditch in front of it were laid out with large stone flags. On a plateau, beyond the boundaries of the settlement, a production complex consisting of two-levelled furnaces and places for clay mixing was explored. The furnaces lay in three rows over the slope of the dune [Movsha 1970:85-86]. Dwelling (ground?) 2 was a rectangular building of frame column construction, measuring 7 x 6 m, the walls and floors of which were smeared with clay plaster. The remains are satisfactorily preserved. On the ground of the dwelling, a small quantity of flint artefacts, a couple of horn mattocks, fragments of painted and kitchen pottery, and some ceramic spinners were discovered. Dug-out 1 is a trough-shaped hollow, measuring 3.8 to 7.1m, partially destroyed. Its depth below the present surface is up to 1.1 m. The bottom is uneven, partially laid out with stone flags of local origin. The remains of masonry (?) were discovered near the southern boundary. The remains

of three fire-places, also flagged, were explored. In addition to horn articles, a grain grater, stumpers, mattocks and battle-axes made of horn were found, as well as some bone awls and a number of flint artefacts - plates, flake and plate scrapers, and chips from a sickle. There are relatively few ceramics - most notably: a table, painted vessels, semi-spherical plates, pots, and some vessels with a conical mouth. The painting was done in black and red. The ornamental compositions consist of semi-ovals and strips. In the middle of the ovals and semi-ovals, compositions of images of people and animals were drawn. What little kitchen pottery was found is made of clay, with an admixture of shell fragments or sand. These vessels are decorated by cord prints in the area under the edge, and with conical "stuck" adornments on the shoulders.

Among other pottery were found ceramic weights, spinners formed of vessel bellies, or conical with a concave base, and a fragment of an anthropomorphic figurine.

T.G. Movsha published data concerning finds of pottery of the Funnel Beaker culture (FBC) (7 fragments and 1 restored vessel from dwellings 1 and 2 of the Zhvaniets - Shchovb settlement [Movsha 1985a:24-26, Fig. 2-4]. This data gives us an impression of what type of dwellings are involved - surface dwellings or dug-outs. Although we have provided dates for objects of both types, along with their corresponding numbers (Fig. 3), we consider it important to add as full a description of them as possible.

The pottery is produced from clay with an admixture of fine-grained sand, of grey or black and grey colour; the surface is polished. Fragments of concave vessels with high funnel brims were found. Two fragments had "ear" handles placed under the edge. On the shoulders of the fragments of three vessels, attachments in the shape of the Cyrillic letters "M" and "L", typical for the FBC, have been preserved. The edge of the brim is decorated with parallel cord prints and tetrahedral die incisions [Movsha 1985a].

1.3. TROYANIV

Table 3

Troyaniv - the dated complexes

Settlement	Complex - material	Stage	index	BP	BC
Troyaniv	excavation 18, sq. LXXII-2, dwelling 28 - bones	TC, C-II	Ki-6748	4360±55	2967±64
Troyaniv	sq. XIII-19, dwelling - bones	TC, C-II	Ki-6749	4410±50	3003±83
Troyaniv	excavation III, sq. LV - B-7, dwelling 25 - bones	TC, C-II	Ki-6750	4430±45	3013±105

The settlement is located on a high dune on the right bank of the Gnylopiatka river (Fig. 1) (District and Region Zhytomyr). It is in the shape of a peninsula. The slopes of the dune are steep. In 1956-58, the remains of 35 dwellings of different types were excavated. During the excavations in Troyaniv, it became possible to trace details of the location plan of the settlement's dwellings. They were arranged in two circles, forming a fortifying cape from the side of the field [Shmagliy 1960: 52-54].

Sample Ki-6748 (bone) was taken from dwelling 28, excavated in 1958. Excavation 18 lay in the most concentrated area of the find. In the western corner of the excavation, a grain grater was discovered. At a depth of 0.8-1.2 m, fragments of pottery, figures, flint flakes, horn and bone tools, and chips of animal bones were discovered in a hollow, which featured the highest concentration of finds. The investigated hollow was assumed to be the remains of the sunken dwelling 28.

Sample Ki-6749 (bone) was taken from dwelling 1, excavated in 1956. Dwelling 1 was partially destroyed in the process of dam construction, so its full dimensions have not been ascertained. Cultural remains of different periods - Late TC and 8th - 7th cent. BC - were found there. A couple of postholes and fragments of burnt clay were discovered, 0.25 to 1.43 m below the surface. In the cultural layer, fragments of pottery and chips of animal bones were found. Scythian artefacts were discovered in the layer above that of the TC period.

Sample Ki-6750 (bone) was taken from dwelling 25, excavated in 1957. At a depth of 0.6 m, an object formed of burnt clay plaster, measuring 3 x 1 m, was observed. Next to this, a stone (granite) flag, measuring 2 x 1 m, was discovered. It can be presumed that this flag served as a fire-place. Both in the plaster and under it, TC artefacts - pottery fragments, spinners, loom weights, tools made of flint and stone, and animal bone chips - were found. The flint tools of the settlement comprised axe blades tetrahedral in cross-section, large flake knives, and chips from axes, scrapers and triangular arrowheads.

Among the stone artefacts, a half-finished battle hammer axe deserves to be specially mentioned. It is flat, with circular convex shoulders. Along the axis of the axe a casting seam is outlined. The butt, probably fungus-shaped, was split out; the inlet is just slightly outlined. This find showed that this type of axe was produced locally. During the excavation, 12 fragments of battle-axes were discovered. Gneiss or fine-grained granite were used for their production. The Troyaniv axes resemble those discovered in Sofievka cemeteries [Klochko, Koško 1995].

The pottery comprises two major groups. The first group contains 3 types of mass admixtures: sand + quartz + mica; crushed shells; and a herbal admixture burnt during the baking process. Pottery with admixtures of the first type was found in larger quantities, and included the following: pots, jugs, amphorae, platters and vessel covers. This type of vessel is characterised by a cord ornamentation. The

cord prints, located along the bellies of the vessels, are in the form of one or two horizontal lines and are characteristic for this type of pottery. There are also fragments featuring prints of die and point-like die (Fig. 5, 6:1-6). Some of the vessels of this group are externally coloured with red paint. The second group of pottery - vessels decorated with drawings - is lesser in quantity and was generally found in fragments, with preserved traces of painting in a dark brown colour (Fig. 6:7-9). The following forms were found: platters, pots, spherical and conical vessels, and beakers.

A large number of anthropomorphic figures of a schematic type, made of clay of type one admixtures, were also discovered. There were also numerous clay spinners, some of them decorated with incised and engraved lines, and some of them bearing drawings of a pictographic type. The find of small votive axes analogous to the Funnel Beaker culture should also be mentioned.

According to the researchers' interpretation, Troyaniv could be compared to such settlements in Volhynia as Gorodsk, Nova Chortorya, Pavoloch [Belanoskaya, Shmagliy 1959:128.]

1.4. TSVIKLOVTSY

T a b l e 4

Tsviklovtsy - the dated complex

Cemetery	Complex - material	Stage	index	BP	BC
Tsviklovtsy	grave? - burnt bones	TC, C-II	Ki-6751	3960±50	2450±89

In 1960, field research of the late TC settlement at Tsviklovtsy in the Kamianets Podilskyi District, Khmelnytskyi Region was commenced (Fig. 1). It is located at the source of the Smotrych river on a high dune on the right river bank, in Gryada site. The settlement, a chance discovery, is a unique jewel in the treasure of the Late TC. During excavations, the remains of a semi dug-out, two multi-purpose pits, a worship flag-stone made of clay and a ritual grave with the remains of a cremated body were found (pits 3 and 5, semi dug-out 1).

In the space between the pits and semi dug-out 1, and slightly to the north-east of the worship flag, in pit 8, a cremation grave was opened. The pit location is traced in grey and yellow loam. However, it only became possible to distinguish its precise boundaries against the background of yellow loam, at a

depth of 0.7 m below the present surface. The lower part of the walls and the bottom of the pit were excavated. The pit is 8-shaped, oriented lengthways to the north-east, with negligible deviation. It is divided into two parts: the smaller north-western, horse-shoe-shaped part (measuring 0.9 x 1.2 m), and the larger, north-eastern, oval-shaped part (measuring 2 x 1.65 m). In the upper layers of the grave was discovered a section of well-burnt plaster, belonging, as was later specified, to the upper part of the vault of the big oven. On the oven's vault in the south-eastern, southern and south-western parts, fragments of a big thick-walled vessel of yellowish colour, containing an admixture of crushed shells in a clay mass, was found. Below the section from the oven's vault, and only partially beyond its outline, 5 piles of burnt human bones - grave remains - were located. The burnt piles were found in the south-eastern part of the grave at a depth of 1 - 1.05 m below the present surface (0.55-0.60 m within the distinguishable boundaries of the pit) in an ash layer rich in charcoal. Fragments of scalp (pile 1) were lying near the eastern wall of the pit. To the south of these was a pile of burnt tubular bones (pile 4), among which V.I. Bibikova identified *Bos taurus* bones, *Unio* mollusc shells and several small, unburned bones of an *Ovis et Capra*. A fragment of a small horn pickaxe with hole was also found there. Its sides were decorated with herring-bone patterned incisions. Two bone piles (2,3) were found closer to the middle of the pit. In addition to fragments of large tubular human bones, probably lower extremities, there was a pile of a large animal bones and *Unio* shells. Near the south-western wall of the pit, the fifth pile was discovered. It was located below the lower stone of the grain grater. Here, besides the burnt human bones, burnt bones of a roe deer, a large hoof (a sheep ?), and two *Unio* shells were found. Several isolated burnt human bones were found outside the contours of the pile. Almost in the middle of the grave, in a layer of ash, the left horn pivot of a goat was found. Near the southern edge, unidentified animal bones, human bones and 18 fragments of *Unio* shells were discovered. To the south-west of the burnt bones, at the same depth, lay vessel shards of a mostly large size. These filled almost the whole south-eastern part of pit 8. Fragments of several vessels were mixed together, with some others lying next to them. There are only two items of painted pottery, both spherical vessels, one is a spherical amphora with a high mouth and a loop handle on convex shoulders. There are two conical attachments on the handle - the rudiments of anthropomorphism. The amphora is painted black. The decorative pattern is an ornamentation of cut strips, crossing at an angle, typical for Late TC.

Various vessels and other clay items (spinners, weights), stone grain graters and horn pickaxes were included in this adult's grave. Judging from the preserved occiput fragment of scalp, M.M. Gerasimov identified the age of death as approximately 18-20 years.

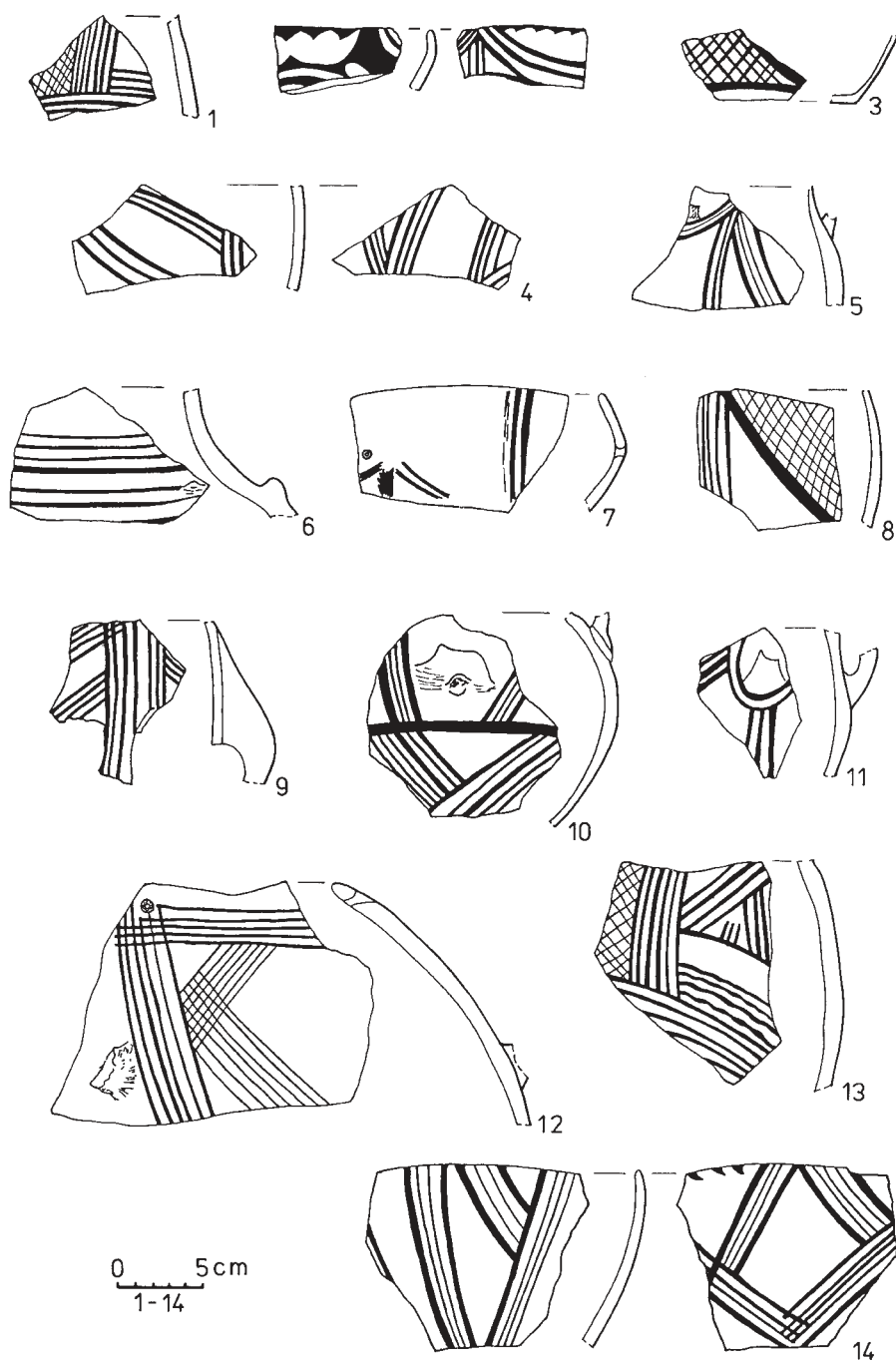


Fig. 4. Sandraki, Vinnitsia Region. "Table" pottery, painted

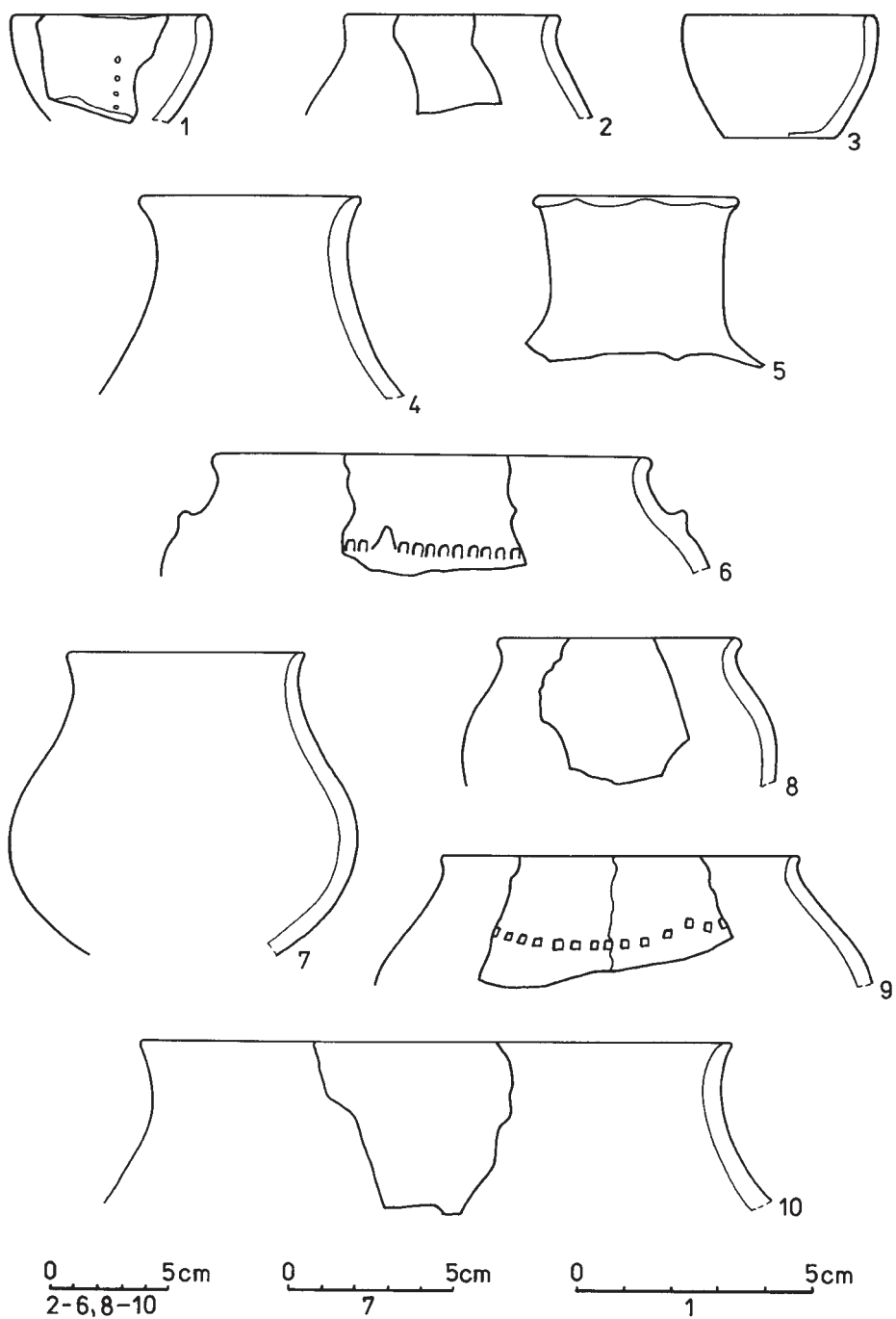


Fig. 5. Troyaniv, Zhytomyr Region. "Kitchen" pottery

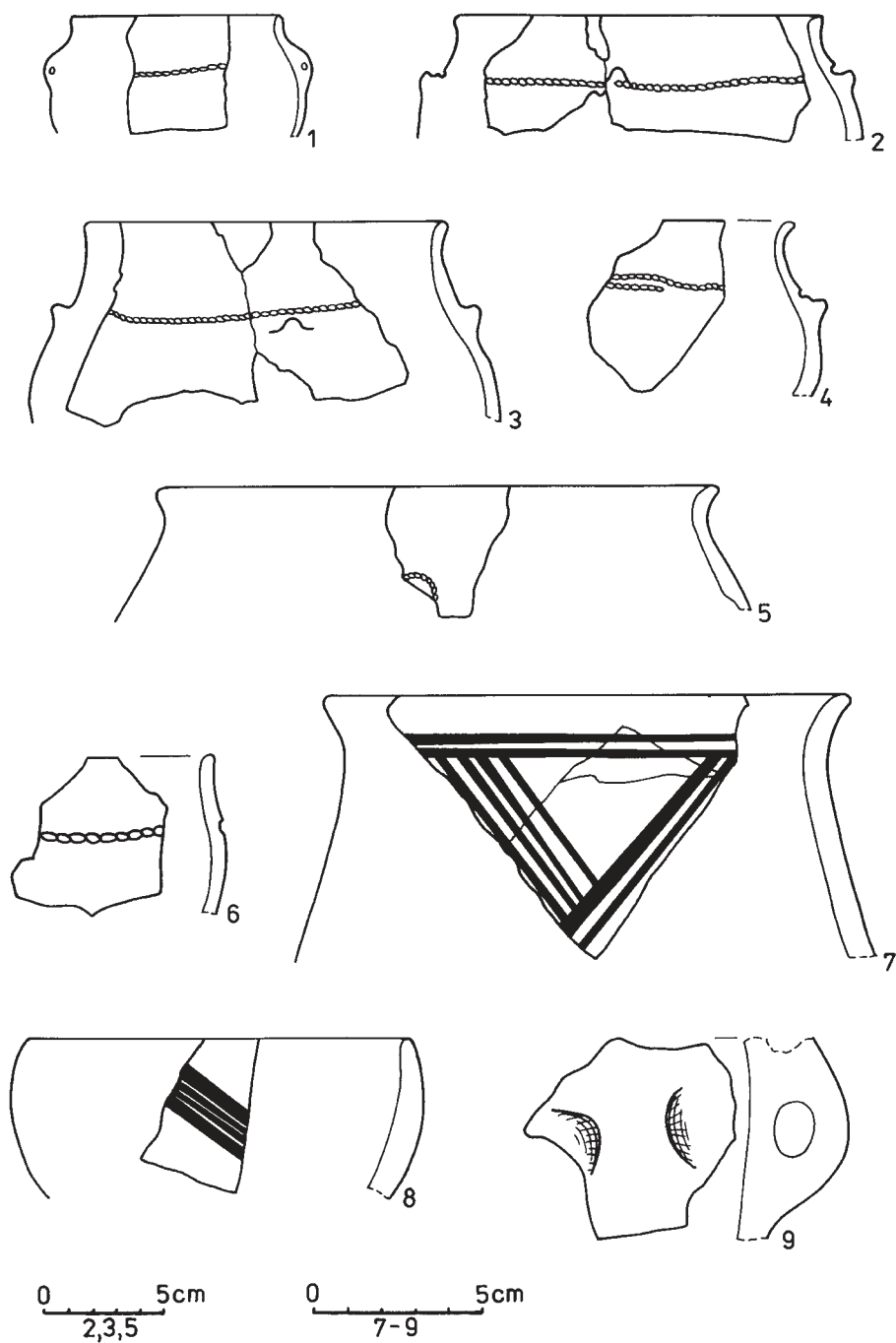


Fig. 6. Troyaniv, Zhytomyr Region. Pottery with corded (1-6) and painted (7-9) ornament

Ceramics from the grave have analogies in a number of the latest TC monuments. Similar samples derive from Gorodsk, Gusyatyn and other sites. Thick-edged cups decorated with cord prints are typical for Gorodsk. In the opinion of T.G. Movsha, there are some indications that the settlement in Tsviklovtsy is one of the very last of the Late TC. A semi-dug-out was excavated which, according to T.G. Movsha, served as a workshop for jewellery production. Half-finished articles, ready-to-wear items and flint artefacts were discovered there, as well as a buried treasure of jewellery: copper bracelets, beads, and necklaces, all with direct analogies among jewellery discovered during the excavations of Sofievka cemetery; and deer-teeth pendants and shell necklaces which have a wide range of analogies in TC complexes of CI and CII stages [Movsha 1964; 1965; 1985b: 238-239].

1.5. GORODSK

Table 5

Gorodsk - the dated complexes

Settlement	Complex - material	Stage	index	BP	BC
Gorodsk	? - bones	TC, C II	GrN-5090	4551±35	3442±59
Gorodsk	? - shells	TC, C II	Ki-6752	4495±45	3212±100

The settlement is situated near Gorodsk village in the Korostyshiv District of Zhytomyr Region. It is located on a high hill, "Chervona Gora", above the Teteriv river (Fig. 1). Archeological field research was carried out in 1936-1940 in Chervona Gora fortified settlement.

The excavations were conducted by V.P. Petrov, E.Y. Krichevskiy and M.L. Makarevich. The settlement is multi-levelled, with early Slavic and Ancient Rus materials over TC layers. It is not known how the first specimen for the dating of the Late TC (?) settlement in Gorodsk was obtained. The laboratory index testifies that the dating was done in a Groningen laboratory, approximately in the 1970s, in the same pack with the dating from Gorodnitsa - Gorodysche (GN - 5088: 4615±35BP, 3420±73BC).

The sample for the new dating (shell remains) was taken from the National Historical Museum (Kiev) collections. We do not possess any information about their interrelation with samples from any other complexes, which is why we will submit below a short description of the research and finds in Gorodsk.

In 1936, V.P. Petrov explored the remains of the overland dwellings. Only clay flags for fire-places spread over the soil, 1-1.5 m in diameter and 0.2 m high, had been preserved. Near the fireplaces, pottery, flint and stone artefacts, spinners, and animal bones were discovered [Petrov 1940:283-451]. Excavations in 1937, carried out by E.Y. Krichevskiy, showed that the TC cultural level lay 0.6-0.9 m below the surface. Fragments of burnt plaster with wood prints that did not constitute piles of ground type were found in the grave. In addition, domestic pits of different sizes were explored. These were filled with pottery fragments, flint, and animal bones [Krichevskiy 1940:383-451]. In 1939-1940, excavations of the two "on-ground" dwellings 7 and 8 were conducted by M.L. Makarevich. The remains of two grounds were explored, and included burnt clay fragments, a large quantity of pottery, tools, anthropomorphic figures, animal bones, and *Unio* shells. Some records of the find were published by T.S. Passek [Passek 1949].

The pottery was of two types: kitchen and table ware. The table pottery can be divided into two subtypes: pottery with or without ornamentation. The pottery bearing ornamentation was represented by platters, wide-mouthed pots, and amphorae with "horn-shaped" handles. The plain painted pottery was represented by platters, cups, amphorae, and pots. Broad lines and nets are the most popular decorative patterns of the C-II stage. The kitchen pottery is made of clay with an admixture of sand and shell folds. It comprises pots and dishes, some of which are decorated with pressed cord and incision ornamentation. In addition to TC vessels, fragments of vessels of the Baden culture (Boleraz stage), decorated with "stuck" rolls and engraved herring-bone ornamentation were discovered in the same layer [Krichevskiy 1940: Fig. 94, 103, 105, 443:30, 32, 445:51; Petrov 1940: Fig. 73-76, 84]. Fragments of pottery with motifs typical for the Globular Amphora culture were also discovered [Krichevskiy 1940: Fig. 98, 143, 154; Petrov 1940: Fig. 83, 96]. Horn-shaped handles and pots with pinches on the brims and decorations in the form of horizontal lines pressed with point-like die, found in different complexes of Gorodsk, have certain analogies in the late Baden culture [Krichevskiy 1940: Fig. 108, 140, 141, 144-148, 155, 156, 170, 172, 175, 190; Passek 1949: Fig. 82:15, 16).

Flint artefacts are represented by wedge-shaped axes with polished blades, triangular arrowheads, scrapers, large flake chips from the axes, grain graters, and stumpers. Chips - waste materials of production - were also found, as were both a whole and a fragmented battle hammer axe with inlet, and double-ended clay spinners decorated with die pressing, an ornamentation typical for Late TC complexes, especially in Volhynia.

Table 6

Vilkhovets - the dated complexes

Settlement	Complex - material	Stage	index	BP	BC
Vilkhovets	pit 1 - bones	TC, C II	Ki-6922	4170±55	2766±97
Vilkhovets	pit 1 - bones	TC, C II	Ki-6923	4165±60	2761±102
Vilkhovets	pit 1 - bones	TC, C II	Ki-6924	4205±50	2786±84
Vilkhovets	pit 1 - bones	TC, C II	Ki-6925	4225±55	2792±86

The monument is situated near the village of Vilkhovets (Olkhovets), in the Zvenygorodka District of Cherkasy Region. Excavations were conducted by M. Vi-deiko in 1993. The remains of two dwellings and one domestic pit were explored. The samples for dating were taken from pit 1.

The settlement is located 1.5 km to the west of the village, on two sides of a cobble-stone road leading to Ryzhanivka village (Fig. 1). In the northern part, the settlement is bordered by a deep steep bank descending to a streamlet. A similar bank is also located in the southern part. Both banks are partially occupied by the present day village. To the west and the east, the territory of the monument is bordered by a fairly noticeable relief descent. After the sorting of dwelling 1 had been completed, horizontal clearance was carried out. The traces of a pit, oval in plan, measuring 3.3 x 2.2 m, were found 1 m below the plaster level, near the plaster edge of square I-4. The pit was partially covered, although not penetrated, by a layer of plaster. Thus, at the time the dwelling was blocked up, the pit had been already filled (presumably, it was full even at the time of the construction of the dwelling). The pit was filled with animal bones, pottery fragments, and a horn hammer and mattock. Fragments of anthropomorphic plastic arts were discovered as well.

Pit 1 in sq. I-4 had probably been dug out before the construction of dwelling 1. Soil from the pit was used for the construction of the dwelling. The pit was gradually filled with rubbish: animal bones, and crushed pottery (Fig. 7 and 8). By the time dwelling 1 was constructed, the pit had been filled. Here we encounter a case of vertical stratigraphy. Typologically, the material from the pit is similar to that found in the dwelling. This means that only a short period had passed between the functioning and the destruction of the dwelling. The find of pottery fragments with cord ornamentation and "caterpillars" deserves to be mentioned Fig. 7. Although not typical for complexes of Kosenivka monuments, such fragments are typically found among TC kitchen and table pottery, which is also made of a similar paste.

These fragments have direct analogies in the materials of Usatovo type monuments and Neolithic complexes of the Dnieper.

1.7. KRASNY KHUTOR

Table 7

Krasny Khutor - the dated complexes

Cemetery	Complex - material	Stage	index	BP	BC
Krasny Khutor	grave 2 - burnt bones	TC, C II	Ki-5038	4280±110	2859±170
Krasny Khutor	grave 6 - organic deposit ("nagar")	TC, C II	Ki-5016	4140±110	2740±144
Krasny Khutor	grave 98 - burnt bones	TC, C II	Ki-5039	4160±90	2742±123

The samples for the dating were taken from late TC cemetery excavations carried out in 1950-1951. Krasny Khutor cemetery (Kiev District and Region) is located on the top of a sand dune on the left bank of the Dnieper (Fig. 1). All of the graves were opened in the layer of yellow sand 0.2-0.6 m below the surface [Danilenko, Makarevich 1956; Videiko 1995]. The graves were identified as burnt bones and funeral equipment concentrations or as isolated urns with body cremation remains. According to this identification, there were a total of 169 graves.

Among the funeral inventories we find pottery, weaponry, tools and jewellery. The pottery is represented by dishes, pots of different types, amphorae, beakers and covers. The majority of vessels were shaped from paste, with a considerable amount of organic admixture and smashed shells, which is why this pottery is so light and fragile. Presumably, it was a special type of funeral pottery [Kruts 1977]. The surface of the vessels is polished. Some vessels have preserved traces of complete ochre painting, and there are several fragments with traces of dark red colour drawings. Part of the pottery is decorated with edge incisions, die pricks and stuck "pearls". The amphorae have horn-shaped handles. The ceramic complex of Krasny Khutor cemetery has certain features analogous to Baden, Kostolac, and Cotofeni cultures [Kadrow, Koško, Videiko 1995:213].

Weaponry is represented by numerous flint arrowheads, stone hammer axes, copper blade daggers and knives [Klochko, Koško 1995]. Several dozen arrowheads were found, several types of which were defined: triangular, with straight, convex or

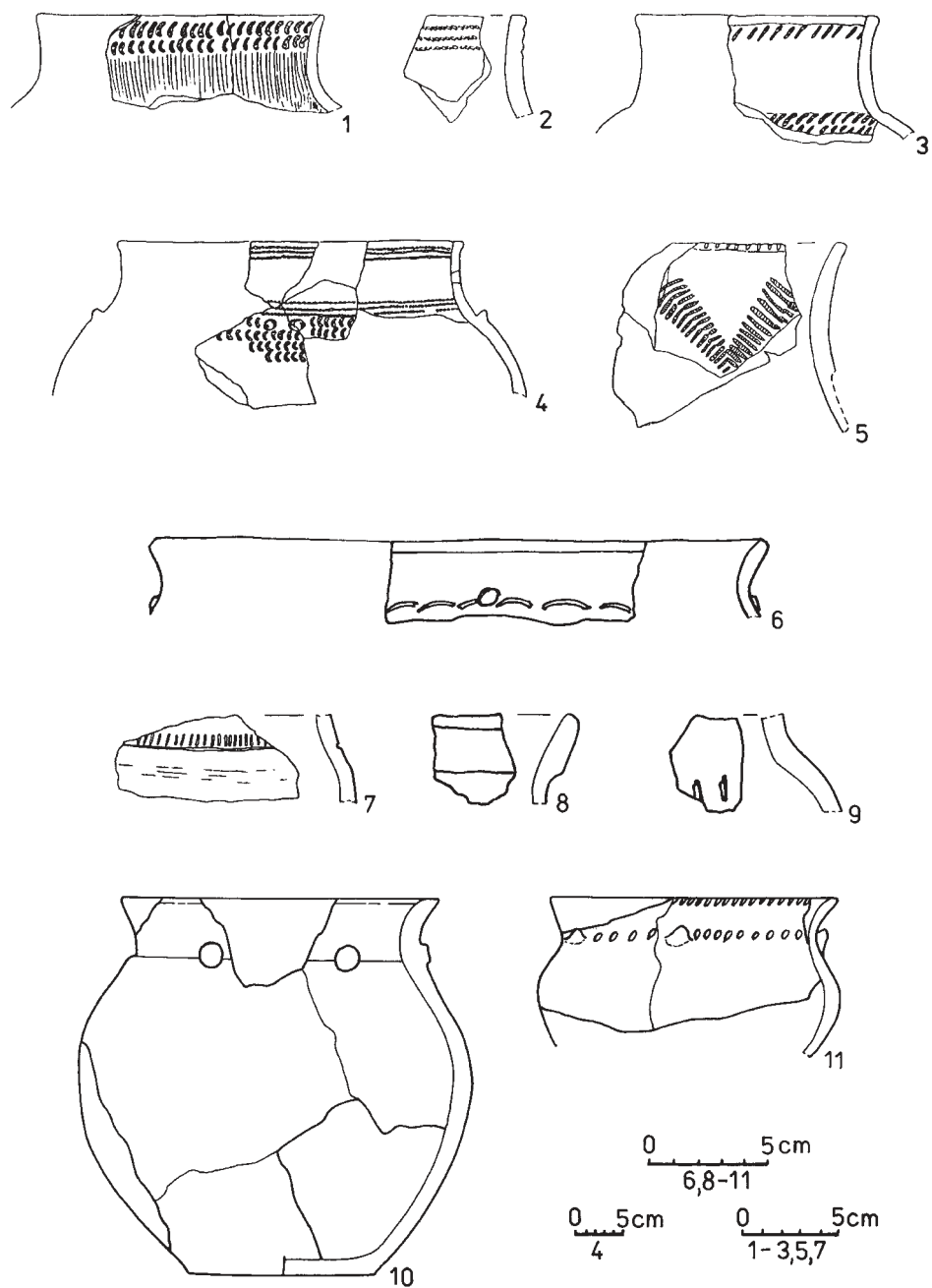


Fig. 7. Vilkhovets, Cherkasy Region. "Kitchen" pottery from pit no. 1

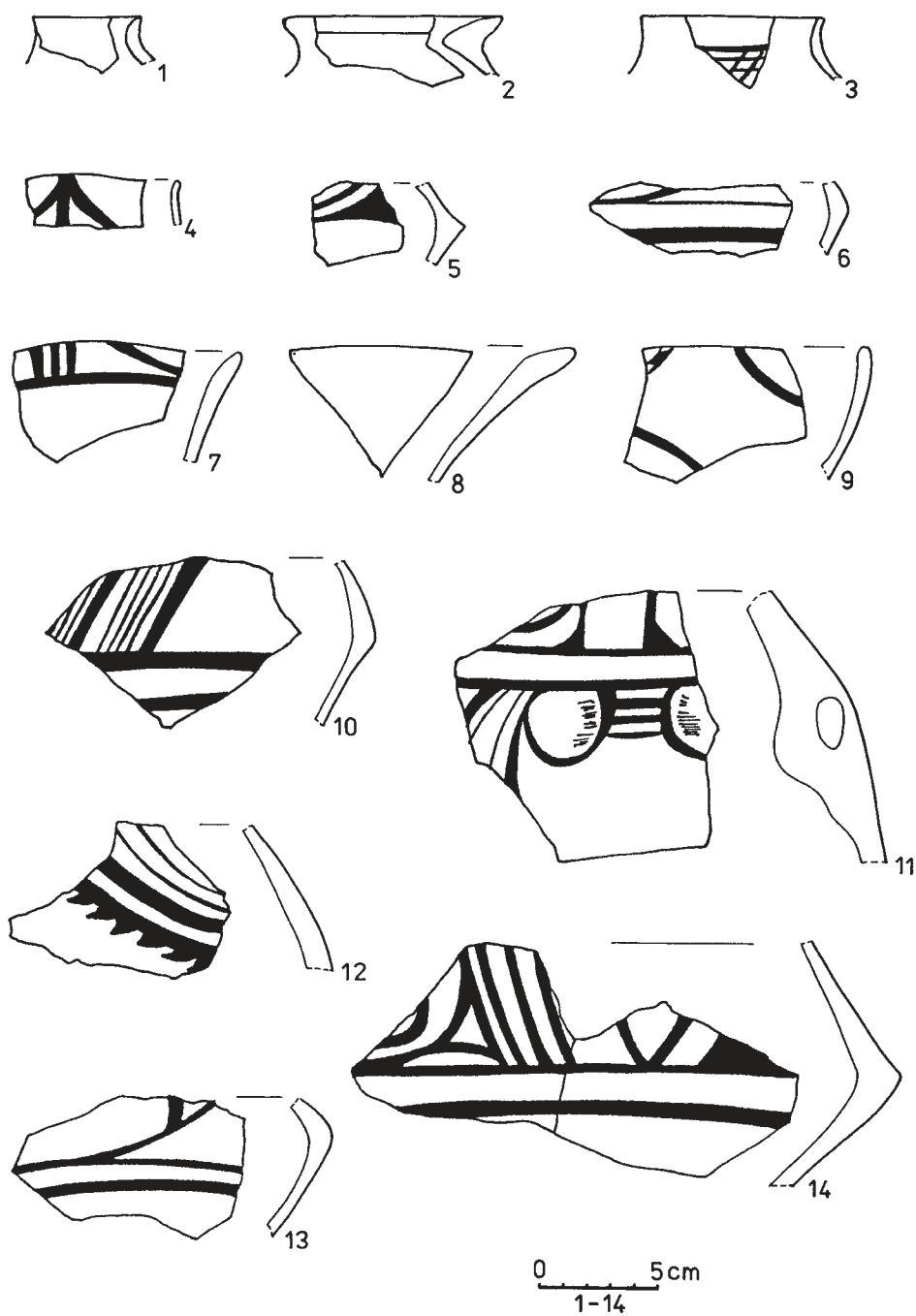


Fig. 8. Vilkhovets, Cherkasy Region. Painted pottery from pit no. 1

concave base. Two types of stone hammer axe - with a long blade and narrow back, and short with a broad back were defined. Some artefacts are made of imported raw materials [Petrugne 1995]. The copper daggers have, on the heel, inlets for pins or fastening handles. They have certain prototypes in Usatovo and Mayaki finds. The rhombic copper blade knives are 6-8 cm long.

The most common production material used for tools is flint. There are flakes from buckets in different stages of wear, leaf-like axes with polished blades, scrapers, strikers, knives and pressers. Flakes - waste materials of production - were discovered as well. More detailed flint work of cemeteries of the Sofievka type is analysed in the research of J. Budziszewski [1995:148-189]. Some ceramic spinners, occasionally decorated, were found as well. The jewellery is made of copper. There are rings and various necklaces, and cylindrical-spiral beads produced from broad rolled copper strips [Klochko 1995].

1.8. SOFIEVKA

T a b l e 8

Sofievka - the dated complexes

Cemetery	Complex - material	Stage	index	BP	BC
Sofievka	grave 1 - burnt bones	TC, C-II	Ki-5012	4320±70	2953±96
Sofievka	sq. M11 - burnt bones	TC, C-II	Ki-5013	4270±90	2830±144
Sofievka	? - burnt charcoal	TC, C-II	Ki-5029	4300±45	2928±59

The samples for the dating were taken from Late TC cemetery excavations carried out in 1947, 1948 and 1963. The Sofievka cemetery (Boryspil District, Kiev Region) is located on the top of a sand dune on the left bank of the Dnieper (Fig. 1). All the graves were opened in the layer of yellow sand, 0.5-0.8 m below the surface, except for individual finds which had shifted to the upper levels due to ploughing and erosion processes. Besides the TC materials, cultural remains of Scythian and Ancient Rus times were found and examined [Samoylovski 1952; Zakharuk 1952; Zakharuk, Kruts 1963; Videiko 1995].

The graves were identified as burnt bones and funeral equipment concentrations or as isolated urns with body cremation remains. According to this identification, there were 148 graves in total, although the real number of graves was possibly several times smaller.

Among the funeral inventories we find pottery, weaponry, tools and jewellery.

The pottery is represented by dishes, pots of different types, amphorae, beakers and covers. The majority of vessels were made of paste, with a considerable amount of organic admixture and smashed shells, which is the reason this pottery is so light and fragile. Presumably, it was a special type of funeral pottery [Kruts 1977]. The surface of the vessels is polished. Some vessels have preserved traces of complete ochre painting, and there are several fragments with traces of dark red colour drawings. Part of the pottery is decorated with edge incisions, pricks and stuck "pearls". The amphorae have hornshaped handles. The ceramic complex of Sofievka cemetery has some analogous features in Baden, Kostolac, Coţofeni cultures [Kadrow, Koško, Videiko 1995:213].

Weaponry is represented by numerous flint arrowheads, stone hammer axes, copper blade daggers and knives [Klochko, Koško 1995]. Several dozen arrowheads were found, several types of which were defined: triangular, with straight, convex or concave base. Two types of stone hammer axe - with a long blade and narrow back, and short with a broad back were defined. Some artefacts are made of imported raw materials [Petroutine 1995]. The copper daggers have on the heel inlets for pins or fastening handles. They have certain prototypes in Usatovo and Mayaki finds. The rhombic copper blade knives are 6-8 cm long.

The most common production material used for tools is flint. There are flake chips from buckets in different stages of wear, leaf-like axes with polished blades, scrapers, steels, knives, pressers. Flakes - waste materials of production - were discovered as well. More detailed flint work of cemeteries of the Sofievka type is analysed in the research of J. Budziszewski [1995: 148-189]. Some ceramic spinners, occasionally decorated, were found as well. The jewellery is made of copper. There are rings and various necklaces, and cylindrical-spiral beads produced from broad rolled copper strips [Klochko 1995]. There are also several glass beads, considered as the most ancient on the continent [Ostroverkhov 1981; 1985; Klochko, Stolpiak 1995].

1.9. ZAVALOVKA

T a b l e 9

Zavalovka - the dated complexes

Cemetery	Complex - material	Stage	index	BP	BC
Zavalovka	grave 6 - burnt bones	TC, C-II	Ki-5015	4290±90	2887±146
Zavalovka	grave 10 - burnt bones	TC, C-II	Ki-5014	4230±80	2790±110

The samples for dating were taken from Late TC cemetery excavations conducted in 1962. Zavalovka cemetery (Vyshe Dubechnya District, Kiev Region) is located on the top of a sand dune on the left bank of the Dnieper (Fig. 1). All the graves were opened in the layer of yellow sand, 0.5-0.8 m below the present surface. Besides TC materials, the dune also revealed cultural remains and pits of the Early Bronze Age, which eventually cut through a cross-section of Late TC graves [Kruts 1968; Videiko 1995].

The graves were identified as burnt bones and funeral equipment concentrations or as isolated urns with body cremation remains. According to this identification, there were a total of 16 graves.

Among the funeral inventories we find pottery, weaponry, tools and jewellery. The pottery is represented by dishes and pot shards. The surface of the vessels is polished. Part of the pottery is decorated with edge incisions, pricks and stuck "pearls". The amphorae have horn-shaped handles. The ceramic complex of Zavalovka cemetery has some analogous features in Baden, Kostolac, Coţofeni cultures [Kadrow, Koško, Videiko 1995:213].

Weaponry is represented by numerous flint arrowheads, stone hammer axes, copper blade daggers and knives [Klochko, Koško 1995]. Several dozen arrowheads were found, several types of which were defined: triangular, with straight, convex or concave base. The flint artefacts exceed other tools in number. There are flake chips from buckets in different stages of wear, leaf-like axes with polished blades, scrapers, steels, knives, pressers. Flakes - waste materials of production - were discovered as well. More detailed flint work of cemeteries of the Sofievka type is analysed in the research of J. Budziszewski [1995:148-189].

The jewellery is made of copper and amber. There are rings and various necklaces, and cylindrical - spiral beads produced from broad rolled copper strips [Klochko 1995]. Several amber beads were also found [Videiko 1995].

1.10. MAYAKI

T a b l e 10

Mayaki - the dated complexes

Settlement	Complex - material	Stage	index	BP	BC
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	Bln-629	4400±100	3049±159
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	Le-645	4340±65	2960±74

Settlement	Complex - material	Stage	index	BP	BC
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	Ki-870	4670±100	3481±148
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	UCLA-1642B	4375±60	2777±76
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	UCLA-1642G	4375±60	2777±76
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	Ki-281	4475±130	3154±180
Mayaki	settlement-ditch (?) -charcoal	TC, C-II	Ki-282	4580±120	3292±189

This settlement of the Usatovo type is located on the north-western outskirts of Mayaki village (Odesa Region) (Fig. 1). It occupied a cape on the edge of a high first terrace (12m) of the Dniester river. In the process of excavations, V.G. Zbenovich explored the remains of two ditches. The width of the ditches was 4-8 m, the funnel cross-section 3.2 - 3.4 m below the ancient surface. The ditches were filled with layers of loam and charcoal, saturated fragments of pottery, animal bones, shells, and charcoals. The only concentration of material is represented by traces of fire-places, which appear at different levels, 2.6-2.9 m below the surface. They are oval in shape and 2-5 m in diameter. The thickness of the layer is 0.2-0.4 m. According to V.G. Zbenovich, the ditches were filled in a comparatively short period of time, because the ceramic goods discovered do not differ between different levels [Zbenovich 1974:30]. The samples for dating (dates Ki-870:4670±100 BP, Le-645:4340±65 BP, Bln-629: 4400±100 BP, UCLA-1642G: 4375±110 BP [acc. Telegin 1985] UCLA -1642B: 4375±60 BP [acc. Wechler 1993], UCLA -1642G:4375±60 BP) are likely to have been taken from the fire-places of Mayaki ditch, as the rest of the settlement area was left unexplored, except for the north-western part of the settlement, where little piles of cultural layers with a capacity of up to 1m, evidently sunken dwellings or domestic pits, were discovered [Zbenovich 1974:31]. There exist two versions of the same dating for Mayaki for the period under consideration: UCLA -1642B: 4375±110 years BP [Telegin 1985] or UCLA -1642B: 4375±60 years BP [Wechler 1994].

In 1986, V.G.Petrenko resumed excavations in Mayaki settlement. He examined a ditch located closer to the bank, from where two samples of charcoal were taken. The samples were selected from the same layer, 20 cm thick, from the surface of the ditch filling. It is worth noting that the difference in dates now reaches 105 years: Ki-281: 4475±130 and Ki-282: 4580±120 [Patokova et al. 1989:115].

The ditch was funnel shape in plan, 3.6 m deep, and had been dug in forest loam. Due to the heterogeneity of the soil, up to 30 consecutive strata were identified in the cross-section. The lower section, 1.5-2 m wide, consisted of strata of yellow

loam and slightly burnt loam of different shades, with an admixture of carbonised stems. There are occasional strata of burnt stems and poles up to 1 cm thick. Ancient coal was also found here, as were several fragments of ceramics, stones, animal bones, and flint flakes. There were many fragments of burnt plaster, with a waste-material admixture, featuring wood prints. These were construction wastes from monument dwellings located in the vicinity. The upper layer of the ditch was filled with a mixture of ash and sandy loam, pot shards, animal bones, flint artefacts, bones, stones, and fragments of figurines [Patokova et al. 1989:89-91].

The ceramics comprise kitchen pottery (70%) and table pottery. Most of the kitchen pottery was made of clay, with a sand and shell admixture. There were pots, platters, a few amphorae, and large vessels for grain storage. The majority of vessels have a die-incision ornamentation. Others feature cord ornamentations, some of mixed technique. A comprehensive pattern of die holes, engraved lines and pinches can occasionally be seen.

The table pottery can be divided into two groups: painted pottery, and pottery with engraved ornamentation. The painted pottery - dishes, pots and amphorae - is not numerous (no more than 6%). It is produced from purified clay, and the painting is in a dark-brown or red colour. The second subgroup of table pottery (11%), consisting of dishes, amphorae and cylindrical vessels, has a polished body, with die or pressing ornamentation. In places, a white clay engraving filling has been preserved.

Anthropomorphic plastic art is represented by schematic images on cubic forms, decorated with pressing or die ornamentation, and by fragments of typical schematic TC figurines. Also worth noting are cubes with engraving and die-incision ornamentation. Tools are not numerous. They include plate and flake scrapers, chips from axes, trapezes, and awls, and a triangular arrowhead with a concave base. The materials used are stone, horn, bone and flint - the last of these being mostly production waste materials.

Many bone articles can be found, such as awls, and several horn artefacts, among them mattocks, a hook, pendants, and various unfinished articles.

1.11. USATOVO

T a b l e 11

Usatovo - the dated complex

Cemetery	Complex - material	Stage	index	BP	BC
Usatovo	grave - charcoal	TC, C-II	UCLA-1642A	4330±60	2952±58

The sample for dating was taken from the second sub-burial ground cemetery of the Usatovo complex (Odessa Region) (Fig. 1). The number of the grave is unknown, hence the general nature of the description which follows. The second sub-burial ground cemetery of Usatovo complex is located on a plateau of the high bank of the Khadzibey estuary, 460 m to the south of the settlement. It occupied an area of 6400 m². It was explored by V.G. Zbenovich (1962) and by E.F. Patokova (1964, 1970, 1971, 1974). Altogether, approximately 30 graves and 10 ritual sites were excavated. The sample for dating was probably selected by V.G. Zbenovich (the index of the dating is close to those for Mayaki, explored by V.G. Zbenovich in the same period). The grave sites were located under stone flags, measuring 1.1-1.5 x 0.6-1 m, and located 0.5-0.7 m below the present surface. The graves were east-west or north-east oriented. The bodies were in a foetal position, lying on their left side, rarely on their right side or on their back; the head oriented to the east or the north-east. The skeletons bear traces of ochre. There were between 1 and 5 vessels in each grave (generally kitchen pottery, with only 4% painted pottery), with occasional examples of anthropomorphic plastic arts. Only a few flint artefacts were found, among them trapezoids, and arrowheads.

1.12. DANKU II

T a b l e 12

Danku II - the dated complex

Cemetery	Complex - material	Stage	index	BP	BC
Danku II	grave 2 - charcoal	TC, C-II	Le-1054	4600±60	2952±58

The sub-burial ground cemetery Danku II is situated near Danku village, in the Hincești District of Moldova (Fig. 1). It is located on a high dune on the left bank of the Prut, 1.5 km to the south of Danku I cemetery. The graves explored were arranged in an oval formation, measuring 10 x 16 m, oriented along the north-north-west/south-south-east axis. The excavations were carried out by V.O. Dergachev in 1968, 1969. The sample for dating (charcoal) was taken from grave 2. Grave 2 is rectangular in plan, 1.4 - 2.2 m in size, located at a depth of 0.4 - 0.45 m. It was filled with burnt soil, with a high admixture of charcoals. The walls bore traces of fire. The body was in a foetal position, lying on its left side; the head oriented to the south-east. The skeleton was just slightly charred. A beaker had been placed in the grave pit, near the head of the deceased. In the western corner of the grave were

an amphora, decorated with circular incisions, and a double-ended conical vessel, decorated with die incisions and cord pressings. All the vessels were made of clay, with a shell admixture. There are traces of repeated firing on the vessel bodies. A goat bone, a flint plate and a stone striker-presser were discovered in the vicinity [Dergachev, Manzura 1991:41-42].

2. ATTRIBUTION AND SYNCHRONIZATION OF THE DATED COMPLEXES

Zhvaniets Shchovb settlement was attributed to the beginning of the CII stage by T.G. Movsha. According to Movsha, Zhvaniets-Shchovb occupied an intermediate place between the settlements of Krutoborontsi-2 and Koshylivtsy - Oboz [Movsha 1970:98]. V.A. Dergachev attributed Zhvaniets-Shchovb to the Brynzeny type, at the beginning of the CII stage, genetically connected with earlier settlements of northern Moldova [Dergachev 1980:115-119]. The data obtained generally supports such conclusions. Two groups of dates can be determined. Dug-out 1 is covered by overland dwelling 2. However, according to T. G. Movsha, the difference in time was insignificant [Movsha 1970:92]. Received isotope data, according to which the age of the site differs by 50 years from the dwelling 2 dating, supports this conclusion. The date obtained from the specimens taken from the bank (charcoal), dug-out 6 and a further, undetermined complex is a later one. As three previous dates were obtained through the animal bones analysis, we face the problem of the peculiarities of isotopic dating according to different materials. Still, the date from dug-out 6 obtained through bone analysis seems to confirm the existence of a later stage in the settlement life. The dates obtained from Zhvaniets-Shchovb are generally simultaneous to those for Gorodsk and Troyaniv, based on the painted vessel finds in Volhynia. In connection with this, it is worth noting a find of two-levelled furnaces [Movsha 1971b:128-134], whose productivity exceeded the needs of the local population.

Troyaniv was dated back to the C-II TC stage. According to V.A. Dergachev, it was partially contemporary to Gorodsk, and to the complexes of Bryzeny and Gordinești in northern Moldova [Dergachev 1980:130]. Its synchronization with the Dnieper complexes of Zhvaniets-Shchovb type and with Brynzeny III was based on finds of painted pottery. The dates obtained support such conclusions. It is worth noting that the chronological division of the late TC complexes of Volhynia into earlier ones (Troyaniv type) and later ones (Gorodsk type) was not confirmed by isotope data. This is completely understandable, as researchers have consistently underlined the problematic character of the existing chronological division of Volhynia TC [Dergachev 1980:130-131].

Gorodsk was attributed to the C-II stage of the TC. T.G. Movsha distinguished the Gorodsk-Kasperivtsy monument type [Movsha 1985a:137-238], which was simultaneous to Sofievka, Gordinești and Usatovo types. The data obtained enables us to state that it was not the oldest TC monument in comparison to the Usatovo and Sofievka sites, but rather a contemporary one to Trojaniv. Here we can speak about the existence of local, but not local chronological types of the late TC in Volhynia. Such was assumed by V.A. Dergachev [1980:130]. The new dating seems to be the most plausible, especially with regard to the fragments of Baden and similar-style pottery discovered during excavations.

Sandraki is attributed to complexes of the Gorodsk type, considered to be later than settlements of the Trojaniv [Shmaglii 1971; Dergachev 1980:200; Movsha 1985b], Gordinești and Usatovo types. The dating obtained does not, generally speaking, contradict these conclusions, when we consider new dating for cemeteries of the Usatovo type, the results of which are considered to show contemporaneity with the cemeteries of Sofievka on the Dnieper.

Tsviklovtsy is attributed to complexes of the Gorodsk-Kasperivtsy type, and is considered to be the latest in this range. Suggestively, the population that had left these complexes took part in the formation of the Upper Dniester group of the Corded Ware culture [Movsha 1985b]. V.A. Dergachev attributed this settlement to the Gordinești type [Dergachev 1980:200]. The find of a body cremation grave in Tsviklovtsy, resembling a Sofievka type cemetery, is worth noting in this context.

According to the dating obtained, Tsviklovtsy can currently be considered the latest TC complex. However, several remarks seem pertinent here. First of all, it should be noted that the difference between the archaeological materials from Tsviklovtsy and those from contemporaneous complexes are not great. Second of all, there is no certainty as to the origin of the sample used for dating from a certain amount of excavated objects.

V.A. Dergachev expressed a supposition concerning the influence of “Western cultures of the Lengyel circle” on the formation of the Gordinești type of the late TC culture [Dergachev, Manzura 1991:13]. The examination of old collections and archive materials allows us to expand on this supposition. The dating of Sandraki and Gorodsk ceramic materials of, or influenced by, the Baden culture may testify to the formation of the Gordinești and Gorodsk types under its effect. The formation of the Sofievka type is connected with the same influence interrelated with the above-mentioned regional TC C-II types.

Vilkhovets is attributed to the Kosenivka type, located in the region of the basin of the Southern Bug and Dnieper rivers. S.M. Ryzhov attributed this type to TC C-II and divided it into three phases. T.G. Movsha attributed it to both C-I and C-II stages. [Kruts, Ryzhov 1985:54; Movsha 1993]. However, dates obtained indicate that Vilkhovets belongs to the same horizon as complexes of Gorodsk, Sofievka, and Usatovo (late) types.

Krasny Khutor, Zavalovka and Sofievka are attributed to the TC C-II stage. The monuments of Sofievka type in its time were synchronised with early complexes of the Usatovo and Gorodsk types and dated back to the beginning of the C-II stage [Dergachev 1980]. It is worth noting that the ceramics, weaponry and tools from the cemetery have a rather wide dating range in connection to various analogies. The set of dates obtained enables us to attribute this monument to the end of TC, together with the latest Usatovo cemeteries, complexes of the Kosenivka and Gorodsk types.

V.G. Zbenovich attributed the settlement in Mayaki to the C-II stage of the TC culture, considering that this complex should be dated back to a later period than Usatovo-Velyky Kuyalnyk. The reason for this was the lesser quantity of painted vessels and comparatively larger number of vessels with engraved ornamentation. It is worth recalling in this context the absence of schematic realistic plastic art in Mayaki. The features listed, in the opinion of the researcher, cannot be regarded as local peculiarities [Zbenovich 1974:134]. V.G. Petrenko, defining the chronological position of Mayaki in the system of monuments of the Usatovo type, took into account the typological and stylistic analyses of the ceramics.

V.G. Petrenko attributed Mayaki to the late Usatovo type monuments [Patokova et al. 1989:105-110]. He distinguished a significant range (more than 500 years) covering the isotope dating for Mayaki which, at the same time, the capacity of the cultural layer and the archaeological materials evidently contradicted. He tried to operate with his own calculated average date - 2509 BC (non-calibrated) and determined the calendar age of Mayaki as the middle of the 33rd century BC [Patokova et al. :115-116].

Y.K. Chernysh included Mayaki among the latest complexes of the C-II stage and attributed it to the 11th level of the late TC [Chernysh 1982:226]. It should be noted that Mayaki settlement is multi-levelled. Thus, a wide dating range is not surprising. However, the question of the accuracy of the previously obtained dates is still open. Similarly, the new dates for Usatovo sanctuary and graves [see Szmyt, Chernyakov, Radiocarbon..., in this volume] testify to the possible existence of later complexes of the Usatovo type than the one explored in Mayaki.

The second sub-burial ground of Usatovo cemetery is attributed to the Usatovo type complexes of the C-II stage of TC [Zbenovich 1974:44-48; Patokova 1979; Dergachev, Manzura 1991:116-129]. It generally corresponds to the range of complexes between Mayaki settlement and the late dates from Zhvaniets. It appeared to be older than Sofievka cemeteries, and archeological materials do not contradict such dating. At the same time, the appearance of the set of dates for sub-burial ground Usatovo cemeteries that are significantly more diverse necessitated the repeated dating of Mayaki and Usatovo settlements and of Usatovo type cemeteries.

The Danku II complex was dated by V.A. Dergachev back to the end of the C-II stage of TC [Dergachev 1980]. Y.K. Chernysh also attributed this monument

to the C-II stage and placed it within the 11th (the last) stage of the late TC [Chernysh 1982:226]. The consequently rather early date (earlier than for complexes of Zhvaniets and Troyaniv type) is, in our opinion, too far back.

3. RADIOCARBON CHRONOLOGY OF THE LATE TRIPOLYE - C-II.

3.1. HISTORIOGRAPHICAL DEVELOPMENT OF THE ABSOLUTE DATING OF TRIPOLYE C-II.

In the Copper Age, monuments of early agricultural cultures of TC-Cucuteni stretched over significant territories - from Romanian Carpathians in the West to the basin of the Middle Dnieper in the East. These cultures, due to their geographical situation, their extensive relations with neighbouring cultures, and the comparatively high level of research which has gone into them, occupy a significant place in the development of the chronology of Neolithic, Copper Age and Early Bronze Age monuments. They are, in addition, linked with the dating of the steppe cultures of the Copper Age and Early Bronze Age.

The complex utilisation of archaeological materials and dates obtained with the help of natural sciences now allows us to specify an absolute chronology of TC-Cucuteni culture and to attribute it to between the 5th and 1st centuries of the third millennium BC

The situation with regards to the absolute dating of TC-Cucuteni culture currently stands as follows. On the one hand, the chronology invented in the 1960-70's, based on conventional radiocarbon dates and partially on archaeological dating (for Usatovo monuments), continues to exist and to be applied. According to this chronology, TC-Cucuteni culture existed between 4000-2500 (2400-2200) BC. On the other hand, we have the chronology based on calibrated (calendar) dating, invented at the end of the 1960's-80's, which is confirmed by stratigraphy and by the archaeological dating of the Early Bronze Age monuments synchronised with particular late TC complexes. According to calendar chronology, TC existed in the period between 5000-2900 (2750) BC. As we can see, the difference between the two chronologies at the primary stage of the culture is 1000 years, and 400-700 years at the final stage. We have encountered as many as two dozen significantly different culture dating schemes Table 13.

Absolute dating of Tripolye-Cucuteni culture and its individual stages. History of the problem

No.	Author	Year*	Period C-I	Period C-II
1	T.S. Passek	1949	2100-	-1700
2	T.S. Passek	1962 (bc)		-2500
3	E. Neustupný	1968 (BC)		-3400
4	H. Quitta, G. Kohl	1969 (bc)	-2900	
5	V. Dumitrescu	1974 (bc)		-2600
6	V.G. Zbenovich	1974, 1989 (bc)		2400-2200
7	Y.K. Chernysh	1982 (BC)	-3750	3750-3250
8	Y.K. Chernysh	1982 (bc)	-3000	3000-2500
9	T.G. Movsha	1984 (bc)	3000-2800/2750	2800/2750-2400/2350
10	S. Cucoş	1984 (bc)	-2900	2900-2600
11	S. Jastrzębski	1985 (bc)	2800-2700	2700-2500/2400
12	M.O. Chmykhov and I.T. Chernyakov	1988 (bc)		-2200
13	M. Y. Videiko	1989 (BC)		3467-2785
14	V.G. Petrenko	1989 (bc)	3000-2800/2750	2800/2750-2500/2400
15	V.G. Petrenko	1989 (BC)	3785-3580/3530	3580/3530-3245/3275
16	H. Parzinger	1993 (BC)	3700/3500-3600/3400	3400/3200-3300/3100
17	K.P. Wechler	1994 (BC)	3780-	-3320
18	C. Mantu	1997 (BC)	3700-3500	3500-3200
19	N.B. Burdo, M.Y. Videiko	1998 (BC)		-2750

* 1 - before ¹⁴C chronology; 2-19 - ¹⁴C chronology (conv.: bc; cal.: BC).

At the beginning of the 20th century, this culture dating was supported by a comparison with cultures of painted pottery of the Mediterranean area. The dates were determined using evidence that had historical dating (Egypt, Crete etc.). It is conceivable that such connections were rather approximate, taking into account the sources existing at that time.

Thus, V.O. Gorodtsov attributed TC to the beginning of the 4th millennium BC, regarding it as contemporaneous with Yamnaya culture [Gorodtsov 1900]. E.P. Shtern attributed TC to the middle of the 3rd millennium BC, previous to the Copper-Stone Age. G.Childe compared the early stages of TC with EM II, dating back not later than 2500 BC.

In the 1930-40's, T.S. Passek published chronological tables of TC-Cucuteni. A number of the finds she attributed to the Eneolithic. The latest finds were attributed to the Bronze Age and dated back to 1700-1400 BC. According to the

author's considerations, the dating of the TC monuments corresponds to I/II-II EM [Passek 1940:18-19, Table 1]. She later specified the chronological limits of TC and determined them, in accordance with Cretan chronology, as two variants: maximal - from the 3rd millennium to 1750 BC and minimal - from 2500 to 1750 BC [Passek 1949:26].

The development of radiocarbon dating, at the beginning of the 1960's, facilitated the re-positioning of TC-Cucuteni culture. In 1962, at the VI International Congress of Prehistoric and Protohistoric Sciences, T.S. Passek attributed the late period of TC to the middle of the 3rd millennium BC [Passek 1964]. In 1965, V. Titov's paper was published. In 1972, all the dates on ¹⁴C known up to that time were published by P.M. Dolukhanov and V.I. Timofeev [Titov 1965; Dolukhanov, Timofeev 1972]. In 1974, V. Dumitrescu published 5 dates for the Cucuteni culture and a significant number of dates for simultaneous cultures [Dumitrescu 1974]. It was clear then that the application of radiocarbon dates would lead to the extension of the absolute age of TC-Cucuteni. The application of dendro-chronological amendments extends dating even more - by 500-800 years [Dolukhanov, Timofeev 1972; Kolchin, Sher 1972].

At the end of the 1960's, it became necessary to calibrate ¹⁴C dates. One of the works from this period with an analysis of the correlation between calibrated carbon dates and archaeological data belongs to E. Neustupný. He clearly demonstrated the chronological positions of European evidence of the Early Bronze Age that permitted the identification of historical dates. Complexes of Baden cultures of the D and E phases were synchronised with Troyan layers, monuments of EM-I and EH-I periods, that date back approximately to 3000 BC, according to the researcher. The stratigraphy of Ezero shows that Gumelnița and Vinča C cultures were previous to EV Egea. The dating of the Early Bronze Age of Egea can be determined on the basis of finds opened during the Knossos excavations of Egyptian stone vases and others of similar style, which date back to approximately 3000 BC [Neustupný 1968:25-28, 31].

The calibrated (calendar) dating generally correlates with this calculation. The Eneolithic period, previous to the Early Bronze Age, must have dated back to the 5th - 4th millennia BC, not to the 4th - 3rd millennia BC as had previously been believed. In a synchronising table, E. Neustupný assigned the period to between 3400-4400 BC, in other words, from the middle of the 5th to the middle of the 4th millennium BC [Neustupný 1968]. It should be noted that the number of datings for the earliest and the latest TC evidence was insignificant, and the range of dating of the culture was gradually extended as new dates appeared.

Simultaneously, the new, absolute chronology for the TC culture, gradually established in Soviet archaeological literature, created conventional dating with regard to radiocarbon. It had been considered that the TC culture existed during the 4th - 3rd millennia BC [Arkheologiya 1985:150]. Dating back late TC (Usatovo)

monuments to 2400-220 BC, V.G. Zbenovich referred to the ^{14}C date for Mayaki [Zbenovich 1971:192]. The options of date calibration were not practically taken into account by TC researchers.

At the same time, researchers continued to use the traditional method of dating TC monuments. V.G. Zbenovich used a source which was, in his opinion, more reliable: copper daggers, with their direct analogies in the Eneolithic monuments of Crete and neighbouring territories, where their prototypes existed in the interval between II EM and the beginning-middle of I MM periods. At that time, scientists dated them back to 2500-2100 BC. That permitted V.G. Zbenovich to identify the date of the Usatovo daggers as being between 2400-2200 BC. Another method of dating - synchronisation with the culture of Černavoda I - linked the finds, according to V.G. Zbenovich, with Early Bronze Age horizons of Ezero in Southern Bulgaria, which were synchronised with Troy I - Troy IV layers, or from the end of the first half - through the whole of the second half of the 3rd millennium. They were synchronised with the Maikop culture, which, at that time, by means of its comparison with cultures of the Near East, Iran and Mesopotamia, was also attributed to the second half of the 3rd millennium BC. Thus, all three methods indicated the second half of the 3rd millennium BC, or more precisely the period between 2400-2200 BC. Radiocarbon dates (non-calibrated) of 2390-2450 BC (Mayaki), according to the researcher, confirmed to a certain degree the above-mentioned ideas [Zbenovich 1974:142-143].

Current dating of the Mediterranean monuments of the early II - middle I Minoya periods is somewhat different to that proposed by V.G. Zbenovich. The following dates were proposed: EMII - 2900-2300 and MMI - 2150-1800 BC [Warren 1980:499]. This means that the prototypes of Usatovo daggers must be attributed to an interval of 1000 years, between 2900-1800 BC, but not to those 500 years between 2500-2000 BC as suggested by V.G. Zbenovich.

In 1982, N.V. Ryndina and L.V. Konkova offered a new comparison and dating of Usatovo daggers with regard to their typology and production technology. Writing about their origin, the authors underlined that Anatolian daggers identical to Usatovo ones originated from hordes and mixed Trojan collections (Troy II, Troy II-IV, Saladzha-Gyuk) and cannot be dated back to a narrow time range. They were dated back to the second half of the 3rd millennium BC [Ryndina, Konkova 1982:41].

The dating of Troy II is still debatable. D. Easton dated Troy II back to the period between 3100-2560 BC; J. Yakar dated it back to 2800-2500 BC; C. Renfrew (referring to calibrated ^{14}C dates) dated it back to 2800-2350 BC [Easton 1976:161-163; Yakar 1979: 23-69; Renfrew 1971:275-282]. In fact, only the initial date for Troy is debatable, as the latest date - 2500 BC - has a historical background and is connected with the synchronisation of Dorak cemetery. An artefact with a cartouche of a pharaoh of the V dynasty who reigned around 2558 BC was found in the grave

there [Easton 1976:163]. Thus, following typological and technological comparisons, Usatovo daggers can be dated back to the period between 3100-2550 BC. Non-calibrated dates for Usatovo are between 2830-2315 BC (with approximate curves), calibrated dates are between 3467-2785 BC. Accepting the priority of typological dating confirmed by historical dates, we come to the conclusion that the dating of the Usatovo daggers is somewhere between 3000-2700 BC and corresponds rather to calibrated dates than to non-calibrated.

V.A. Dergachev, giving the characteristics of the late period of TC in his monograph in 1980, noted that the dating is based on the typological comparison of metal artefacts and ceramics, and on the synchronisation of TC complexes with materials of the Maikop culture (dated back according to Near East-Mesopotamian analogies) and with the cultures of Černavoda and Coțofeni, and EBA layers in Ezero and others dated back according to Hellenic-Anatolian analogies. V.A. Dergachev claims that the two ways of dating generally coincide and indicate the period between 2600-2500 and 2100-2000 BC. He also asserts that non-calibrated radiocarbon datings (six of them were sampled for Mayaki, Usatovo and Danku II) confirmed the dates obtained by means of traditional archaeological methods. At the same time, he noted that, although absolute dating of the late TC is rather convincing, it cannot be regarded as the conclusive one, as not all of the previously identified analogies and synchronisations are well reasoned, and since typological comparisons are sometimes rather superficial. The author also tended to extend the dating range of the Early Bronze Age of Bulgaria. This tendency was also connected with isotopic dating calibration [Dergachev 1980:18].

In the 1980's, T.G. Movsha was also working on the chronological problems of TC-Cucuteni culture. In 1984, she proposed her own chronological scheme, according to which TC C-II must have dated back to 2800-2400 (2750-2350) BC [Movsha 1985b].

In 1989, V.G. Petrenko published a paper dedicated to Usatovo monuments in the north-western Pontic region (Patokova et al. 1989:3-4). In the introduction to the collective monograph, he proposed a chronological table for TC, with absolute dates. It was based on the scheme of T.G. Movsha [Movsha 1985b]. Specifying a chronology of Usatovo finds in the corresponding section, the author supplies a number of analogies to the materials from Ezero (XII-VII), Černavoda III and Coțofeni. With regard to large Usatovo daggers, he noted that their analogies were discovered in mixed Trojan collections of the second half of the 3rd millennium BC. Their late appearance in the northern Pontic region is doubtful, as Anatolian complexes of Troy II type disappeared in the period between 2300-2200 BC, according to radiocarbon chronology. Thus, the radiocarbon method dates Usatovo materials back to approximately the 27th - 25th centuries BC. However, according to V.G. Petrenko, the materials do not reflect the real age of the monuments. Taking into account dendro-chronological probability, according to R. Clark calibration, the late

part of the Usatovo group must be dated back to the middle of the 33rd century BC [Patokova et al. 1989:115-116].

In 1994, an article by K.P. Wechler dedicated to the state of isotopic dating of TC-Cucuteni culture was published. He had taken 51 dates into account. More than two thirds of these, according to this data, were calculated by Berlin and Kiev laboratories. Summarising the obtained data, the author proposed the following dating for the latest stages of TC-Cucuteni culture: 3780-3320 BC.

Allowing for a 50% mistake probability, TC C-I can be dated back to 3890-3620, and C-II to 3150-2880 BC (cal. BC). In that case, the whole period of the culture's existence must be dated back to 4500-2900 BC [Wechler 1994:13]. According to K.P. Wechler, the data obtained can be confirmed by archaeological dating carried out by H. Parzinger. The latter compared stratified monuments of south-eastern Europe and the Mediterranean.

The fundamental two volume research of H. Parzinger, covering hundreds of stratified monuments of the South of Europe and the Near East, is of special interest in the search for a solution to the problems of Neolithic - Early Bronze age chronology [Parzinger 1993]. All the monuments of the Neolithic, Eneolithic and the Early Bronze Age, together with their corresponding layers, were included in one of the 15 horizons, according to their position. This system includes, in particular, monuments of the Cucuteni culture on the territory of Romania - such well-known multi-levelled settlements as Tirpești, Trayan-Dyaul, Fintynilor, Esvoar, and Cucuteni-Foltești. The stage of TC C-I represented by the B1-2 layer of the Cucuteni settlement is attributed by H. Parzinger to the second half of the 9th horizon (9b), generally dated back between 3700-3600 and 3500-3400 BC. However, the monuments of Cucuteni A-B were also attributed to horizon 9. This may be correct from the stratigraphic point of view, but does not correlate with the absolute dating of the stage in general. To our mind, the threshold of horizon 9 has to be shifted back 400-500 years, as archaeo-magnetic and isotopic data testifies. The following date - TC C-II - represented by layer I of the Foltești layer, is attributed to the 10th horizon, which must place it in the period between 3400-3300 and 3200-3200 BC, in analogy with Egypt and Mesopotamia [Parzinger 1993:290]. This evidently corresponds, in general, to calibrated, but not to conventional dates. Unfortunately, the region covered by this research only extended as far east as the river Prut, i.e. the western division of the TC-Cucuteni culture. Materials from the territories of Moldova and Ukraine have not been used, though it is conceivable from the context of the research that they were, to a certain extent, taken into account.

The latest researches in the field of the isotopic chronology of TC-Cucuteni culture are connected with a set of dates from the samples of Sofievka type in Kiev Laboratory. The development of new laboratory equipment and the improvement in the processing of samples enabled the use of calcinated bones from the gra-

ves with body cremation remains, and the micro-testing of charcoal and organic saturated ceramics from the cemeteries [Kovalyukh, Videiko, Skripkin 1995:135]. The results, to a certain extent, have changed the idea of the dating of the end of the TC. According to the authors of the publication of the dates, the cemeteries of Sofievka type date back to 3300-2900 BC [Kovalyukh, Videiko, Skripkin 1995:135-140]. The analysis of archaeological dates does not contradict this. Thus, a vessel with features characteristic of the artefacts of the Globular Amphora culture, the chronological position of which, with regard to TC, is not doubted, was discovered in the ceramic complex of the cemeteries [Kadrow, Koško, Videiko 1995:211-213].

S. Kadrow [1995] offered a slightly different version of the absolute chronology of Sofievka monuments. He used a data processing program that enables us to obtain the minimum interval for a specific date. As a result of this processing, all individual dates from Sofievka cemeteries were between 2950 -2700 BC. According to S. Kadrow, the set of dates from Sofievka covering 100-130 years between 2920 -2790 BC is the most compact [Kadrow 1995].

3.2. THE RELATIVE AND ABSOLUTE CHRONOLOGY OF TRIPOLYE CII ACCORDING TO THE ISOTOPIC METHOD

The new set of 18 dates for complexes from the Dniester, the Volhynia and the region of the Bug and the Dnieper river basins allows us to make the isotopic chronology of the latest TC more detailed. It is important that they were obtained using the same method and that the dates for Sofievka cemeteries mentioned above are relatively precise. In addition, the dating of the Usatovo complexes from the burial ground (at least 3 dates) should be mentioned. Thus, the new set of dates exceeds in quality and in quantity the set obtained in the previous decade.

The dates obtained do not generally contradict the results of the archaeological comparison of complexes of the basic types of the late TC. The latter concerns the division of the C-II stage into two horizons - early and late. Each of these has its specific set of types [Dergachev 1980:192]. However, the concrete set of dates and the attribution of individual complexes to different stages was not significantly changed in the light of isotopic chronology.

Let us begin with the early horizon. We have written before about the necessity to eliminate the Lukashy type. In view of this, it is worth mentioning V.A. Dergachev's conclusion that this type definitely has no place within the parameters of the general Late TC period, as distinguished by him [Dergachev 1980:136,142]. According to isotopic dates, the Gorodsk settlement, which gave its name to the

type included in the Late TC C-II, should, in fact, be attributed to the early stage. In the light of the new dates, several questions arise regarding the attribution of Mayaki, a settlement of the Usatovo type, to the late stage. At the same time, the existence of the Usatovo type throughout the whole of TC C-II is beyond doubt.

Certain changes also took place in terms of the nomenclature of the late stage of the C-II period. These are connected with the rather old age of cemeteries of Sofievka type that had previously been compared to the Troyaniv type, belonging to the early stage. The place of Gorodsk is occupied by Sandraki. The Usatovo type should be represented not by Mayaki, but by Usatovo burial ground cemeteries and sanctuary. The appearance of Kosenivka type complexes in the region of the Bug and the Dnieper river basins, represented by Vilkhovets settlement, was rather unexpected.

The appearance of dates for Tsviklovtsy (if correct) and Usatovo burial ground cemeteries, which, in general, exceed the bounds of the late TC isotopic dates, may testify to the existence of an intermediate period on the edge of the disappearance of the Late TC monuments.

The results of the relative chronology of the Late TC complexes according to isotopic dating is summed up below in Table 14.

Table 14

The relative chronology of the late period (C-II) of Tripolye according to isotopic dates

Moldova	South (steppe)	The Dniester	Volhynia	The Southern Bug	The Dnieper
	Usatovo cemeteries	Tsviklovtsy			
	Usatovo sanctuary	Zhvaniets-2	Sandraki	Vilkhovets	cemeteries of Sofievka type
	Mayaki, Usatovo, sub-burial ground cemetery	Zhvaniets-1	Troyaniv, Gorodsk		
Danku-II					

In the light of the new dates, the absolute chronology of the late TC has also slightly altered. When the dates from Gorodsk and a number of the dates for Mayaki settlement are taken into account, the beginning of the early stage of C-II period coincides with the beginning of the second half of the 4th millennium BC. In the future, this threshold will probably move to the last quarter of the same millennium, if the dates from Troyaniv are taken into account. The conclusion concerning the earlier dating of TC C II decline has recently been confirmed. We would remind you that the final limit of TC C-II was previously dated back to the last quarter of the 4th millennium BC. Presently, this period is considered to see the beginning of TC

C-II. With the appearance of the dates for Sofievka type, the end of Tripolye C-II was shifted to the first quarter of the 3rd millennium BC. This limit is confirmed by the set of dates for such settlements as Sandraki, Zhvaniets and Vilkhovets. The dates for Tsviklovtsy and for the Usatovo sub-burial ground cemeteries and sanctuary, however, allow us to shift this date to the middle of the 3rd millennium BC.

Translated by Maria Ogiyenko

Victor I. Klochko, Vladimir A. Kruts

RADIOCARBON DATES FROM THE YAMNAYA CULTURE BARROW AT THE TRIPOLYE CULTURE “GIANT SETTLEMENT” NEAR TALYANKY

The “giant settlement” of the late Tripolye culture (TC) near the village of Talyanky, in the Talne District of the Cherkasy Region, has been studied by researchers led by Vladimir A. Kruts for many years [Kruts 1994: 29-30, Fig. 2]. In 1986, the fourth burial mound (hereinafter, barrow 4) of the Yamnaya culture (YC) was excavated at the site of the settlement by an expedition led by Victor I. Klochko.

Barrow 4 was located at the south-eastern end of the settlement. It was 0.7 m high and about 22 m in diameter. It was built over the remains of two constructions of the TC (so-called “ploshchadki” or grounds) that belonged to the outer row of the settlement constructions - “ploshchadki” 13 and 14. The bank of the barrow (heavily smoothed down by modern ploughing) consisted of black earth and contained a large number of fragments of baked clay and ceramics from the partially ruined remains of the TC huts (Fig. 1).

1. THE GRAVES

Grave 1 (the YC) (Fig. 1; 2:1) was situated 1.5 m to the north of the assumed centre of the barrow and represented the main (primary) grave. The discharge (i.e. the soil taken out in the process of digging the grave) was scattered along the western wall of the pit in a layer 7 m long, up to 2 m wide and up to 0.5 m high. The lower part of the discharge consisted of humus, while the upper level was formed of mainland clay.

The rectangular pit, its walls slightly slanted inwards, was 1.9 m x 1.1 m in size, and 0.8 m deep from the edge (the level of buried soil). Its long sides were oriented along the north-east-to-south-west line. The filling was of humus, with occasional

small pieces of wood from the “ceiling”. It was a double grave. Skeleton 1, of an adolescent (still with some milk teeth)¹ lay on its back at the eastern wall of the pit, with its arms extended along the body. The legs, bent at the knees, later fell to the right. The bones were covered with a thick layer of raddle. Skeleton 2 belongs to an adult. It lay on its back, head to the north-east, arms slightly bent at the elbows and extended along the body. The legs had been bent at the knees and fell to the right and to the left; the feet had been positioned next to each other.

The whole floor of the pit under skeleton 1 displayed traces of a mat woven of plant fibre (linen); in addition, there were traces of another covering, which had been put over the first mat, currently represented by brownish rot, thickly covered with ochre. At the bottom of the pit, near the left heel bone of skeleton 1, there was a flint tool (a scraper?) made of a triangular flake of yellow local stone, with one edge retouched.

The radiocarbon date of the grave — 3990 ± 50 BP (Ki-6714) was obtained from the human bones.

Grave 2 (the YC) (Fig. 1; 2:2) was located 2.5 m to the east of the assumed centre, cut into the edge of the first bank. Its discharge lay at the foot of the first bank, practically on the mainland clay, covered with a thin layer of humus (up to 10cm thick) (the rest of the humus in this place had been used for the construction of the first bank). The discharge, up to 0.4 m high, consists of two parts: humus (below) and clay (above).

The rectangular pit was 1.8 m x 1.1 m in size, 1.3 m deep from the edge, its long sides oriented along the north-east-to-south-west line. The filling is heavily mixed, containing occasional small fragments of wood from the “ceiling”. The skeleton of an adult man lay on its back, head towards the north-east, arms slightly bent and positioned along the body. The legs, bent at the knees, fell to the left. The floor of the pit displayed traces of a rug woven from plant fibre. On top of this, under and along the bones of the skeleton, there are traces of brown rot (remains of clothes?). Two coals were placed above the skull.

This grave is the main grave of the second bank.

The radiocarbon date of the grave — 3945 ± 50 BP (Ki-6715) was obtained from the human bones.

Grave 3 (the YC) (Fig. 1; 3:1) was located 5 m to the north-west of the assumed centre, cut into the edge of the second and first banks. The clay discharge, up to 0.4 m high, was placed on the slope of the second bank.

The rectangular pit, with slightly convex walls, was 2 m x 1.2 m in size and 1.3 m deep. The filling contained white rot (remainders of the ceiling made of some organic material?). The skeleton of an adult lay on its back; the arms extended along the body; the legs, bent at the knees, falling to the right.

The bottom of the pit displayed the remains of a rug made from plant fibre.

¹ Here and below anthropological definitions are given by Dr. Svetlana Kruts.

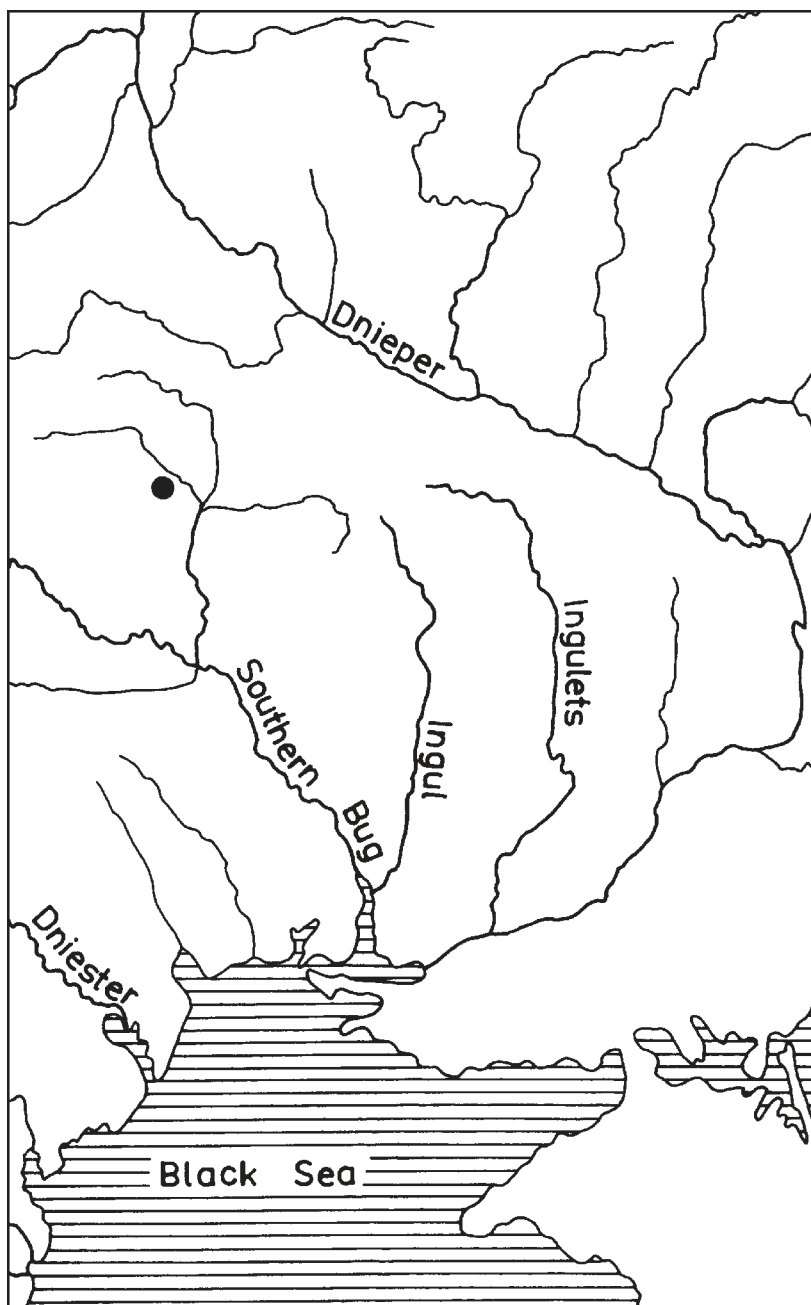
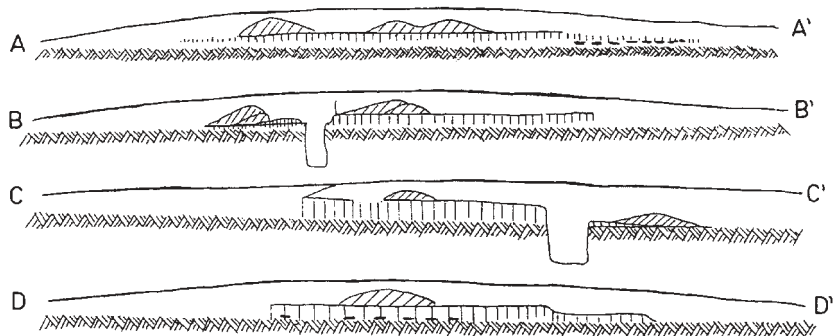
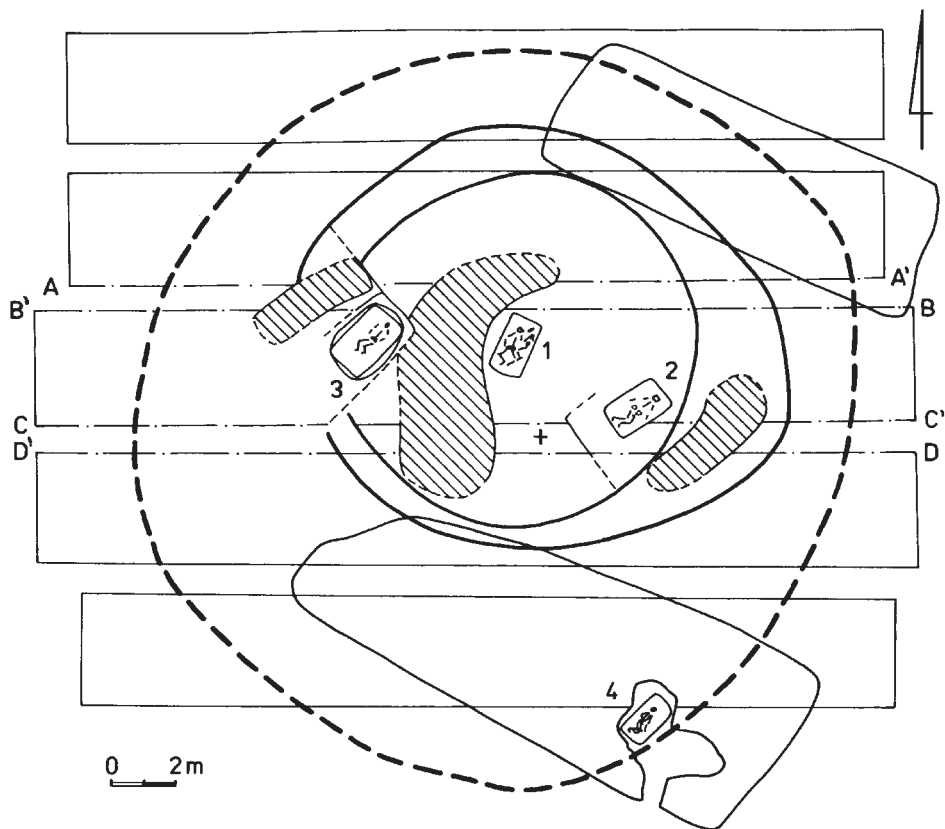


Fig. 1. Talyanky, Cherkasy Region. Location of the site (left) and plan of the barrow 4 (right)



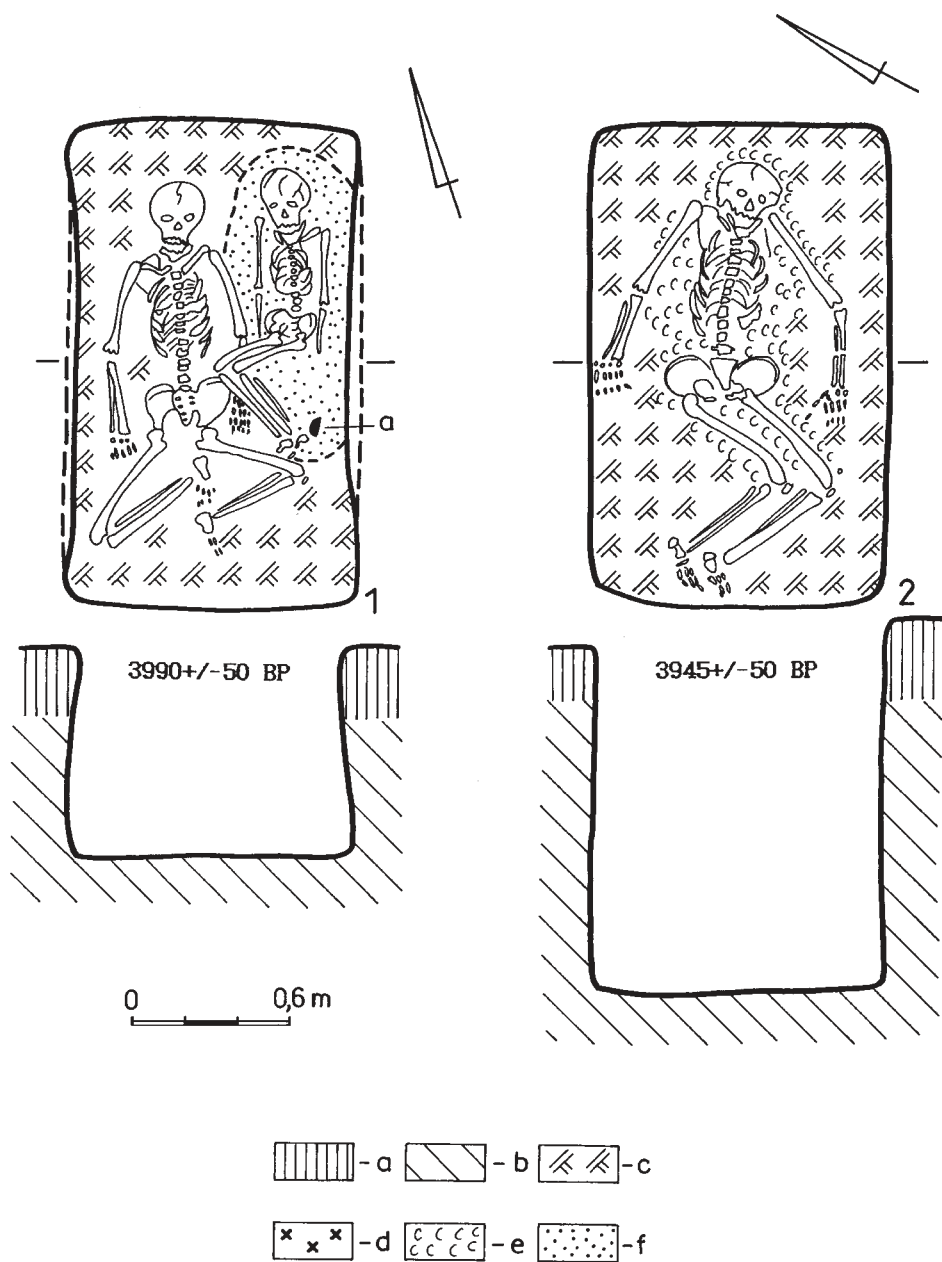


Fig. 2. Talyanky, Cherkasy Region. The barrow of the Yamnaya culture: 1 - grave 1 (a - flint tool); 2 - grave 2

Key: a - humus (arable layer); b - rock-bed (clay); c - remains of mat; d - charcoals; e - ochre; f - remains of plant fibres

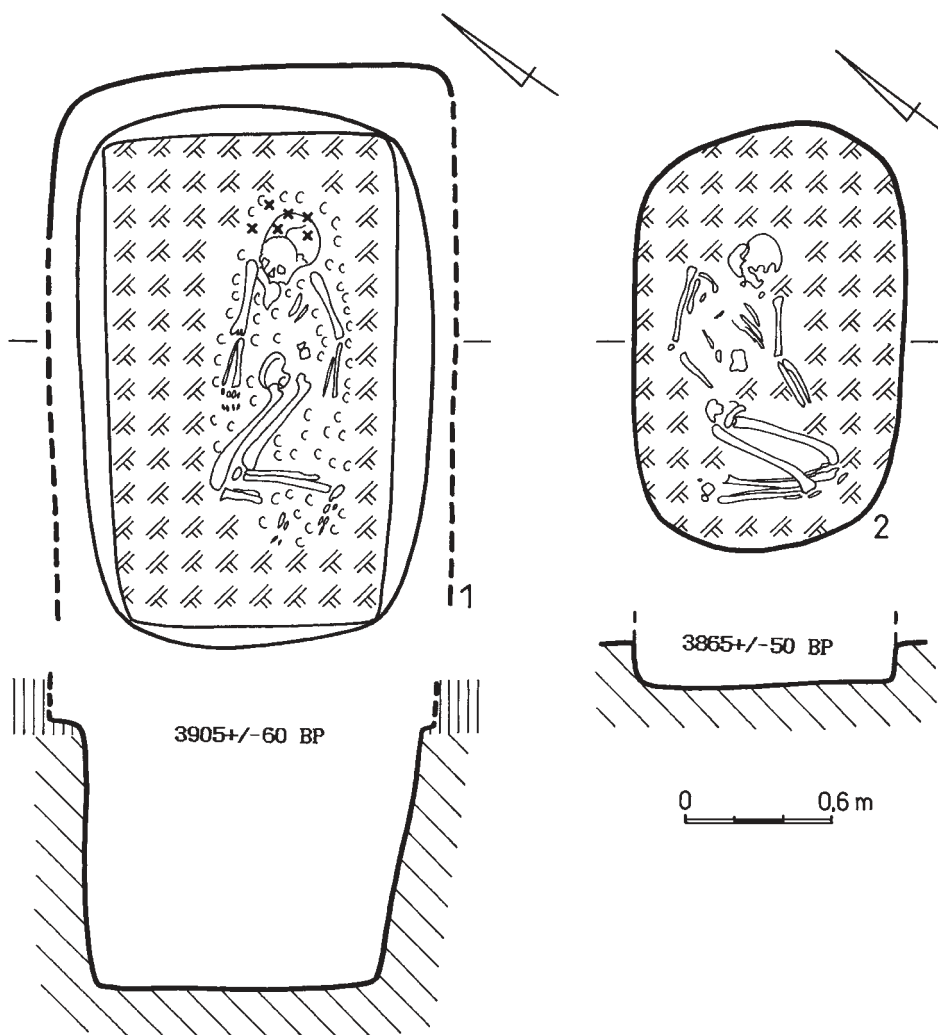


Fig. 3. Talyanky, Cherkasy Region. The barrow of the Yamnaya culture: 1 - grave 3; 2 - grave 4

The skull was covered with black, velvet-like rot (remains of a head-dress?), while both under and over the bones of the skeleton was a brown-coloured rot (remains of clothes?). Two coals were found near the skull.

The radiocarbon date of the grave — 3905±60 BP (Ki-6716) was obtained from the human bones.

Grave 4 (the Late YC) (Fig. 1; 3:2) was located 8.5 m to the south-east of the

assumed centre, in the field of the third bank. While this grave was being made, the TC “ploshchadka” was broken through.

The rectangular pit was 1.8 m x 1.1 m in size, and about 0.9 m deep, with its long sides oriented along the north-east-to-south-west line. The skeleton of an adult man lay in a foetal position on its left side, head towards the north-east, with the arms extended along the body, and the legs bent at the knees, heels under the pelvis.

The bottom of the pit displayed traces of a rug that had decayed into brown rot. This grave — the latest in the barrow — was sunk into the bevel of the third bank.

The radiocarbon date of the grave — 3865 ± 50 BP (Ki-6717) was obtained from the human bones.

2. STRATIGRAPHY OF THE BARROW 4

Bank 1. The original bank of the barrow was made over grave 1. The diameter can be reconstructed from the edge of the burial soil as being no more than 5.5 m. Its height remains unknown, since the top of the bank was destroyed by ploughing. The bank was made from humus, with lumps of clay, baked clay and ceramics from the ruined TC “ploshchadki”. Most probably, turf cut nearby was used as construction material for this and two other banks of the barrow.

Bank 2 was made over grave 2, sunk in the eastern slope of the first bank. The bank is oval in shape, 13 to 15 m in diameter. It was built from humus, with admixtures of baked clay and ceramics from the ruined TC “ploshchadki”.

Bank 3 was built over grave 3, sunk in the western slope of the second and first banks. The diameter can be reconstructed from the final excavation of soil in the field as being 21 to 22 m. The bank was made from humus, with admixtures of TC ceramics and baked clay.

CONCLUSIONS

The stratigraphy of the barrow and the series of radiocarbon dates, allow us to make the following observations.

- a. The Talyanky settlement of the TC dates back to 4800-4700 BP (3640-3460 BC)². Since life in the settlement ceased, the layer of soil over the remains of the TC huts has reached up to 10 cm.
- b. The construction of the barrow began (date of the primary grave, no.1) in 3990±50 BP (2502±71 BC).
- c. The second bank of the barrow (grave 2) was built in 3945±50 BP (2398±78 BC). The third bank of the barrow (grave 3) was built in 3905±60 BP (2371±86 BC).
- d. Hence, the early YC graves in this barrow date back to 4000-3900 BP. The Late YC grave (grave 4) dates back to 3865±50 BP (2309±89 BC).

Translated by Maria Ogiyenko

² The dates ¹⁴C (from the animal bones) 4755±50 BP (Ki-6865); 4720±60 BP (Ki-6866); 4810±55 BP (Ki-6867); 4780±60 BP (Ki-6868) = 3640-3460 BC.

Alla V. Nikolova

RADIOCARBON DATES FROM THE GRAVES OF THE YAMNAYA CULTURE AT THE INGULETS RIVER (THE KIROVOHRAD REGION)

For the purposes of analysis, researchers selected a group of the Yamnaya culture (YC) graves studied by the expedition of the Institute of Archaeology of the Ukrainian Academy of Sciences in 1990-1992. The graves were part of the burial site located in the south-eastern part of the Kirovohrad Region near the villages of Golovkovka and Protopopovka in the Aleksandria District (Fig. 1:A, B).

The burial site was situated on the watershed plateau of the Ingulets river and its tributary, the Beshka, and consisted of 48 individual mounds. The mounds formed separate groups that stood 0.5 to 2 km from each other (Fig. 1:C-I). All in all, 56 graves were found in 41 excavated burial mounds, and human bones were taken from 17 YC graves for ^{14}C calibration dating (Table 1). Below is a description of the graves.

1. DESCRIPTION OF MATERIALS

1.1. BURIAL MOUNDS NEAR GOLOVKOVKA

Barrow 3. Height: 0.4 m, diameter: 20 m. Made over grave 1 of the YC (Fig. 2:1).

Grave 1 (main, Fig. 2:2) was found in the centre of the barrow. At the level of the buried black earth, the grave was covered with wooden blocks up to 0.18 m wide. The rectangular pit, 1.85 m x 1.06 m in size, was oriented from south-west to north-east. The bottom of the pit lay at a depth of 1 m from the level of the black earth. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended along the body. The legs, bent at the knees and raised up, later

fell down in a rhombus. The bones were covered with ochre. To the left of the skull, there was a lump of ochre shaped in the form of a crimson oval “flat cake”, 9.5 x 8 x 4 cm in size. There was some brown rot on the floor of the pit.

Barrow 5. Height: 3 m, diameter - 35 m. There were two graves of the YC in this barrow (Fig. 2:3).

Stratigraphy of the barrow. The barrow was built in two stages. The earlier mound was made over grave 5; it is 2.3 m high and about 25 m in diameter. Two fire-beds were found under this mound at the level of the ancient horizon: one in the north-eastern sector of the barrow, and the other 2.5 m to the south-east of the grave. The second mound of the barrow was connected with grave 3; after it was built, the barrow reached its current size.

Grave 3 (Fig. 3:1) was sunk into the south-eastern sector of the first mound, and covered with wooden blocks at that level. The rectangular pit, 1.4 x 1.05 m in size, oriented with its long sides from north-east to south-west, was ruined at some stage. The pit was 1 m deep. At the bottom of the pit, along the long walls, there was a groove, 5 cm wide and 2-4 cm deep. Only the upper part of the skeleton was preserved; it lay in a foetal position on its right side, head to the north-east. The right arm was extended, and the left arm was slightly bent at the elbow. There was a sheep/goat hoof behind the skull, and some white rot, coloured with ochre, on the floor of the pit.

Grave 5 (main, Fig. 3:3) was found at the centre of the barrow. The pit, rectangular in projection, with rounded corners, was 2 x 1.2 m in size, with its long sides oriented from south-west to north-east. It was covered with wooden blocks, placed parallel to the long sides. The pit was 1 m deep from the level of the buried black earth. The skeleton lay in a foetal position on its back, head to the south-west, arms slightly bent at the elbows. The bones were covered with ochre, and there were several lumps of ochre behind the skull. The floor displayed brown rot and patches of ochre.

Barrow 6. Height: 3.3 m, diameter: 40 m. Three graves of the YC were found in this barrow (Fig 4:1).

Stratigraphy of the barrow. The first bank was made over grave 8; it was 1.7 m high and 15 m in diameter. Later, grave 9 was sunk into the southern edge of the barrow, and was subsequently covered with a bank (2.5 m high, 22 m in diameter). The construction of the second bank was connected with grave 11, sunk in the south-eastern sector of the barrow; it was local in nature and made no significant changes to the size of the barrow. The next bank of the barrow was connected to graves of the Catacomb culture (CC). The last bank of the barrow was made over grave 2 of the Mnogovalikovo Pottery culture (MPC), and also connected to the construction of a moat around the previous bank, as fragments of vessels belonging to that culture which were found in the moat suggest.

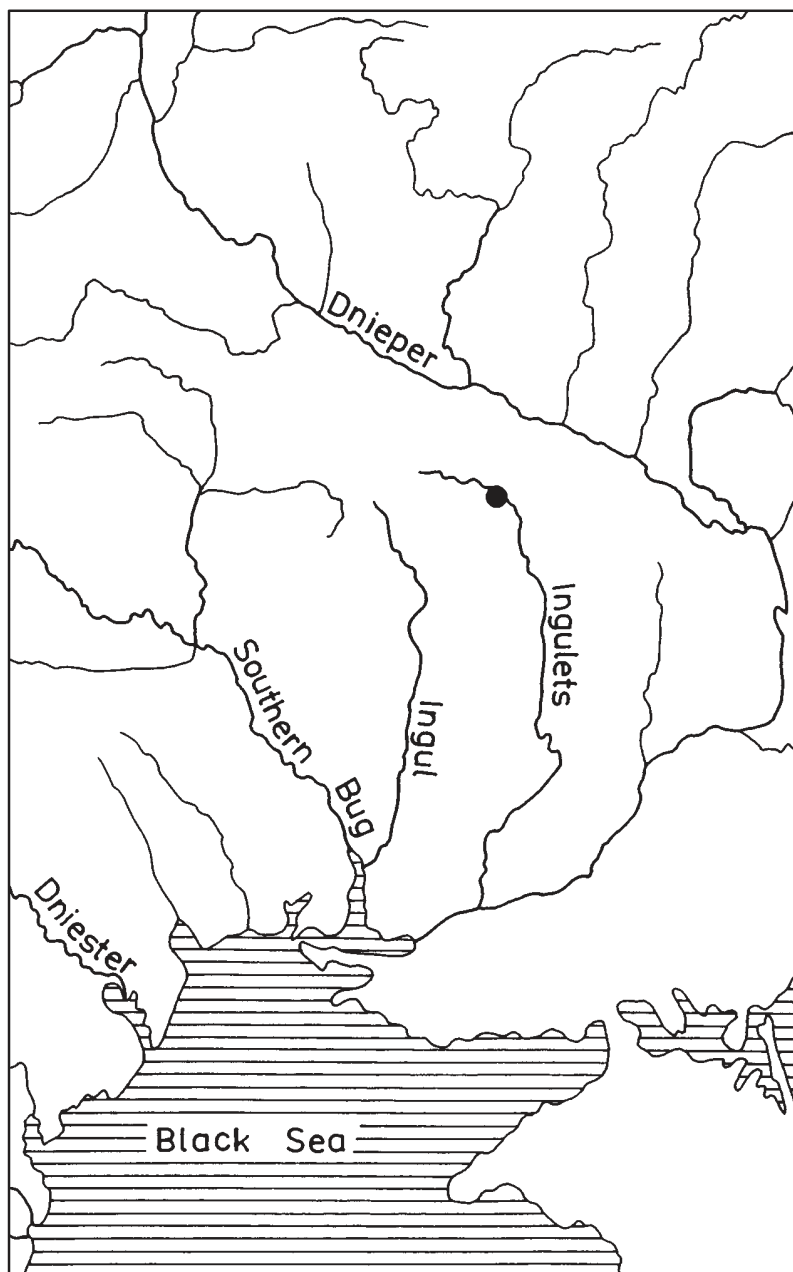
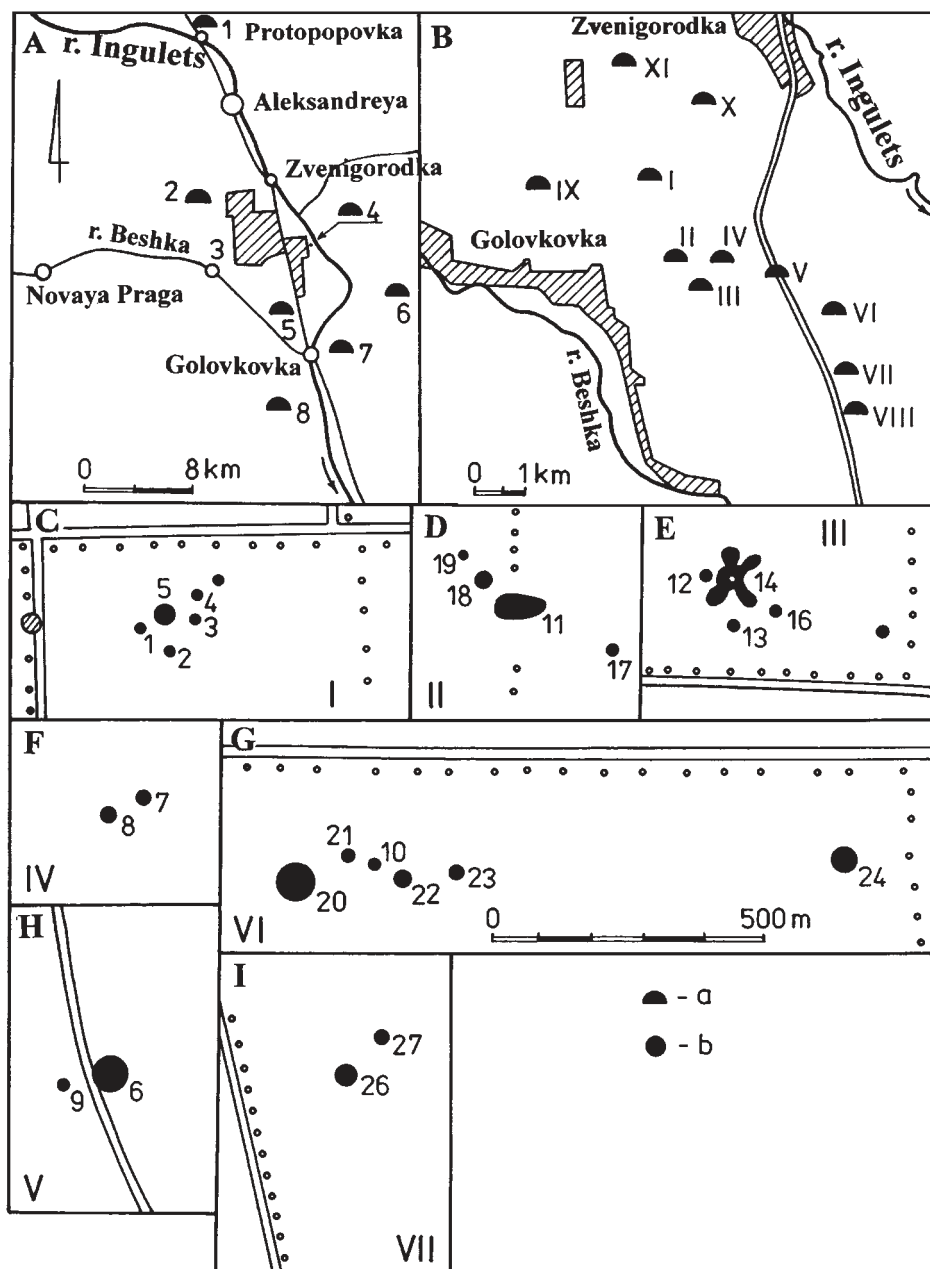


Fig. 1. Location (left) and layout (right) of the burial mound near the villages of Golovkovka and Protopopovka in the Aleksandria District, Kirovohrad Region

A-B - layout of the location of the barrow groups; C-I - layouts of the location of the barrows within the barrow groups; (I-XI - barrow groups near the village Golovkovka). Legend: a - barrow groups; b - barrows



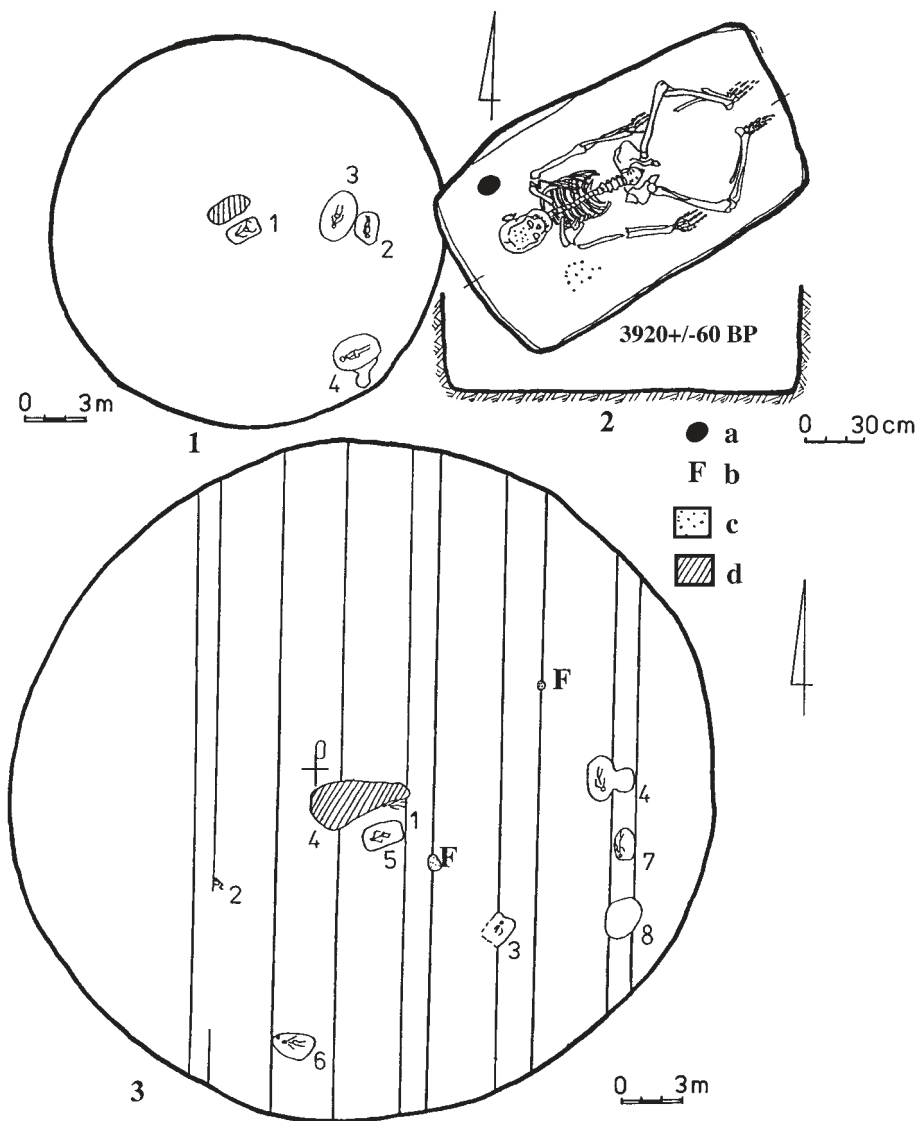


Fig. 2. Golovkovka, Aleksandria District, Kirovohrad Region

1 - general layout of barrow 3; 2 - plan and section of grave 1 of barrow 3; 3 - general layout of barrow 5. Legend: a - lump of ochre; b - remains of hearth; c - patches of ochre; d - diggins.

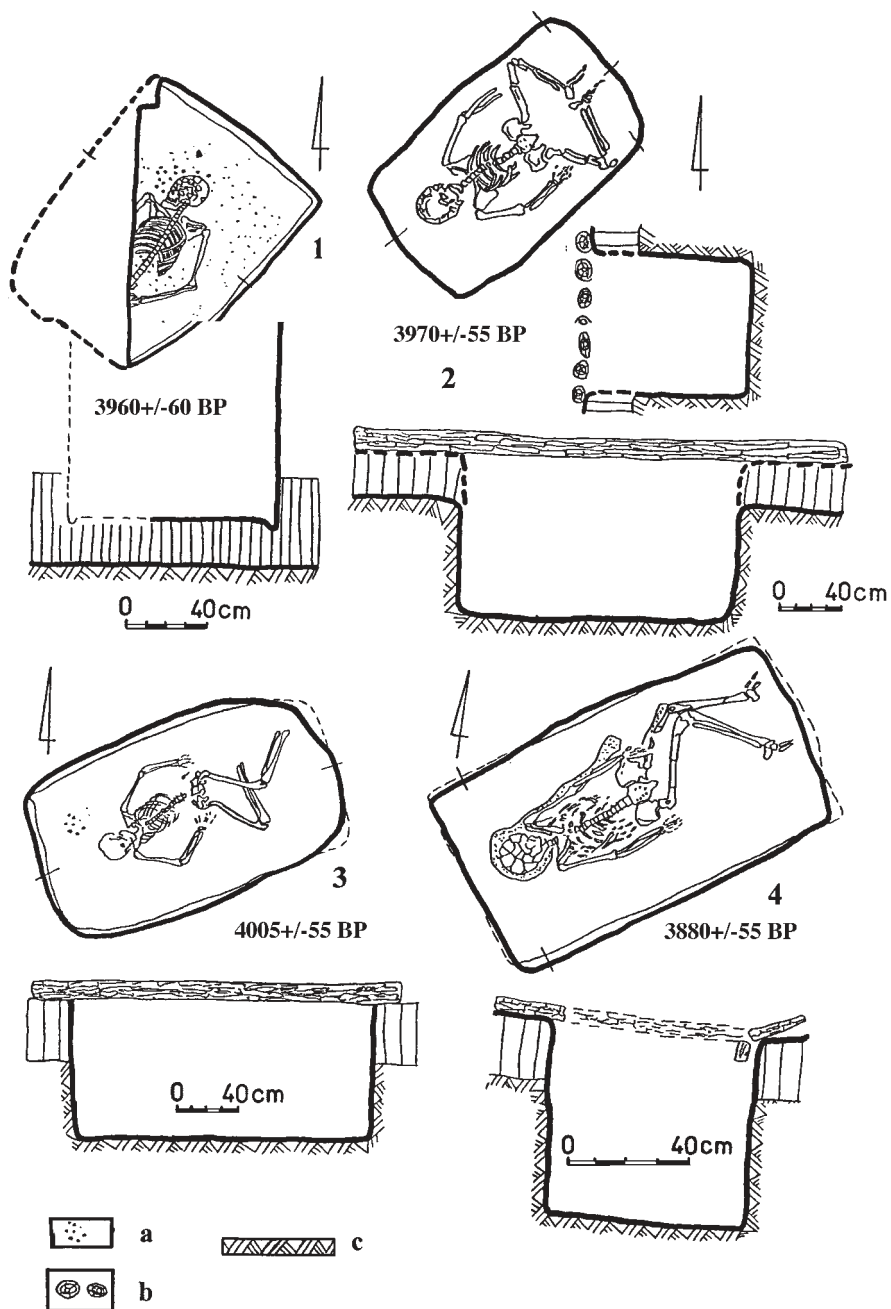


Fig. 3. Golovkovka, Aleksandria District, Kirovohrad Region

1 - plan and section of grave 3 of barrow 5; 2 - plan and section of grave 8 of barrow 6; 3 - plan and section of grave 5 of barrow 5; 4 - plan and section of grave 9 of barrow 6. Legend: a - patches of ochre; b - wooden shield; c - digging

Table 1

List of ^{14}C datings

Site	Lab. No.	No barrow /No grave	Culture, Stratification Level	Date BP	Date BC 68% - 1 sigma	Date BC 95% - 2 sigma
Golovkovka	Ki-6718	3/1	YC 1	3920 \pm 60	2468-2312 2304-2296	2566-2524 2502-2270 2260-2202
Golovkovka	Ki-6730	5/3	YC 2	3960 \pm 60	2564-2526 2500-2398 2378-2348	2612-2280 2220-2210
Golovkovka	Ki-6731	5/5	YC 1	4005 \pm 55	2580-2460 2660-2640 2382-2338	2856-2820 2624-2394
Golovkovka	Ki-6719	6/8	YC 1	3970 \pm 55	2568-2522 2504-2450 2434-2402 2374-2356	2610-2598 2588-2290
Golovkovka	Ki-6720	6/9	YC 1	3880 \pm 55	2456-2418 2410-2284	2470-2192 2162-2146
Golovkovka	Ki-6721	6/11	YC 3	3850 \pm 55	2460-2314 2302-2296	2552-2542 2492-2198
Golovkovka	Ki-6722	7/4	YC 1	3980 \pm 60	2574-2452 2430-2402 2370-2360	2846-2826 2652-2648 2618-2288
Golovkovka	Ki-6723	11/5	YC 1	4030 \pm 60	2614-2464	2866-2810 2746-2726 2698-2450 2434-2400 2374-2354
Golovkovka	Ki-6724	12/3	YC 1	3950 \pm 50	2556-2536 2494-2444 2442-2398 2378-2348	2572-2518 2506-2288
Golovkovka	Ki-6727	14/2	YC ?	3910 \pm 55	2464-2316	2558-2532 2494-2270 2260-2202
Golovkovka	Ki-6725	14/3	YC ?	3895 \pm 55	2458-2312 2304-2294	2548-2544 2490-2196 2156-2150
Golovkovka	Ki-6726	14/4	YC ?	3840 \pm 50	2398-2378 2348-2198	2456-2184 2170-2140

Site	Lab. No.	No barrow /No grave	Culture, Stratification Level	Date BP	Date BC 68% - 1 sigma	Date BC 95% - 2 sigma
Golovkovka	Ki-6728	14/7	YC 1	3905±55	2500-2300	2580-2530 2510-2270 2250-2200
Golovkovka	Ki-6729	14/9	YC ?	3920±50	2580-2540 2500-2010	2580-2200
Protopopovka	Ki-6733	1/2	YC 1	3945±50	2580-2530 2510-2450 2430-2360	2590-2300
Protopopovka	Ki-6734	1/3	YC ?	3925±55	2560-2540 2500-2340	2580-2280 2230-2210
Protopopovka	Ki-6732	1/4	YC ?	3890±55	2410-2310	2570-2540 2500-2210

Grave 8 (main, Fig. 3:2) was located in the centre of the barrow. The clay discharge lay to the north-west and the south-east of the pit. The pit was rectangular in shape, 1.8 x 1.1 m in size, with its long walls oriented from south-west to north-east. At the level of the buried black earth it was covered with wooden beams (0.18 m in diameter), placed along the longer walls. The pit was 0.95 m deep. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended; the legs, bent at the knees and raised up, later fell down in a rhombus. The bones were coloured with ochre. The floor of the pit displayed brown rot.

Grave 9 (Fig. 3:4) was sunk in the barrow, 4.2 m to the south of the "0". The rectangular pit, 1.85 x 1 m in size, was oriented with its long sides from south-west to north-east. It was 0.9 m deep, and covered with wooden blocks placed across it. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended; the legs, bent at the knees and raised up, later fell down to the left. The bones were covered with ochre, especially intensive on the skull. Patches of ochre were also found under the skull and near the left hand. There was some brown rot on the floor of the pit.

Grave 11 (Fig. 4:2) was found to the east of the previous grave. The pit was trapezoid in shape, 1.7 x 0.85-1.15 m in size, with its long sides oriented from south-west to north-east. The entrance to the 0.7 m deep pit was blocked with beams, arranged across it. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended; the legs, bent at the knees and raised up, fell to the right. The skull, bones of the hands and the feet were coloured with ochre. There was brown rot at the bottom of the pit.

Barrow 7. Height: 0.9 m, diameter: 30 m. It contained one grave of the YC, and was constructed over that grave (Fig. 5:1).

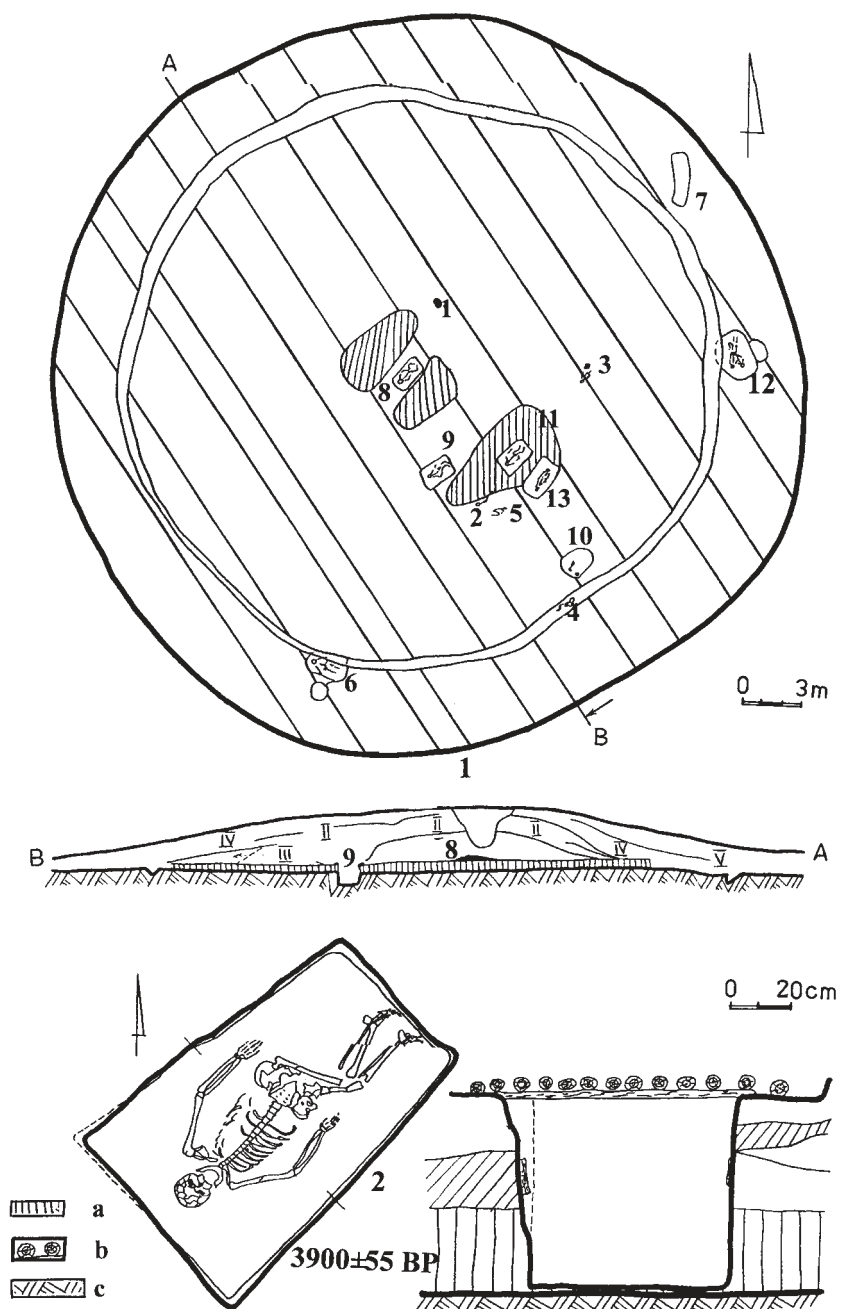


Fig. 4. Golovkovka, Aleksandria District, Kirovohrad Region

1 - general layout and section of barrow 6; 2- plan and section of grave 11. Legend: a - buried black earth; b - wooden shield c - digging

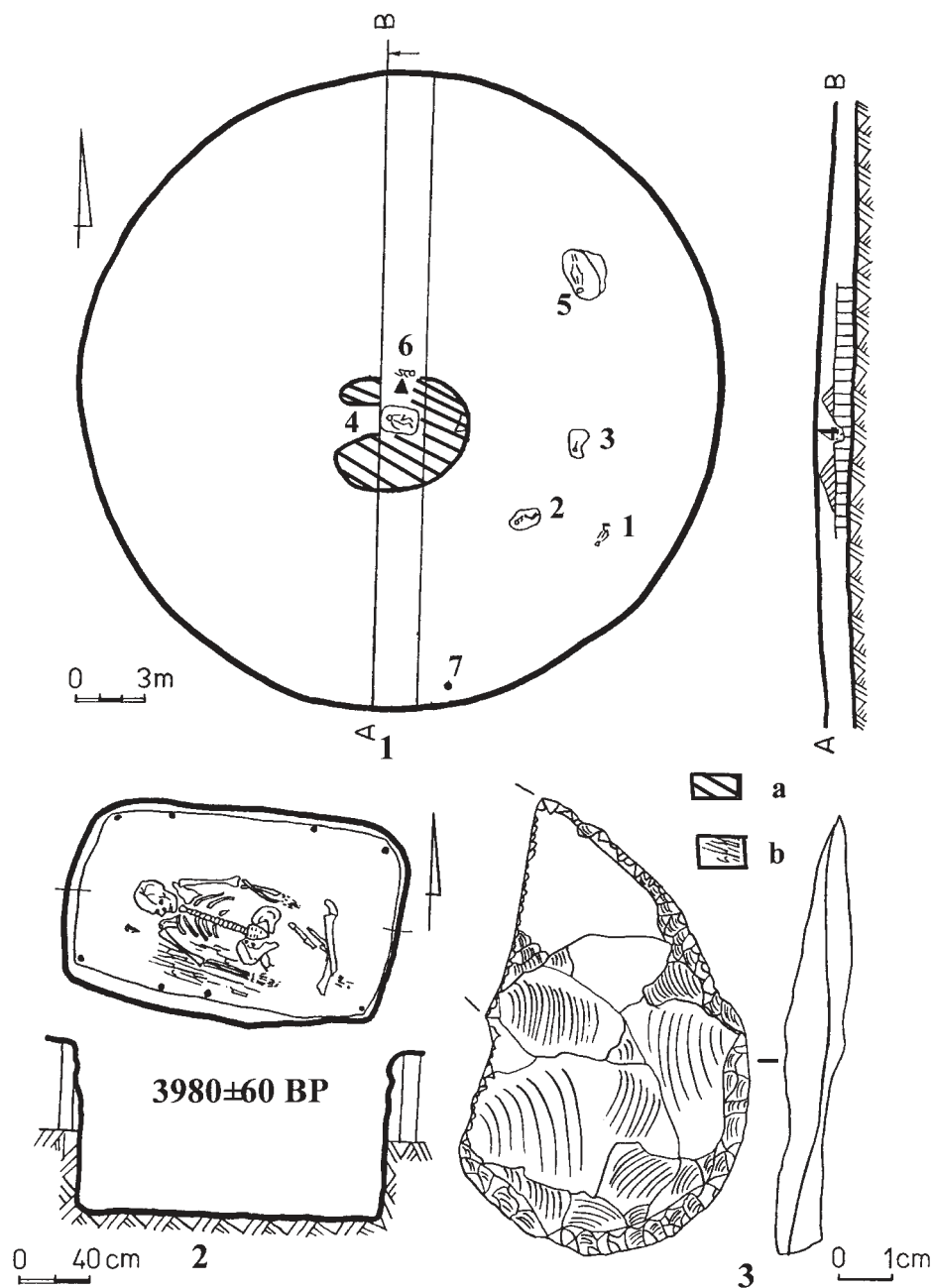


Fig. 5. Golovkovka, Aleksandria District, Kirovohrad Region
 1 - general plan and sections of barrow 7; 2 - plan and section of grave 4 of barrow 7; 3 - flint knife from grave 4. Legend: a - diggings; b - fibre rot from the mat

Grave 4 (main, Fig. 5:2) was found in the centre of the rectangular pit, 1.7 x 1.1 m in size, oriented with its long sides from west to east. The discharge lay to the north of the pit, which was 0.95 m deep. At the level of the buried black earth, the pit was covered with wooden blocks; in the south-eastern corner of the pit there was a block of granite, 0.4 x 0.3 x 0.08 m in size. The skeleton lay in a foetal position on its back, head to the west. The arms were extended; the legs, bent at the knees and raised up, later fell to the right. To the right of the skull, there was a fragment, 8 x 5.5 x 0.8 cm in size, of a flint knife with a broken blade (Fig. 5:3). The remaining piece, made of a flat flint flake, retouched on both sides, consisted of a part of the blade and the blunted base of the haft, and was possibly used as a scraper. In the bottom of the pit, along the walls, there were postholes 10 cm deep, 5 cm in diameter. The skull, bones of the hands and the feet were coloured with ochre. There were also the remains of a grass mat on the pit floor.

Barrow 11. It represented the so-called “maidan”, i.e. its bank was used for the production of saltpetre in the XVII-XVIII centuries, and, therefore, the major part of it was ruined. Only a small part of the ancient bank remained. There, two graves of the YC were found; the one that was chosen for determining the dates had presumably been connected to the construction of the second bank of the barrow.

Grave 5 (Fig. 6:2) was made in a pit 3 x 2.7 m in size, with its long walls oriented from south-west to north-east. On a ledge in the pit, 1.6 m deep from the “0” level, there was a shield made from ten beams. Below the ledge, there was a trapezoid pit, 1.95 x 1.45-0.9 m in size. The bottom of the pit lay 1 m below the ledge and displayed 8 postholes, 3-4 cm in diameter and up to 15 cm deep. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended; the legs, bent at the knees and raised up, later fell to the right. The bones were covered with ochre. There was brown rot at the bottom of the pit.

Barrow 12. Height: 0.5m, diameter: 20 m. It was made over a YC grave (Fig. 6:1).

Grave 3 (main, Fig. 7:2) was located in the centre of the barrow. The rectangular pit, with rounded corners, was 2.45 x 1.25 m in size, with its longer walls oriented from north-east to south-west. The pit was 0.6 m deep. The filling contained the remains of a wooden shield and lumps of ochre. The skeleton lay in a foetal position on its back, head to the north-east. The arms were extended, the legs, bent at the knees and raised up, later fell down in a rhombus. The skull and the bones were covered with ochre. The skull rested on a 15-cm earth “pillow”.

Barrow 14. The bank of the barrow originally reached the height of 6-8 m and was 60 m in diameter. Of seven graves of the YC that were found in the barrow, 5 were selected for analysis (Fig. 7:1).

Stratigraphy of the barrow. The central part of the barrow had been ruined by a pit (“maidan”) made for the production of saltpetre; the remaining “flaps” of the barrow suggested that the earliest of the excavated graves had been grave 7 and

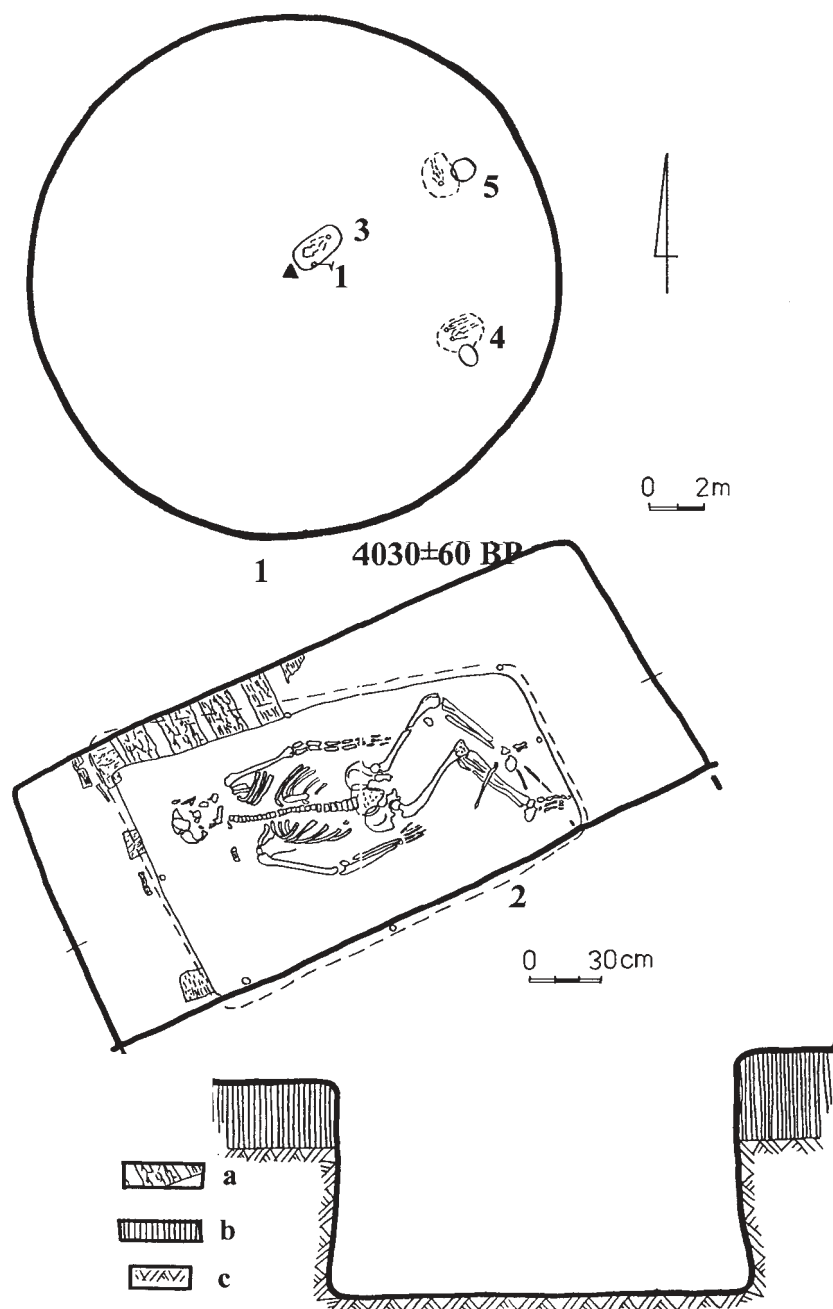


Fig. 6. Golovkovka, Aleksandria District, Kirovohrad Region

1 - general plan of barrow 12; 2 - plan and section of grave 5 of barrow 11. Legend: a - wooden shield; b - buried black earth; c - digging

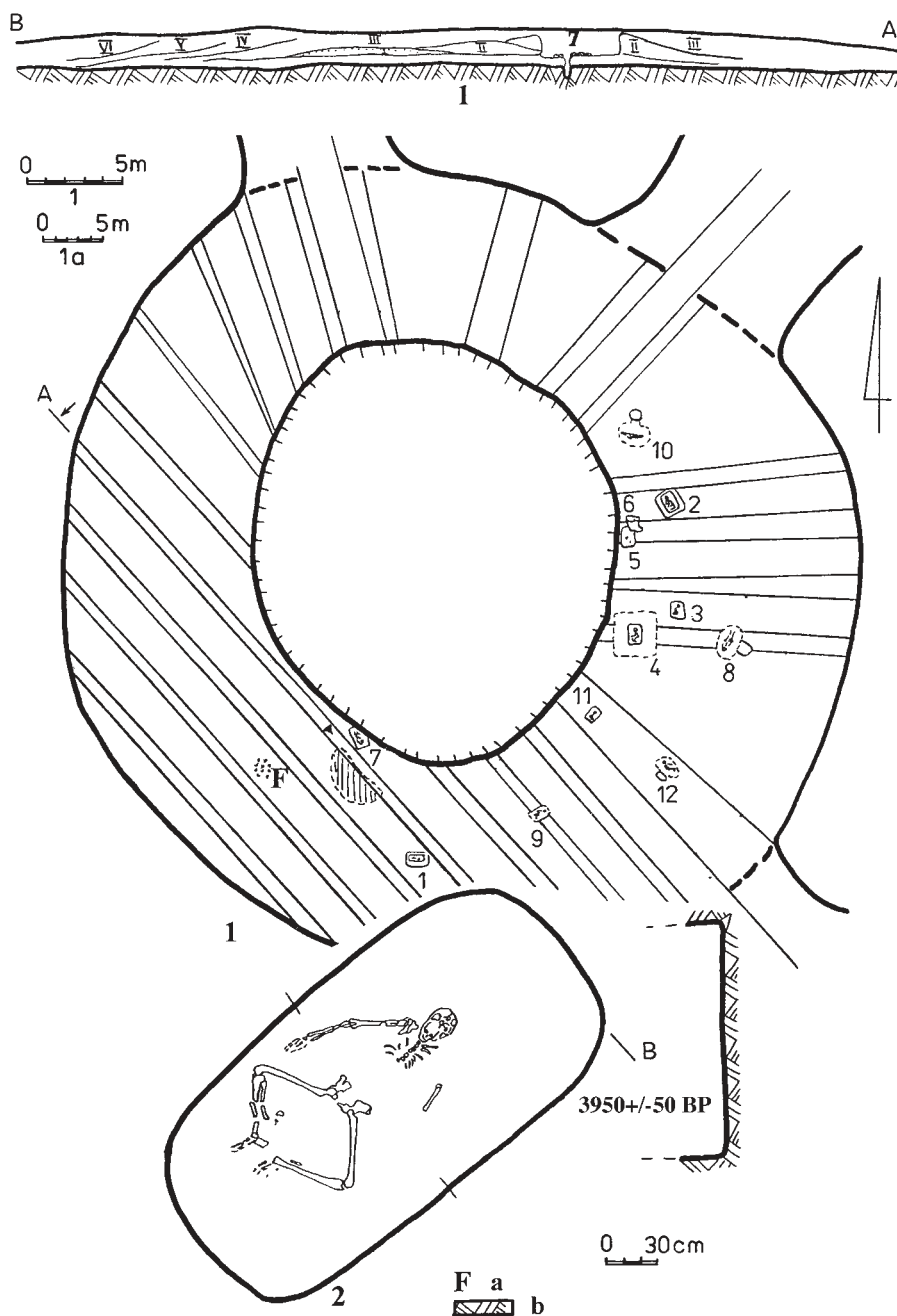


Fig. 7. Golovkovka, Aleksandria District, Kirovohrad Region

1 - general plan and section of barrow 14; 2 - plan and section of grave 3 of barrow 12. Legend: a - remains of fire-beds; b - digging

that one of the traced banks of the barrow had been connected to that grave. The other excavated graves were sunk after grave 7.

Grave 2 (Fig. 8:1) was located at a distance of 18 m to the north-east of the assumed centre of the barrow. It was made in a pit 2.15 x 1.9 m in size, with its longer walls oriented from north-west to south-east. On a ledge in the pit, 1.85 m deep, there were wooden blocks. In the south-eastern corner of the pit there was a small pile of slightly burnt bones of a small animal (sheep-goat?). Below the shield there was a rectangular pit, 1.55 x 1 m in size, 0.65 m deep from the level of the ledge. The skeleton lay in a foetal position on its left side, head to the north-west. The left arm was extended, the right arm was bent at the elbow. The legs were bent at right angles to the body. On the floor of the pit were the remains of a grass mat, 1.15 x 0.65 m, covered with wooden rods. Under the skull and in the northern corner of the mat there were traces of ochre. In front of the skeleton there was a long wooden bar, 0.78 m long and 1 cm thick. Beyond the mat there were several bones of a small animal. Behind the head of the skeleton was a moulded vessel with a short straight neck, strongly contoured shoulders and a flat bottom. The shoulders were decorated with a "herringbone" pattern made with a comb-like instrument. The vessel was 14.1 cm tall, the diameter 12.2 cm at the rim, 16.6 cm in the body, and 6 cm at the bottom (Fig. 8:2).

Grave 3 (Fig. 8:3) was found 19.5 m to the south-east of the assumed centre. The rectangular pit, 1.3 x 1 m in size, was oriented with its long walls from north to south. The filling contained the remains of a wooden shield. The bottom of the pit lay 2.2 m deep from the "0" level. The skeleton lay in a foetal position on its left side, head to the north. Both arms were slightly bent at the elbows. The legs were bent at right angles to the body. There was a grass mat on the floor, with an unbroken layer of thin rods.

Grave 4 (Fig. 9:3) was found 15.5 m to the south-east of the assumed centre. At the depth of 1.1 m, there were partially preserved longitudinal ledges, 1.05 and 1 m wide, which had served as rests for the beams, 16 cm in diameter, that had been placed along the pit. One of the beams was partially burned. Below the shield, there was a rectangular pit with rounded corners, 1.7 x 1 m in size, with its longer walls oriented from north to south. The pit was 1 m deep from the level of the ledge. The skeleton lay in a foetal position on its back, head to the north. The arms were extended; the legs, originally bent at the knees and raised up, fell to the right. The bones were covered with ochre. The bottom of the pit was covered with a grass mat, sprinkled with ochre, and featured six postholes, 5 cm in diameter and 10 cm deep.

Grave 7 (Fig. 9:2) was found 15 m to the south-west of the assumed centre. Ledges, 1 m wide, were made at a depth of 1.5 m from the entrance level, and supported several beams, placed along the pit. Below the shield was a rectangular pit, its corners emphasised with vertical grooves. The pit, 1.8 x 1 m in size, and 1.1

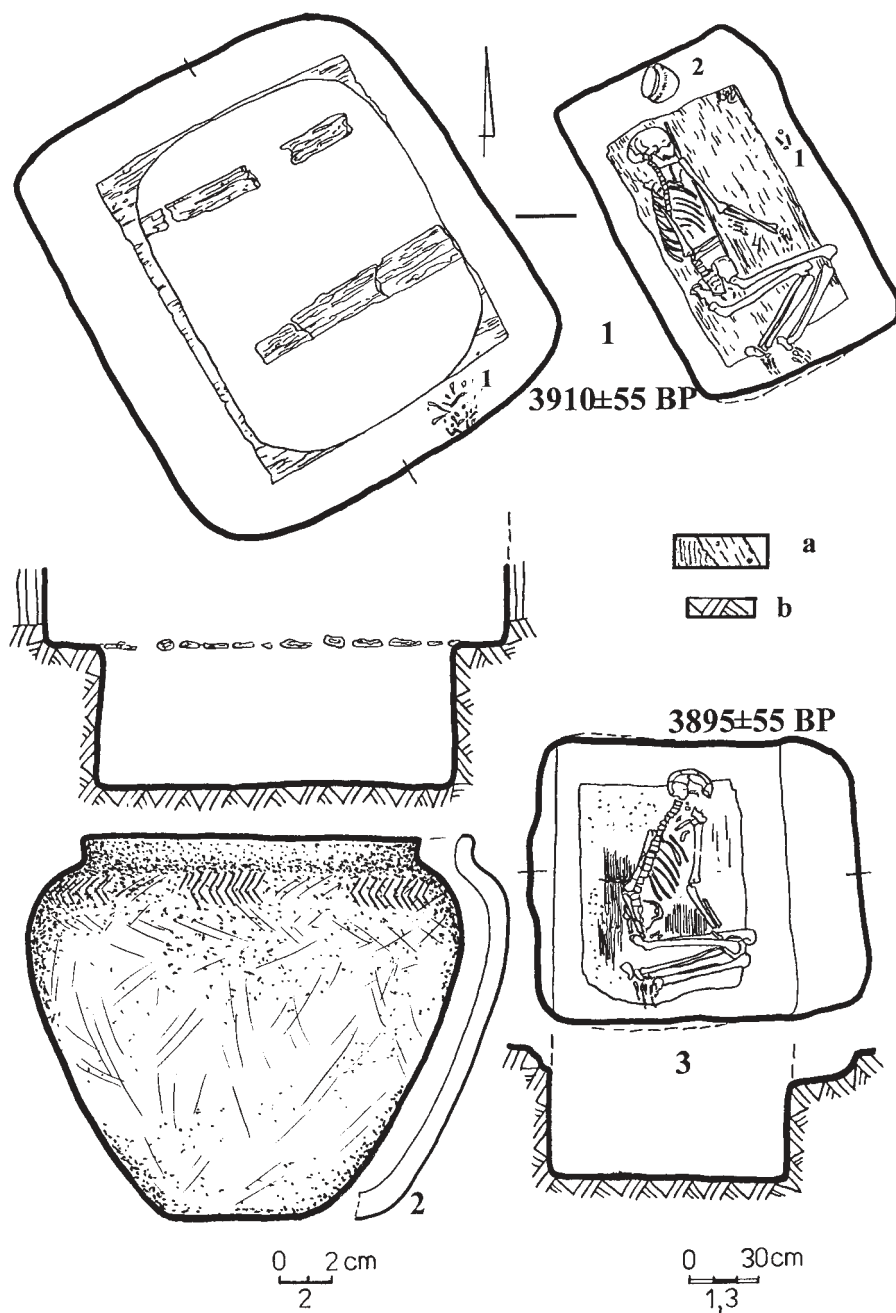


Fig. 8. Golovkovka, Aleksandria District, Kirovohrad Region

1 - plan and section of grave 2 of barrow 14 (1 - animal bones; 2 - vessel); 2 - vessel from grave 2; 3 - plan and section of grave 3 of barrow 14. Legend: a - fibre rot from the mat and wooden shield; b - digging

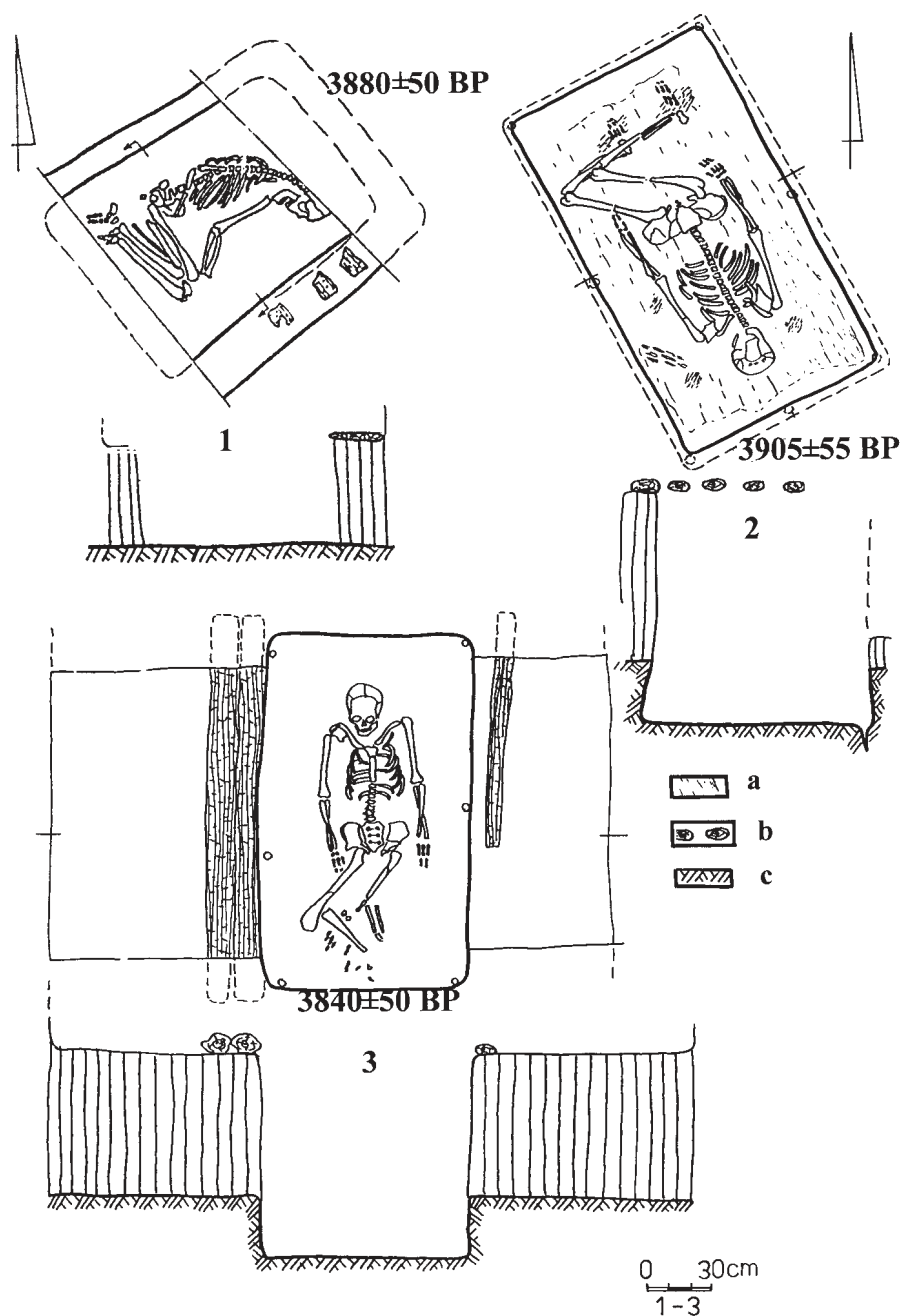


Fig. 9. Golovkovka, Aleksandria District, Kirovohrad Region

1 - plan and section of grave 9 of barrow 14; 2 - plan and section of grave 7 of barrow 14; 3 - plan and section of grave 4 of barrow 14. Legend: a - fibre rot from the mat; b - wooden shield; c - digging

m deep from the level of the ledges, was oriented with its long sides from south-west to north-east. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended; the legs, bent at the knees and raised up, later fell to the left. The bones were covered with ochre. There were patches of ochre and some brown rot on the floor. At the bottom of the pit, along the wall, there were six postholes with wooden remains inside. The hollows were 5 cm in diameter and 10 cm deep.

Grave 9 (Fig. 9:1) was sunk 22.5 m to the south-east of the assumed centre. 1.5 m deep from the "0" level there were several ledges, 0.12-0.2 m wide, which had served as the rests for 0.1 m wide wooden blocks placed across the pit. The filling of the pit contained one half of a granite grinder, oval in projection and semi-circular in section. The working facet of the grinder displayed traces of ochre. Its dimensions were 12.2 x 9.5 x 4.5 cm. Below the shield there was a rectangular pit, 1.1 x 0.8 m in size, with its longer sides oriented from north-east to south-west. The pit was 0.4 m deep from the level of the ledges. The skeleton lay in a foetal position on its left side, head to the north-east. Both of the arms were bent at the elbows. The legs were bent at right angles to the body. There was brown rot on the floor.

1.2. BARROW 1 NEAR THE VILLAGE OF PROTOPOPOVKA

The barrow stood on the high plateau of the Ingul's left bank. By the time the excavations began, the central part, and the north-eastern and south-western "flaps" had been ruined by earlier construction works. The remaining barrow was 2 m high, and 20 m in diameter.

Of the four graves of the YC found in the barrow, samples for analysis were taken from three (Fig. 10:4; 11).

Stratigraphy of the barrow. The barrow was constructed in two stages. The first bank was connected to grave 2. It consisted of 2 construction layers. The first of these, 0.9 m deep and 10 m in diameter, was made of black earth "pellets". In the process of making the bank, the buried black earth and the surface of the bank had been covered with a watery layer of soil. On top of this was the second layer, 0.5 m thick and 15 m in diameter, also made of black earth "pellets". The excavation team did not manage to trace the connection of the second black earth bank with a particular grave (Fig. 10:1-3).

Grave 2 (main, Fig. 10:4) was found in the centre of the barrow; the discharge lying to the south of the grave. At the level of the buried black earth, the pit was covered with a layer of cane and two layers of crossed thin rods. The rectangular

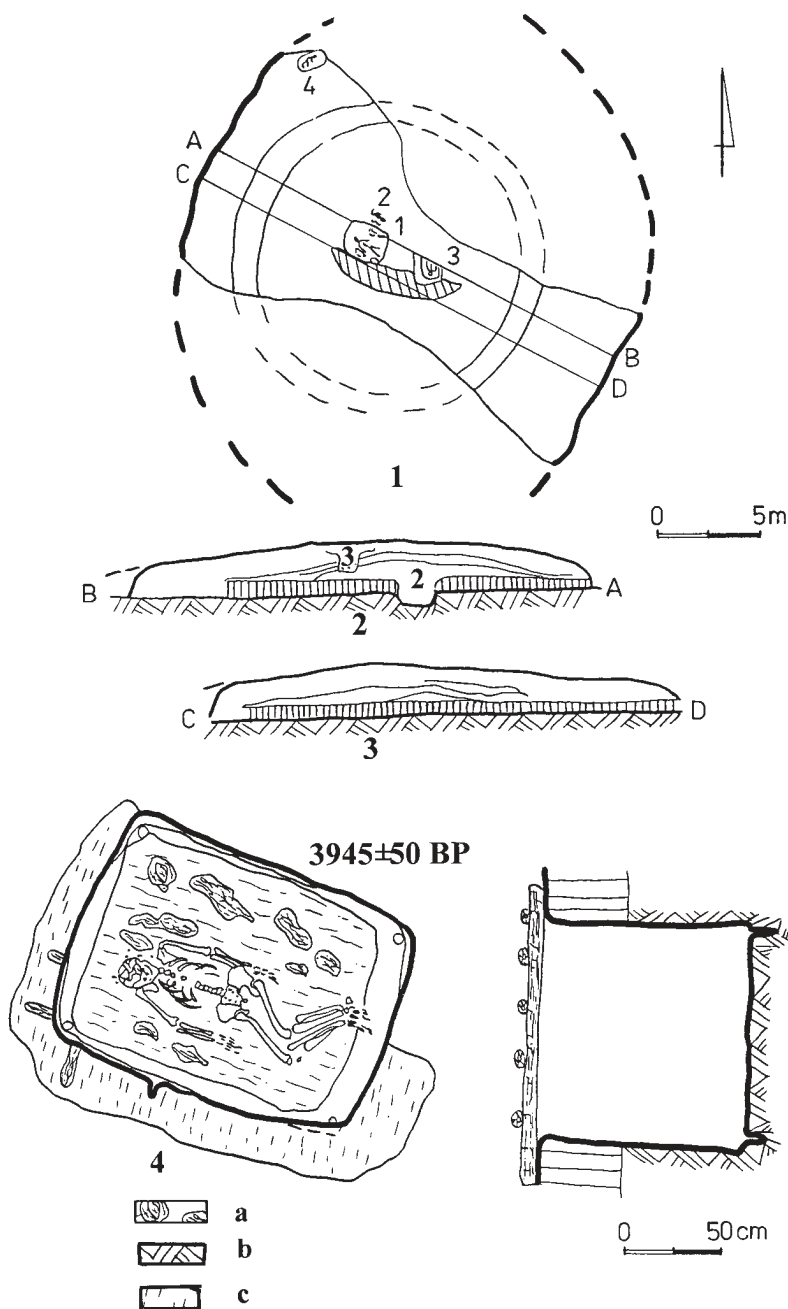


Fig. 10. Protopopovka, Aleksandria District, Kirovohrad Region

1 - plan of barrow 1; 2-3 - sections of barrow 1; 4 - plan and section of grave 3 of barrow 1. Legend: a - wooden shield; b - digging; c - fibre rot from the mat

pit, with rounded corners, was 2 x 1.6 m in size, with its longer walls oriented from north-west to south-east. The pit was 1.25 m deep from the level of the buried black earth. The skeleton lay in a foetal position on its back, head to the north-west. The arms were extended along the body; the legs, originally bent at the knees and raised up, fell to the right. The skull was intensively covered with ochre. Patches of ochre were also seen on the pelvis and the feet bones. There was brown rot at the bottom of the pit. In the corners at the bottom there were holes made by wooden poles, 5 cm in diameter and 11 cm deep.

Grave 3 (Fig. 11:2) was sunk into the centre of the last bank. There were ledges made, 0.5 m deep from the entry level, which served as rests for the beam cover placed across the pit. Below the level of the ledges there was a rectangular pit, 0.9 x 0.8 m in size, with its longer walls oriented from south-west to north-east. The pit was 0.6 m deep from the level of the ledges. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended; the leg bones were not preserved. There was some brown rot at the bottom of the pit.

Grave 4 (Fig. 11:1) was sunk 10.5 m to the north-east of the assumed centre. The rectangular pit, 1.5 x 0.96 m in size, was oriented with its longer sides from south-west to north-east. The bottom lay 2.7 m from the "0" level. The skeleton lay in a foetal position on its left side, head to the south-west. The left arm was extended, the right arm was bent at the elbow; the legs were bent at right angles to the body. There was some brown rot and patches of ochre at the bottom of the pit.

2. CHRONOLOGY (CONCLUSION)

2.1. RELATIVE DATING OF THE MONUMENTS

From the features of the burial rite, the presented group of graves may be divided into two groups: (1) graves with skeletons in a foetal position on their backs (12 graves); and (2) graves with skeletons in a foetal position on their side (5 graves, with 1 skeleton on its right side and 4 on their left side). Most of the graves of the first group were oriented in a westerly direction: skeletons in 8 out of 12 graves lay with their heads to the south-west; one to the west, one to the north-west, one to the north, and one to the north-east. In two of the graves, the skeletons were positioned either on the right or on the left side, heads to the north-east; and in three other graves, the skeletons lay in a foetal position on their left side with their heads to the south-west, the north-west and the north.

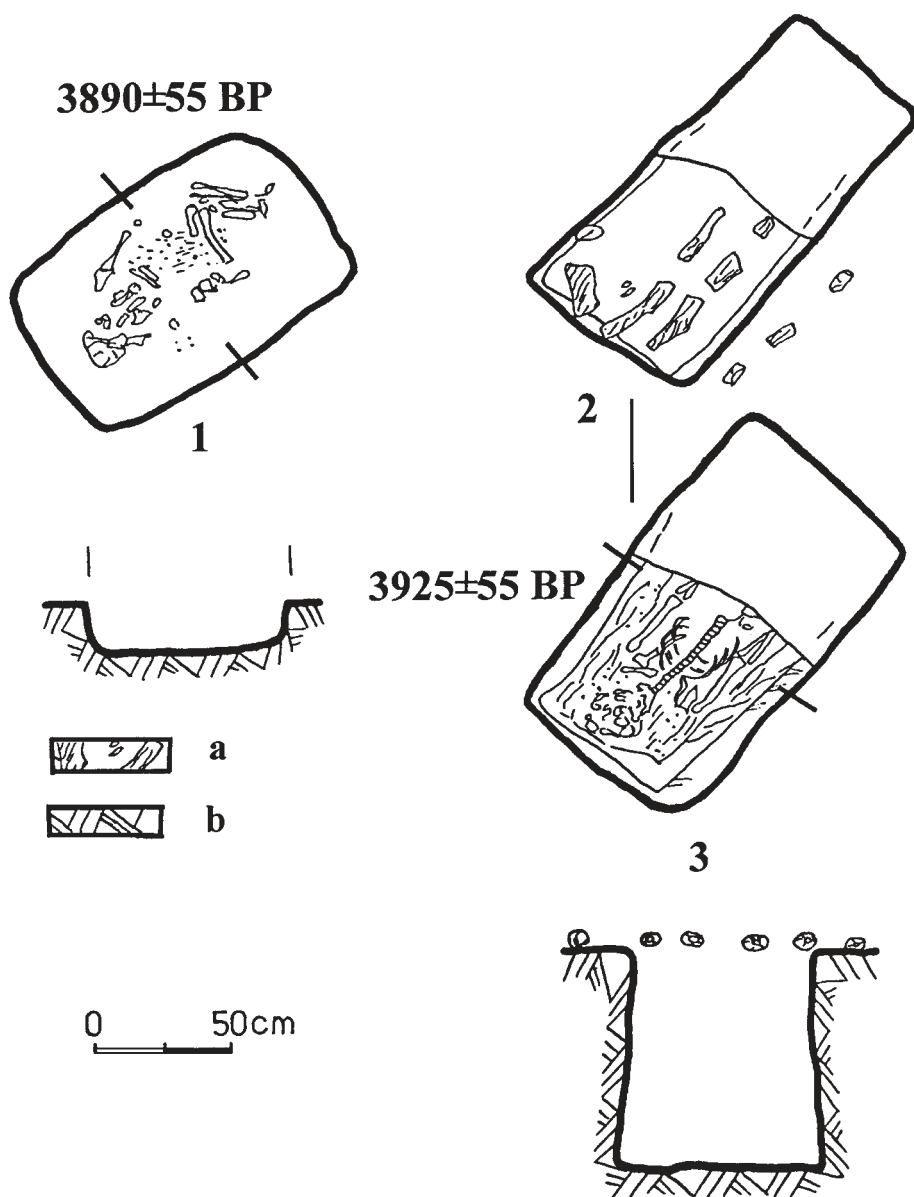


Fig. 11. Protopopovka, Aleksandria District, Kirovohrad Region
 1 - plan and section of grave 4 of barrow 1; 2-3 - plans and section of grave 3 of barrow 1. Legend: a - wooden shield; b - digging

Stratigraphically, the graves can be divided as follows: in one case, only one type of grave was found (barrow 6), while in three other barrows there were graves in which the skeletons had been positioned in the same way but oriented differently, and there were graves in which both the position of the skeleton and its orientation were different (barrows 5 and 14 near the village of Golovkovka, and barrow 2 near the village of Protopopovka). In these barrows, graves that contained skeletons positioned on their backs had been made earlier than the graves with the skeletons in a foetal position on their right or left side. On the other hand, 5 graves with skeletons that lay in a foetal position on their backs, with their heads towards the south-west, the north-west, the west and the north, had some specific details such as postholes in the bottom of the grave. In general, this detail was typical for 40 percent of the graves studied at the burial site, and distinguished the site significantly from those in other regions of Ukraine, where this detail of the burial rite did not occur in more than 5 to 10 percent [Nikolova 1992]. It should be noted that the role of these postholes is not sufficiently clear, despite the assumptions of some researchers that they were used for installing some specific wooden constructions in the pits. Although wood was typically very well-preserved in this region, our observations suggest that no traces of wood were found inside the postholes in most of the graves. Possibly, before closing the grave, such constructions were removed from the pit, or else the postholes may have been designed for a completely different purpose. Whatever the case, this detail of the burial rite may probably be regarded as a specific ethno-cultural feature.

The analysis of the stratigraphic location of the features of the burial rite, made for all graves of the burial site concerned, suggests that the earliest graves were the small group of those which contained skeletons in a foetal position on their backs, with their heads to the east [Polin, Tupchenko, Nikolova 1992; 1993; 1994]. The next chronological group is represented by graves that contained skeletons that had been positioned on their backs, with their heads to the west and the south-west, the latter being the key direction in that burial site and occurring in about 70 percent of cases. Other graves that were made at the same time contained skeletons that were positioned on their right side and oriented towards the south-west. These graves displayed a specific feature: postholes at the bottom of the pit. The fact that the two ways of positioning the body coincided in time is proved by cases where a single bank covered graves of both kinds, as well as by graves where the bodies were buried on their backs that were made later than those containing skeletons that lay on their right side (for instance, Golovkovka, barrows 20, 25), and by several double and group graves [Polin, Tupchenko, Nikolova 1993:17; 1994:10]. The last chronological group of the burial site consists of graves containing skeletons in a foetal position on their left side. One of the graves, dated with the use of the ¹⁴ method, contained a vessel related to the ninth cluster, according to our classification [Nikolova, Mamchych 1997:108], and has a wide range of similarities both with the Late YC and the Early CC.

Within the above framework of chronological classification of the YC monuments of the Ukrainian steppe, these materials relate to the 3rd and the 4th chronological periods [Nikolova 1992:16].

2.2. ABSOLUTE DATING OF THE MONUMENTS

The analysis of the dates obtained using the ^{14}C method and the archaeological data brings us to the following conclusions.

a. According to the calibrated ^{14}C dates, with 95.5% probability (Table 1), the YC graves of this burial site had existed for a substantial time, and the graves were dated between 2866 - 2140 BC (Ki-6723, 4030 ± 60 - Ki-6726, 3840 ± 50 BP). However, taking into account standard deviations, the difference between individual radiocarbon dates of some graves amounts to 460-300 years (for example, Ki-6723 and Ki-6725).

Table 2

Calibration after Weninger 1993

Lab. No.	No. barrow /No. grave	Date BP	Date BC/AD cal
Ki-6718	3/1	3920 ± 60	2379 ± 85
Ki-6730	5/3	3960 ± 60	2446 ± 97
Ki-6731	5/5	4005 ± 55	2516 ± 72
Ki-6719	6/8	3970 ± 55	2472 ± 90
Ki-6720	6/9	3880 ± 55	2356 ± 89
Ki-6721	6/11	3850 ± 55	2296 ± 94
Ki-6722	7/4	3980 ± 60	2480 ± 93
Ki-6723	11/5	4030 ± 60	2539 ± 81
Ki-6724	12/3	3950 ± 50	2403 ± 81
Ki-6727	14/2	3910 ± 55	2377 ± 79
Ki-6725	14/3	3895 ± 55	2371 ± 83
Ki-6726	14/4	3840 ± 50	2285 ± 90
Ki-6728	14/7	3905 ± 55	2374 ± 80
Ki-6729	14/9	3920 ± 50	2386 ± 72
Ki-6733	1/2	3945 ± 50	2398 ± 78
Ki-6734	1/3	3925 ± 55	2388 ± 78
Ki-6732	1/4	3890 ± 55	2364 ± 85

b. The use of the B. Weninger program [Kadrow, Szmyt 1996b: 104-108] somewhat reduces this time span (Table 2). According to these data, the dates of the graves for this burial site fall between 2620-2195 BC, while standard deviations of

individual calibrated ^{14}C dates fall in the range of 194 to 144 years (for example, Ki-6730 and Ki-6731).

c. Comparison of the data of the burial rite and of the calibrated ^{14}C dates obtained suggests that some of the graves which display the same sets of burial rite features differ substantially in their calibrated ^{14}C dates, while graves with different sets of features have close calibrated ^{14}C dates. The graves containing skeletons positioned on their backs display the broadest range of dates: 2539 ± 81 (Ki-6723) - 2285 ± 90 (Ki-6726) BC (Table 2); one grave containing a skeleton positioned on its right side dates back to 2446 ± 97 BC (Ki-6730). The range is somewhat narrower for the graves that contain skeletons positioned on their left side: it falls within 2386 ± 72 - 2364 ± 85 BC (Ki-6729 and Ki-6732). Of the 12 graves of the first group, nine fall into the range of 2539 ± 81 (Ki-6723) - 2374 ± 80 (Ki-6728) BC (Table 2); meanwhile, the graves of this group, united by the occurrence of postholes in the floor of the pits, produce the most substantial difference in ^{14}C calibrations: 2539 ± 81 (Ki-6723) - 2285 ± 90 Ki-6726 BC.

d. Comparison of stratigraphic observations and of ^{14}C calibration dates in general points to their close compatibility, except in barrow 14, where the obtained ^{14}C dates of the graves do not correspond to their stratigraphical sequence. However, it should be noted that the severe ruination of the barrow's bank, and the former practice of using it for the production of saltpeter, not only prevented the researchers from determining the real stratigraphic sequence of the graves, but could also have influenced the quality of the original samples. According to the ^{14}C dates obtained, the graves containing skeletons positioned on their backs (Ki-6726 and Ki-6728) date back to a more recent period (3905 ± 55 and 3840 ± 50 BP) than the graves (Ki-6725, Ki-6727, Ki-6729) containing skeletons lying in a foetal position on their left side (3895 ± 55 BP, 3910 ± 55 BP, 3920 ± 50 BP, respectively).

Therefore, the results obtained from the ^{14}C dating of the YC monuments analysed allow us to address a number of issues linked to general problems of analysis and of the archaeological interpretation of radiocarbon dates for determining absolute dates of archaeological data [see in this volume: Nikolova, Radiocarbon dating...].

Translated by Maria Ogiyenko

Alla V. Nikolova

RADIOCARBON DATING OF GRAVES OF THE YAMNAYA AND CATACOMB CULTURES ON THE DNIEPER RIGHT BANK

The expedition of the Institute of Archaeology of the National Academy of Sciences of Ukraine has been investigating barrow burial places in the Nikopol District of the Dnipropetrovsk Region (the right bank of the Dnieper) (Fig. 1) for many years. A number of graves of the Yamnaya culture (YC) and the Catacomb culture (CC) were selected for ^{14}C dating, some of which have been analysed [see Kaiser, Radiocarbon. . . , in this volume]. This article presents materials of the YC and the CC from two barrows.

1. MATERIAL DESCRIPTION

Chkalovo, barrow 11 (Fig. 2-4). One of the barrow burial sites, barrow 11, was part of the large barrow group near Chkalovo village. The excavations began in 1979 and are still being carried out. The group was located at the watershed of two ancient banks. At the time of excavation, barrow 11 was 0.65 m in height, with a diameter of 20 m. A filled ditch was discovered, typical for barrows of the Eneolithic-Bronze Ages, formed due to the excavation of soil for the embankment construction.

13 graves were discovered in the barrow: 6 graves of the YC; 5 of the CC and 2 of the Mnogovalikovo Pottery culture (MPC). Bones from the YC and CC graves were taken for ^{14}C dating (Table 1). This paper presents all the findings from the YC graves, including cenotaphs, as the details of the burial ceremony testified to the relative simultaneity of those burial places containing YC skeletons and those of a symbolic nature.

The barrow was constructed one shot above grave 9, which was surrounded by a ring digging, with a break in its south-western part, at the level of the buried

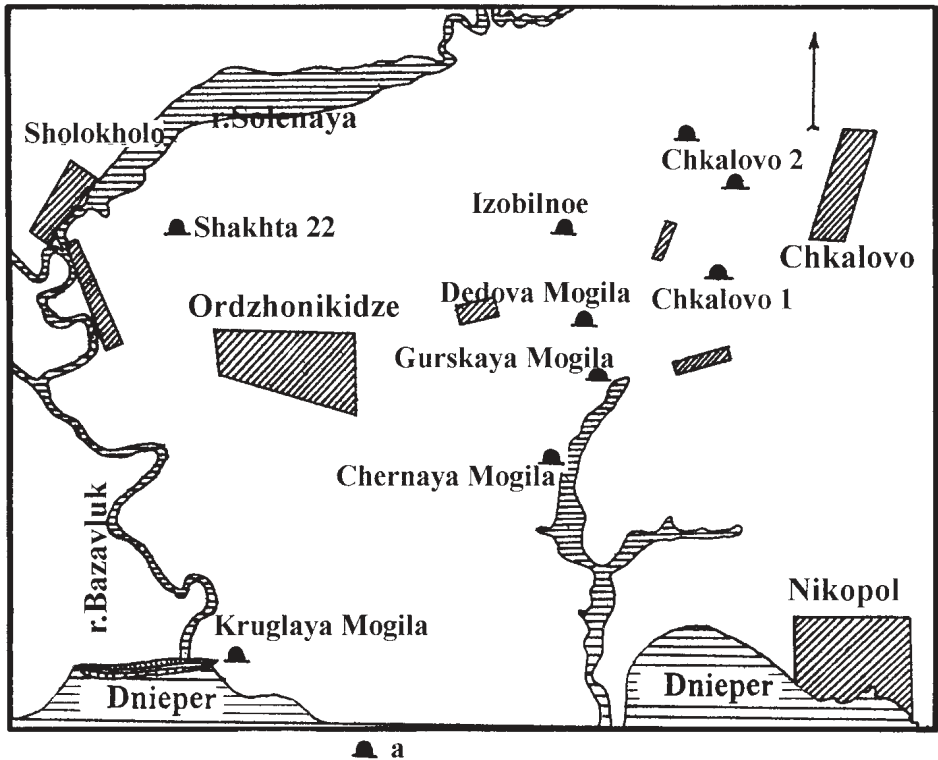


Fig. 1. The circuit of the arrangement of barrow groups near Ordzhonikidze and near Chkalovo in the Nikopol District of the Dnipropetrovsk Region [see Pustovalov 1994]. Legend: a - barrow group

chernozem. The outlet was up to 0.35 m thick and 7.5 m in diameter. All the subsequent graves were sunk into the embankment with no visible additions (Fig. 2). *Grave 2* (YC, Fig. 4:2) was unearthed 9 m to the south-east of the established centre of the barrow. It is a cenotaph type burial place, dug in a pit with ledges, which were located at a depth of 0.7 m. Below the ledges, the pit was rectangular, 1.5 x 0.9 m in size, oriented lengthways from east to west with insignificant deviation. The bottom was at a depth of 1.15 m. A fragment of fashioned ochre, of a claret colour and rectangular in shape, 20 x 18 cm in size and 3 cm thick, lay at the bottom of the pit, near the northern wall. Similar ochre was found in graves 5 and 11.

Grave 5 (YC, Fig. 4:1) is a cenotaph type burial place, discovered 9 m to the east of the barrow centre. There were ledges at a depth of 1.4 m, with wooden blocks resting on them along the tomb. Below the ledges, the pit was rectangular, 1.4 x 0.8 m in size and oriented lengthways from north-east to south-west. The bottom was at a depth of 1.9 m. A fragment of fashioned ochre, of a claret colour, 14 x 10 cm

in size and 3 cm thick, was found at the bottom of the pit near the western wall. A *Unio* shell was found near the north-eastern wall of the pit.

Grave 6 (CC, Fig. 4:4) lay 6 m to the south-west of the barrow centre. The entrance hole was round, 1.1 m in diameter. The bottom of the chamber descended from a depth of 1.3 m towards the entrance located in the eastern wall of the pit. Isolated human bones were found in the filling. There had been two entombments in the chamber, the first body being removed from the tomb during the second burial ceremony. The chamber was oval in shape, 2 x 1.3 m in size, oriented lengthways from north to east. The bottom lay at a depth of 1.84 m. The second sepulchre was at a depth of 1.76 m. The skeleton lay extended on its back, head to the north-west. The arms were bent at the elbows, the hands placed near the chin. The remains of a white substance were found under the skeleton, and preserved human bones from the earlier grave were scattered on the bottom of the catacomb.

Grave 7 (CC, Fig. 3:3) was discovered 3.5 m to the north-west of the barrow centre. The entrance hole was oval in plan, 1.2 x 1.1 m in size, oriented lengthways from west to east, the bottom at a depth of 1.4 m. The pit was filled with clay. The burial chamber adjoined the eastern wall of the pit. It was oval, 2.1 x 1.4 m in size, and oriented lengthways from north to south. The bottom of the pit lay at a depth of 1.65 m. The skeleton lay extended on its back, head to the north. The left arm was extended, the right arm slightly bent at the elbow. A stain of red ochre was found near the skull on the pit floor.

Grave 8 (YC, Fig. 3:1) was located 3.5 m to the east of the barrow centre. It was constructed in a pit with ledges formed at a depth of 0.65 m. Below the ledges, the pit was rectangular, 1.8 x 1.1 m in size, oriented lengthways from south-west to north-east. The bottom lay at a depth of 2.05 m. Fragments of a wooden covering were found in the filling. The skeleton lay in a foetal position on its back, head to the south-west. The arms were slightly bent at the elbows, the legs bent at the knees and raised, later falling apart in a rhombus. The skull and feet bore traces of ochre powdering. Near the right shoulder of the body lay an awl (bronze, four-sided in plan, 6.5 cm long; Fig. 3:2). Brownish remains (leather/skin?) were found on the pit bottom. Small postholes were traced in the bottom of the pit along the tomb perimeter. There were three postholes near the south-western front wall and three near the longitudinal walls of the pit. They were 4 cm in diameter and up to 3.5 cm deep.

Grave 9 (main YC, Fig. 3:6) was sunk at the level of buried chernozem in a rectangular pit 2.2 x 1.04 m in size, oriented lengthways from north-east to south-west. The bottom lay at a depth of 1.15 m. The body lay in a foetal position on its back, head to the north-east. The arms were extended along the body. The legs were bent at the knees and raised, but had fallen down. The bones bore traces of ochre. Brownish remains (leather/skin?) were found on the bottom of the pit. Numerous postholes, 4.5 cm in diameter and 4 cm deep, were traced along the front walls.

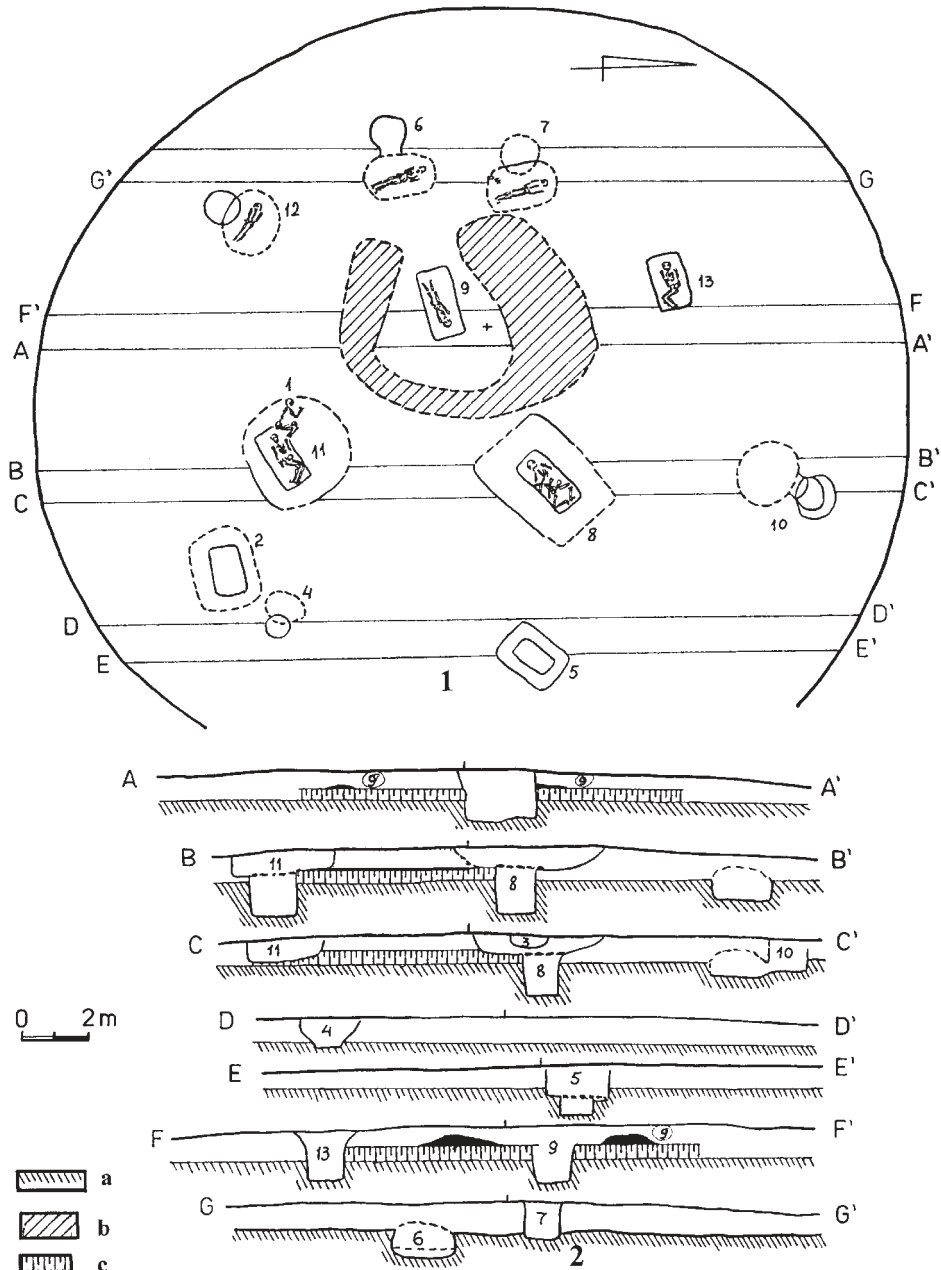


Fig. 2. Chkalovo, Nikopol District, Dnipropetrovsk Region
1 - general plan of barrow 11; 2 - cross-sections of barrow 11. Legend: a - the continent, b - the digging, c - buried chernozem

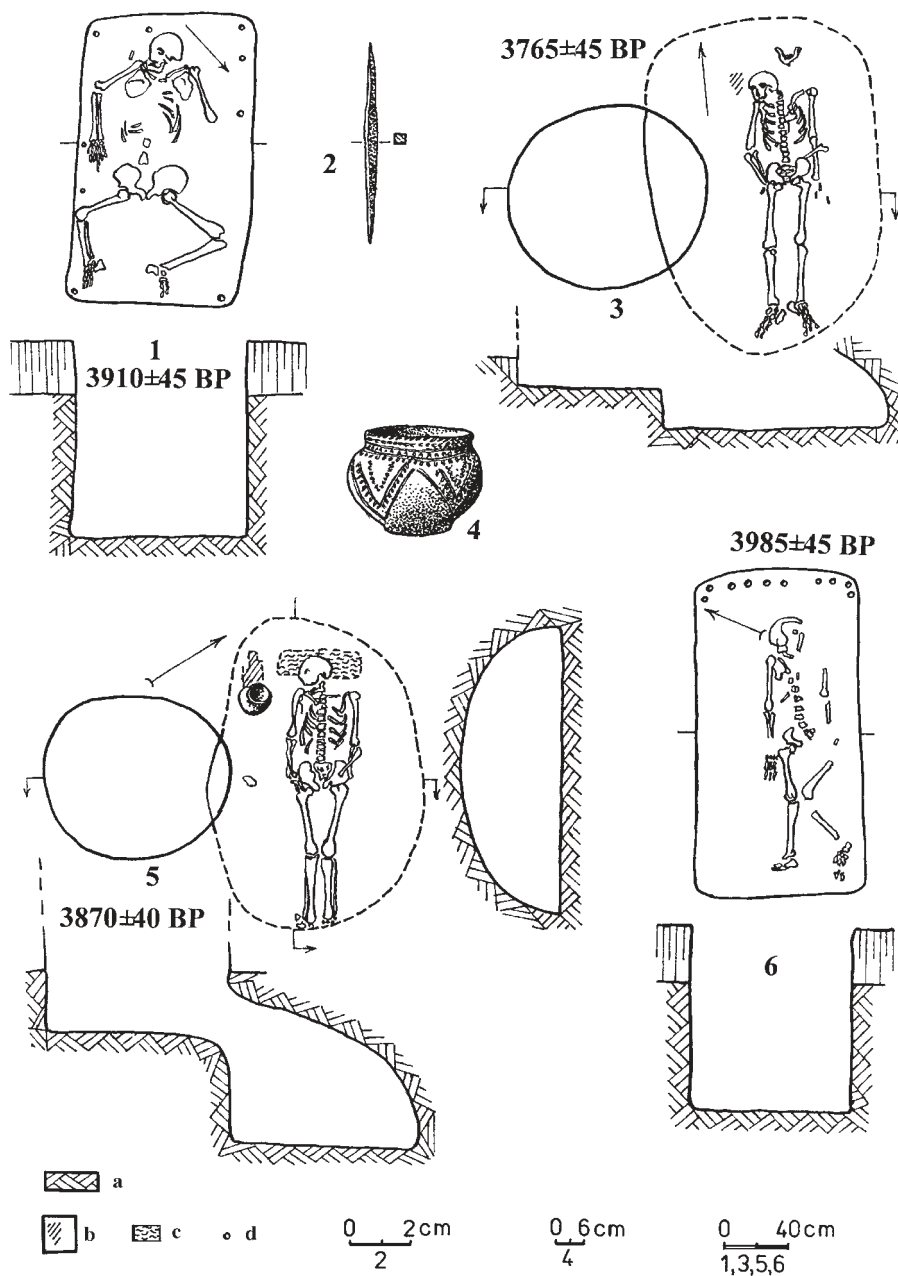


Fig. 3. Chkalovo, Nikopol District, Dnipropetrovsk Region, barrow 11

1 - plane of grave 8; 2 - bronze awl from grave 8; 3 - plan of grave 7; 4 - clay vessel from grave 12; 5 - plan of grave 12; 6 - plan of grave 9. Legend: a - continent; b - ochre stains; c - black remains; d - hollow

Grave 11 (YC, Fig. 4:3) was discovered 6.5 m to the south-east of the barrow centre. It was sunk in a pit with ledges, which lay at a depth of 0.9 m and were from 40 cm to 1.1 m wide. Below the ledges, the pit was rectangular, 1.9 x 1 m in size, its corners strengthened by vertical rods which extended down the walls to the bottom or up to 0.05 m from the bottom of the pit, which lay at a depth of 2.1 m. The pit was oriented lengthways from south-west to north-east. The remains of a form of shovel were found in the walls. These fragments were 48 cm long, 2 cm wide and 1 cm deep. The skeleton lay in a foetal position on its back, head to the south-west. The left arm was extended, the right arm was slightly bent at the elbow. The legs, bent at the knees and raised, had fallen to the left. The skeleton was painted with ochre, traces of which were found on the pit floor in the areas of the skull and feet. Fashioned ochre lay to the left of the shoulder (fashioned ochre, cylindrical in shape, of a claret colour, 8 cm in diameter, 2.8 cm high; Fig. 4:5). Brown remains (leather/skin?) were also found on the bottom of the pit.

Grave 12 (CC, Fig. 3:5) was located 6.5 m to the south-west of the barrow centre. The entrance passage was oval, 1.2 x 1 m in size, oriented lengthways from north-east to south-west. The bottom lay at a depth of 1.4 m.

The burial chamber adjoined the north-eastern wall of the pit. The chamber entrance was arched in form, 0.52 m long, 0.3 m high. The chamber itself was oval in shape, 1.9 x 1.4 m size, oriented lengthways from north-west to south-east. The bottom lay at a depth of 2.1 m, the vault height was 0.86 m. Fragments of a form of shovel, 4 cm in width, 28-30 cm long and 2 cm deep had been preserved in the chamber walls. The skeleton lay extended on its back, head to the north-east. The arms were bent at the elbows, the hands placed on the pelvic bones. The brownish remains of a pillow or hat (leather/skin?) can be observed on the skull, and some black colour remains on the leg bones. A vessel (a ceramic, flat bottomed vessel with low and contoured shoulders. It is decorated with engraved lines and slanting die points. The brim edge and the mouth of the vessel are decorated with "herring-bone" incisions. Below this are engraved double zigzag lines, the areas between which are filled with slanting incisions. The vessel is 14 cm tall, and the diameters are 14 cm at the mouth, 19 cm at the belly and 9 cm at the base; Fig. 3:4) stood to the right of the skull, surrounded by a painted layer of ochre, 20 cm long and 12 cm wide.

Grave 13 (YC, Fig. 4:6) was located 5 m to the north of the barrow centre. The pit was rectangular in shape, with rounded corners, 1.6 x 1 m in size, oriented lengthways from south-west to north-east. The bottom lay at a depth of 1.6 m. The skeleton lay in a foetal position on its back, head to the south-west. The arms were extended, the legs, bent at the knees and raised, had fallen to the right. The skull and extremities were painted with ochre.

Shakhta 22, barrow 2 (Fig. 5-8). The second barrow was part of the Shakhta 22 group, located at the watershed of the left bank of the Solena river, to the north of

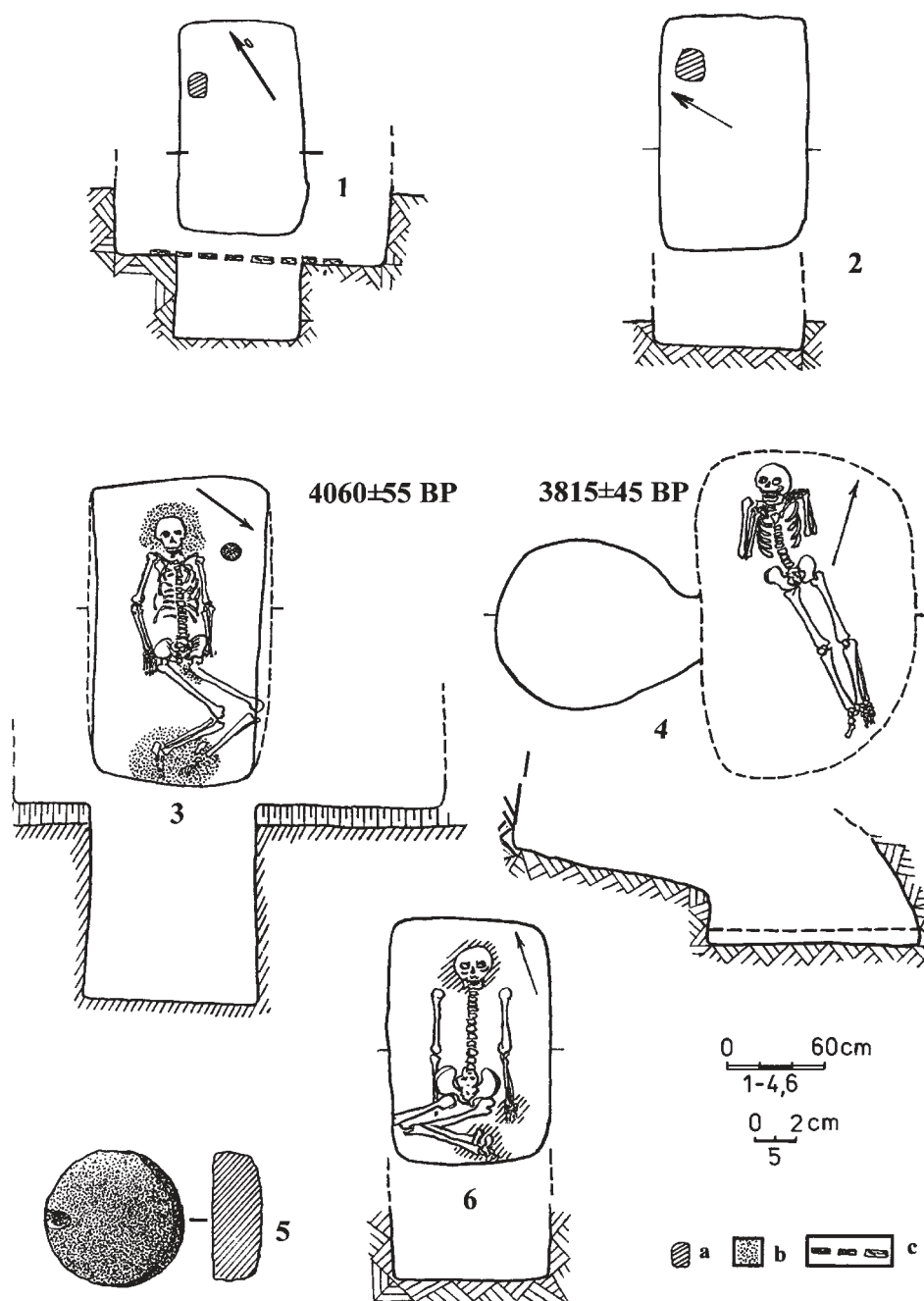


Fig. 4. Chkalovo, Nikopol District, Dnipropetrovsk Region, barrow 11

1 - plan of grave 5; 2 - plan of grave 2; 3 - plan graves 11; 4 - plan graves 6; 5 - fashioned ochre from grave 11; 6 - plan of grave 13. Legend: a - fashioned ochre; b - ochre stains; c - wood

the manganese production mine (Shakhta 22), whence the group obtained its name (Fig. 1). The group consisted of 17 banks extended in a chain from west to east. Barrow 2 was the second highest in the group and lay in its western extremity. At the time of excavation, its height was 2.05 m, diameter 34 m. The barrow embankment had been ploughed up, and a ditch, formed as a result of soil excavations for the embankment construction was discovered around it. There were 17 graves in the barrow: 10 of the YC 6 of the CC and 1 of the framework cultures (Fig. 5). Human bones from two graves of the YC were selected for the ^{14}C dating, and we have consequently confined our presentation to graves of this culture.

The barrow was constructed by the YC population. The ancient embankment, consisting of chernozem mounds, was raised over grave 12. Its height was 2 m, diameter - 20 m. The diameter of the embankment was subsequently increased to 27 m when grave 14, covered with an embankment of friable chernozem, was sunk into the north-west part. The next embankment of a local type, covering the southern sector of the barrow, was connected with grave 9. The final barrow embankment, consisting of loam, was constructed following the sinking of graves 6, 3, 13 and 16, and thus reached its final dimensions. The subsequent graves were sunk without the construction of further embankments (Fig. 6:1-7).

Grave 2 was located in the south-eastern sector of the barrow. Stone covering plates were found at a depth of 1.72 m. Below these was a rectangular pit with rounded corners, 0.8 x 0.5 m in size, oriented lengthways from north-east to south-west. The bottom lay at 2.91 m (1.19 m lower than the covering). The skeleton of a child had been eaten away by rodents. Judging by the remains of the skull, it lay towards the north-east. At the bottom of the pit, an ochre stain was observed.

Grave 3 (Fig. 7:1) was located in the south-eastern sector of the barrow. The rectangular pit, with rounded corners, 4 x 2.5 m in size, was oriented lengthways from south-west to north-east. It featured ledges, at a depth of 2.05 m, upon which lay a decayed covering of cane up to 2 cm thick. Below the ledges, the pit was rectangular in plan and 1.6 x 1 m in size. Its depth was 3.12 m (1.06 m lower than the ledges). The skeleton lay in a foetal position on its left side, head to the south-west. The right arm was extended. The bones of the left arm were not preserved. The skeleton was painted extensively with ochre.

Grave 4 (Fig. 6:8) was situated in the southern sector of the barrow. The rectangular pit, with rounded corners, 0.8 x 0.6 m in size, was oriented lengthways from south-east to north-west. The bottom lay at a depth of 2.78 m. A child was buried in the grave, although only some barely appreciable remains of his skeleton have been preserved. A ceramic egg-shaped vessel with a low straight mouth and small, flat bottom stood near the south-eastern wall. The area under the rim was decorated with cord prints. The vessel was 12.5 cm high, the diameter of the mouth 9.5 cm (Fig. 6:9).

Grave 6 (Fig. 7:3) was located in the western sector of the barrow. The rectangular

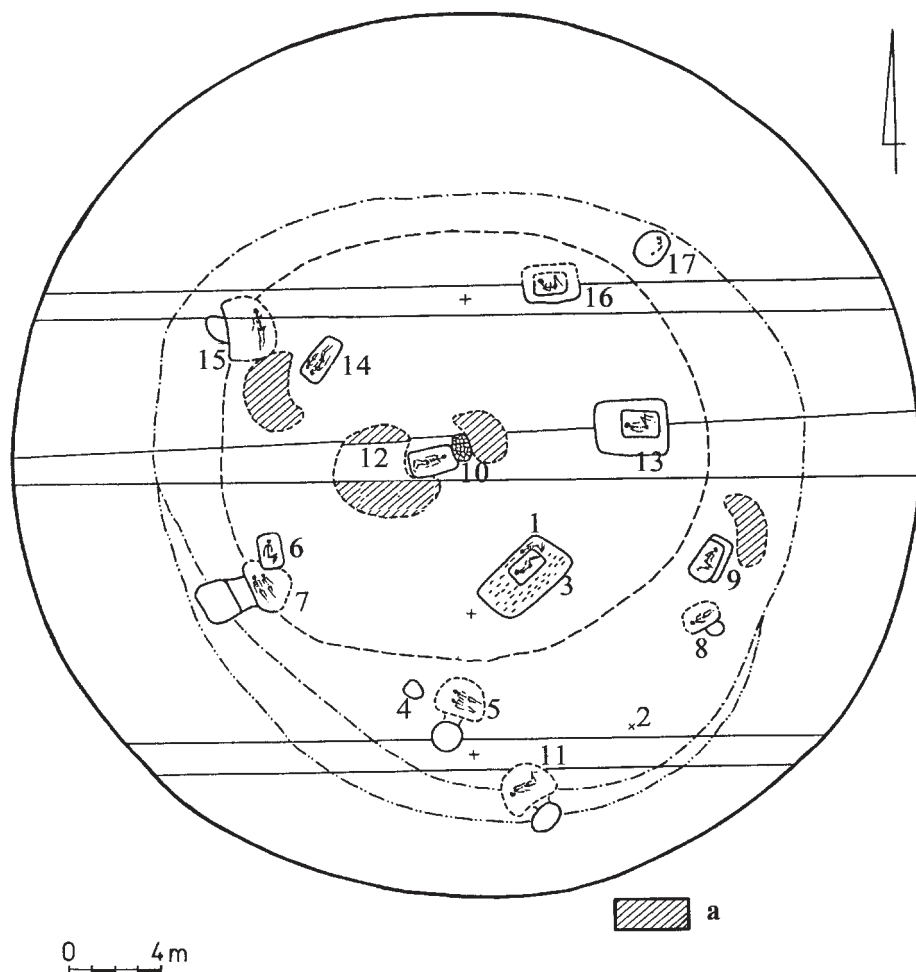


Fig. 5. General plan of barrow 2, Shakhta 22 group, Nikopol District, Dnipropetrovsk Region
Legend: a - grave outlet

pit, with rounded corners, 1.5 x 0.94 m in size, was oriented lengthways from north to south with insignificant deviation. The depth of the pit was 3.31 m. The skeleton lay in a foetal position on its side, head to the north. The left arm was extended. The legs were bent at right angles to the body. A fragment of the bottom part of a large vessel lay to the left of the body. Its internal and external sides were covered with lines (Fig. 4:4). A piece of ochre lay behind the skull, and a shell was found near the feet.

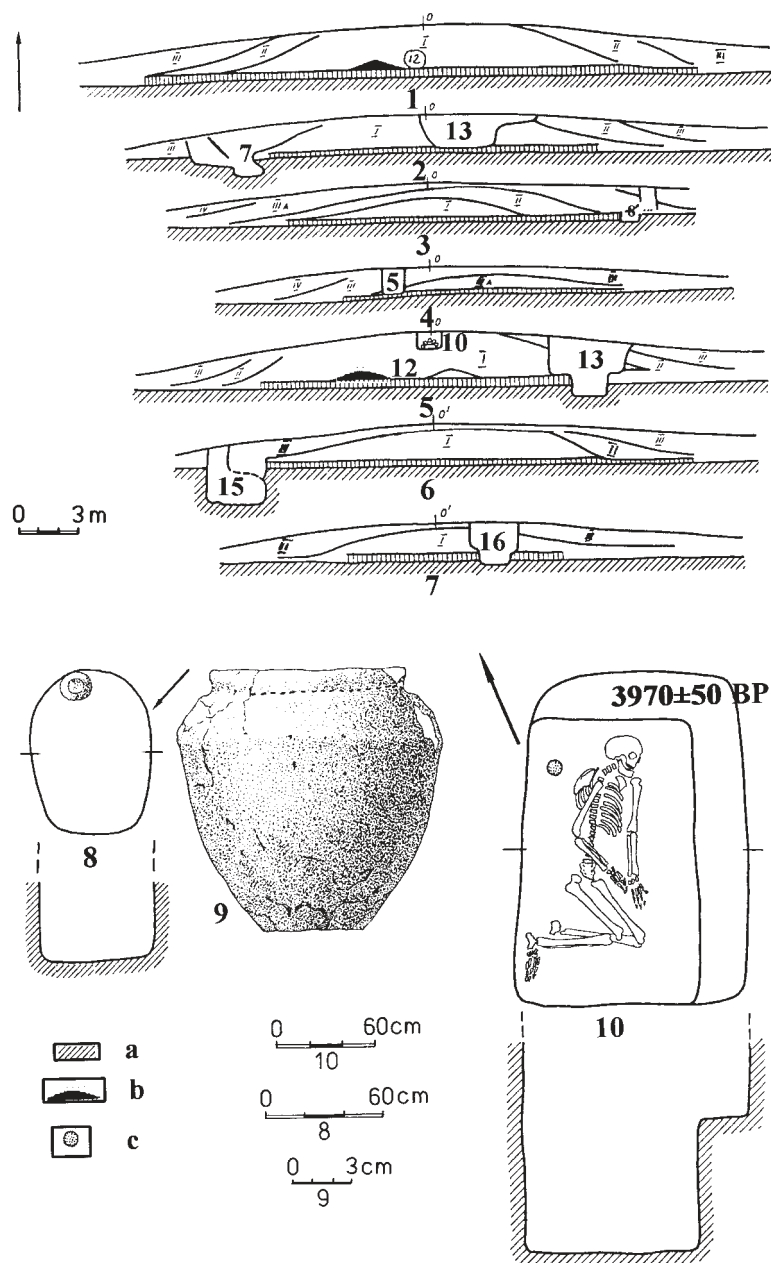


Fig. 6. Group Shakhta 22, Nikopol District, Dnipropetrovsk Region barrow 2.
1-7 - cross-section of barrow 2; 8 - plan of grave 4; 9 - pottery vessel from grave 4; 10 - plan of grave 9.
Legend: a - continent; b - ochre; c - piece of ochre

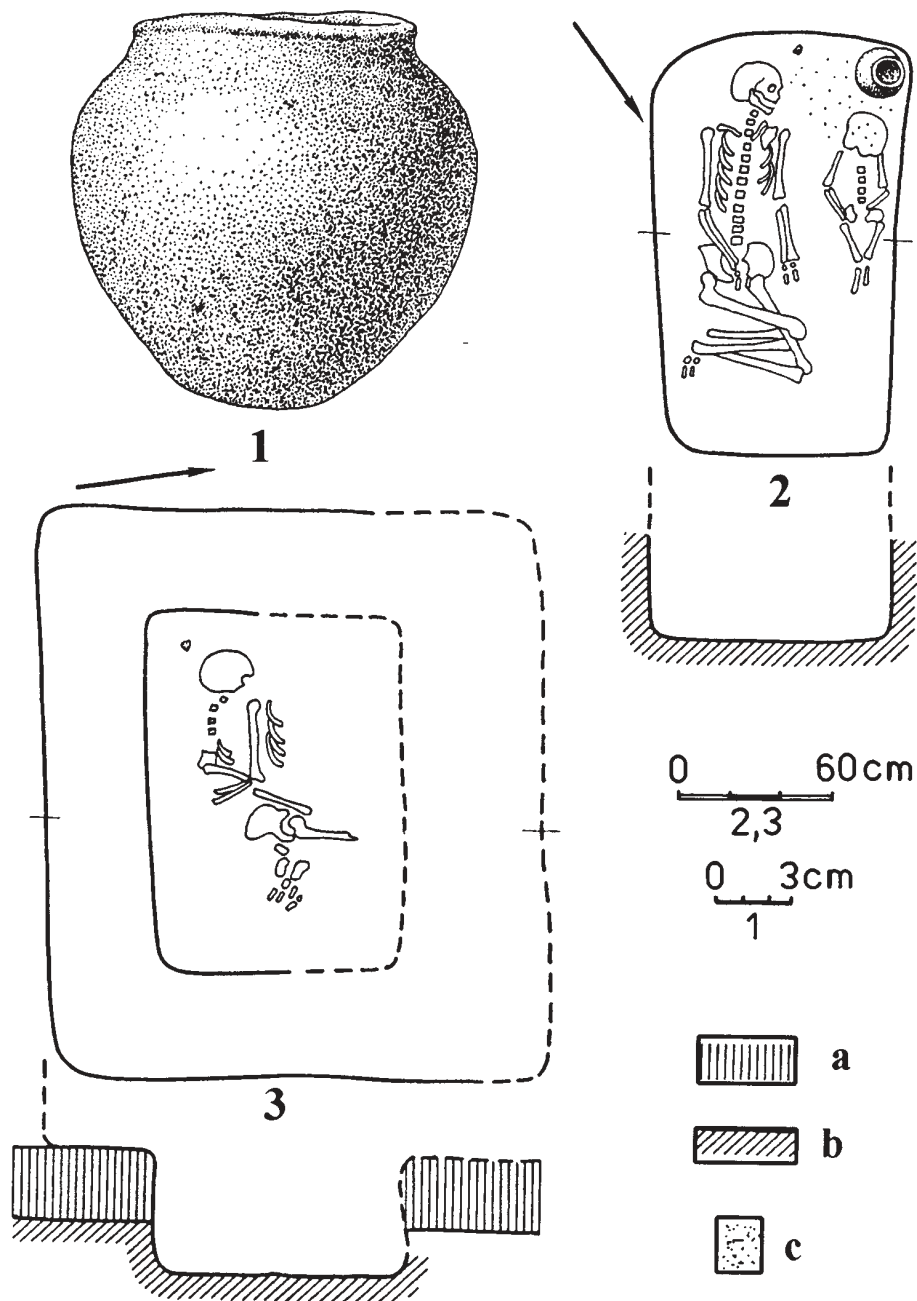


Fig. 7. Group Shakhta 22, Nikopol District, Dnipropetrovsk Region barrow 2
 1 - vessel from grave 14; 2 - plan of grave 14; 3 - plan of grave 16. Legend: a - ochre; b - buried chernozem; c - continent; d - small goat hooves

Grave 9 (Fig. 6:10) was located in the south-eastern sector of the barrow. The pit was rectangular in plan, with rounded corners, 2 x 1.34 m in size, and oriented lengthways from north-east to south-west. At a depth of 3.11 m there were ledges, upon which were the remains of a wooden covering. Below the ledges, at a depth of 3.81 m (0.8 m below the ledges) the pit was rectangular in plan, 1.7 x 1 m in size. The skeleton lay in a foetal position on its left side, head to the north-east. The left arm was extended, the right arm bent at the elbow. The legs were bent at an obtuse angle to the body. A piece of ochre lay near the feet.

Grave 12 (major, Fig. 7:5) was located in the centre of the barrow. The pit was covered by cane at the level of the ancient horizon. The pit is rectangular in plan, 2 x 1.1 m in size, oriented lengthways from north-east to south-west. The pit is 0.9 deep from the level of the buried chernozem. The skeleton had been satisfactorily preserved. It lay in a foetal position on its back, head to the north-east. The arms were extended. The raised legs had fallen to the right. A piece of ochre lay to the right of the skull.

Grave 13 (Fig. 7:20) was located in the eastern sector of the barrow. The rectangular pit, 3.1 x 2 m in size, was oriented lengthways from east to west. Ledges, at a depth of 2.05 m, bore traces of a wooden covering. Below the ledges, the pit was trapezoid in plan, 1.8 x 1.1 - 1.2 m in size. Its depth was 3.15 m (1.1 m below the ledges). The skeleton lay in a foetal position on its back, head to the west. The arms were extended along the body. The legs, raised, and bent at the knees, had fallen to the right. The skeleton was painted in ochre, particularly marked on the skull. Some brownish remains were found on the bottom of the pit.

Grave 14 (Fig. 8:2) was constructed in the north-western sector of the barrow. The pit was trapezoid in plan, 1.7 x 0.8-1 m in size, oriented lengthways from south-west to north-east. The depth was 3.09 m. The remains of a wooden covering were found in the filling. The grave contained the skeletons of an adult male and a child. The adult skeleton lay in a foetal position on its left side, near the south-eastern wall, with its head to the south-west. The left arm was extended, the right arm bent at the elbow. The legs were bent at an obtuse angle to the body. The skeleton of the child lay on its back, next to the adult, oriented in the same direction, with its arms slightly bent at the elbows. Behind the skull, the bottom of the pit was covered with ochre. A ceramic vessel with a rounded bottom stood nearby (Fig. 8:1). It was egg shaped, with a low, straight mouth, 14.5 cm high, and with a diameter at the mouth of 8.8 cm. Two small goat hooves lay near the vessel. The skulls of both the deceased bore stains of ochre. Brown coloured remains were observed on the bottom of the pit.

Grave 16 (Fig. 8:3) was located in the north-eastern sector of the barrow. It had been partially destroyed by a bulldozer. The pit was rectangular, 2.4 m long, oriented lengthways from west to east. At a depth of 2.05 m were ledges with a wooden covering over them. Below the ledges, the pit was 1.4 m long. It was 2.55 m deep (0.55 m lower than the ledges). The grave contained the skeletal remains of an adult

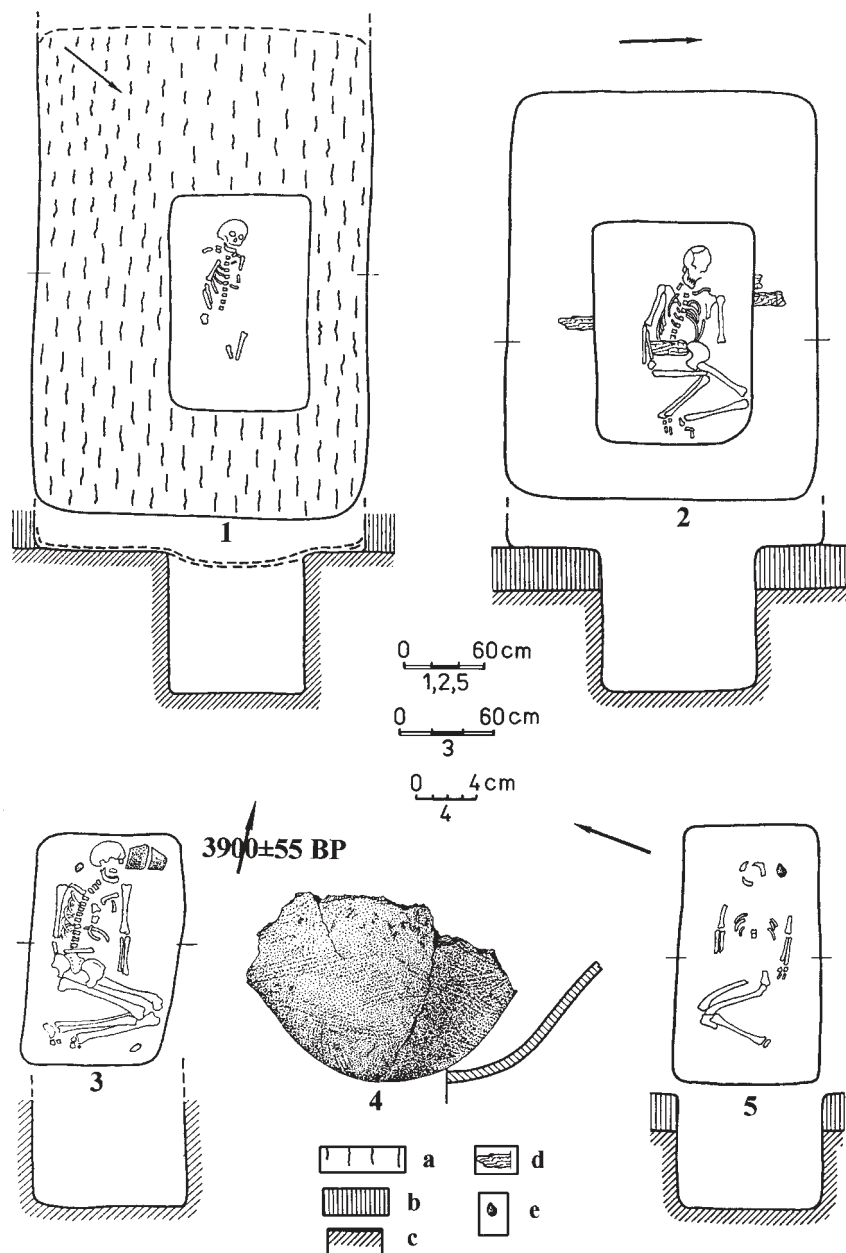


Fig. 8. Group Shakhta 22, Nikopol District, Dnipropetrovsk Region barrow 2
 1 - plan of grave 3; 2 - plan of grave 13; 3 - plan of grave 6; 4 - fragment of vessel from grave 6; 5 - plan of grave 12. Legend: a - cane; b - buried chernozem; c - continent; d - wood; e - ochre

and a child. They lay in a foetal position on their left side with their heads to the west. The right arm of the adult was bent at the elbow. The bones of the other arm had not been preserved. The legs were bent at right angles to the body. A small goat hoof was found behind the skull of the child. Brown remains were observed on the pit floor.

2. DATING OF THE YAMNAYA CULTURE

a. A comparison of the graves of the YC presented here with the YC graves near Golovkovka village in Kirovograd Region [see Nikolova, Radiocarbon dates. . . , in this volume] reveals significant resemblances, not only with regard to general features of the burial ceremony, as testified by the similar position and orientation of the skeletons, but additionally in peculiarities of the grave construction, including the presence of small holes at the bottom of the grave pits.

The analysis of changes in the burial ceremonies of the YC of Ukraine has revealed comparable tendencies between different regions, despite the existence of local peculiarities. This allows us to determine four basic chronological periods in the development of the YC [Nikolova 1992]. The most ancient among these is characterised by the establishment of a relative uniformity in the burial ceremony. One of the most important features of this period was the construction of the basic quantity of initial embankments above the graves, with the obligatory support of graves by additions to existing barrows, including those of other cultures. All the infrequent cases of stone circles and ditch constructions, types of funeral feasts and so on around the burial places have been attributed to this period. Graves were sunk only in the centre of barrows. The principal grave shape is of a simple pit with rounded corners, blocked with a tree or a stone. The skeletons lay in a foetal position on their backs, with the legs raised, and the head oriented to the east, north-east and occasionally to the south-east. The bodies were frequently coloured with ochre. The monuments of this period are concentrated mainly on the territory of the left bank of the Dnieper river (the basin between the Don and the Molochna rivers, the Orel and the Samara rivers basin, the Lower Dnieper and the Crimea); in some areas of the Dnieper right bank; and, probably, along the Ingul river basin. The period corresponds to the most ancient YC monuments of the Lower Volga basin (Bykovo 2, 2/3) the Middle and the Lower Don basin (settlement near Repin), the Kuban basin and also the materials of the Mikhailivka settlement (layer 2).

The following period saw the expansion of the distribution of the YC territory further to the west, which proceeded to cover the whole of the territory of the right

bank of the Dnieper down to the basin of the Dniester and Prut rivers. At the same time, the majority of traditions of the preceding period had been preserved. The major changes appeared in the orientation of the bodies. This tendency is evident across practically all the territories, both on the left and the right banks of the Dnieper. Graves of this period were frequently the first graves sunk in barrows of the local Late Eneolithic and Usatovo type cultural groups. The Post Maikop types of metal products and ceramics of the third layer of Mikhailivka, as well as the first graves featuring the remains of carriages appeared in this period. The burial places of this period were accompanied by embankments or soil additions. The central sections of the previous embankments were used for sinking graves. The prevailing position of the dead remained the foetal position.

The richest flourishing of the YC on the territory of Ukraine came during the third stage of its development. Although our data is relative, it is possible to assume that the height of the development of the YC population came at this time from a quantitative assessment of burial monuments. Its final boundaries extend across all regions of the steppe and forest-steppe zone of Ukraine, down to the regions of the Danube river basin. The linking of certain territories with separate social groups (tribes?), appears to be attributable to this period, as certain specific features of both the burial ceremony and ceramic complexes have been traced to separate territorial groups. A more detailed comparison, along with the collection of additional materials, will obviously enable a more precise picture of their borders to be ascertained in the nearest future. The current stage of analysis already allows us to distinguish at least two basic territorial groupings, the populations of which had rather intensive cultural connections. The first of these included the southern areas of the Dnieper left bank territory - the Azov Sea basin, the Molochna basin, the basin of the Dnieper and the Northern Pontic area, as well as the Crimean steppe. The characteristic feature of this sub-cluster was the preservation of the mainly easterly direction of body orientation. This distinguished it from all other territorial groups of monuments, including the Northern Donets and the Orel and the Samara rivers basin, which were part of the second grouping, including all regions to the west of the Dnieper.

The occurrence of numerous cemeteries filled with relatively simultaneous graves is attributed to this period. The transformation of barrows into cemeteries of small, separate collections entailed changes in certain burial traditions. This can be observed to the greatest degree in the parameters of orientation, which had gradually lost its independent, ceremonial meaning and surrendered to the tradition of a planigraphic manner of cemetery construction. It is worth noting that the observable distinctions in orientation across a range of regions generically ascended to the preceding period. Consequently, for the monuments included in the first territorial grouping, the easterly direction remained prevalent until practically the end of the YC. The western orientation was established in other monuments. This was

a period of gradual cultural transformation, by the end of which the tradition of embankment construction and soil addition over the burial places had disappeared by the end of the period. Changes in the shapes of the grave pits have been found in a number of areas. Burial places with bodies in a foetal position on their side appeared during this period. For a certain time, the culture was characterised by bi-ritual ceremonies, until the re-establishment of a unity in the burial ceremony.

The final chronological period in the development of the burial ceremony of the YC monuments of Ukraine, as well as in other regions of its distribution, is characterised by the ultimate transformation of all its features. The practice of raising embankments and soil additions above the burial places finally came to an end, until only old cemeteries were used. The position of the bodies was exclusively in a foetal position on their side, their orientation diverse and not conforming to any pattern, determined instead by the position of the grave inlets in the barrow embankment, as at the end of the previous period. The custom of powdering the dead bodies with ochre practically disappeared. The ceramic complex varied as well, with flat bottomed vessels of different shapes becoming dominant. In addition, a certain change in the connections between territorial groups has also been discovered [Nikolova 1992:18-20].

The graves presented herein, as well as materials of the Kirovohrad Region within the framework of the given chronological classification [see Nikolova, Radiocarbon dates..., in this volume] can be definitely attributed to the third and fourth chronological periods.

b. The graves presented above and the graves from Golovkovka village [see Nikolova, Radiocarbon dates... in this volume] represent two groups according to the customs of the ceremonies: (1) graves with skeletons in a foetal position on their back (Chkalovo, barrow 11); (2) graves with skeletons in a foetal position on their side (Shakhta 22, barrow 2). The analysis of graves discovered in each of these barrow burial grounds clearly testifies to a certain similarity between those attributed to one of the distinct ceremonial groups, and correspondingly points to their chronological affinity. This can be observed not only in general ceremonial features, but also in individual details, such as the presence of accompanying pieces of ochre and the construction type of the bottom of the grave (Chkalovo).

c. Fifteen radiocarbon dates were obtained from six graves from barrow 11 near Chkalovo. Eight of these were obtained for graves 9 and 11 (Table 1). It should be stressed that this quantity of dates was obtained inadvertently, due to a mistake in the process of completing the data cards. However, this inadvertent experiment has allowed a number of problems to be raised concerning the accuracy of the individual ^{14}C dates obtained. Out of four pairs of individual radiocarbon dates for these graves, just three corresponded to the observed stratigraphy (Ki-6828 and Ki-6829; Ki-6828a and Ki-6829a; Ki-6571 and Ki-6572) and one pair of dates for the same grave contradicted it (Ki-6571 and Ki-6572). Three radiocarbon dates for two

Table 1

Chkalovo and Shakhta 22, Nikopol District, Dnipropetrovsk Region, graves of the Yamnaya and Catacomb cultures. List of ^{14}C datings

Site	Lab. No.	No. barrow/ No. grave	Culture, stratification level	Date BP	Date BC 68% - 1 sigma	Date BC 95% - 2 sigma
Chkalovo	Ki-6608	11/6	CC	3815 \pm 45	2316-2190 2164-2144	2452-2432 2402-2370 2358-2130 2074-2052
Chkalovo	Ki-6608a	11/6	CC	3770 \pm 50	2278-2228 2206-2132 2078-2048	2390-2388 2334-2070 1998-1986
Chkalovo	Ki-6610	11/7	CC	3765 \pm 45	2276-2246 2204-2130 2080-2046	2314-2300 2298-2032
Chkalovo	Ki-6610a	11/7	CC	3750 \pm 45	2270-2260 2202-2122 2086-2040	2284-2028 1998-1984
Chkalovo	Ki-6827	11/8	YC	3910 \pm 45	2460-2390 2388-2334	2550-2542 2490-2276 2240-2238 2236-2204
Chkalovo	Ki-6571	11/9	YC 1	3985 \pm 45	2540-2522 2504-2456	2610-2598 2588-2396 2380-2344
Chkalovo	Ki-6571a	11/9	YC 1	4035 \pm 50	2608-2600 2586-2470	2862-2816 2694-2676 2668-2456 2418-2412
Chkalovo	Ki-6828	11/9	YC 1	3960 \pm 50	2562-2528 2498-2448 2436-2400 2374-2354	2576-2312 2304-2294
Chkalovo	Ki-6828a	11/9	YC 1	4010 \pm 50	2574-2514 2508-2454	2854-2822 2658-2642 2622-2448 2436-2400 2376-2352
Chkalovo	Ki-6572	11/11	YC	4060 \pm 55	2850-2824 2656-2644 2620-2488	2866-2810 2754-2724 2698-2462

Site	Lab. No.	No. barrow/ No. grave	Culture, stratification level	Date BP	Date BC 68% - 1 sigma	Date BC 95% - 2 sigma
Chkalovo	Ki-6572a	11/11	YC	4005±55	2580-2460	2856-2820 2660-2640 2624-2394 2382-2338
Chkalovo	Ki-6829	11/11	YC	3900±55	2460-2314 2302-2296	2552-2542 2492-2198
Chkalovo	Ki-6829a	11/11	YC	3990±50	2574-2516 2508-2456	2840-2834 2616-2332 2384-2336
Chkalovo	Ki-6609	11/12	CC	3870±40	2452-2430 2404-2368 2364-2282	2458-2270 2260-2202
Chkalovo	Ki-6609a	11/12	CC	3800±50	2310-2308 2294-2138	2450-2432 2402-2370 2358-2124 2086-2040
Shakhta 22	Ki-6833	2/6	YC 4	3900±55	2460-2314 2302-2296	2552-2542 2492-2198
Shakhta 22	Ki-6834	2/9	YC 3	3970±50	2568-2524 2502-2452 2430-2402 2370-2360	2584-2314 2302-2296
Shakhta 22	Ki-6834a	2/9	YC 3	3930±50	2470-2390 2388-2332	2566-2524 2500-2300 2240-2208

graves from barrow 2, Shakhta 22 corresponded to the stratigraphy observed in the barrow. Based on a comparison of the results for the radiocarbon dates obtained for graves 9 and 11 in Chkalovo, it is clearly necessary to consider three dates (Ki-6827, Ki-6828 and Ki-6829) as incorrect. The remaining dates are similar and their distinctions within the limits of the measurement mistake. The results of the ^{14}C dating Ki-6833 and Ki-6834 are authentic for graves from barrow 2, Shakhta 22.

d. Based on the results of the radiocarbon dating calibration with 95.5% error probability (Table 1), the graves presented above should be dated back within a significant time interval 2866-2198 BC. This corresponds to the dating obtained for the cemetery near Golovkovka village [see Nikolova, Radiocarbon dates. ..., in this volume]. The synchronism of the YC graves from territories of the Dnipropetrovsk

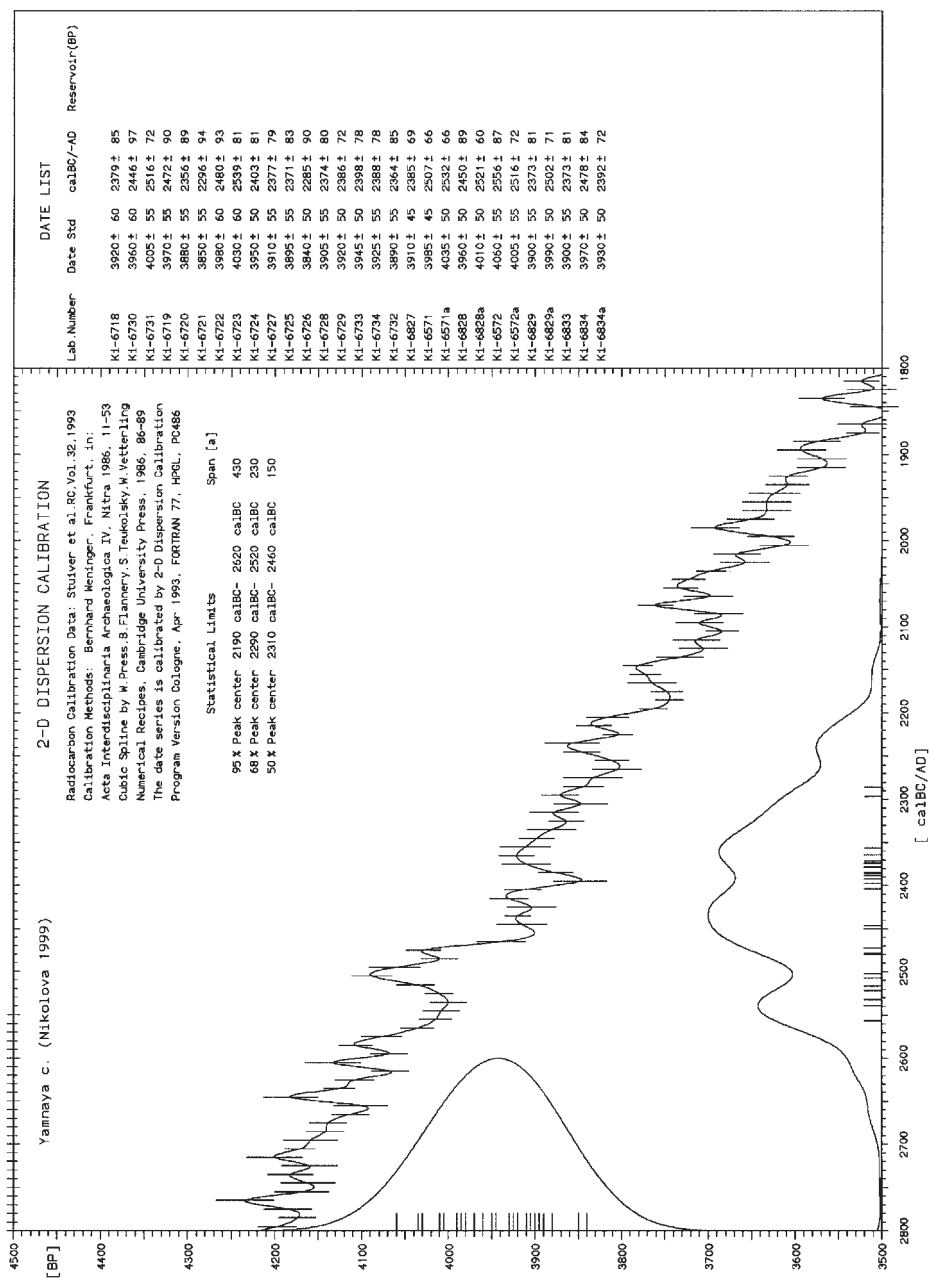


Fig. 9. Radiocarbon dating of the Yamnaya culture [using Weninger 1993 calibration]

and Kirovohrad regions is therefore determined not only by means of analysis of the archaeological data but also by their radiocarbon dating. The interval according to ^{14}C dating for the graves from barrow 11 in Chkalovo is determined as 2860-2330 BC. The dates for the later graves from barrow 2, Shakhta 22 correspond to the interval 2560- 2198 BC (Table 1). Comparing the ^{14}C dating results for the YC graves from the Dnipropetrovsk and Kirovohrad Regions [see Nikolova, Radiocarbon dates. . ., in this volume], it is worth noting that due to range of the radiocarbon dates obtained, it was possible to determine the time difference between the graves with skeletons in a foetal position on their back and those with skeletons in a foetal position on their side (compare Chkalovo and Shakhta 22). This has also been observed in archaeological data.

e. The significant differences in the series of radiocarbon dates obtained which were observed in the results analysis of ^{14}C dating for graves from barrow 11 near Chkalovo village (for example Ki-6572 = 2866-2462 BC and Ki-6829 = 2552-2198 BC) highlight the extreme care needed in the archaeological interpretation of individual radiocarbon dates. The error probability of dating results is probably not high. Nevertheless, it is clearly necessary to recognise that at the present level of development of the ^{14}C dating method, the definition of absolute range of chronological periods, which are narrower than those for the culture in general cannot be based on individual radiocarbon dating, but requires the accumulation of significant series of data, allowing us to specify the productivity of the radiocarbon dating and the possible archaeological interpretation of its results. Therefore, it is clearly necessary to admit that, at the modern level of development, attempts to base the definition of the chronological sequence of separate monuments on radiocarbon are still problematic, taking into account the ambiguity of results. It is possible that an insignificant quantity of ^{14}C dates permits us to determine only the general temporal orientation of separate cultures, which is already a very important achievement of absolute dating.

f. The application of the B. Weninger programme, taking into account the above mentioned problem, nevertheless allows us to narrow slightly the chronological range of the considered monuments [Kadrow, Szmyt 1996:104-108]. The calibration results of individual dates are shown in Table 2. According to these data, the YC graves presented in this article, allowing for standard deviations, date back to approximately 2598-2431 BC (Chkalovo) and about 2465-2292 BC (Shakhta 22). In general, based on 27 ^{14}C dates obtained (Fig. 9), the late monuments of the YC on the territory of the Dnipropetrovsk right bank can be dated back to approximately 2620-2279 BC. For the graves presented herein, the majority of the ^{14}C dates obtained are concentrated in the range of 2500-2300 BC (Fig. 9).

3. DATING OF THE CATACOMB CULTURE

a. The radiocarbon dates obtained for the catacomb graves from barrow 11 near Chkalovo (Table 1) initially differed slightly from the dates obtained for similar graves on the same territory [see Kaiser, Radiocarbon..., in this volume]. The analysed results of the ^{14}C dating of three graves where the burial ceremony was of a similar nature (Ki-6608, Ki-6610, 6609), dated back to 2458-2032 BC, seemed rather doubtful. Their ^{14}C calibrated dates, obtained using the programme of B. Weninger [1986], differed insignificantly and were all within 2403-2039 BC (Table 2). Additional ^{14}C dating of samples Ki-6608a, Ki-6610a and Ki-6609a was therefore carried out. The results obtained seem to be more correct and coincide well with the other results of dating for CC graves of the territory under consideration (Table 3). According to these results, the catacomb graves from barrow 11 in Chkalovo date back to within 2304-2032 BC.

Table 2

Calibration after Weninger 1993 (see Table 1)

Lab. No.	No. barrow/ No. grave	Date BP	Date BC/AD cal.
Ki-6608	11/6	3815 \pm 45	2231 \pm 81
Ki-6608a	11/6	3770 \pm 50	2135 \pm 92
Ki-6610	11/7	3765 \pm 45	2131 \pm 82
Ki-6610a	11/7	3750 \pm 45	2117 \pm 75
Ki-6827	11/8	3910 \pm 45	2385 \pm 69
Ki-6571	11/9	3985 \pm 45	2507 \pm 66
Ki-6571a	11/9	4035 \pm 50	2532 \pm 66
Ki-6828	11/9	3960 \pm 50	2450 \pm 89
Ki-6828a	11/9	4010 \pm 50	2521 \pm 60
Ki-6572	11/11	4060 \pm 55	2556 \pm 87
Ki-6572a	11/11	4005 \pm 55	2516 \pm 72
Ki-6829	11/11	3900 \pm 55	2373 \pm 81
Ki-6829a	11/11	3990 \pm 50	2502 \pm 71
Ki-6609	11/12	3870 \pm 40	2320 \pm 83
Ki-6609a	11/12	3800 \pm 50	2217 \pm 87
Ki-6833	2/6	3900 \pm 55	2373 \pm 81
Ki-6834	2/9	3970 \pm 50	2478 \pm 84
Ki-6834a	2/9	3930 \pm 50	2393 \pm 72

Table 3

Barrows near Ordzhonikidze, graves of the Catacomb culture. List of ^{14}C datings (Calibration after Weninger 1993)

Sample location	Number barrow/ Number grave	Lab. number	Date BP	Cal. Date BC/AD
Chernaya Mogila	3/17	Ki-6553	3745 \pm 50	2118 \pm 79
Chernaya Mogila	3/27	Ki-6554	3805 \pm 45	2217 \pm 80
Chernaya Mogila	3/28	Ki-6555	3825 \pm 45	2255 \pm 72
Gurskaya Mogila	2/30	Ki-6556	3720 \pm 55	2103 \pm 83
Chkalovo 1 Mogila	7/8	Ki-6558	3835 \pm 40	2266 \pm 72
Chkalovo 2 Mogila	1/20	Ki-6559	3740 \pm 45	2115 \pm 73
Kruglaya Mogila	1/7	Ki-6560	3680 \pm 45	2041 \pm 76
Kruglaya Mogila	1/14	Ki-6561	3710 \pm 40	2085 \pm 68
Kruglaya Mogila	1/15	Ki-6562	3750 \pm 45	2117 \pm 75
Kruglaya Mogila	1/18	Ki-6563	3775 \pm 50	2191 \pm 93
Kruglaya Mogila	8/5	Ki-6564	3560 \pm 55	1851 \pm 82
Kruglaya Mogila	8/5	Ki-6564a	3620 \pm 55	1953 \pm 80
Kruglaya Mogila	8/12	Ki-6565	3690 \pm 45	2048 \pm 75
Kruglaya Mogila	8/13	Ki-6566	3720 \pm 50	2101 \pm 78
Kruglaya Mogila	8/13	Ki-6566a	3760 \pm 50	2127 \pm 85
Kruglaya Mogila	11/7	Ki-6567	3680 \pm 50	2044 \pm 80
Kruglaya Mogila	11/12	Ki-6568	3810 \pm 50	2224 \pm 88
Kruglaya Mogila	11/17	Ki-6569	3730 \pm 45	2106 \pm 72

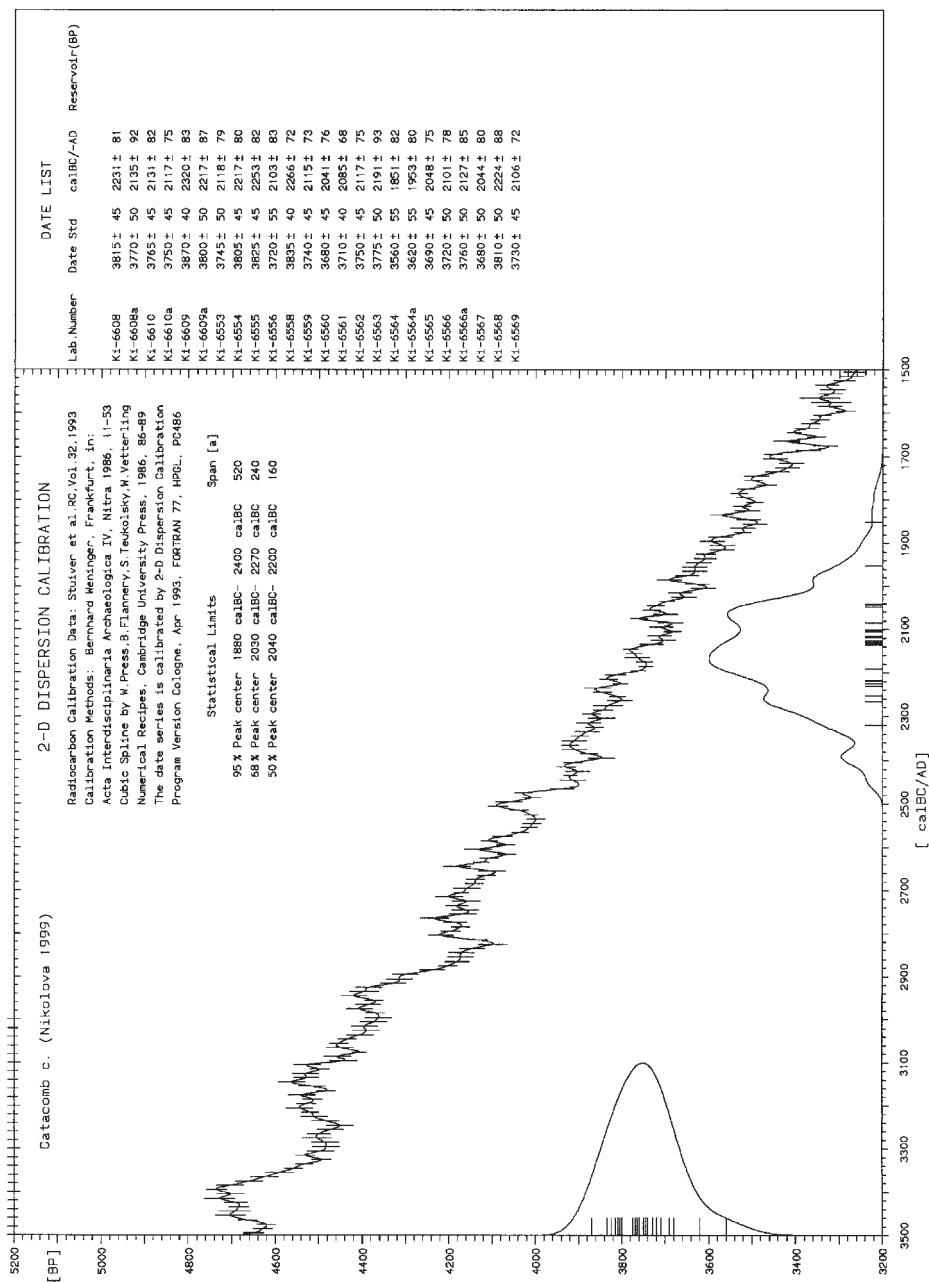


Fig. 10. Radiocarbon dating of the Catacomb culture [using Weninger 1993 calibration]

b. One of the versions of data analysis has been offered for the interpretation of the radiocarbon dates obtained for the graves of the CC of the given region [see Kaiser, Radiocarbon. . . , in this volume]. Here, we would like to consider another possible method of analysis. The dates calibrated according to the programme of B. Weninger are submitted in Table 3. One grave (Ki-6553) should be attributed to the Mnogovalikova Pottery culture. In accordance with the radiocarbon dates, among 12 graves of the CC, two groups can be distinguished according to the type of burial ceremony carried out. The first of these consists of 4 graves (Ki-6555, Ki-6562, Ki-6566 and Ki-6568), and the ceremony features correspond to the early period of the CC. The remaining 14 graves, comprising the second group, correspond to the late Ingul period. A direct stratigraphy is observed between the graves of different groups in only one case (Ki-6554 and Ki-6555) [see Kaiser, Radiocarbon. . . , in this volume]. The analysis of ^{14}C dates for graves of the first group demonstrates that in three cases these graves had the earliest dating among the graves of the CC found in one barrow (Ki-6555, Ki-6566 and Ki-6568). However, the chronological range of this group (2327-2023 BC) is broad enough to be acceptable (Table 3). On the other hand, certain discrepancies are observed in the analysis of the ^{14}C dates for the second group. Thus, for example, considerably different radiocarbon dates (Ki-6563 = 2284- 2098 BC and Ki-6564 = 1933-1769 BC) were obtained for two graves featuring identical burial ceremonies, in which stone axes similar in shape were found. It should be noted that the final date dropped out of the whole range of the ^{14}C dates obtained, which raised doubts as to its reliability. The new ^{14}C dates of the sample from the same grave allow us to reduce this discrepancy slightly (Ki-6564a = with. 2033-1873 BC). In general, assuming the radiocarbon data under consideration is correct, even taking into account the discrepancies revealed, the time range determined for the existence of this group is too broad - 2304-1873 BC. Furthermore, in this context, the accuracy of some of them is doubtful.

It should be emphasised that, as with the graves of the YC, based on the radiocarbon dates obtained, it is still impossible to trace the different dates for those CC graves which the archaeological analysis identified as displaying distinct features of the burial ceremony. If we consider the results obtained from the ^{14}C dating of the Catacomb culture in general, it is clearly visible that the majority are concentrated in the range of 2200-2000 BC (Fig. 10).

CONCLUSION

Notwithstanding the observations expressed above concerning the accuracy of the radiocarbon dating results obtained, the recently obtained set of ^{14}C dates considerably expands the opportunities for an absolute dating of the YC and the CC,

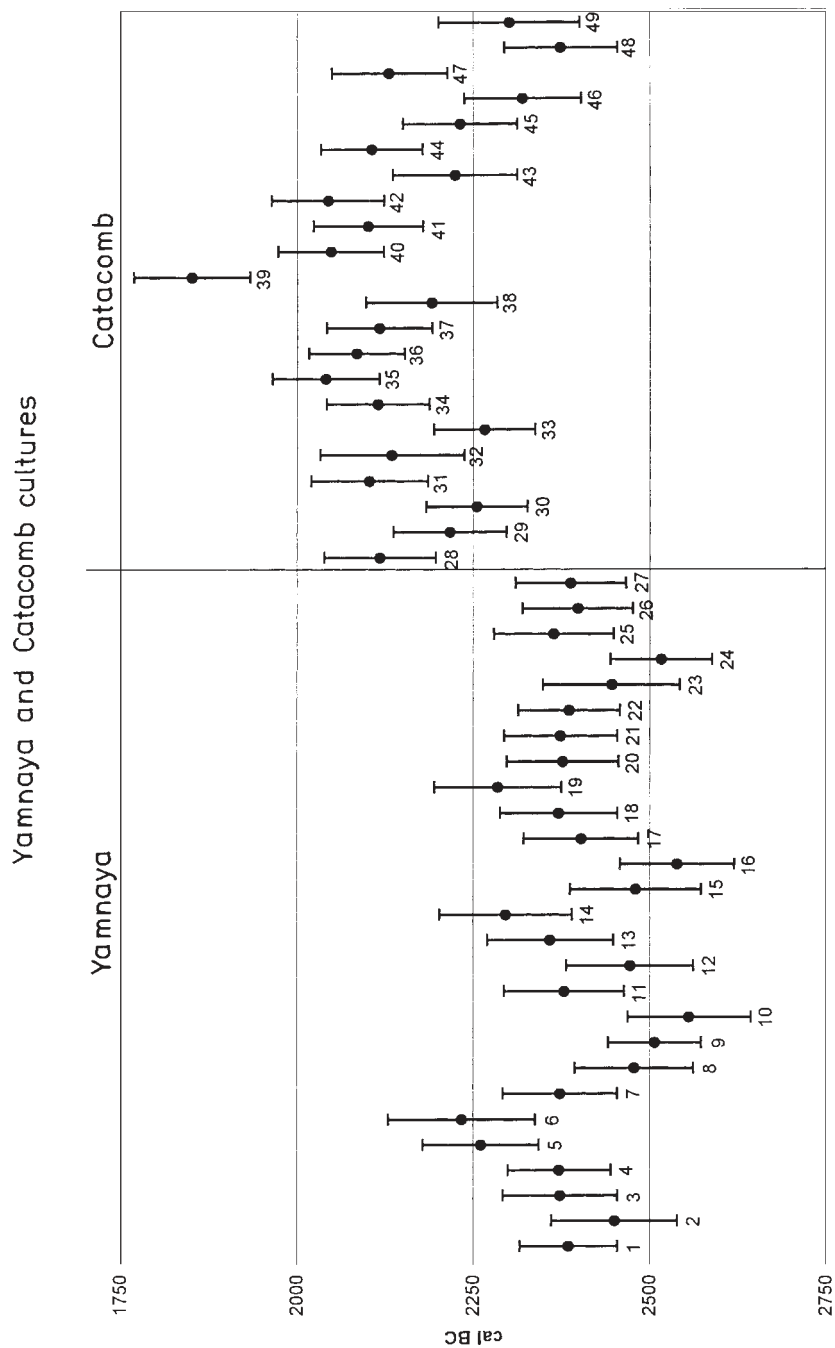


Fig. 11. Radiocarbon dating of the Yamnaya and Catacomb cultures [using Weninger 1993 calibration]

whilst at the same time allowing us to consider the problem of their chronological correlation at a new level.

According to the results of the ^{14}C dating obtained (Fig. 11), the late period in the development of the YC on the territory of the right bank of the Dnieper can be dated between 2550-2250 BC.

The distinctions between the dating of the YC and the CC are absolutely clearly observed: the dating for the latter can be determined in the range of 2250-2000 BC. 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.

Elke Kaiser

RADIOCARBON DATES FROM CATACOMB GRAVES

Until now, the chronological classification of the Catacomb culture (CC) has been based on the typological comparison of findings and on synchronisation with other cultural groups, especially in south-eastern Europe [Bogataya, Manzura 1994: 81ff.]. Its absolute chronological frame had not changed substantially since its first, and last, complete examination in the fifties [Popova 1955:28ff.], according to which the CC dates from the transition of the 3rd to 2nd millennia BC to the middle of the 2nd millennium BC. In recent years, there have been a number of attempts to date the early Bronze Age in the steppe regions further back, according to the chronology of south-eastern and central Europe [Pustovalov 1994:86ff.]. However, the author did not give any reasons for these new dates. This was complicated by the fact that the absolute chronology of the early Bronze Age in south-eastern Europe did not seem sufficiently secure [Raczky 1995:51ff.; Makkay 1996:219ff.]. Additionally, there is often little evidence to compare the findings of the steppe groups with those in the Carpathian Basin and the Balkans during this period.

Thus, the pursuit to obtain an independent dating is understandable. In 1997, 22 samples taken from catacomb graves of grave mounds in the District Nikopol, of the Dnipropetrovsk Region, were analysed in the ¹⁴C Laboratory in Kiev (State Scientific Center of Environmental Radiogeochemistry Ukrainian Academy of Sciences). The grave mounds are situated in different *kurgan* groups on the western bank of the Dnieper river around the town of Ordzhonikidze (Fig. 1). They have been excavated since 1979 by annual expeditions. The samples are bones of skeletons from 21 graves (Fig. 2), five of which were excavated in the summer of 1997, the others being found in the years from 1980 to 1983. The author was able to examine the graves of the older excavations¹.

Several datings belong to graves of the same *kurgans*, and it seems interesting to check the relative chronology of these barrows. **Mound 3** of the group at Chernaya

¹ The material is still in preparation for printing. A.V. Nikolova and E.P. Bunyatyan kindly gave their permission to publish the material used in this article. Only the graves of the finds from the 1980's will be presented.

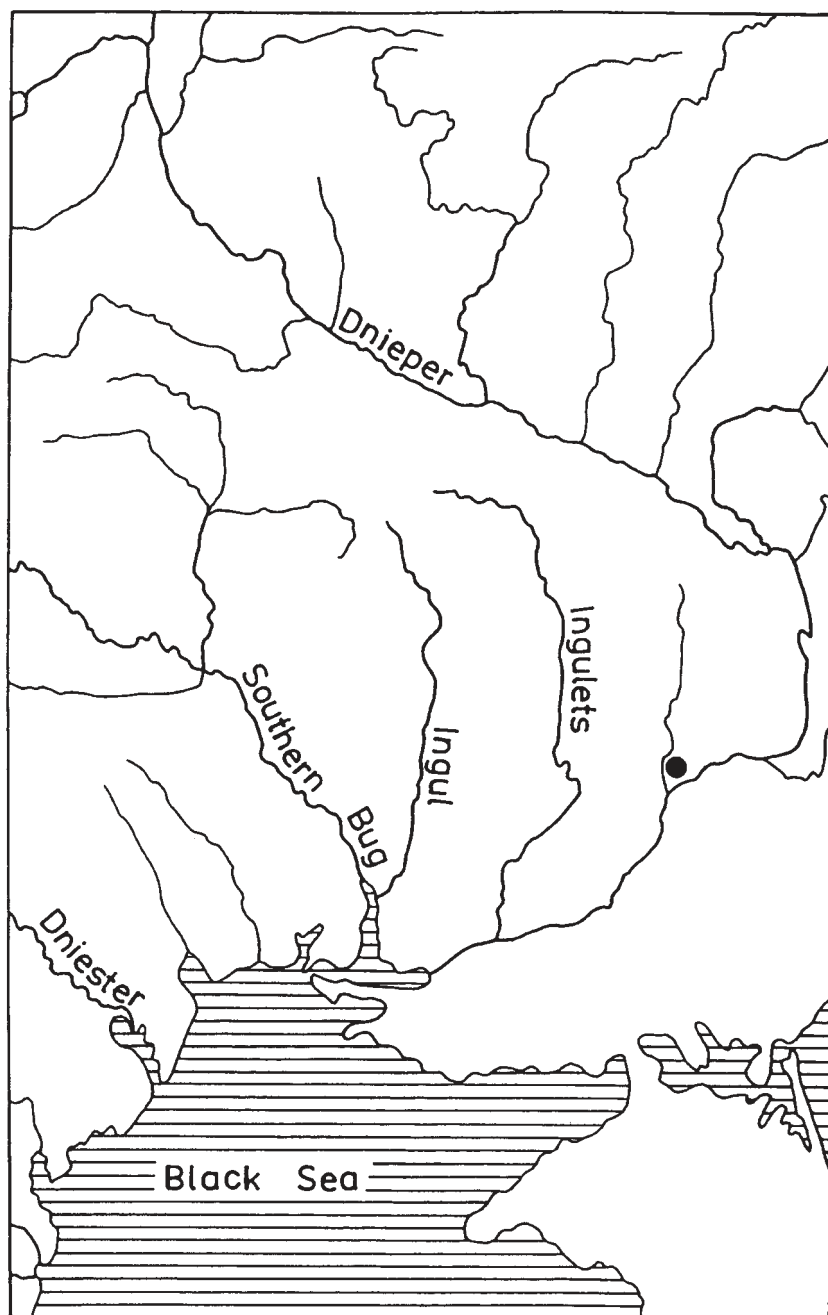


Fig. 1. Location of kurgan groups near Ordzhonikidze, Nikopol District, Dnipropetrovsk Region

M. Stuiver and R.S. Kra eds. 1986 Radiocarbon 28(2B): 805-1030; OxCal v2.18 cub r.4 ad.12 prob[chron]

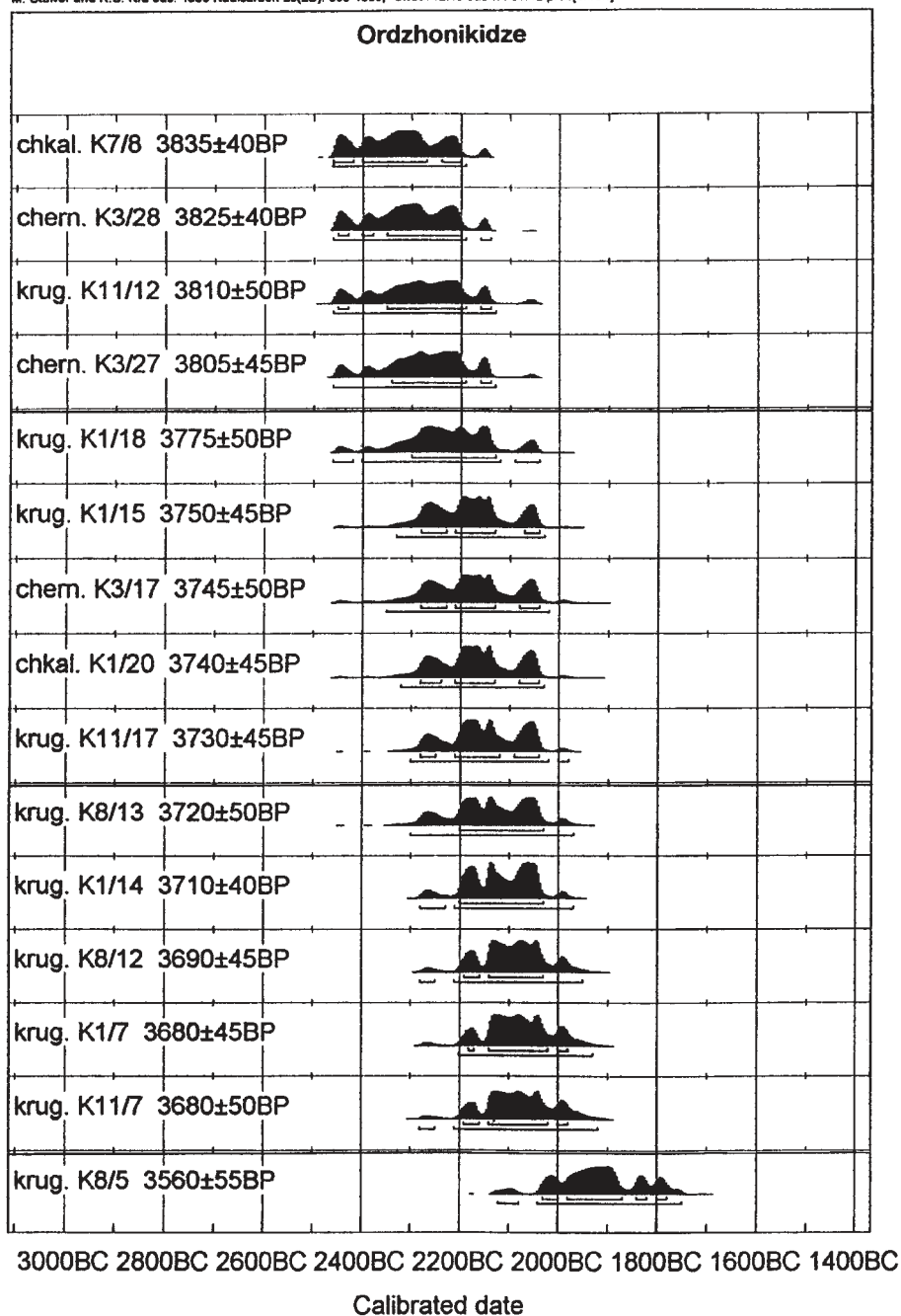


Fig. 2. Calibrated dates of 15 catacomb graves around Ordzhonikidze, Nikopol District, Dnipropetrovsk Region (the abbreviations are explained in the appendix)

Mogila was excavated in 1980, and 11 catacomb burials were found (Fig. 3). Bones from three skeletons were analysed (Fig. 2). According to the absolute dating, **grave 28** is the oldest. It displays a construction with a rectangular entrance pit, an entrance passage and a semi- circular chamber. The deceased was placed in a shallow foetal position on his right side (Fig. 4). As previously described, these features seem to be characteristic for the early phase of the CC. **Grave 27** is only 20 years more recent (in absolute terms), and was situated directly above the chamber of **grave 28** (Fig. 4). The entrance pit was not found. The deceased lay in a stretched position on his back, which suggests a dating in the late phase of the CC, which is also supported by the orientation of the grave within the *kurgan*. However, according to a calibration with a probability of 95% (2 sigma), the graves could be contemporary to one another. A probability of 68% (1 sigma) shows a time range from 2450 to 2200 BC for grave 28, and from 2350 to 2150 BC for grave 27.

Grave 17 of **barrow 3** is definitely younger (Fig. 5). It ranges from 2300 to 2050 BC, with a probability of 68%. Despite this, the deceased lay in an deep foetal position in the grave, which is constructed in the typical way for the late phase, with an round entrance pit and an oval-shaped chamber. On first view, therefore, this date seems to be contradictory to the traditional classification of catacomb graves. However, for the region between the Orel and Samara rivers, I.F. Kovaleva points out that several graves which were built in the abovementioned way, and which contain skeletons in a foetal position, lying on one of their sides, represent the latest horizon of the CC in this area [Kovaleva 1983:20ff.].

The other samples were taken from three mounds of the large group at Kru-glaya Mogila. According to the radiocarbon dates, the oldest burial was in **barrow 11** (Fig. 6). The skeleton of **grave 12** lay in a foetal position on its left side, in a rectangular chamber with a similarly formed entrance pit (Fig. 7). The ^{14}C date (3810 ± 50 BP) of the grave is slightly earlier than that for grave 28 of Chernaya Mogila. It could have been constructed between 2450 and 2150 BC (with a probability of 68% - 1 sigma). The two other graves from this barrow which were analysed are much younger. The three deceased of **grave 17**, as well as the individual of **burial 7**, were buried in grave constructions with a round entrance pit and an oval-shaped chamber. All were buried in a stretched position on their back. In grave 17, one of the skeletons was partly destroyed and apparently pushed to the wall. This was probably the result of a preceding burial. There is no information concerning which skeleton the sample was taken from. Grave 17 was sunk between 2300 and 2050 BC, grave 7 between 2200 and 2000 BC (with a probability of 68%).

Of all the graves of **barrow 1** (Fig. 8) which were analysed, **grave 18** (Fig. 9) is the oldest (with a probability of 68%, it was constructed between 2300 and 2100 BC). In this mound, six catacomb graves were found. Radiocarbon dates were made from four graves, three of which could be classified in the late phase, due to the

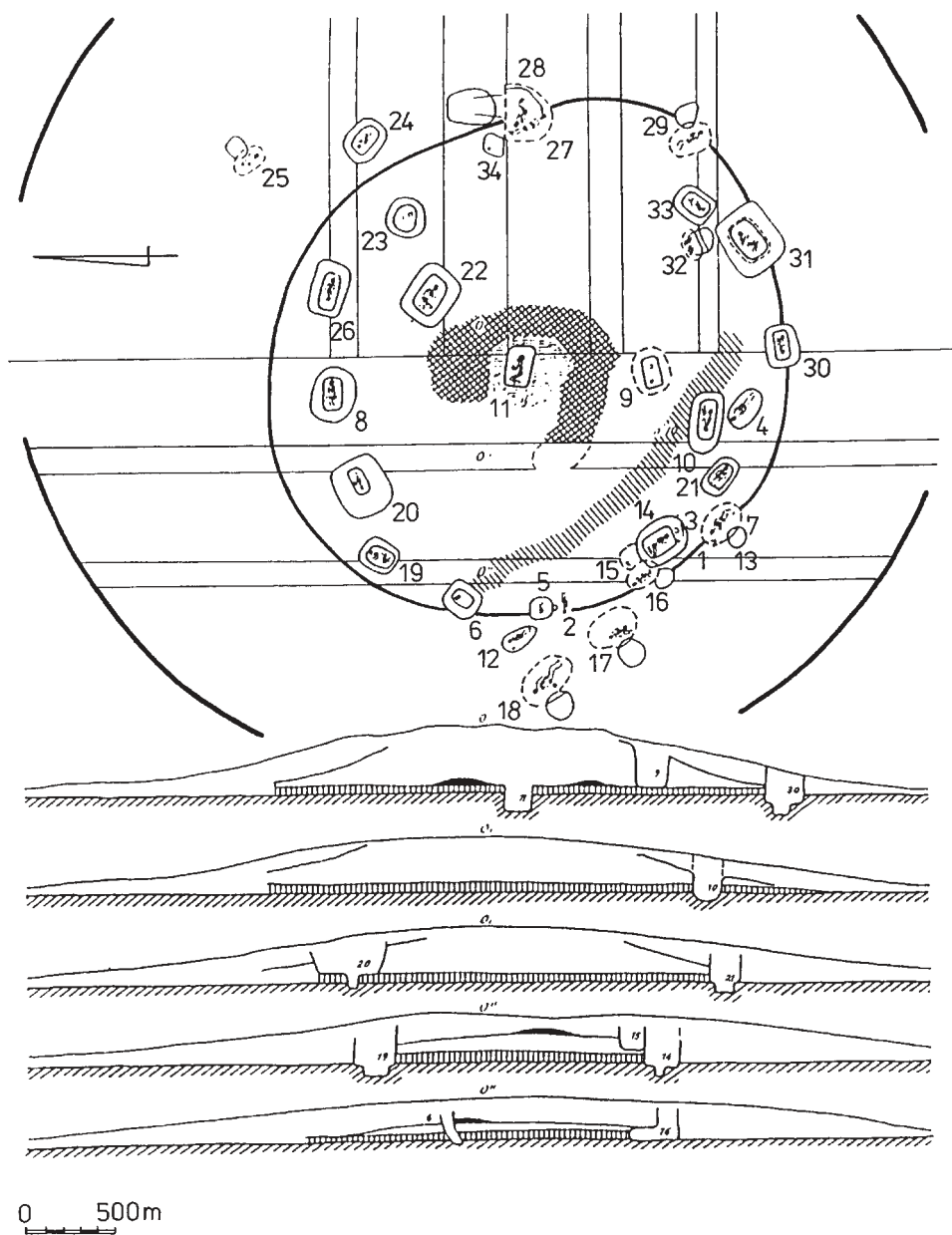


Fig. 3. Chernaya Mogila, barrow 3

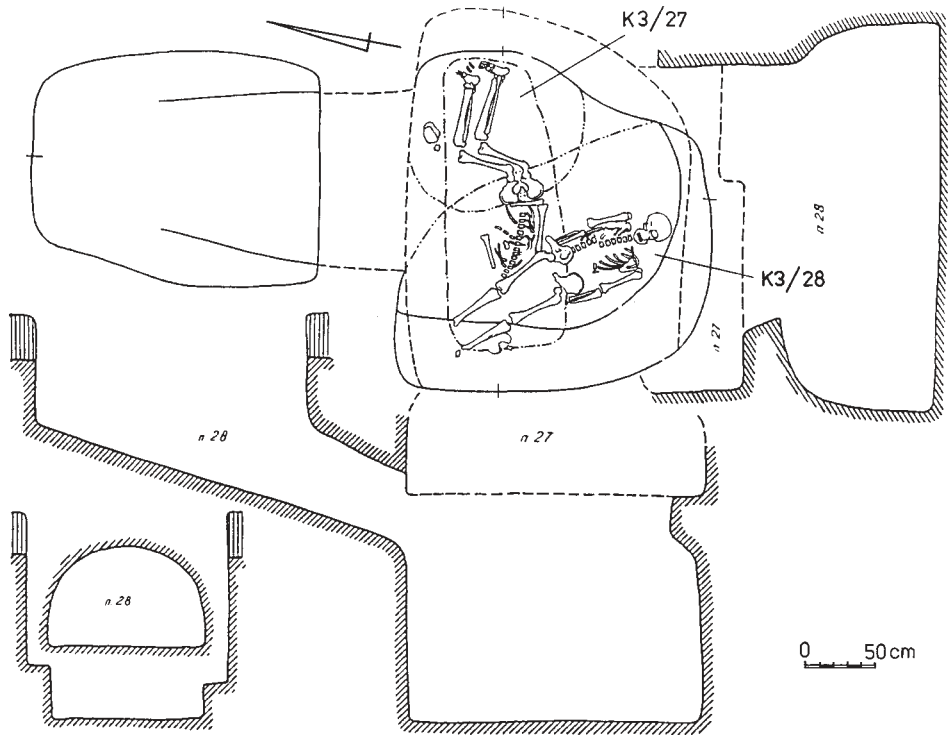


Fig. 4. Chernaya Mogila, barrow 3, grave 27 and 28

stretched position of the skeleton. **Grave 15** was empty, except for a few human bones which were found in the filling of the pits. At the bottom of the chamber, an egg-shaped pot was found, although there is no other evidence to suggest that this grave belongs to the early phase. Unfortunately, none of the skeletons in a foetal position were analysed (grave 6). Both of the graves found in the northern part of the *kurgan* seem to represent a more recent horizon of deceased buried in a stretched position (Fig. 8). **Grave 15** could also be classified in the first half of the 21st century BC, according to a probability of 68%. The two more recent graves - 14 and 7 - range from 2200 to 2000 BC, with a probability of 68%.

The most recent graves could be identified in **barrow 8** (Fig. 10). **Grave 13** is characterised by a rectangular grave construction and an entrance passage, and represents the oldest catacomb in this mound, although its absolute date is about 3720 BP (Fig. 11a). Compared to the other catacomb graves with characteristics of an older horizon, this seems to be too young. Younger than this, by 30 years, is grave 12, composed of an oval-shaped entrance and grave pit, in which an individual was

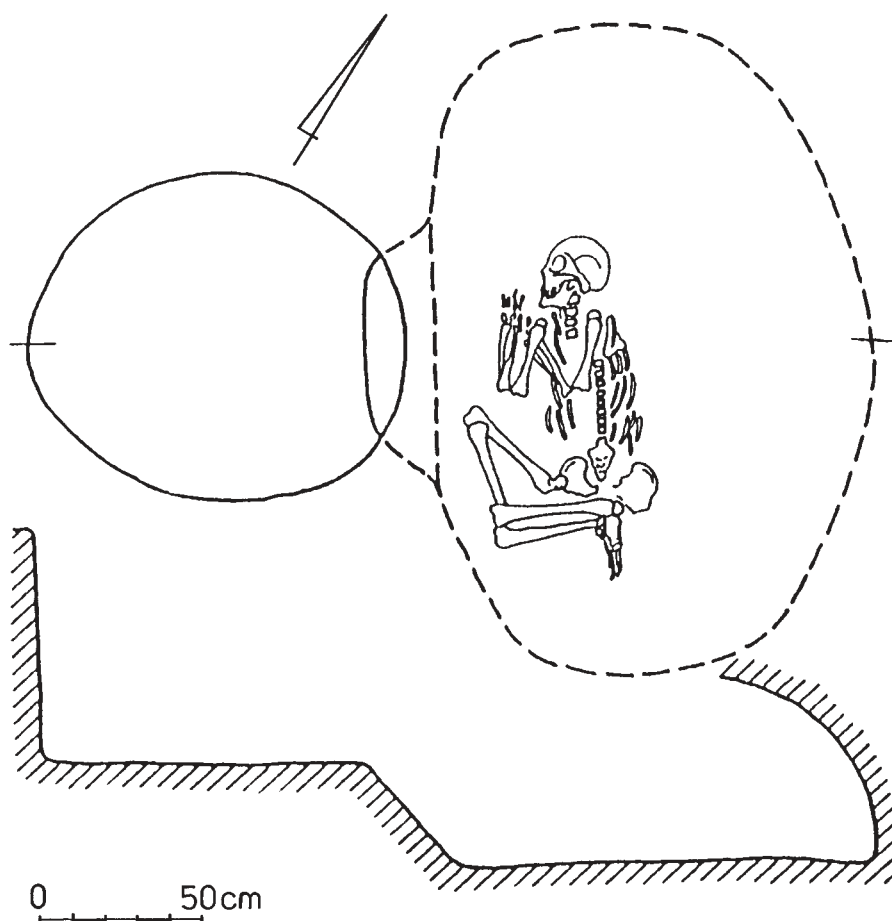


Fig. 5. Chernaya Mogila, barrow 3, grave 17

buried in a stretched position (Fig. 11b). After calibration, both graves could have been sunk between 2200 and 2050 BC, with a probability of 68%. **Grave 5** is the most recent grave (Fig. 12), showing a calibrated time range from 2050 to 1800 BC - extreme compared to the other radiocarbon results.

Thus, the ^{14}C dates from the barrow near Ordzhonikidze confirm the theory of a relative chronology of CC insofar as that, in three *kurgans*, all the graves with characteristics of the so-called older phase of the CC represent the oldest catacombs. One has to admit, however, that in two cases (mound 3 of Chernaya Mogila and mound 8 of Kruglaya Mogila), the absolute age of the next more recent burial, which already shows the characteristics of the next phase, is very close to that of the

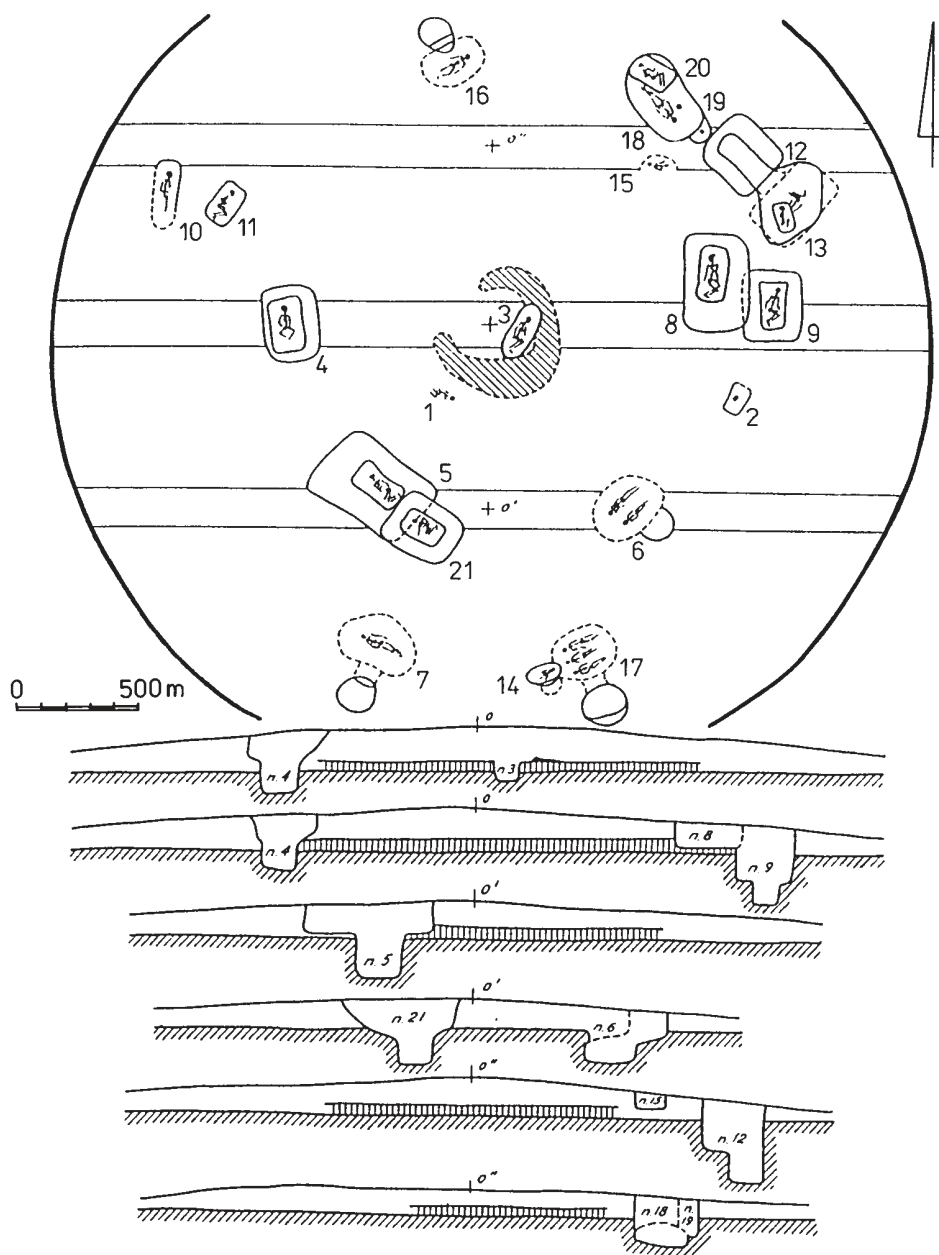


Fig. 6. Kruglaya Mogila, barrow 11

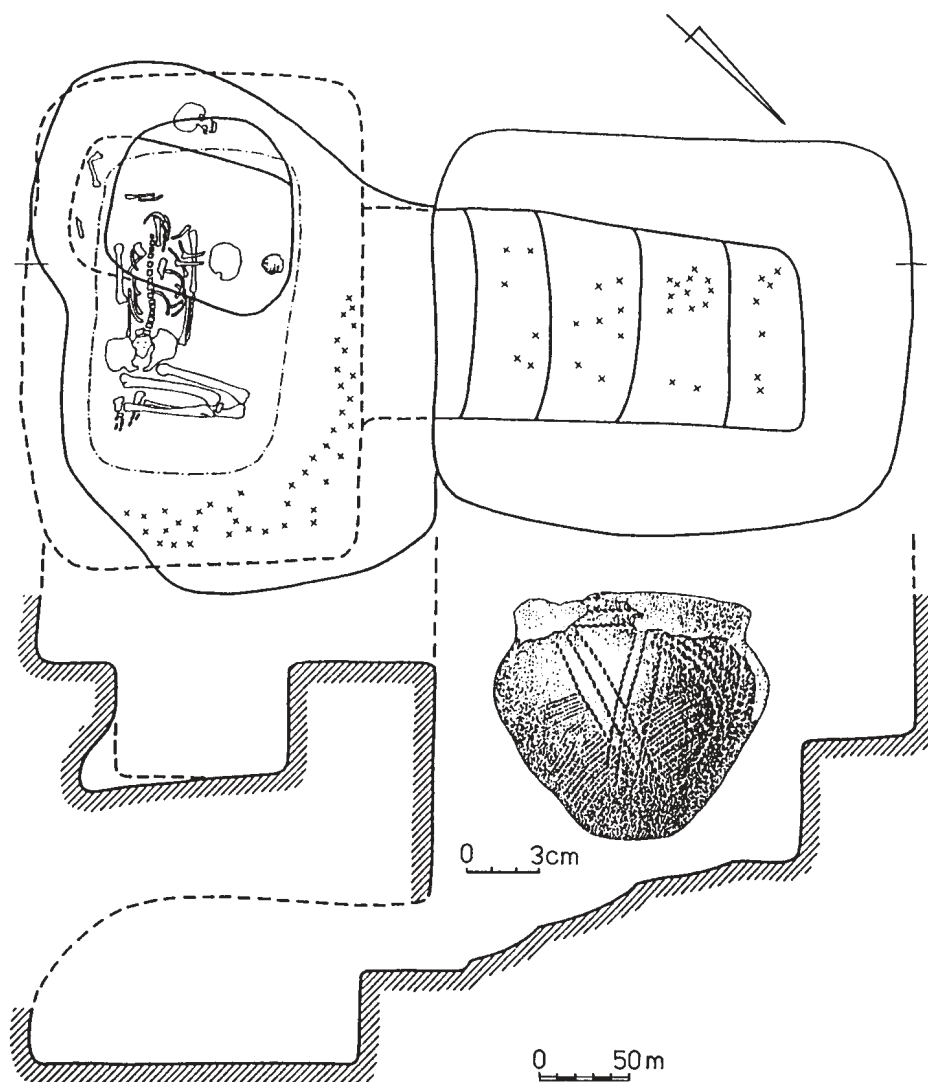


Fig. 7. Kruglaya Mogila, barrow 11, grave 12

so-called “old” grave. According to the calibration, the time range of construction is nearly the same for all of these graves.

According to their dating, with a probability of 68% confidence, the 15 catomb graves could be divided into four chronological phases, which follow one

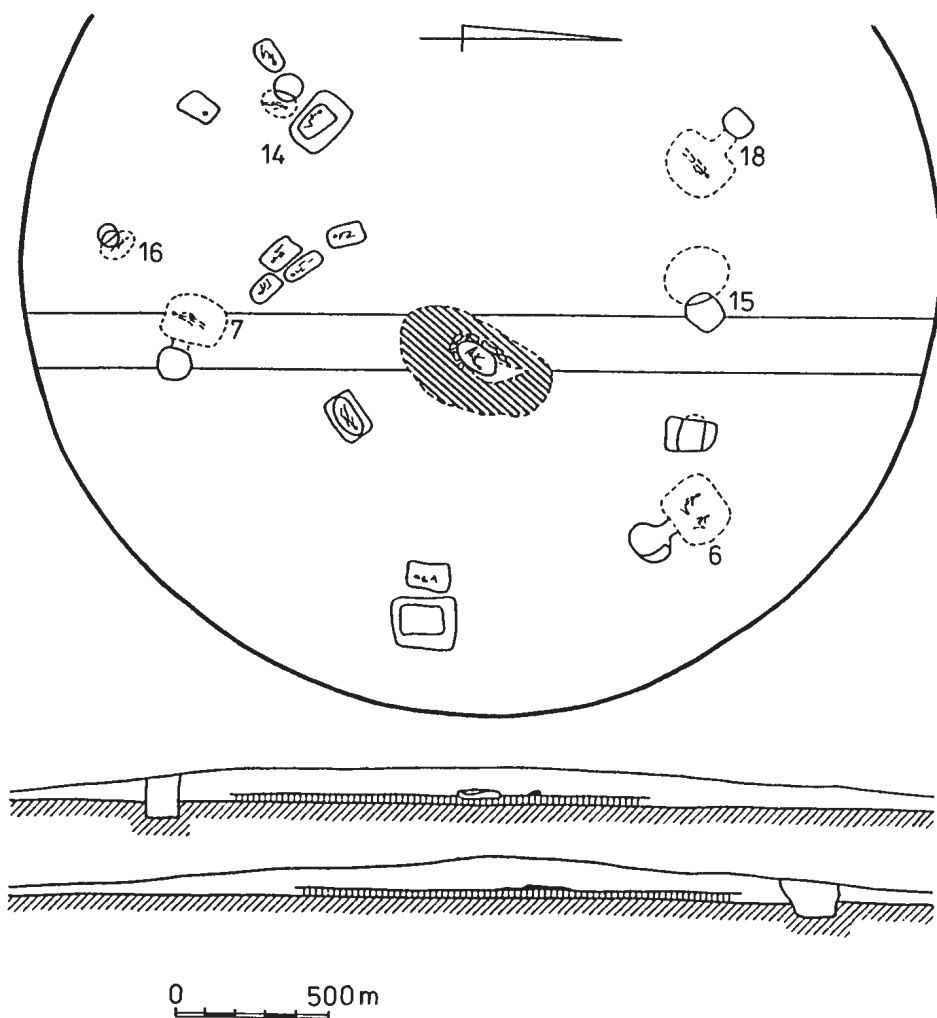


Fig. 8. Kruglaya Mogila, barrow 1

after the other and overlap in some places (Fig. 2)². The first range, which dates from 2450 to 2200 BC, covers four graves from three *kurgans*. Most of them show a further small range of probability beyond the mentioned period. The next phase, covering five catacombs, ranges from 2300 to 2000 BC, with a probability of 68%. With the exception of the date for grave 18 of barrow 1 of Kruglaya Mogila, all dates, with a probability of 95%, lie within this period, or seem to be slightly older.

² The calculations were made using the program OxCal 2.18.

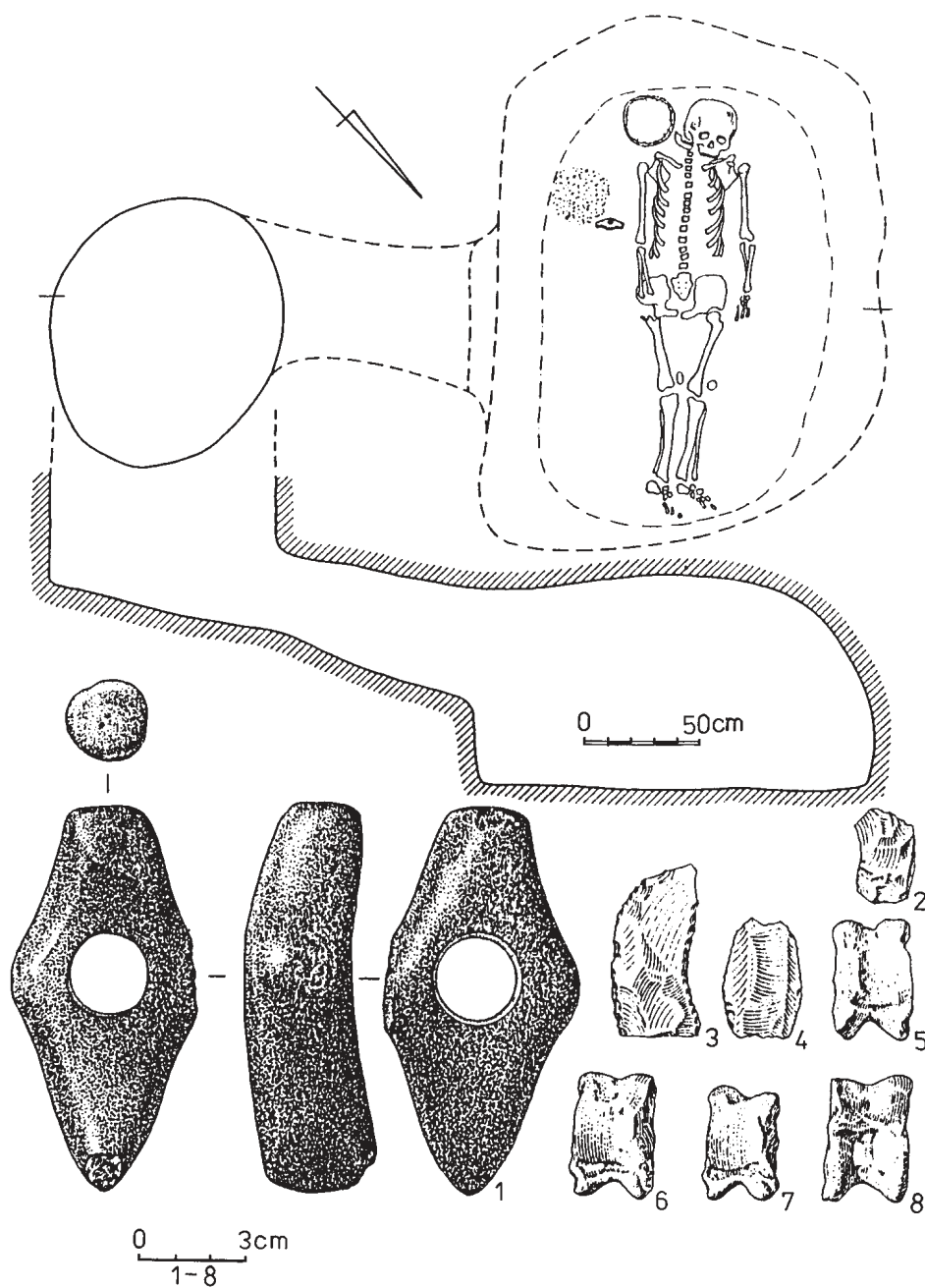


Fig. 9. Kruglaya Mogila, barrow 1, grave 18

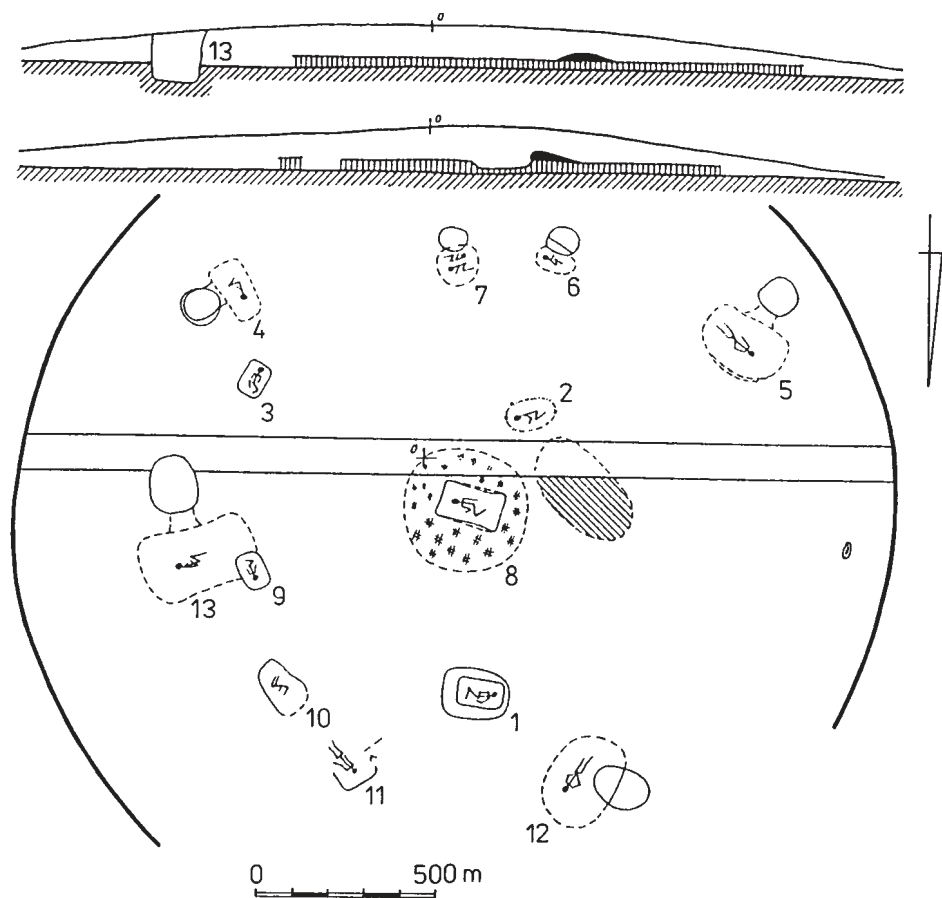


Fig. 10. Kruglaya Mogila, barrow 8

The next range, again covering five graves, of different mounds from the group at Kruglaya Mogila, dates between 2200 and 1950 BC, with a probability of 68%. A probability of 2 sigma would extend the period from 2300 to 1900 BC. The most recent grave comes from *kurgan* 8 of Kruglaya Mogila. Its absolute dating is 80 years later than the preceding one of the third phase. This grave ranges between 2050 and 1800 BC, with a probability of 68%.

A brief overview of the graves which compose each of these phases, after calibration, shows no direct conformities of grave constructions, position of the buried, rituals etc. These graves and their relative chronology will be discussed later. First, we will turn to the question of whether these datings correspond to others from Bronze Age cultures in the steppe. Datings were recently published of

wood samples taken from catacomb graves in different regions of Ukraine [Telegin 1992:68ff.]. The largest series was taken from a group of mounds situated near Svatovo on the northern Donetsk river. Only a few other findings from these graves have yet been published [Smirnov 1996: Fig. 9:11; 11:3; 47:23.25].

The range of time resulting from the calibration of all analysed graves is much longer than that for the graves near the Dnieper. The oldest four graves date from between 2900 and 2600 BC, with a probability of 68% (Fig. 13). The other five dates are later than 2500 BC, one grave following gradually after another. The dating of grave 2, mound 12, has to be excluded, since the standard deviation is too high to give a clear result. Unfortunately, this is the only grave of Svatovo which has had its findings analysed and published with an illustration. Its construction, with a big, semi-circular entrance pit, which is only slightly smaller than the grave chamber, is regarded as typical for the late phase of the CC in the Donetsk region [Bratchenko 1976:32, Fig. 11; Smirnov 1996:57]. The datings for Svatovo could prove the actual conception as to belonging to the internal chronology of the CC. According to this, the catacombs of the Donetsk and Don region are considerably older than those in the western parts of the Ukrainian steppe, where the population who buried their dead in catacombs later expanded. The grave constructions of the late period are characterised by round entrance pits and oval-shaped chambers (see below).

The results of radiocarbon datings of Bronze Age graves from Kalmykia, including CC graves, have already been presented [Aleksandrovskiy et al. 1997: 9ff.]. The graves of five different barrow groups were analysed and, taking extreme values into consideration, the datings for the CC range from 2600 to 1850 BC in this area. The most recent values, however, often range from 2200 to 2000 BC, the oldest being about 2500 BC [Aleksandrovskiy et al. 1997:20, Tab. 2]³.

Although these are still preliminary results, and not all of them are comprehensible, the period of the catacomb graves can be compared with that of the graves near Ordzhonikidze. In contrast to this, the early datings from Svatovo in the Donetsk region seem to be too high. A comparison of dates and graves is, therefore, indispensable in order to be able to work with the datings.

J.P. Mallory and D.Y. Telegin published the results of the radiocarbon analysis of wood samples taken from catacombs in which the remains of wagons were found [Mallory, Telegin 1994: 30ff.]. One wagon was found in the entrance pit of grave 11 of mound 9 near Kamenka-Dniprovskaya, Zaporizhia Region [Chernykh 1991:137ff.]. The grave was constructed with a rectangular entrance pit, which was connected through a 50 cm long entrance passage with a semi-circular chamber. On the bottom of the pit, an elderly man was buried in a shallow foetal position on his right side. The grave construction and the position of the skeleton are assigned to the early phase of the CC [Chernykh 1991: 139].

³ In Tab. 1 of this publication all results of analyses are listed in detail, but there is no cultural classification of the grave from which samples were taken, which makes it impossible to confirm the detail values with the compilation in Tab. 2.

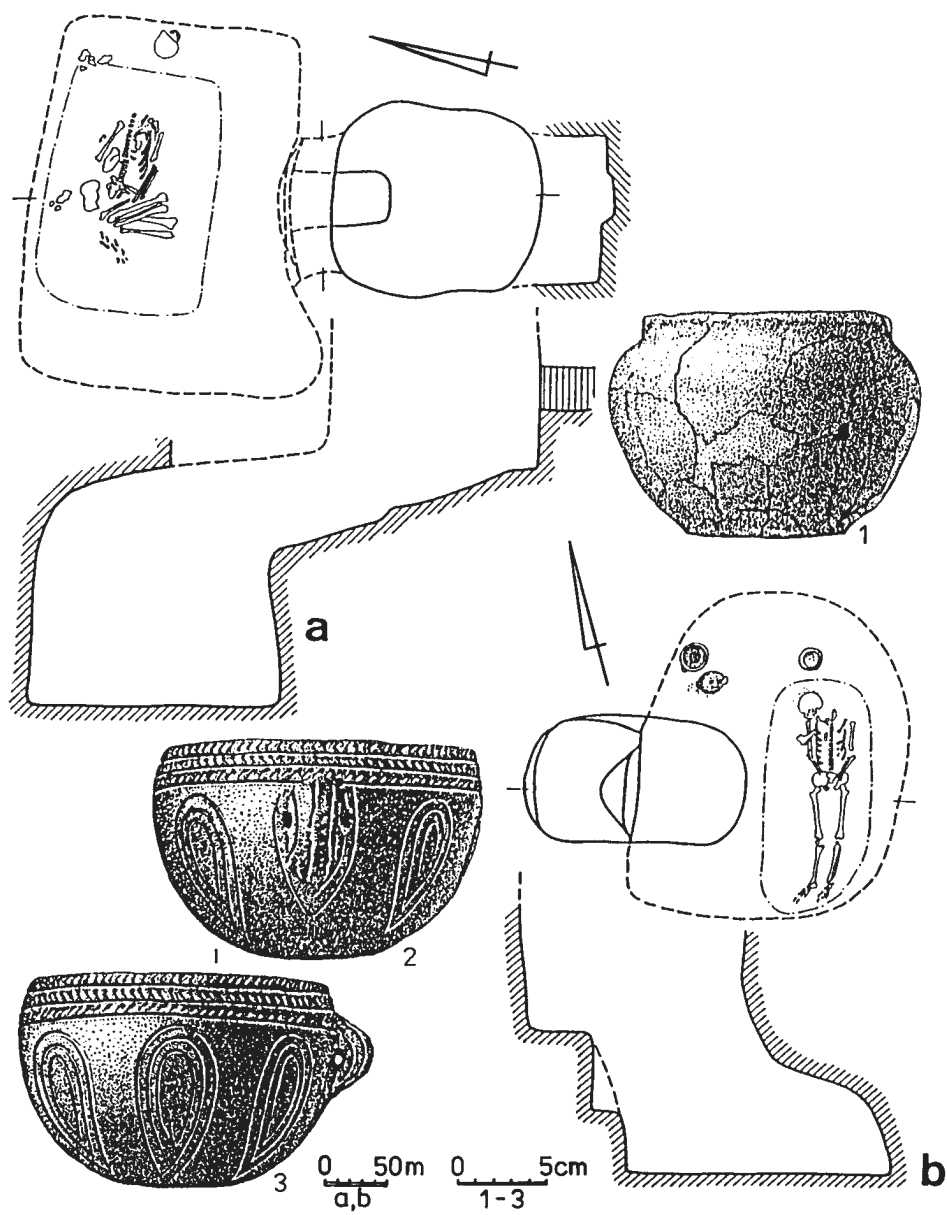


Fig. 11. Kruglaya Mogila, barrow 8 a - grave 13, b - grave 12, 1-3 - pots from grave 12

Three samples from this grave were taken and analysed. They each date from different a period. The two extreme values come from the laboratory of Kiev (Ki-3368: 3900 ± 50 BC; Ki-3592: 4370 ± 50 BC). Another value was determined in a different radiocarbon laboratory (UB-3135) and gives a date of 4062 ± 19 BC. The oldest result would be much earlier than the earliest datings of Svatovo in the Donets region, the second could be correlated with the graves of Svatovo and the most recent is parallel with the oldest CC from Ordzhonikidze, in the Dnieper region.

The other published results of radiocarbon analyses of wagon graves range from 4200 to 4100 BC, which itself suggests that the second dating of grave 11 of Kamenka-Dniprovskaya is the correct one. The only grave which falls outside of this range is grave 27 of mound 11 at Marevka, which shows an absolute result of about 3908 BC. However, the standard deviation of ± 120 years is too high to show a clear dating after calibration. The wagon was found in one of the two chambers which branch off from a more or less rectangular entrance pit [Cherednichenko, Pustovalov 1991: 206ff.]. In the eastern chamber, three adults and one child were buried behind the remains of a two-wheeled wagon. Again, the grave construction and the position of the skeleton suggest that the grave was built in the early phase of the CC. The site is situated on the right bank of the Dnieper river, not far from the city of Zaporizhia, also close to the wagon grave of Kamenka-Dniprovskaya.

Ultimately, the diverging results mean that the absolute dating of the catacomb graves containing wagons is still inconclusive. The existing values seem to prove only that they belong to the early phase of the CC. One has to admit that the base of radiocarbon dates is still not solid enough to give exact limits for the absolute chronological position of the CC.

In the relative chronology of the steppe region, the CC is followed by the Srubnaya culture (SC), which was also spread over a wide territory - between the Dnieper and the Volga rivers. The separate periods, especially in different regions, still need further investigation. As yet, there exist no interpretable radiocarbon results from the Northern Pontic zone. However, some of the graves near Utevka were analysed, which are said to represent the Potapovo period. This period is suggested to be the foundation for the evolution of the SC in the forest steppe zone of the central Volga region [Trifonov 1996: 62 Tab. 1; Vasilev, Kuznetsov, Semenova 1992: 52ff.]. The results give a possible dating from 2100 to 1700 BC, with a probability of 68% (1 sigma, Fig. 14).

The graves of Krivoye Ozero, from which horse bones were also analysed by Trifonov, probably belong to the same horizon [Trifonov 1996: 62, Tab. 1]. After calibration, the four datings show two phases - the first ranging from 2300 to 2000 BC, the second from 2000 to 1800 BC (again with a probability of 68%). If one accepts the general opinion of Ukrainian archaeologists that the CC in the eastern

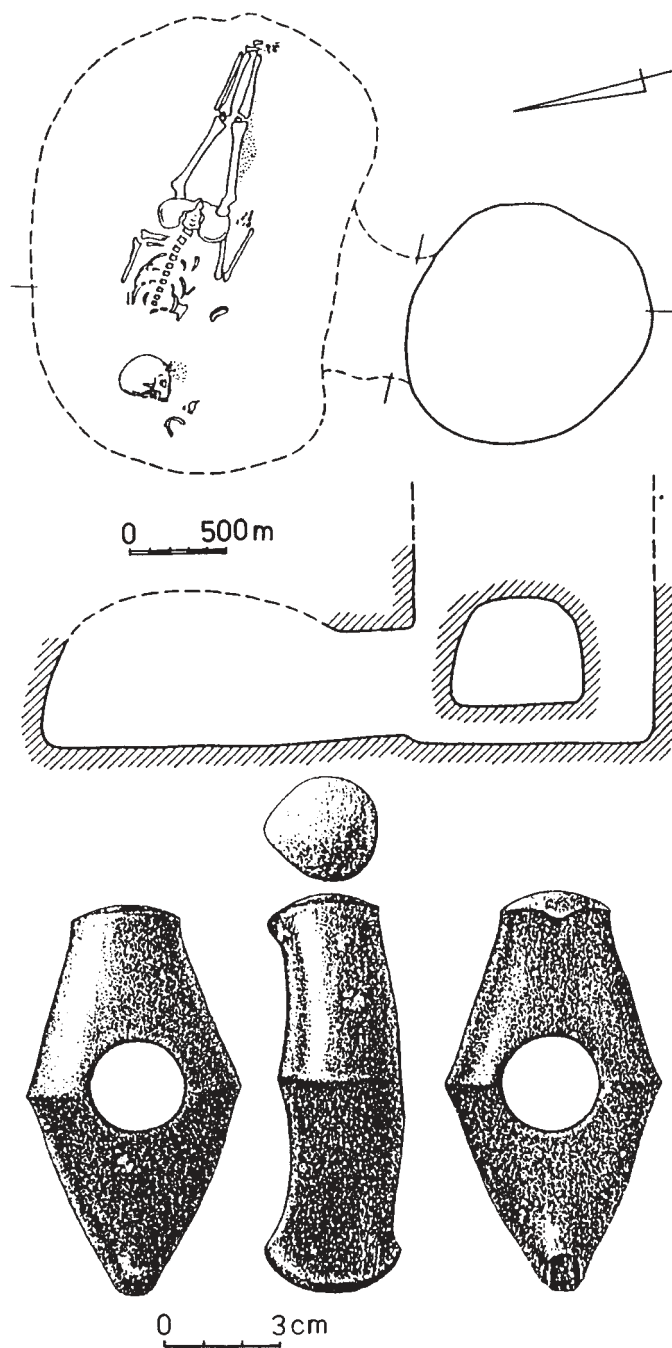


Fig. 12. Kruglaya Mogila, barrow 8, grave 5

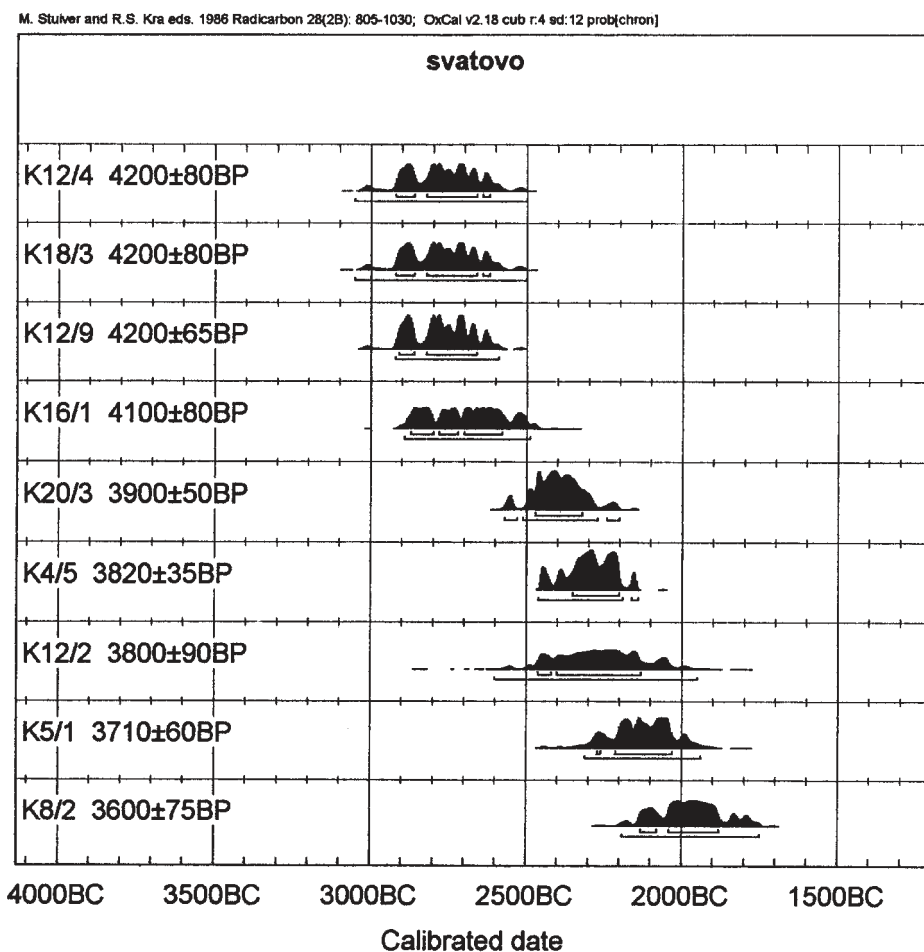


Fig. 13. Calibrated dates of nine graves of Svatovo, Donets region [after Telegin 1992, 68ff]

regions of Ukraine is much older than in western parts, and if one adjusts the datings of Svatovo, the results of the SC graves will correspond to the chronological concept.

It is ultimately proposed that the CC and SC existed simultaneously, when SC was still in an evolutionary phase. The Potapovo phase was preceded by the Poltavkinskaya culture, which, in some parts, existed parallel to the CC [Kuznetsov 1996: 56ff.]⁴.

⁴ The calculation of the intervals shown by Kuznetsov is in parts unclear, especially the datings for the Potapova culture, which show a much older timespan.

M. Stuiver and R.S. Kra eds. 1986 Radiocarbon 28(2B): 805-1030, OxCal v2.18 cub r.4 sd:12 prob[chron]

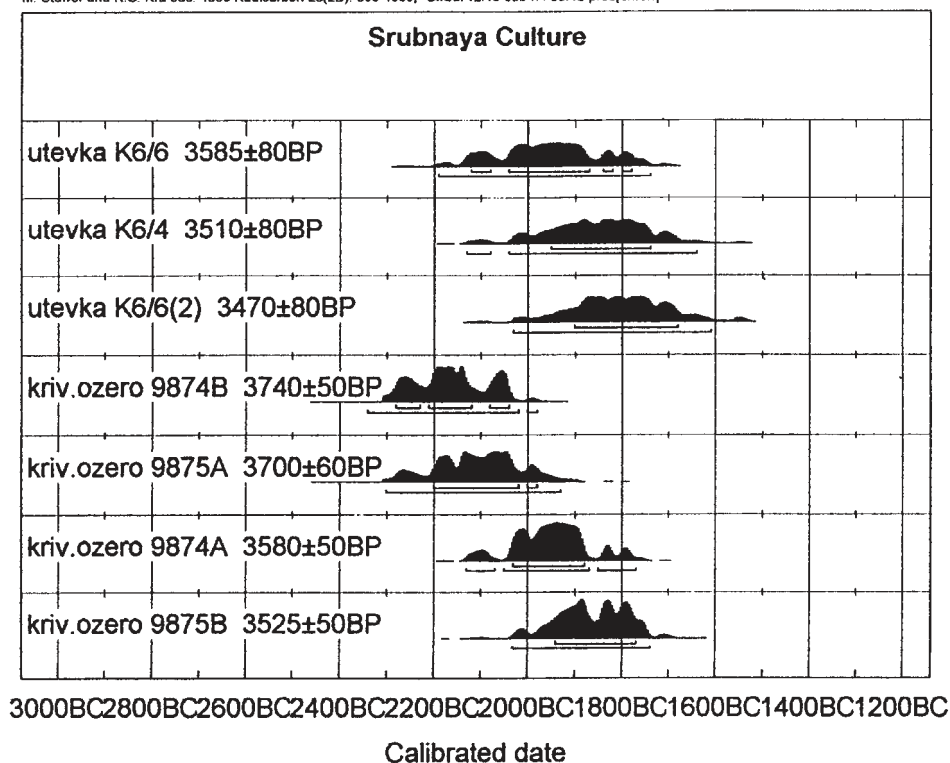


Fig. 14. Calibrated dates of Srubnaya culture graves (from Utevka and Krivoye Ozero, after Trifonov 1996:62 Tab. 1)

Although further radiocarbon analyses may, in the future, result in some changes in absolute chronology, the existing results allow us to build an initial frame for the absolute dating of the early and middle Bronze Age in eastern Europe. However, even the 15 dates from the mounds near Ordzhonikidze only (approximately) fit into this frame because datings of different regions were linked. Even more complicated is the chronological position of the Yamnaya culture (YC). Several results of radiocarbon analyses have already been published [Telegin 1977:5 ff.; Telegin, Sobotovich, Kovalyuch 1978:55ff.; Telegin, Sobotovich, Kovalyuch 1981:78ff.; Sementsov, Romanova, Dolukhanov 1969:251 ff.; Dvoryaninov, Dzigovskiy, Subbotin 1985:161], but the standard deviation is mostly too high for a calibration to be successful. Another problem with the old Ukrainian datings is the existence of many extreme values, even from samples of the same horizon. The sources of error are not clear; again, only a few of the findings from the analysed graves have been published.

The only reliable results currently available come from samples which were taken from material of pit graves in Bulgaria [Görsdorf, Boyadzhiev 1996:155f.]. Their chronological ranges are from 3100 to 2910 BC for the older graves and from 2890 to 2490 BC for the more recent ones, with a probability of 68%. Samples from both the central and the secondary burials of the mound of Poruchik Geshanovo were analysed. The authors suggest that this mound was in use for a period of about 100 years, and consequently date it from 2950 to 2850 BC (2960-2860 BC for the mound of Plačidol, the second site from which samples were taken).

Considering the final possible dating for the Bulgarian pit graves of about 2500 BC, and the fact that they probably do not represent the most recent phase of the whole late pit grave horizon, these dates can be correlated with those of the catacombs near Ordzhonikidze.

This leads to the conclusion that the CC could be synchronised with the early Bronze Age in the Carpathian Basin and in the Balkans (and with the Middle Bronze Age in Bulgaria). After linking the civilisations in Mesopotamia and Egypt, via their relations to Crete and Anatolia, with the cultures of the middle and late Eneolithic in south-eastern Europe H. Parzinger integrated the latter into an absolute chronological system. The Eneolithic in south-eastern Europe ends with the so-called horizon 13, which includes the Vučedol culture and influences of Glina III. This horizon is dated from 2500/2400 to 2300/2200 BC [Parzinger 1993: 270f., 290].

This dating, based on archaeological-historical comparison, is essentially confirmed by Raczy, who compared the radiocarbon datings for the Eneolithic graves in the Carpathian Basin and along the Lower Danube, as well as those for the Aegean and north-western Anatolia [Raczy 1995:60, Fig. 1]. According to his systematics, all Eneolithic cultures are approximately 100 years older than the dates suggested by H. Parzinger. The datings of the early Bronze Age in Bulgaria correspond with the results of the radiocarbon measurements [Görsdorf, Boyadzhiev 1996:107].

The new results of ^{14}C datings allow us to confirm the general succession of YC, CC and SC in the 3rd millennium, and the beginning of the 2nd millennium BC. Exact time ranges for the transitional periods between cultures are still not clear. In the area west of the Dnieper river, the CC definitely begins about 2500 BC, although there is some evidence of much older graves such as the wagon graves in the surroundings of Zaporizhia. In the Donets and Don regions, some of the analysed burials are much older than in the western part, and seem to prove the suggestion that a central part of CC was situated here. However, further details, and the confirmation of the internal chronology of the CC, require additional series of ^{14}C samples.

Finally, the results of the radiocarbon measurements from the three mounds of Kruglaya Mogila give rise to a number of speculations which, although as yet impossible to prove, should nevertheless be mentioned. The mounds of Kruglaya

Mogila contained more than 18 *kurgans*. In six of these, catacomb graves were found, which were all secondary burials in grave mounds of Eneolithic or YC. There is no proof of any kind of artificial accumulation of earth above the CC graves, and thus no evidence for vertical stratigraphic observations. The characteristics for graves of the so-called early and late phases of the CC have already been mentioned.

The results of the radiocarbon analysis indicate that the construction of catacomb graves was started at different times in each mound. As already shown, the oldest and the most recent graves with characteristics of the old phase were found in mound 11 in mound 8 respectively. It is not sure when the first catacomb burial in barrow 1 was established, because there is no analysis from grave 6, which is probably the oldest. However, the succession of the catacomb burials of mound 1 seems to imply that after each generation a new grave was built. There are several hints which point to the fact that a *kurgan* group represents the grave yard of a particular community (for example, the catacombs of Kruglaya Mogila are often situated in opposite “corners” of the mound; the only two graves with stone axes, of all the groups around Ordzhonikidze, were found in barrow 1 and 8 in the group of Kruglaya Mogila).

It might be suggested that the establishment of catacomb graves in a *kurgan* begins with a highly respected figure of the community, and perhaps the status of the buried was emphasised by a corresponding grave construction (compare with barrow 11/grave 12, barrow 8/grave 13 of Kruglaya Mogila and barrow 3/grave 28 of Chernaya Mogila). After this first grave had been sunk, other members of the community were allowed to be buried in the same mound. This would also explain why some of the graves hitherto considered to be older do not differ distinctly from the younger ones according to the ^{14}C dates. At the beginning of this article, it was pointed out that the values of the radiocarbon analysis of the barrows around Ordzhonikidze, after calibration, could be divided into four phases. The dates of the old catacomb graves are spread over two of these phases. No results of anthropological analyses were available, so it was not possible to make any statements concerning gender in the burial rites.

These reflections are intended to be speculative. They are to lead to new approaches in analysing catacomb graves, especially in the territory to the west of the Dnieper river. However, there is no doubt about the need for further radiocarbon measurements and further investigations to be carried out, in order to solve the general problem of absolute dating, the problem of internal chronology and specific problems of social structure.

LIST OF THE GRAVES AND THE ^{14}C DATES

INFORM : References - M. Stuiver and R.S. Kra [eds.] 1986 Radiocarbon 28(2B): 805-1030; OxCal v2.18 cub r:4 sd:12 prob[chron]

DATE Chkal. K7/8 (Chkalovo, group I, K7/gr.8) [Ki-6558]: $3835 \pm 40\text{BP}$: 68.2% confidence: 2460BC (0.14) 2420BC; 2400BC (0.68) 2270BC; 2240BC (0.18) 2200BC. 95.4% confidence: 2460BC (1.00) 2190BC

DATE Chern. K3/28 (Chernaya Mogila, K3/gr. 28) [Ki -6555]: $3825 \pm 40\text{BP}$: 68.2% confidence: 2450BC (0.08) 2430BC; 2400BC (0.05) 2380BC; 2350BC (0.87) 2200BC. 95.4% confidence: 2460BC (0.97) 2190BC; 2160BC (0.03) 2140BC

DATE Krug. K11/12 (Kruglaya Mogila, K11/gr.12) [Ki-6568]: $3810 \pm 50\text{BP}$: 68.2% confidence: 2450BC (0.04) 2430BC; 2350BC (0.89) 2190BC; 2160BC (0.07) 2140BC. 95.4% confidence: 2460BC (1.00) 2130BC

DATE Chern. K3/27 [Ki-6554]: $3805 \pm 45\text{BP}$: 68.2% confidence: 2340BC (0.92) 2190BC; 2160BC (0.08) 2140BC. 95.4% confidence: 2460BC (1.00) 2130BC

DATE Krug. K1/18 [Ki-6563]: $3775 \pm 50\text{BP}$: 68.2% confidence: 2300BC (1.00) 2130BC. 95.4% confidence: 2460BC (0.03) 2420BC; 2400BC (0.89) 2120BC; 2090BC (0.08) 2040BC

DATE Krug. K1/15 [Ki-6562]: $3750 \pm 45\text{BP}$: 68.2% confidence: 2280BC (0.28) 2230BC; 2210BC (0.59) 2130BC; 2070BC (0.13) 2040BC. 95.4% confidence: 2330BC (1.00) 2030BC

DATE Chern. K3/17 [Ki-6553]: $3745 \pm 50\text{BP}$: 68.2% confidence: 2280BC (0.26) 2230BC; 2210BC (0.56) 2130BC; 2080BC (0.19) 2040BC. 95.4% confidence: 2350BC (1.00) 2020BC

DATE Chkal. K1/20 (Chkalovo, group II, K1/20) [Ki-6559]: $3740 \pm 45\text{BP}$: 68.2% confidence: 2280BC (0.18) 2240BC; 2210BC (0.60) 2130BC; 2080BC (0.22) 2040BC. 95.4% confidence: 2320BC (1.00) 2030BC

DATE Krug. K11/17 [Ki-6569]: $3730 \pm 45\text{BP}$: 68.2% confidence: 2280BC (0.09) 2250BC; 2210BC (0.61) 2120BC; 2090BC (0.30) 2040BC. 95.4% confidence: 2300BC (0.99) 2020BC; 2000BC (0.01) 1980BC

DATE Krug. K8/13 [Ki-6566]: $3720 \pm 50\text{BP}$: 68.2% confidence: 2200BC (1.00) 2030BC. 95.4% confidence: 2300BC (1.00) 1970BC

DATE Krug. K1/14 [Ki-6561]: $3710 \pm 40\text{BP}$: 68.2% confidence: 2200BC (1.00) 2030BC. 95.4% confidence: 2280BC (0.06) 2230BC; 2210BC (0.94) 1970BC

DATE Krug. K8/12 [Ki-6565]: $3690 \pm 45\text{BP}$: 68.2% confidence: 2190BC (0.11) 2160BC; 2140BC (0.89) 2030BC. 95.4% confidence: 2280BC (0.02) 2250BC; 2210BC (0.98) 1950BC

DATE Krug. K1/7 [Ki-6560]: $3680 \pm 45\text{BP}$: 68.2% confidence: 2180BC (0.01) 2170BC; 2140BC (0.92) 2020BC; 2000BC (0.07) 1980BC. 95.4% confidence: 2200BC (1.00) 1930BC

DATE Krug. K11/7 [Ki-6567]: 3680 ± 50 BP: 68.2% confidence: 2190BC (0.07) 2160BC; 2140BC (0.84) 2020BC; 2000BC (0.09) 1980BC. 95.4% confidence: 2280BC (0.02) 2250BC; 2210BC (0.98) 1920BC

DATE Krug. K8/5 [Ki-6564]: 3560 ± 55 BP: 68.2% confidence: 2030BC (0.13) 2000BC; 1980BC (0.74) 1870BC; 1840BC (0.08) 1820BC; 1800BC (0.06) 1780BC. 95.4% confidence: 2120BC (0.03) 2080BC; 2040BC (0.97) 1750BC

Translated by author

Mikola M. Kryvaltsevich, Nikolay Kovalyukh

RADIOCARBON DATING OF THE MIDDLE DNEIPER CULTURE FROM BELARUS*

Until now, radiocarbon chronology had yet to be obtained for the Middle Dnieper culture (MDC). I.I. Artemenko suggested only one ^{14}C date. Barrow 5 of the **Belynets** cemetery was dated to 2350 ± 50 conv BC using the ^{14}C method [Artemenko 1987: 41]. This date was published without any laboratory number or calibration. The date was obtained in 1970 from grave 1, in which many remains of burnt wood were found. This grave also contained small pieces of cremated bones, some red ochre, a stone axe, two polished flint axes with a rectangular cross-section, a flint knife and two flint blades [Artemenko 1976a: 156].

The elaboration of a more accurate chronology was provided by a programme of investigation of MDC from Belarus which includes radiocarbon dating (Fig. 1). ^{14}C analyses were carried out at the State Scientific Center of Environmental Radiogeochemistry of the National Academy of Sciences of Ukraine in Kiev (head Dr. N.N. Kovalyukh).

A series of ^{14}C dates were obtained from 5 graves of **Prorva site 1** (near the town of Ragachow, Homel Region), which was excavated by Mikola Kryvaltsevich and Igar Yazepenko in 1994-1997. Cemetery Prorva 1 is located in the valley of the left bank of the Dnieper and on the southern bank of the Prorva lake. There were more than 20 graves at this cemetery, with some remains of inhumed and cremated individuals. Prorva site 1 is one of the numerous cemeteries of MDC which have been opened and excavated in Ragachow micro-region by I.I. Artemenko (some barrow cemeteries near Hodasavichy), and M. Kryvaltsevich with I. Yazepenko (Prorva site 1 and 2, barrow near lake Kamaryn). Two radiocarbon dates from Prorva site 1 have already been presented in *Baltic-Pontic Studies* [Kryvaltsevich 1996:98-102; Kadrow, Szmyt 1996b:109-110]. Charcoal for radiocarbon analysis was taken from burnt wooden structures of grave 1. The dates of *grave 1* were cal. 4150 ± 80 BP

* Project financed with grant no. 1H01G01810 provided by the Polish Committee for Scientific Research in 1996-1998.

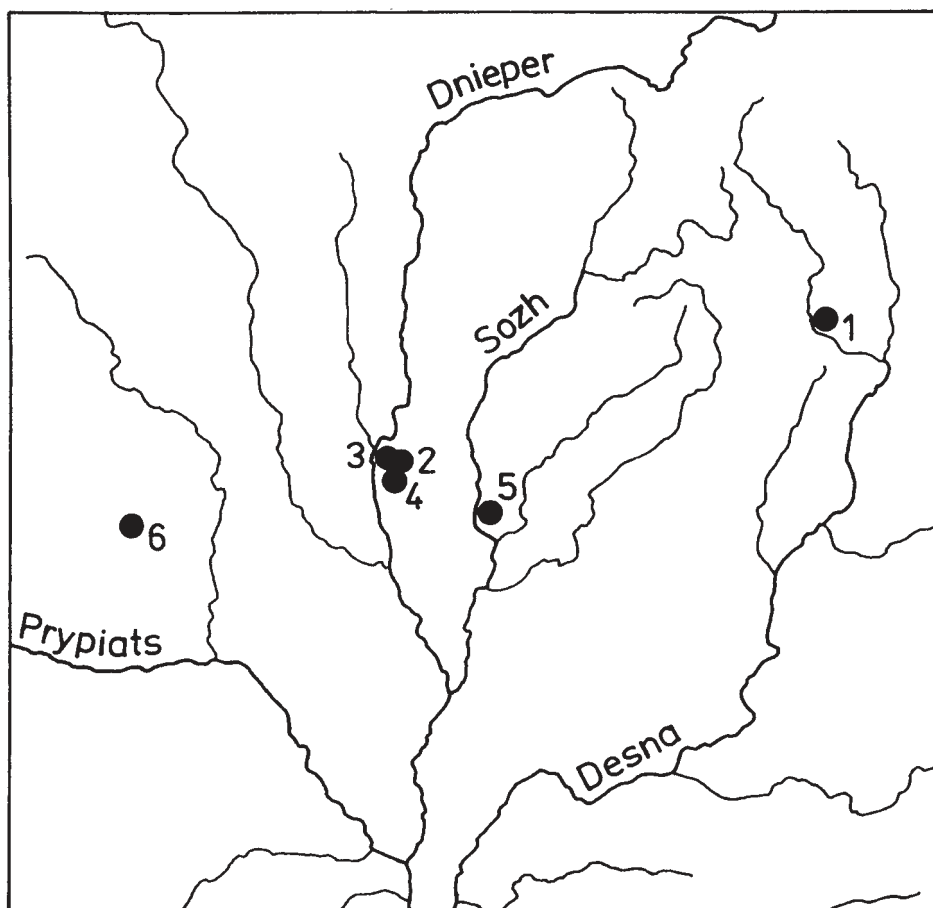


Fig. 1. Location of sites.

Legend: 1 - Belynets; 2 - Prorva site 1; 3 - Prorva site 2; 4 - Hodasavichy; 5 - Stralitsa; 6 - Aziarnoye site 1

(Le-5020), 2736 ± 119 BC and 4060 ± 45 (Ki \pm 5140), 2548 ± 78 BC [Kadrow, Szmyt 1996b:109-110].

Grave 2 was situated in the highest part of the barrow mound. A circular trench (nearly 7m in diameter) had been made around this grave in ancient times. Traces of graves were found 0.43-0.45m below the present ground level. The burial pit penetrated the ground more than 0.2m deeper than the ancient surface. The grave was rectangular in shape and oriented along the NE-SW line (Fig. 2). Charcoal from burnt wood was found along the edges of the burial pit. Two samples for radiocarbon analysis were taken from these burnt wooden structures (Ki-5612; Ki-5613 - Tabl. 1).

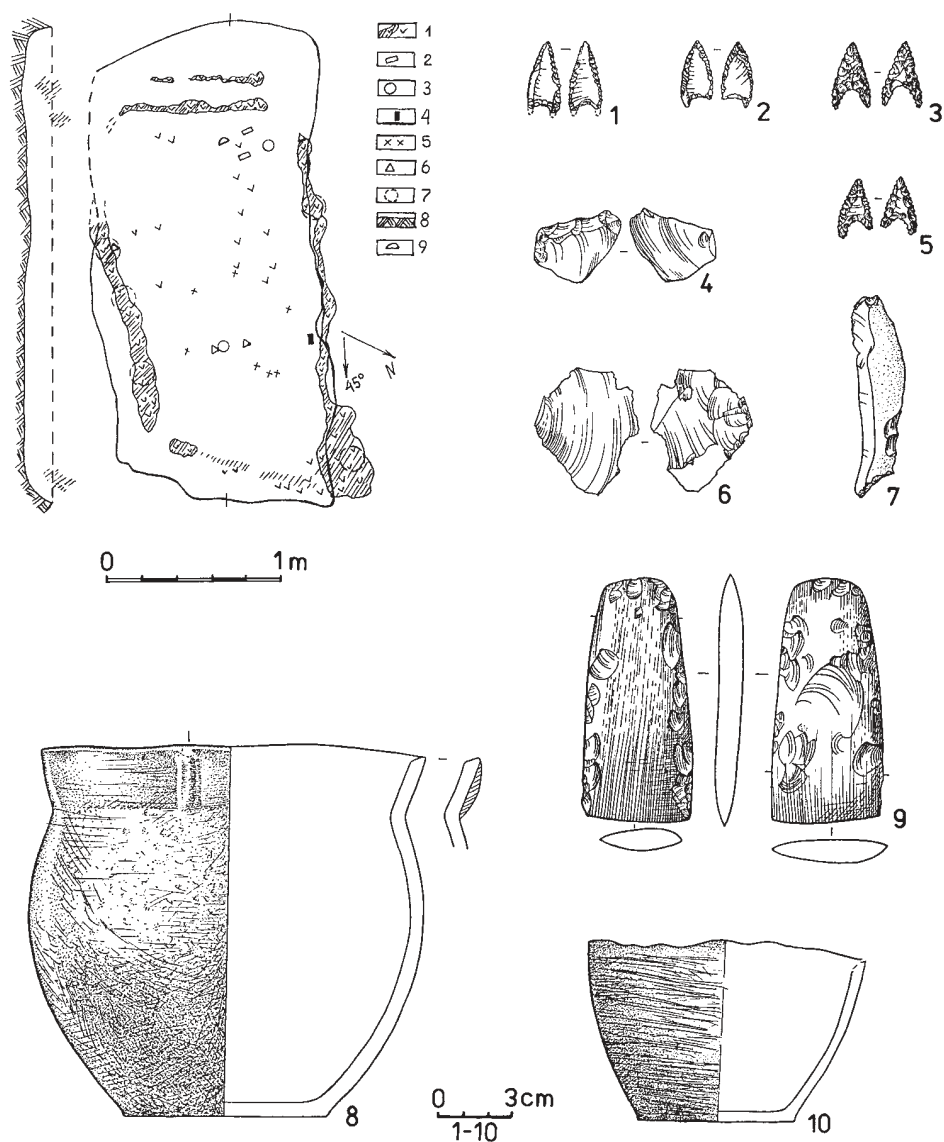


Fig. 2. Prorva site 1, Homel Region, grave 2.

Cross-section and plan of grave showing location of grave-goods (Legend: 1 - dark-grey layer and charcoal, 2 - laminar flake, 3 - pottery, 4 - blade, 5 - fragments of burnt bones, 6 - flint arrowheads, 7 - places where charcoal samples were taken for radiocarbon analysis, 8 - sand, 9 - flint axe). Grave goods (1-7, 9 - flint, 8, 10 - pottery).

Table 1

List of ^{14}C datings of Middle Dnieper culture from Belarus

Sites	Lab. No.	^{14}C age, BP	Intervals of calibrated ages, cal BC	
			1σ	2σ
Prorva 1 grave 1	Le-5020	4150 ± 80	2874 - 2826	2894 - 2549
			2824 - 2807	2525 - 2485
			2796 - 2772	2485 - 2473
			2759 - 2716	
			2714 - 2655	
			2655 - 2623	
			2610 - 2600	
			2587 - 2582	
Prorva 1 grave 1	Ki-5140	4060 ± 45	2828 - 2821	2853 - 2811
			2664 - 2654	2756 - 2740
			2627 - 2608	2731 - 2721
			2602 - 2545	2704 - 2646
			2527 - 2473	2643 - 2466
Prorva 1 grave 2	Ki-5612	3490 ± 45	1878 - 1834	1896 - 1684
			1822 - 1794	
			1788 - 1744	
Prorva 1 grave 2	Ki-5613	3570 ± 40	1952 - 1960	2026 - 2002
			1950 - 1877	1982 - 1864
			1838 - 1818	1848 - 1768
			1798 - 1784	
Prorva 1 grave 10	Ki-6205	3890 ± 50	2456 - 2418	2468 - 2198
			2410 - 2312	
			2306 - 2294	
Prorva 1 grave 10	Ki-6206	4010 ± 40	2568 - 2522	2614 - 2456
			2502 - 2468	2422 - 2408
Prorva 1 grave 18	Ki-6207	3960 ± 40	2560 - 2532	2570 - 2520
			2496 - 2452	2504 - 2390
			2430 - 2402	2388 - 2332
			2370 - 2360	
Prorva 1 grave 20	Ki-6208	3830 ± 40	2330 - 2196	2452 - 2430
			2154 - 2152	2404 - 2366
				2364 - 2182
				2170 - 2140
Prorva 2 grave 1	Ki-6590	3870 ± 55	2454 - 2424	2466 - 2190
			2408 - 2280	2162 - 2144
			2224 - 2208	

Sites	Lab. No.	^{14}C age, BP	Intervals of calibrated ages, cal BC	
			1σ	2σ
Hodasavichy (Siargeeva Gryva) barrow 3 grave2	Ki-6592	3855 ± 40	2448 - 2438 2400 - 2376 2352 - 2276 2246 - 2204	2456 - 2418 2410 - 2196 2156 - 2150
Stralitsa grave 14?	Ki-6585	3425 ± 45	1862 - 1850 1764 - 1674 1650 - 1640	1876 - 1836 1820 - 1798 1784 - 1610 1550 - 1536
Stralitsa grave 43?	Ki-6586	3500 ± 60	1886 - 1742	1964 - 1678
Stralitsa grave 53?	Ki-6587	3460 ± 70	1878 - 1836 1822 - 1796 1788 - 1682	1936 - 1606 1560 - 1532
Stralitsa grave 53?	Ki-6588	3515 ± 60	1892 - 1746	1972 - 1684
Stralitsa grave 56?	Ki-6589	3440 ± 55	1872 - 1840 1812 - 1808 1780 - 1676	1884 - 1610 1550 - 1538
Aziarnoye 1	Ki-6209	3580 ± 50	2014 - 2010 1976 - 1876 1878 - 1818 1798 - 1784	2100 - 2098 2036 - 1858 1854 - 1752
Aziarnoye 1	Ki-6210	3520 ± 40	1886 - 1864 1850 - 1766	1934 - 1740

The vessel (Fig. 2:8) from the burial complex was standing bottom up in the grave. At the bottom of the pit a flint axe (Fig. 2:9), 2 laminar flakes (Fig. 2:4, 6) and a blade (Fig. 2:7), 4 flint arrowheads (Fig. 2:1-3, 5), a bowl (Fig. 2:10), and fragments of burnt bones were found. It is possible that cremation was used as the burial custom in this grave.

According to horizontal and vertical stratigraphy, grave 2 could be one of the latest MDC burials at Prorva-1. This may be confirmed by ^{14}C dating (Table 1). *Grave 10* (dimensions of the pit were 2.70x1.95m) was oriented along the E-W axis (Fig. 3). The depth of the pit, measured from the ancient surface, reached more than 0.70 m. A large vessel (Fig. 3:19) was standing bottom up in the burial pit. The surface of the vessel was decorated with cord ornaments and imprints of a stamp with a pattern of short lines. A portion of soot from the inside of this vessel was submitted to the ^{14}C analysis (Ki-6205 - Table 1).

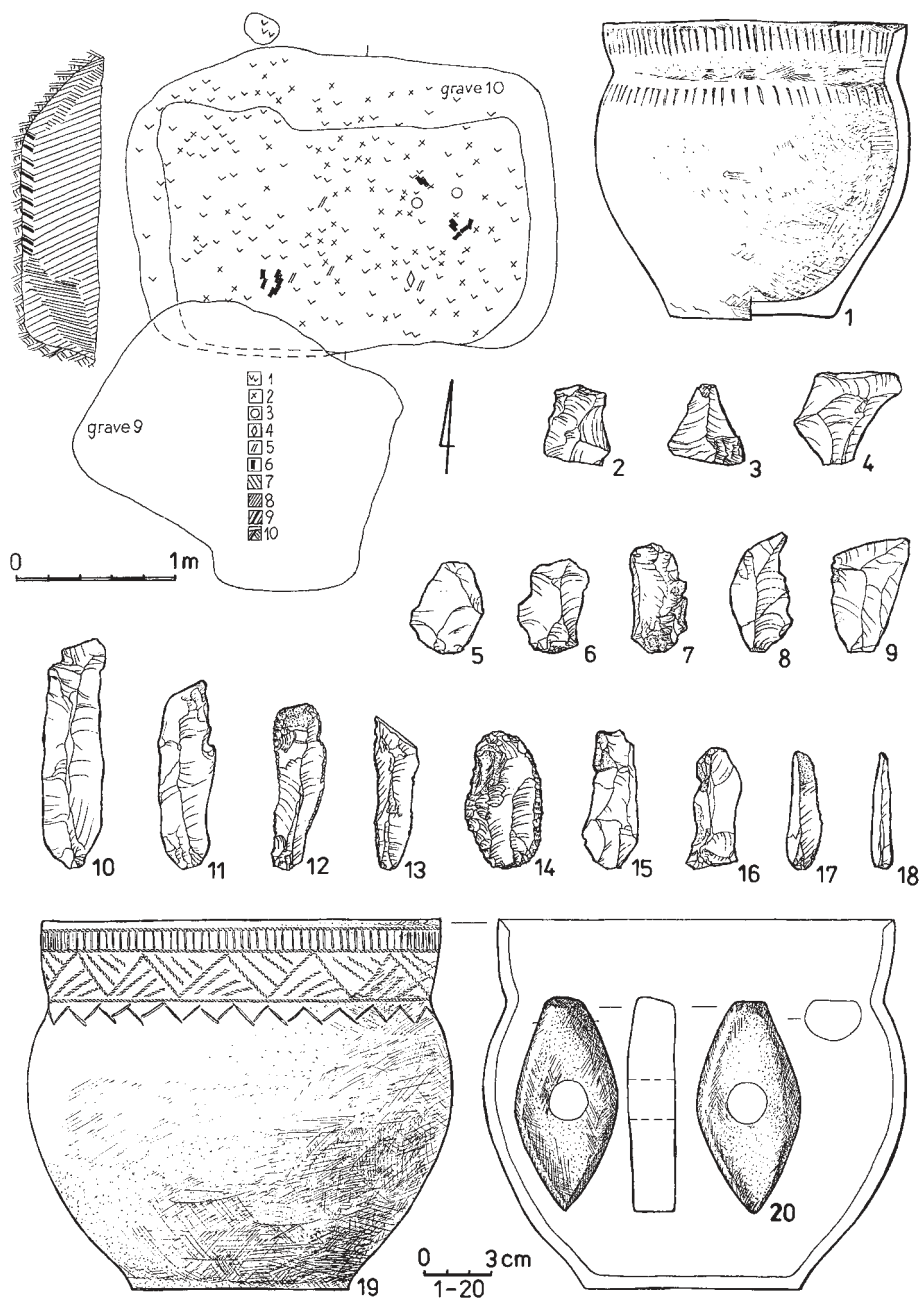


Fig. 3. Prorva site 1, Homel Region, grave 10.

Cross-section and plan of grave showing location of grave-goods (Legend: 1 - charcoal, 2 - fragments of burnt bones, 3 - pottery, 4 - stone axe, 5 - bones, 6 - flint products, 7 - grey layer, 8 - dark-grey layer, 9 - brown layer with remains of bones, 10 - sand). Grave goods (1, 19 - pottery, 2-18 - flint, 20 - stone).

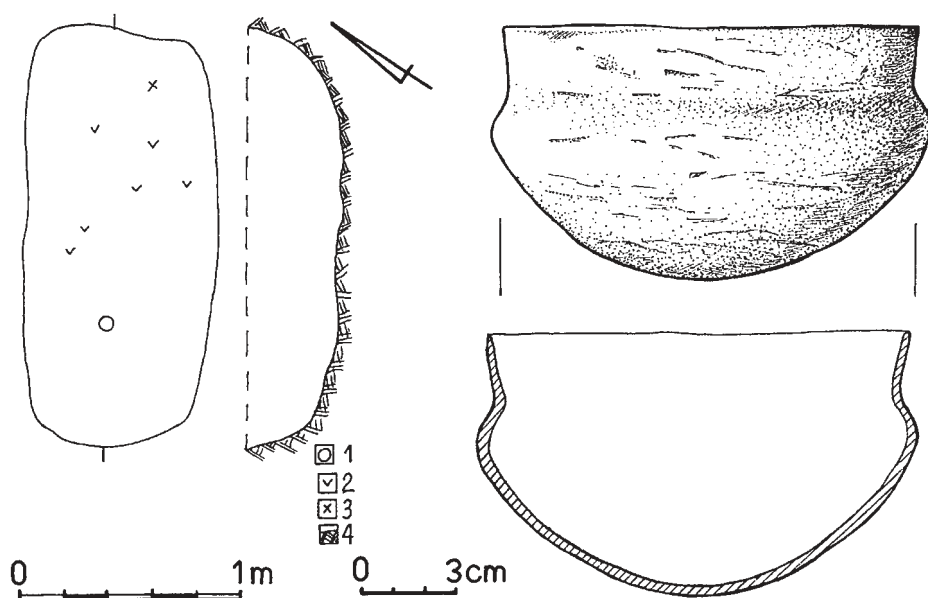


Fig. 4. Prorva site 1, Homel Region, grave 18.

Cross-section and plan of grave showing location of finds (Legend: 1 - bowl, 2 - charcoal, 3 - a fragment of cremated bone, 4 - sand). A bowl from the grave.

Besides this vessel, the feature included the following elements: a pot decorated with rows of imprints (Fig. 3:1), flint products (blades, knives, laminar flakes; Fig. 3:2-18), and a stone axe (Fig. 3:20). There were some small fragments of cremated bones and the remains of uncremated bones in the filling and at the bottom of grave 10. The cremated bones were human and animal. The remains of a tortoise testa were among them¹. The remains of uncremated bones were found in piles of brown layer (traces of some animal carcasses?). The same fragments were also submitted to the ¹⁴C analysis (Ki-6206 - Table 1).

Grave 18 (dimensions of the pit were 1.85x0.83m) was oriented along the NE-SW axis. The depth of the pit, measured from the ancient surface, reached more than 0.45m. There were several separate minor pieces of charcoal and cremated bones in the filling of the grave pit (Fig. 4). A round-bottomed bowl was standing in the grave (Fig. 4). Many pieces of charcoal were found in the bowl, some of which were submitted to the ¹⁴C analysis (Ki-6707 - Table 1).

Grave 20 was covered by a firm cultural layer, in which traces of a building with Sosnitsa-type ceramics were found. At a depth of 0.37 m below the outline of

¹ All investigations of the bone materials from Prorva sites 1 and 2 were made in Poznań by Prof. J. Piontek, M. Krenz-Niedbala M. Sc., Dr D. Makowiecki.

the grave, traces of burnt wooden structures were discovered along three walls of the grave pit, below the Sosnitsa cultural layer. The burial pit (dimensions were 2.80x1.85 m) was oriented along the NE-SW line (Fig. 5). The depth of the pit reached more than 0.20m from the ancient surface. There were traces of burnt wooden structures along three walls (excepting the NE edge of the grave). Some charcoal for the ^{14}C analysis was taken from the south-eastern wall of the grave-pit (Table 1). Traces of posts (?) 10-15 cm in diameter were found in the corners of the grave. The filling of the pit contained small fragments of burnt bones, some pieces of charcoal, a stone cylinder from the hole of a stone axe (Fig. 5:10), and fragments of a bowl (Fig. 5:9). At the bottom of the grave pit, there were two patches with the remains of human teeth, which may be interpreted as traces of two human skeletons (?). Possibly, one of them lay along the grave pit and was oriented with its head towards the north (?). Underneath the grave pit, there was a layer of sand, in which many fragments of MDC ceramics were found (Fig. 5:1-2, 4-8, 9-11).

Thus, an analysis of the series of radiocarbon datings of the Prorva site 1 graves may lead to the conclusion that the cemetery was a long-standing burial complex. In accordance with a preliminary assumption, this corresponds to its archaeological date. The earliest dating obtained for the Prorva graves is 2740-2550 BC (grave 1). According to ^{14}C chronology, the latest MDC grave at the Prorva site 1 was grave 2. Its intervals of calibrated age are 1960-1740 BC. A ^{14}C chronology of the cemetery is to be corrected and calibrated; some dates have yet to be received.

An MDC grave was also found at **Prorva site 2**. Excavations were carried out by I. Yazepenko in 1994-1998. *Grave 1* was located on the highest part of the hill. A circular trench was probably made around this grave in ancient times. The feature must have been oriented along the W-E axis. There were many grave goods at the bottom of the burial pit (Fig. 6): (1) a vessel with the clay mass tempered with pieces of fine-grained charcoal (Fig. 6:1); this vessel was standing bottom up in the grave pit; (2) flint knives, blades and laminar flakes with retouch (Fig. 6:4, 6-11); (3) arrowheads (Fig. 6:12-16); (4) a flint axe (Fig. 6:3); (5) a stone axe (Fig. 6:2); (6) a large core (Fig. 6:5); (7) a bronze awl with some traces and remains of a wooden helve.

Small fragments of cremated animal bones (birds, a pike, and a tortoise testa) were found among the contents of the pit. The pieces of charcoal from the clay mass of the vessel (Fig. 6:1) were submitted to the ^{14}C analysis (Ki-6590 - Table 1).

Some materials from old collections of I.I. Artemenko were used for the ^{14}C dating, too. In particular, a sample from the *barrow cemetery Hodasavichy site "Siar-geyeva Gryva"* (Homel Region). Some teeth and remains of human bones from *grave 2 (barrow 3)* were taken for the ^{14}C analysis (Ki-6592 - Table 1). Barrow 3 (0.65m in height and 10 m in diameter) yielded 5 burials. According to I.I. Artemenko, the central grave 1 was the earliest burial in this barrow. Burial 2 was carried out some time later [Artemenko 1964:67-68]. This grave must have been oriented along the

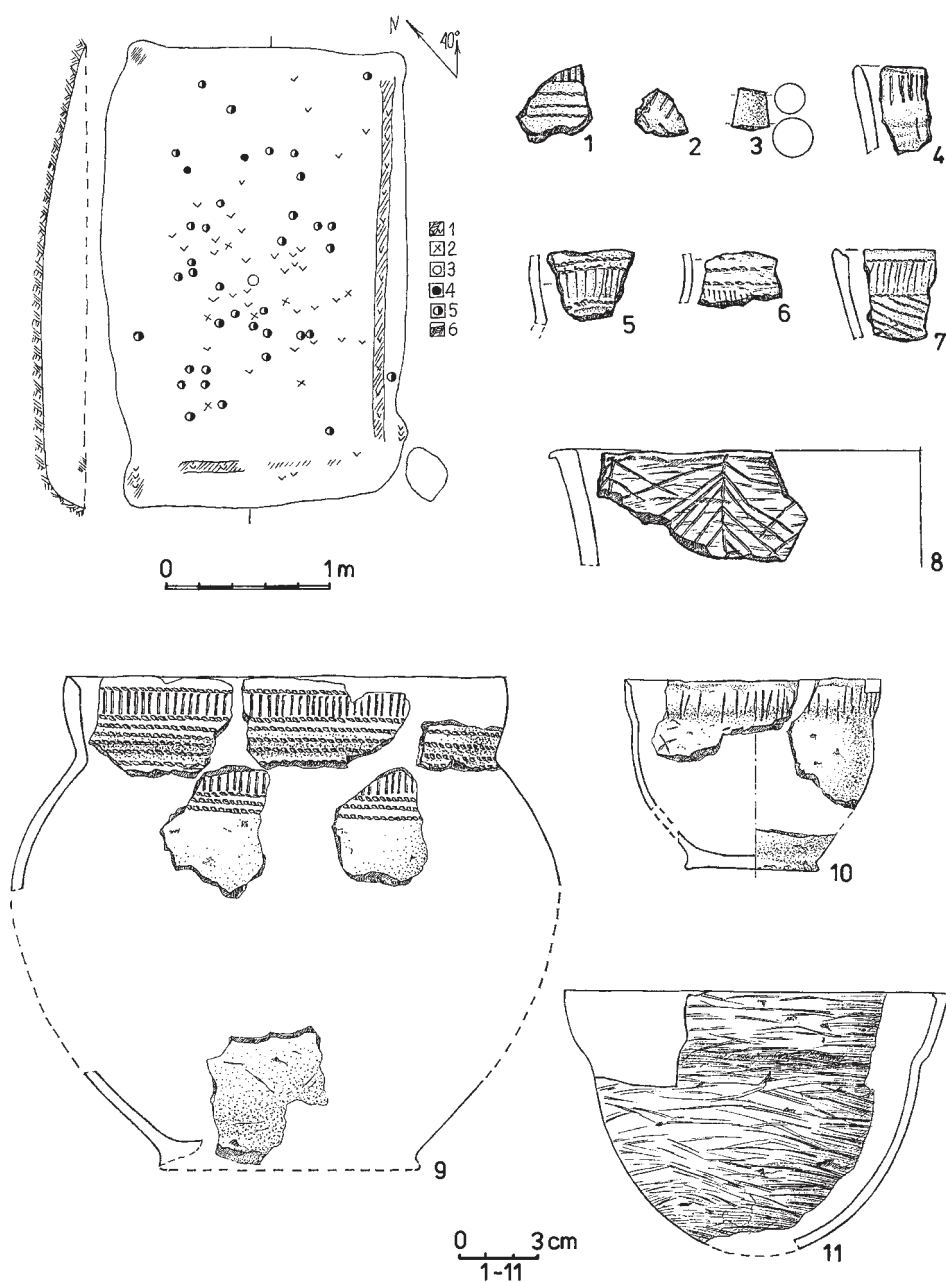


Fig. 5. Prorva site 1, Homel Region, grave 20.

Cross-section and plan of grave showing location of grave-goods (Legend: 1 - dark-grey layer and charcoal, 2 - fragments of burnt bones, 3 - pieces of the bowl, 4 - remains of human teeth, 5 - pieces of ceramics, 6 - sand). Grave goods.

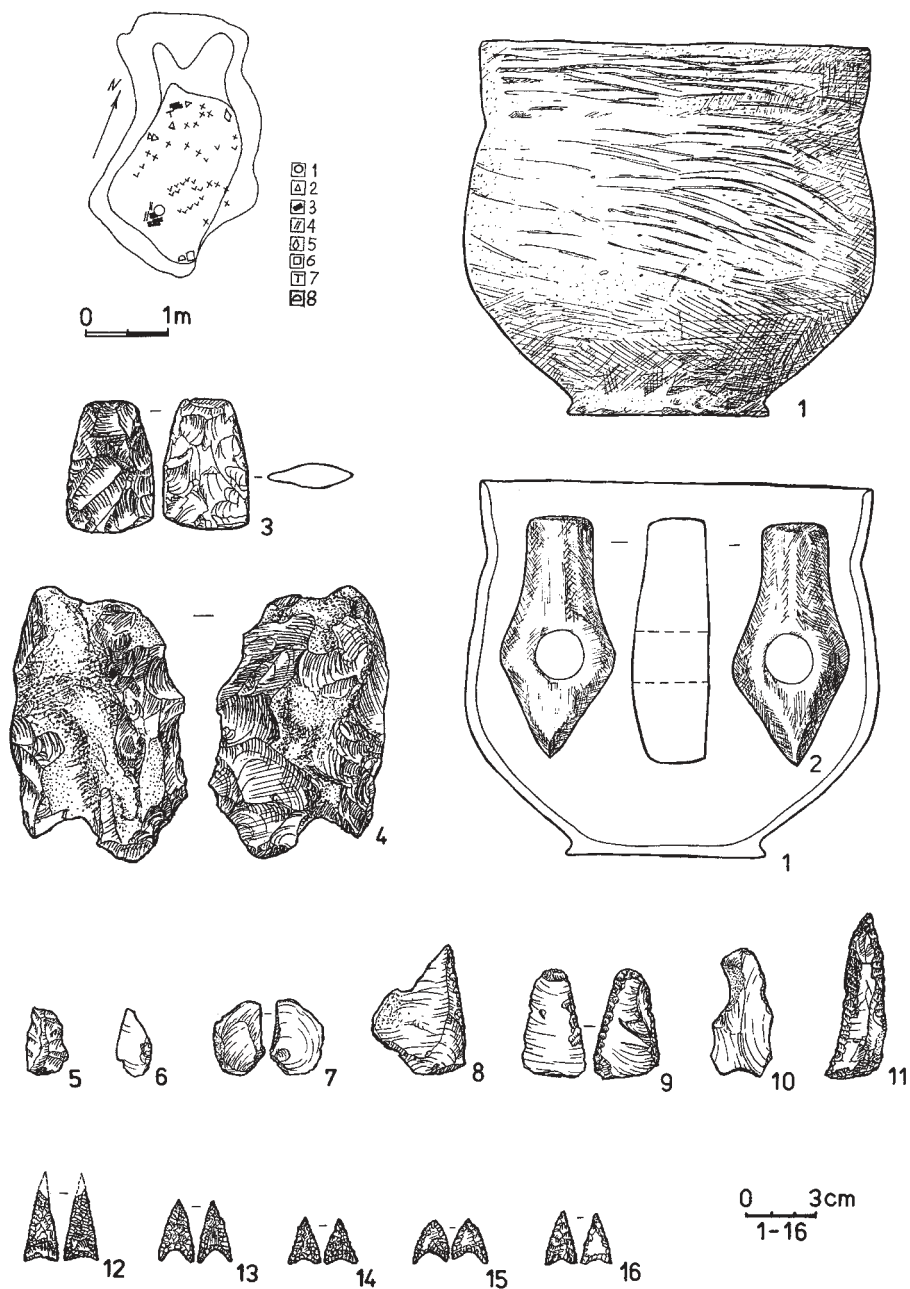


Fig. 6. Prorva site 2, Homel Region, grave 1.

Plan of grave showing location of grave goods (Legend: 1 - vessel, 2 - arrowheads, 3 - flint knives, blades and flakes, 4 - bones, 5 - stone axe, 6 - core, 7 - bronze awl, 8 - flint axe). Grave goods (1 - vessel, 2 - stone, 3-16 - flint).

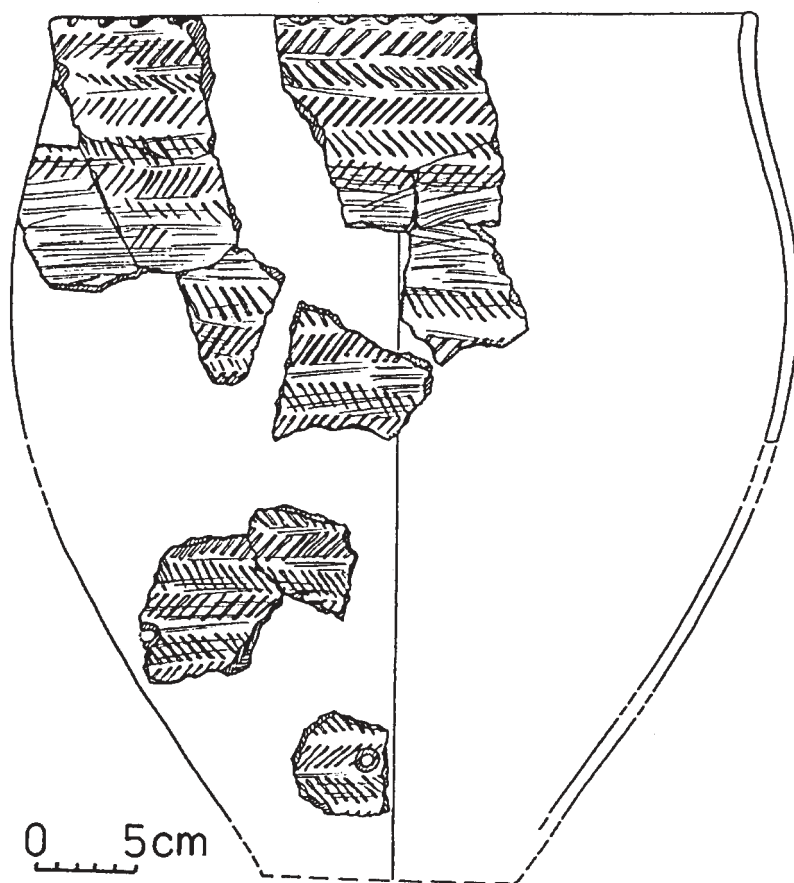


Fig. 7. Aziarnoje site 1. Minsk Region. One pot of type 1 which was dated using the ^{14}C - method.

N-S axis, and contained the remains of a human skeleton². The bones belonged to a child whose age was estimated to have been 5-6 years. The body could have been oriented with its head towards the north. The grave goods included an ornamented clay vessel, a stone axe, flint knives and blades, an arrowhead, and a flint axe [Artemenko 1964:67-68]. Judging from the ^{14}C chronology, it may be stated that some MDC graves of barrow 3 were contemporary with the intervals of calibrated age of the Prorva sites 1 and 2 (except for grave 2).

We made an attempt to carry out ^{14}C dating of some materials from the well-known cemetery at **Stralitsa** (near the villages of Yurkovichy and Rudnia Shlia-

² Its teeth were submitted to the anthropologists L.I. Tegaka and I.I. Salivon (of the Institute of Ethnography of the National Academy of Sciences of Belarus).

ginskaya, in the Vetka District of the Homel Region). The Stralitsa cemetery was excavated in 1963-1965 by I.I. Artemenko. According to I.I. Artemenko, the MDC graves at Stralitsa dated from the first half of the 2nd millennium BC [Artemenko 1976b:89-96].

Many of the inscriptions on the boxes in which the organic remains and some finds from the Stralitsa cemetery were kept did not fit the description of the separate features. This being the case, ¹⁴C dates obtained from the Stralitsa cemetery should be perceived as ¹⁴C chronology not for any separate graves but for the whole cemetery (Table 1).

Teeth (grave 14?), some remains of the organic facing of a copper artefact (grave 43? and grave 53?), some bone beads (grave 56?), and the remains of some animal bones (grave 53?) were used as the samples for radiocarbon data (Ki-6585-6589 - Table 1). We should note that the dates obtained for Stralitsa have a late ¹⁴C age. Several intervals of calibrated age are of approximately the same time as that for grave 2 from the Prorva site 1.

The majority of materials from the **Aziarnoye site 1** settlement (Luban District of the Minsk Region) corresponded to the late phase of MDC in Palesseye. The settlement was excavated by M. Kryvaltsevich in 1985-1988 [Kryvaltsevich 1999]. The shards of two pots of type 1 (the final stage of MDC; Fig. 7) were dated according to the results of an analysis of soot using the ¹⁴C method (Ki-6209-6210 - Table 1). The same intervals of calibrated age may be found at the Prorva site 1 (grave 2) as at Stralitsa. They possibly represent the late age of MDC in Belarus.

This paper submits the first series of ¹⁴C dates obtained from several sites of MDC in Belarus. It is only the beginning of our investigative project. We intend to increase the number of ¹⁴C dates, which will make it possible for us to complete the calibration of some MDC radiocarbon dates.

Translated by author

Viktor I. Klochko

RADIOCARBON CHRONOLOGY OF THE EARLY AND MIDDLE BRONZE AGE IN THE MIDDLE DNEIPER REGION. THE MYRONIVKA BARROWS

In the south of the Kiev Region, on the right bank of the Dnieper, within the Kaharlyk and Myronivka Districts, there is a natural landscape phenomenon known as the “Myronivka Steppe”, a peculiar “island” of the steppe landscape in the right-bank forest steppe zone.

Excavations of barrows in this region were first undertaken by the director of the St. Petersburg Artillery History Museum N. E. Branderburg in 1888-1902 [Pechenkin 1908; Kachalova 1974].

In 1984, an expedition led by the author of this article excavated eight barrows of the Bronze Age in the vicinity of Myronivka at the southern end of this collection of monuments [Klochko 1984] (Fig.1). These were emergency excavations conducted in an area where the irrigation system for a local collective farm was about to be built. A description of the barrows is given in a hypothetical sequence of the construction of their main graves.

Barrow 1. The largest barrow in the excavated group (barrow 1, “Kozatska Mogila”) was 6.6 m high, about 50 m in diameter, and stood on the high left bank of the Rosava river (a tributary of the Ros), 1.5 km to the east of the Kiev-Dnieperpetrovsk motorway (Fig. 1). The surface of the barrow was edged with turf, but had been badly damaged by subsequent digging. In the centre, there was a large pit, up to 15 m in diameter, while the eastern side of the barrow was taken down when a road was built across the field. The bank of the barrow was asymmetric in shape: the northern side was steeper, the southern side more sloping. The barrow, like all the other barrows in this group, was excavated using the technique developed by Ukrainian archaeologists in the 1960s-1970s, i.e. with the use of a 100 hp bulldozer. In the process of excavation, the bank was taken down completely except for some inner walls, later also destroyed. Because there was a field road running past the edge of the barrow, the walls had to be deviated from the north-south axis, and since the barrow’s geometrical centre had been destroyed by the previous digging, the highest point of the remaining part of the bank, located 5 m to the north, was

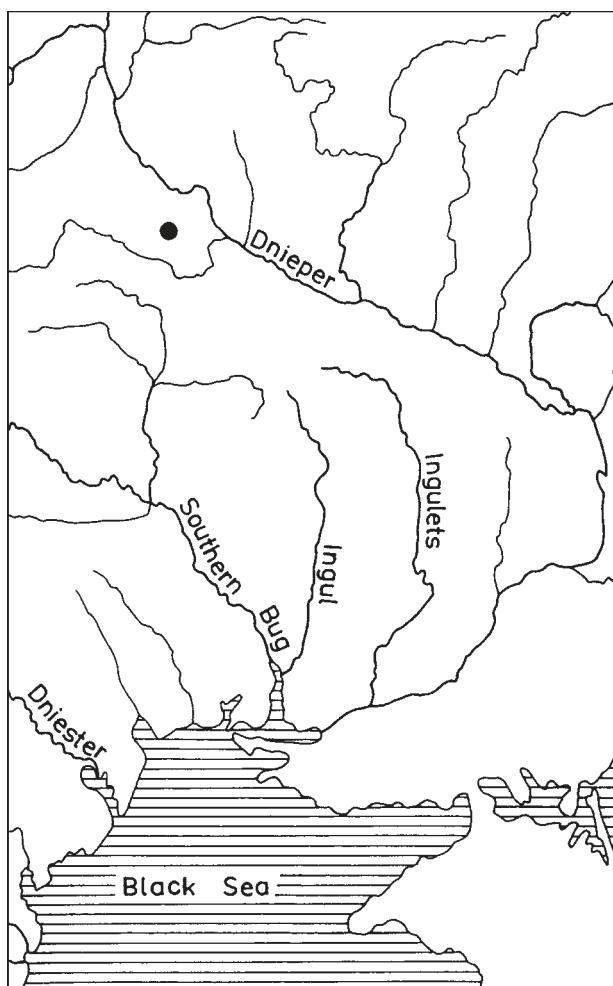
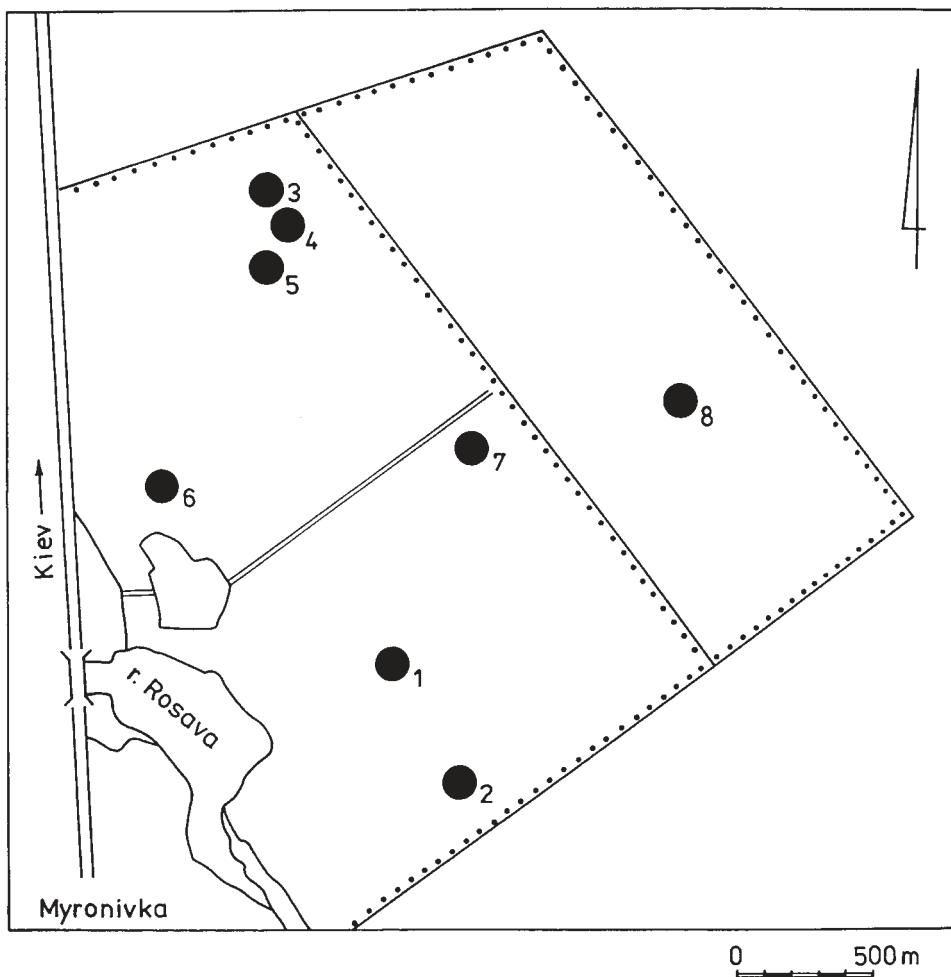


Fig. 1. Myronivka, Kiev Region. Location (left) and plan (right) of the Myronivka barrows

assumed to be the generally-accepted centre. The central wall, 2.5 m wide, had to be moved accordingly. The first western wall was 2 m wide, the second 1 m wide. Due to the ruination of the bank, no additional walls could be left in the eastern part of the barrow.

All in all, eight graves were studied in the barrow. A study of the stratigraphy of the banks and the location of the graves allowed us to reconstruct the following sequence of burial rituals and construction of the barrow's banks.

The oldest (also the main one in the barrow) was a grave of the Yamnaya culture (YC) No. 1/8 (Fig. 2), made in a rectangular pit 1.2 m x 1.8 m in size,



0.9 m deep from the level of buried soil, with its long walls oriented, with slight deviation, along the east-west line. The soil removed during the digging of the grave had been put into two banks along the northern and southern edges of the grave, according to its original layers (with black earth below and clay above). The pit had been covered with wood, the remains of which could be seen in the filling. The bulk of the preserved wood was of thin, partially-burned rods (probably, after the cover was made, some smouldering coals were thrown onto it). In the middle of the pit there were traces of a wooden beam, 5 x 12 cm in section, the remaining part of which, 1.1 m long, lay along the long walls of the

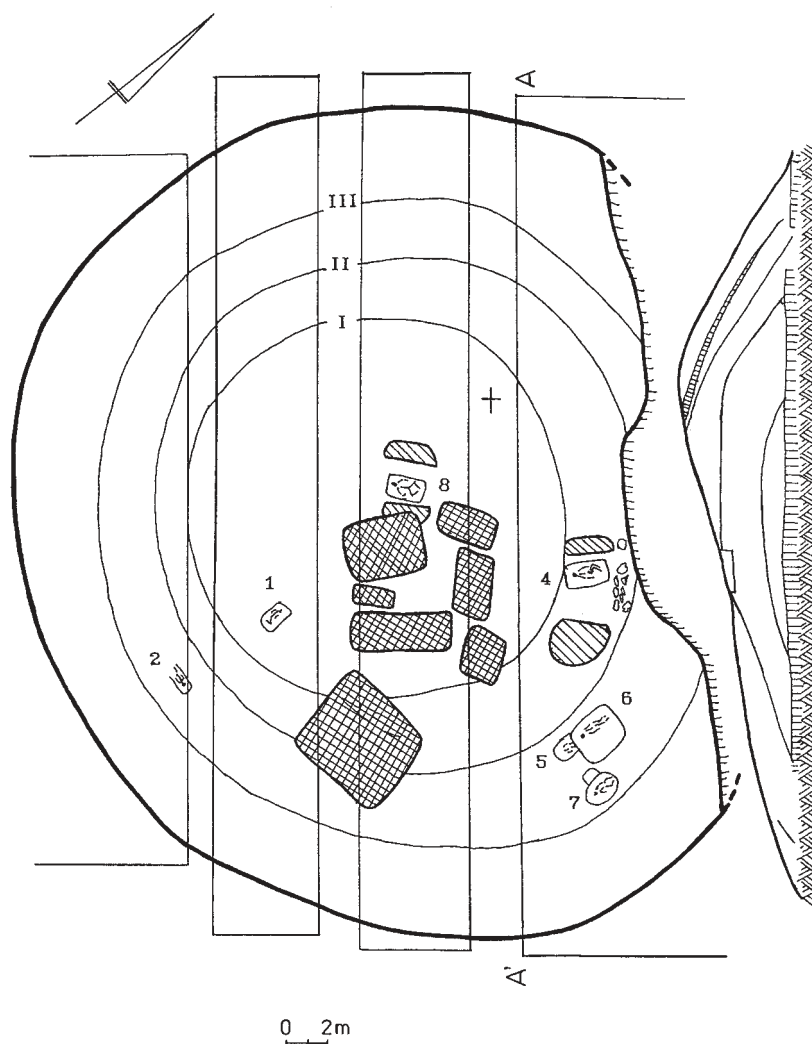


Fig. 2. Myronivka, Kiev Region. Plan of barrow 1

pit, and had probably once served as the main support for the overhead cover (Fig. 3:1).

The skeleton of a 35-45-year-old woman [anthropological definitions here and below are given by Dr. Svetlana I. Kruts] lay on its back, head to the south-west. The arms were slightly bent at the elbows and extended along the body. The legs had been bent up at the knees, and later fell down in a rhombus. The skull is covered

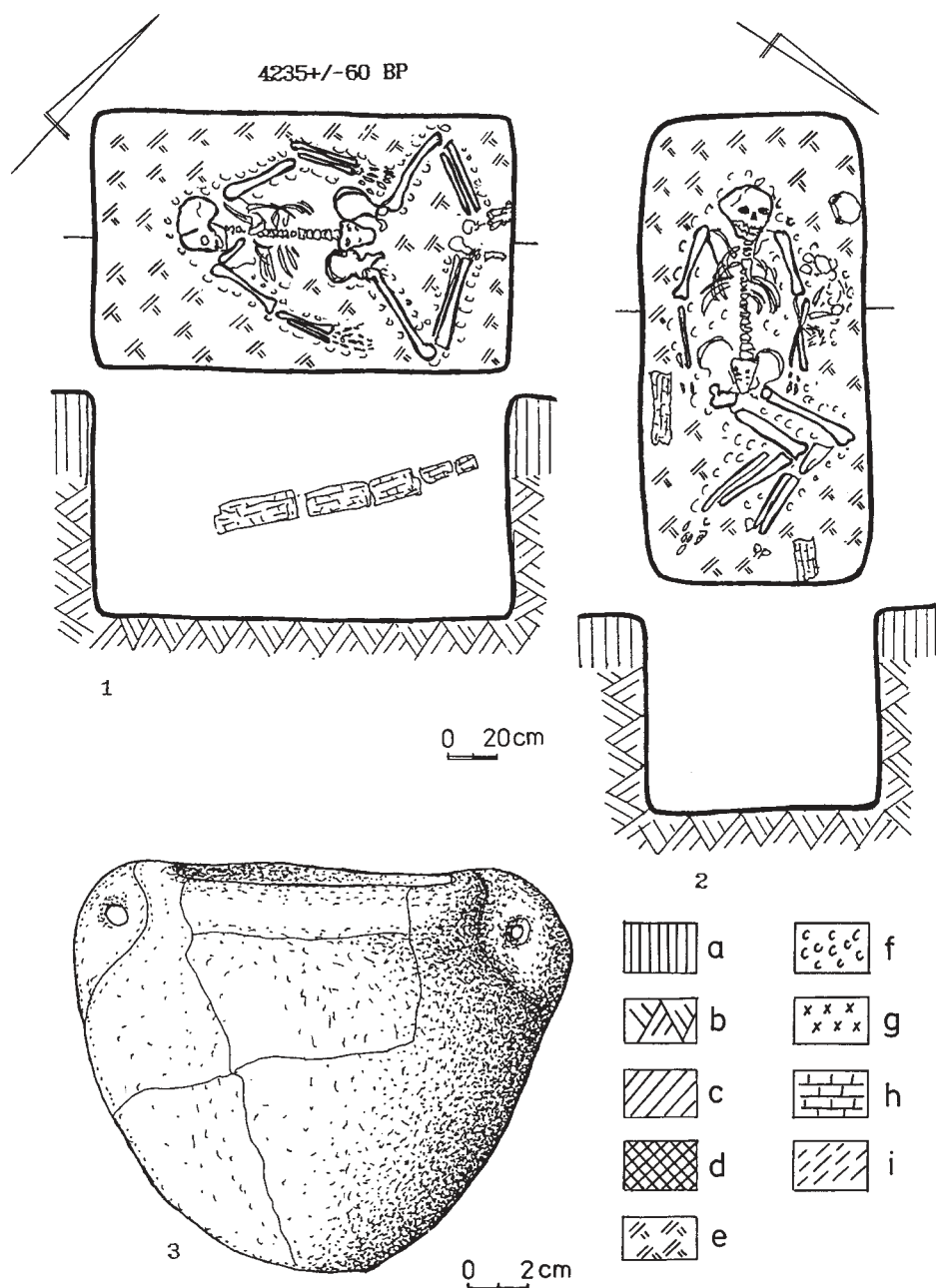


Fig. 3. Myronivka, Kiev Region, barrow 1. 1- grave 1/8; 2 - grave 1/4; 3 - vessel from grave 1/4
Key: a - humus (arable layer); b - clay (rock-bed); c - digging; d - old trench; e - remains of mat; f - ochre; g - charcoals; h - wood; i - birch bark

with bright raddle (red ochre), while other bones of the skeleton display traces of dark raddle; there was also dark brown rot (remains of clothes?) along the bones and under the skull (Fig. 3:1). The bottom of the pit displays the remains of a cane (?) mat.

The radiocarbon date of the grave — 4235 ± 60 BP (Ki-6741) was obtained from the wood of the overhead cover.

Over the grave there was a bank of black earth, 2.5 m high and 14 m in diameter (Fig. 2: bank I).

After a short period of time (too short for the grass to grow on the surface of the first bank) another grave of the YC No. 1/4 (Fig. 2), was made on the eastern edge of the initial barrow in a rectangular pit with rounded edges, 0.9 m x 1.9 m in size, 0.8 m deep from the level of the buried soil. The soil removed when the pit was dug lay in two banks along the long walls of the pit, the northern bank partly covering the edge of the first bank. Between the edges of the banks formed by the discharges, we found a stone wall made of large slabs of granite. The wall was up to 0.5 m high, built at the level of the buried soil (the remains of the ancient grass layer could still be seen under the slabs), and shielded the grave from the side opposite the barrow.

The grave contained the remains of a wooden ceiling that had fallen parallel to the long walls. At the bottom of the pit, there were skeletons of an elderly man and a baby under a year old. The adult skeleton lay on its back, head to the south-west. The arms were extended along the body; the legs had been bent with the knees up, and later fell to the right. The baby skeleton lay in a foetal position on its right side, also with the head towards the south-east (Fig. 3:2). To the left of the skeletons, in the corner of the pit, there was a moulded ceramic vessel. The whole grave was sprinkled with lilac ochre. On the bones of the adult were the remains of clothes made of coarse-woven linen fabric, finished with leather, with traces of ochre painting, and black long-haired fur. Near the baby skeleton was a bright raddle artefact modelled in the shape of a stretched rhombus.

The vessel was made of clay, with an admixture of mica. It had rounded sides, a small, slightly convex bottom and a short neck. On both sides, from the edge to the ribs, there were moulded “ear-shaped” handles. The light brown surface was covered with a layer of black organic substance, with a thicker layer inside the vessel. The vessel was 13.2 cm tall, with a diameter of 11.7 cm at the rim (Fig. 3:3).

Above the grave was a bank, which increased the height of the barrow to 3 m and its diameter to 22 m. The bank was asymmetric: its southern half was more sloping, the northern one steeper, and the top was flat (Fig. 2: bank II). Later on, it was covered with grass, traces of which could still be seen, which proves that the bank had stood open for a long period of time.

After a relatively long period of time (?), another grave of the YC No. 1/5 (Fig. 2), was made on the south-eastern edge of the second bank. The grave was made in

a rectangular pit with rounded corners, 1.0 m x 1.5 m in size, about 0.9 m deep from the level of the buried soil. The discharge from this grave was not found, as the buried soil in this area had been partially removed during the construction of the first and second banks; therefore, the pit could be clearly seen only at the mainland clay level. The filling of the pit was heavily mixed, with a substantial admixture of clay. As for the wooden ceiling, only one, poorly preserved fragment of the beam was found, on the bottom of the pit in the north-western corner. Its position allows us to assume that the beams of the ceiling were laid along the long walls of the pit, similarly to the earlier graves.

The skeleton of a man aged 50-55 lay on its back, with the knees raised up, head to the south, and hands under the pelvis. It had been partially ruined when grave 1/6 was made. The lower part of the skull and hand bones were found in the filling of the pit. The upper part of the skull had been severed and was not present in the grave (according to the anthropologist, the section was made on relatively fresh bone). The bones in the pelvic area displayed slight traces of ochre. At the bottom of the pit there were traces of a mat. The northern part of the grave had been ruined when grave 1/6 was built (Fig. 4:1). The nature of the ruination of the skeleton allows us to assume that it had occurred before the ceiling of the pit collapsed and the burial chamber was filled with earth. In my personal opinion, all these facts suggest that there could have been no more than 100 years between the construction of grave 1/5 and the ruination of grave 1/6. Most probably, it was over this grave that the third and final bank of the barrow (Fig. 2: bank III) was built, which increased the barrow's diameter to 31 m. Later on, the upper part of this bank was destroyed by amateur excavations, but its height is reconstructed as no more than 5-6 metres.

All further burials in the barrow were sunk from the surface of this bank; however, their sequence may only be assumed on the basis of their typological characteristics:

(1) A grave of the late YC No. 1/1, (Fig. 2; 5:1) was found inside the bank of the barrow, in its south-eastern part, 2.3 m deep from the surface. The shape of the pit was almost impossible to determine and was traced only by the rot from the mat that had been put on the bottom.

A human skeleton, very poorly preserved, lay in a foetal position on its left side, head to the north. The legs were bent at the knees. The left arm was extended, hand under the thigh; the right arm bent at the elbow, hand on the pelvis. Over the skeleton there were traces of the ceiling, made of wooden beams that had fallen lengthwise (parallel to the long walls of the pit). On the bones there were traces of clothes represented by some brown rot. At the bottom of the pit there was a smear of rot from the mat. The mat had been made in several layers: under the skull there was some dark brown rot (leather?), brown rot (fabric or leather?), and whitish reed rot; the whole floor of the pit was covered with a thin layer of brown

rot and whitish grass rot. Amongst the grass rot, one could see large stalks of reed with leaves, and fine stems of some grass.

(2) A grave of the Middle Dnieper (?) culture (MDC) No. 1/6 (Fig. 2; 4:2, 3), was found in the south-eastern part of the barrow, 6 m deep from the surface. The rectangular pit with rounded corners, 1.8 m x 0.6 m in size, could be traced from the mainland clay level.

At the bottom of the pit, along the western wall, there was the skeleton of a woman aged 30-40, stretched on its back, head towards the south. The skeleton was poorly preserved and badly ruined by shrew holes. Under the bones were the remains of a birch bark rug. Several coals were found by the legs and the feet, where the earth was sprinkled with lilac ochre. At the skull there were fragments of a ceramic vessel.

The vessel was an asymmetric clay "amphora", coarsely moulded, with a spherical body, a flat bottom, and a short straight neck (Fig. 4:3). On the upper part of the vessel there were two oval moulded "ears" with vertical openings. The upper part was decorated with two rows of light impressions made with a stick. The dough was black, crumbly and coaly. The surface was covered with a light reddish-yellow coating that had flaked off in places. The vessel was covered, inside and out (under the coating), with grass scratches. It was 15.4 cm tall and 20 cm in diameter. While the form of this unusual vessel was somewhat similar to that of Globular Amphora ceramics, the technology of manufacture resembles that of burial ritual ceramics of the Catacomb culture (CC).

The YC grave 1/5 was partially ruined when grave 1/6 was built. Part of this older grave, found in the confines of the 6/1 pit together with some leg bones and the remains of the wooden ceiling, was covered with earth and well-embedded in the bottom of the new grave. As was mentioned above, field and anthropological observations suggest that the period of time between these two graves was relatively short (under 100 years).

(3) A grave of the CC No. 1/7, (Fig. 2; 5:3) was also found in the south-eastern part of the barrow near graves 5/1 and 6/1. The rectangular entry shaft, 0.6 m x 0.7 m in size, in the lower part (at the mainland clay level), 6.35 m deep from the surface, was filled with clay with an admixture of humus. In the lower part of the shaft, we found part of a pig carcass (the spine and ribs). The entrance to the chamber was located in the eastern wall of the shaft. The ceiling of the chamber had collapsed. The chamber was filled with mud and contained numerous shrew holes. Near the entrance there were traces of a wooden shield that used to cover it. The chamber was oval in form, and oriented along the north-south line. It was 1.8 m x 1 m in size, the bottom of the chamber 0.3 m below the entrance shaft.

The skeleton of a young man aged 18-22 lay on its back, head to the south. The right arm was bent at the elbow, with the hand near the shoulder; the left arm was extended along the body, with the hand under the thigh. The legs were arranged in

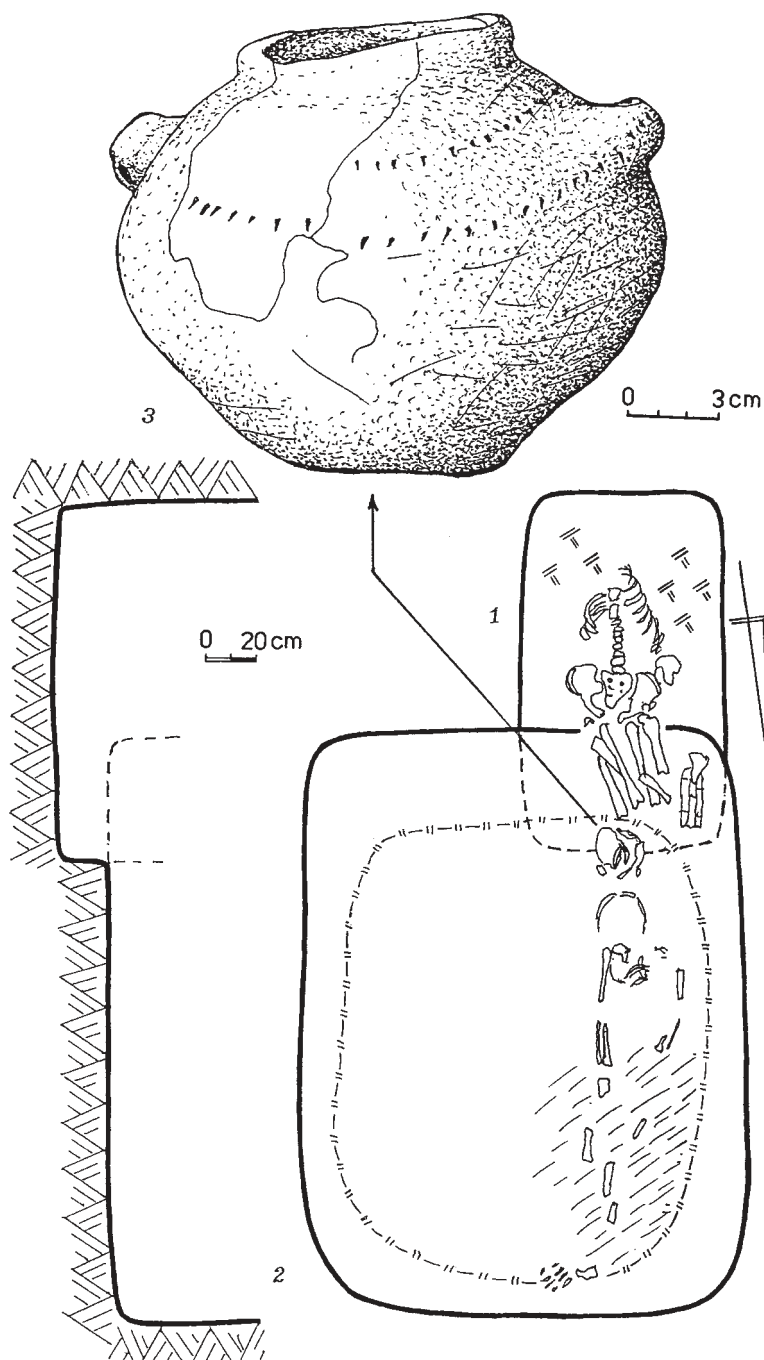


Fig. 4. Myronivka, Kiev Region, barrow 1. 1- grave 1/5; 2 - grave 1/6

a rhombus. Under the bones there were faint traces of a brown and grey mat. Near the skull there were two lumps of lilac ochre; at the feet were several coals.

(4) A grave of the MDC No. 1/2, (Fig. 2; 5:2) was found in the southern part of the barrow, 4.4 m deep from the surface. The rectangular pit was partly ruined by the bulldozer during the excavation. The remaining part is 1.1 m long and 0.7 m wide.

The skeleton of an elderly man lay stretched on its back, head to the east. The right arm was bent at the elbow, with the hand at the shoulder; the left arm was extended along the body, with the hand under the pelvis. The skull was turned to the left. Under the skeleton were the remains of a mat, now represented by traces of light brown rot. In the neck area, we found a long bronze bead rolled from a 5 mm-long plate. The bead was in a very poor condition and could not be taken from the excavations.

The middle part of the barrow had been ruined by the digging of a trench during amateur excavations (or a robbery?) conducted, judging from the finds of fragments of ceramics in the pit, at the end of the 19th century. The finds in the pit suggest that the excavation destroyed a burial of the Mnogovalikovo Pottery culture (MPC) (from the remains of the pit, it appears to be grave No. 1/3), a grave of the Early Middle Age period (an iron stirrup and horse teeth were found in it), and the remains of a funeral feast of the Yamnaya period (as may be seen from the fragments of ceramics). In the southern part of the barrow the “researchers” made several shafts that went into the mainland clay as deeply as 2 m. The earth removed from the pit was scattered nearby at the edge of the bank, mostly onto its north-western slope, and increased the diameter of the barrow to 40 m. Following the excavations, the pit was not filled in, and a crater which emerged there damaged the central and southern parts of the barrow.

Barrow 2. Barrow was situated 300 m further to the south-east of barrow 1 (Fig. 1). It was 0.7 m high and 31 m in diameter, and its surface had been ploughed.

All in all, four graves were investigated in the barrow (Fig. 6). The study of the vertical (stratigraphy) and horizontal (planigraphy) location of the objects allowed us to reconstruct the following sequence of burial rituals and construction of the barrow's banks.

First, there was a YC No. 2/2, (Fig. 6, 7:1). Its discharge lay in two banks along the burial pit at the level of the buried soil. The rectangular pit, with rounded corners, is 1.6 m x 1.4 m in size and 1.1 m deep from the level of the buried soil. Its long walls are oriented, with slight deviation, along the east-west line. The grave was damaged during the 1892 excavations (see below). Bones of a woman of indefinite age, heavily coloured with ochre, were moved to one side by the archaeologists and lay in a small pile in the northern corner of the pit. Over the grave there had been a bank, then 24 m in diameter. Its initial height could not be identified, as the upper part had been ploughed.

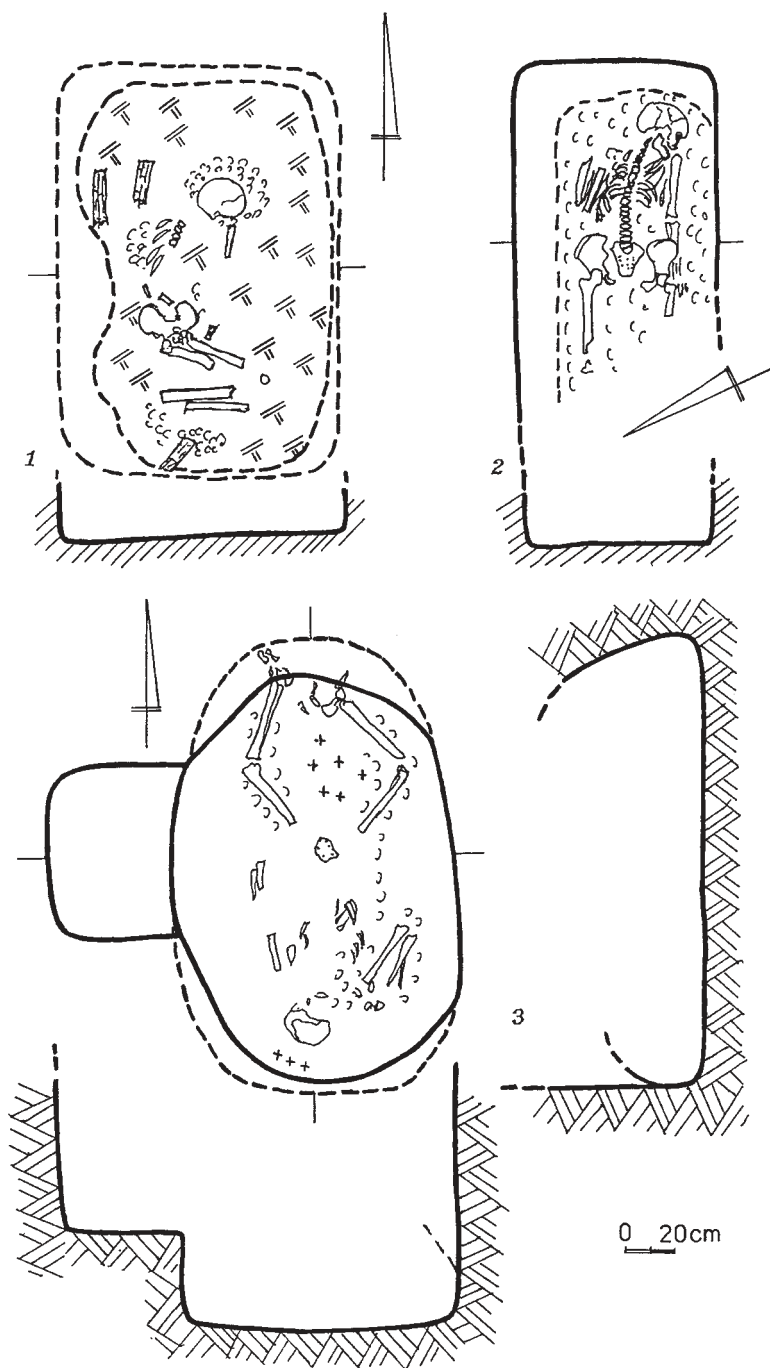


Fig. 5. Myronivka, Kiev Region, barrow 1. 1- grave 1/1; 2 - grave 1/1; 3 - grave 1/7

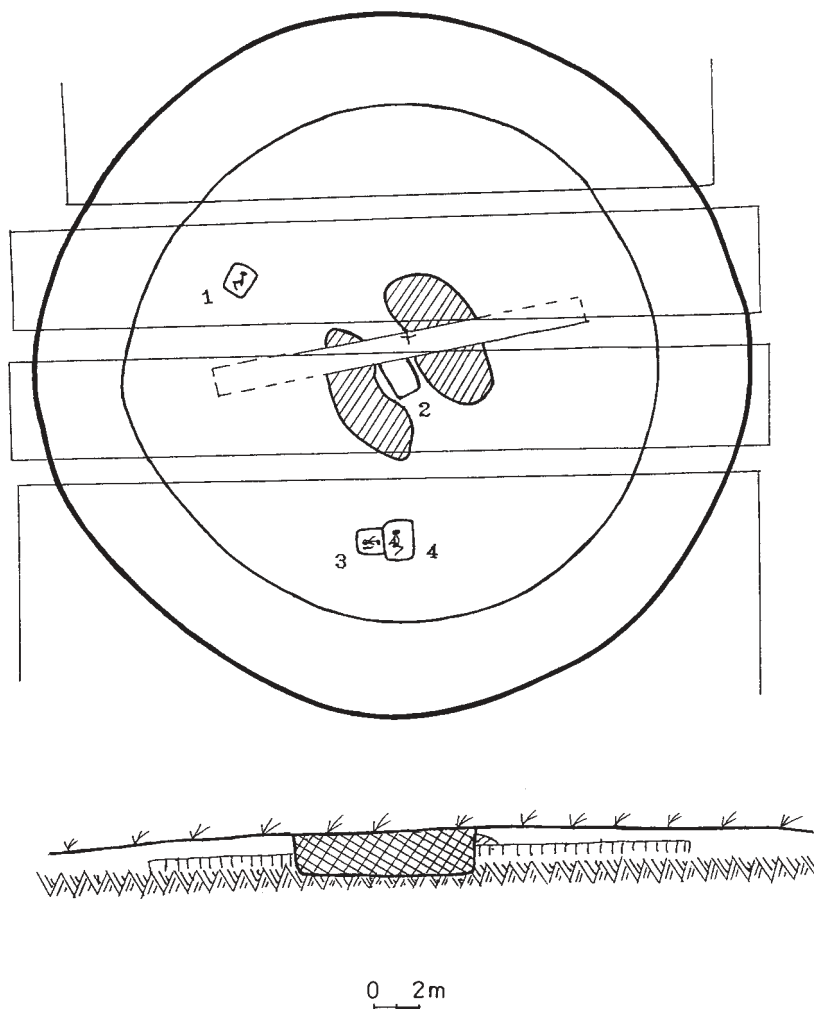


Fig. 6. Myronivka, Kiev Region. Plan of barrow 2

At a later period, a late YC No. 2/3, (Fig. 6; 7:2a) was made in the eastern part of the bank. The rectangular pit, with rounded corners, was oriented with its long sides along the north-south line. The northern wall was taken down at the time grave 2/4 was sunk. The size of the remaining part is 1.25 m x 0.95 m, the depth 1.8 m from the surface. At the bottom of the pit there was the skeleton of a man aged 40-45 that had been ruined when grave 2/4 was built. The bones were intensively coloured with ochre, and the skull displayed a wound mark. The original

position, most probably, was in a foetal position on the right side. To the right, there was the skeleton of a child aged under 7, in a foetal position on its left side. The child's skull was coloured with ochre. There were the remains of a reed mat on the floor.

The radiocarbon date of the grave — 3875 ± 60 BP (Ki-5826) — was determined from the bones of the adult.

Over the grave there was the second bank of the barrow, which increased its size to 31 m. Its height could not be determined.

Later on, yet another late YC grave **No. 2/4** (Fig. 6, 7:2b), was made in the eastern part of the barrow, partly ruining grave 2/3. The rectangular pit was 1.5 m x 1.3 m in size, and 1.8 m deep from the surface. The skeleton of a man aged 25-35 lay in a foetal position on its left side, head to the west. The left arm was extended along the body, the right arm bent at the elbow, with its hand on the thigh. Near the left elbow was a piece of coal. The bones of the skull, the lower part of the chest, and the feet were lightly coloured with ochre.

The radiocarbon date of the grave — 3810 ± 55 BP (Ki-5825) — was determined from the human bones.

Grave **No. 2/1**, found in the north-western part of the barrow, was attributed to the MPC (Fig. 6; 7:3). The square pit, with rounded corners, was 1.3 m x 1.3 m in size and 1.6 m deep from the surface. The poorly preserved skeleton of a young man lay in a foetal position on its right side, head to the north-west. The arms were extended to the knees. Under the bones were the remains of a mat, identified from brown rot, and traces of ochre.

At the end of the 19th century, a 1 m-wide trench was dug that cut into the centre of the barrow (Fig. 6). During the excavations, the barrow's central grave was damaged¹.

Barrow 3. Barrow was situated 2.3 km to the north of barrow (Fig. 1). The bank was ploughed, and the remaining part is 0.5 m high. The barrow is 28 m in diameter (the bank was widened by ploughing; the original diameter is assumed to be 11-12 m).

The main (and the only) grave in the barrow belonged to the YC. The rectangular pit, with rounded corners, was 1.8 m x 1.1 m in size and 0.85 m deep from the level of the buried soil. The pit was covered with a reed rug. The skeleton of a man (?) aged 20-23 lay on its back, head to the south-west (Fig. 9). The legs were raised at the knees; the arms extended along the body. At the bottom of the pit was a second reed rug. There was brown rot from clothes on the bones. A thick (up to 0.5 cm) layer of similar rot could be seen under the skull.

¹ In the pit was left a brandy bottle, containing several visiting cards and a silver Russian 5-kopeck coin, dated 1890. All of the visiting cards were printed in Polish, and belonged to the following people: a Professor of Warsaw University, Prof. dr. Teodor Wierzbowski (Aleje Jerozolimskie 25); a local landlord August Morzkowski (Mironivka Kievskoy gubernii); Tadeusz and Anna Wierzyński; Stanisław Zuch; and Józef Jakobi. On the reverse side of Prof. dr. Teodor Wierzbowski's card were a few words written in ink: "This grave was excavated on July 21 (August 2) 1892. Only bones of the corpse were found" (Fig. 8).

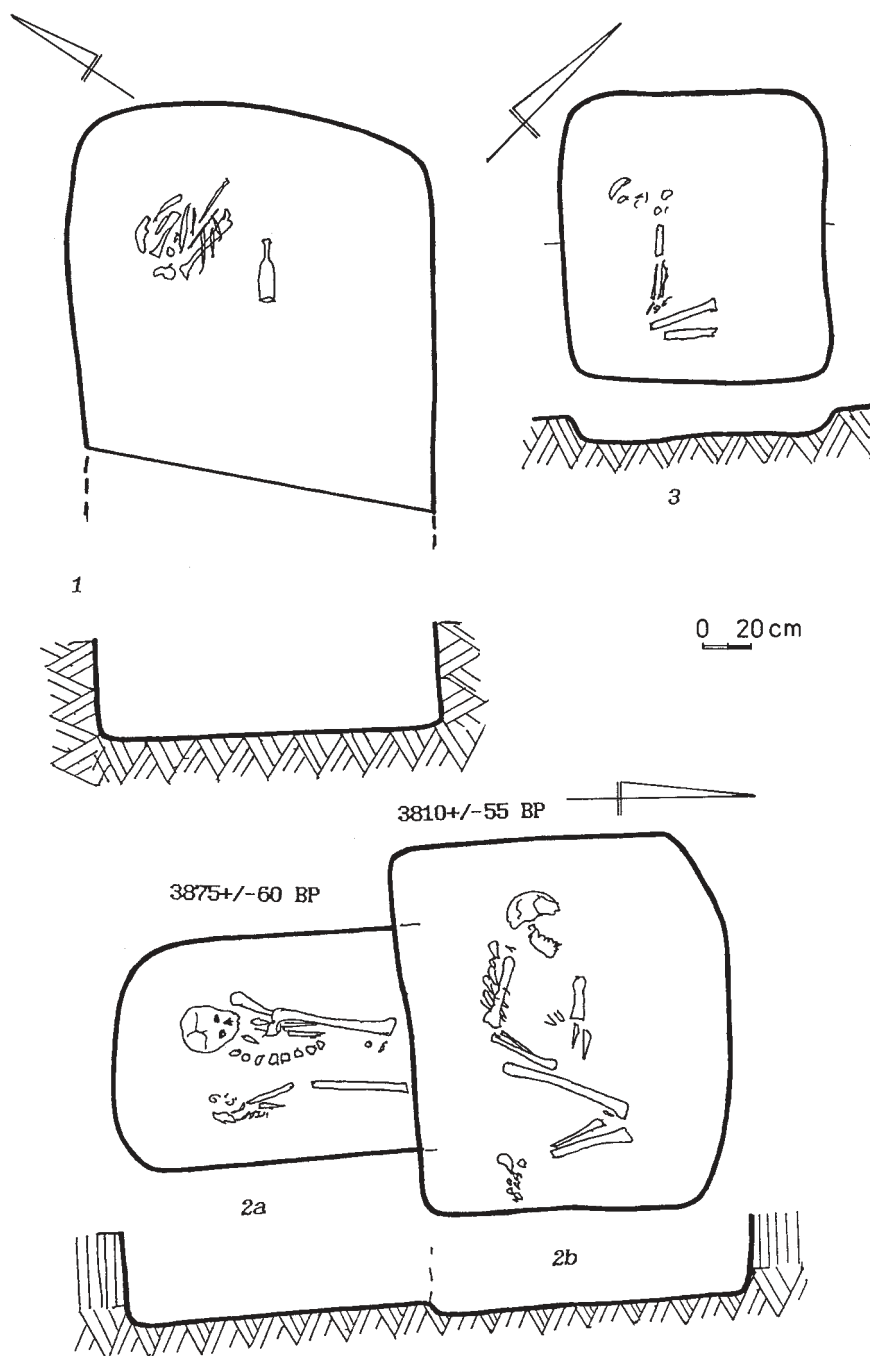


Fig. 7. Myronivka, Kiev Region, barrow 2. 1- grave 2/2; 2a - grave 2/3; 2b - grave 2/4; 3 - grave 2/1



Fig. 8. Myronivka, Kiev region. Polish archaeologists' visiting cards

The radiocarbon date of the grave — 4010 ± 60 BP (Ki-5828) — was determined from the human bones.

Barrow 7. Barrow was situated 1 km to the north-east of barrow 1 (Fig. 1). The bank had been ploughed, and the remaining part was 0.3 m high and about 20 m in diameter (the original diameter was estimated to be from 8 to 10 m). The main grave in the barrow No. 7/2 (Fig. 10:1, 2). The discharge lay in the shape

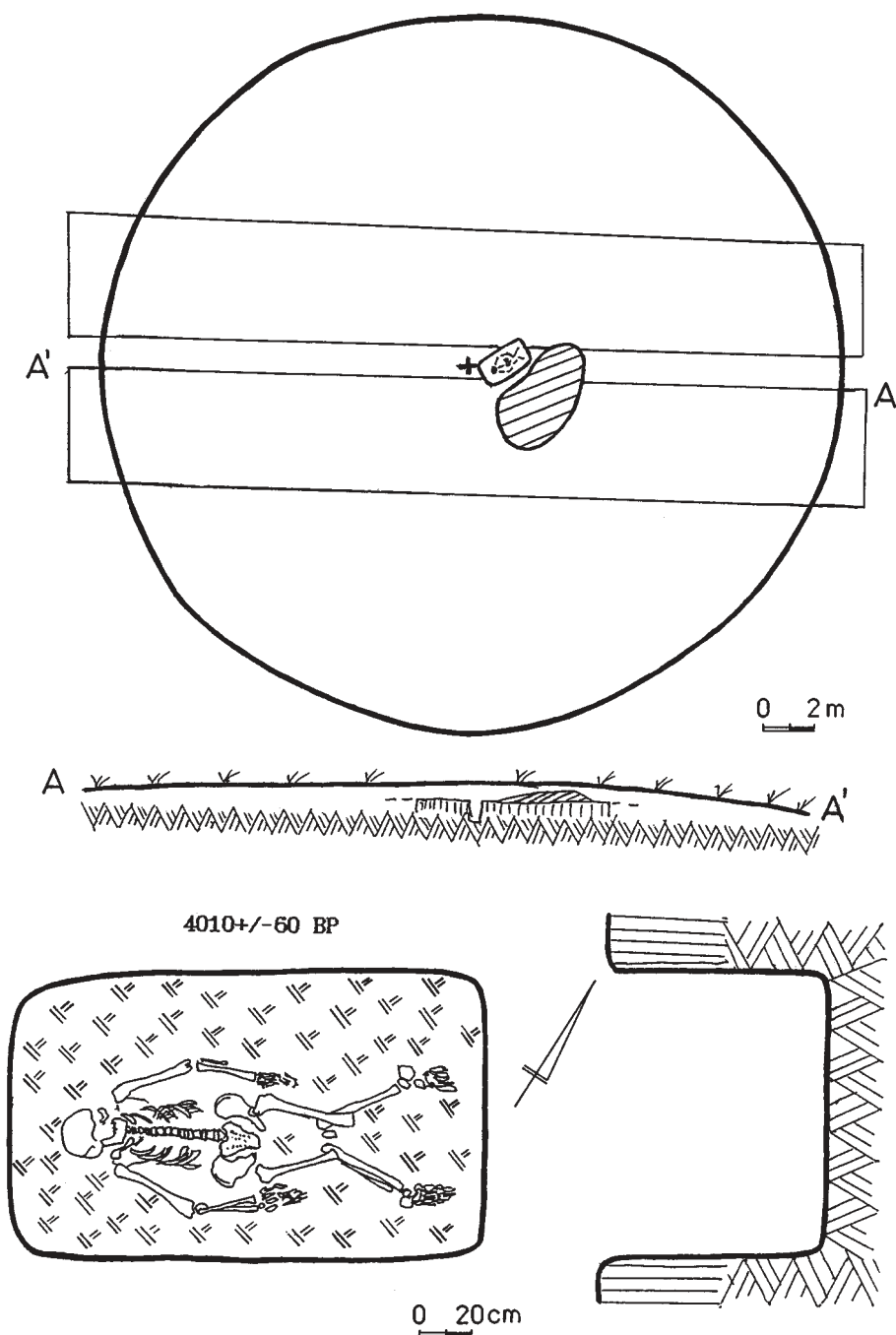


Fig. 9. Myronivka, Kiev Region, barrow 3

of a continuous semi-circle on the buried soil. The rectangular pit, with rounded corners, was 2.0 m x 1.5 m in size and 0.9 m deep from the level of the buried soil, its long axis oriented along the east-west line.

It was a collective grave: there were four skeletons in the pit, all with their heads to the west. In the centre of the pit was the skeleton of a woman aged 30-35, which lay on its back with its knees raised (legs falling to the right), and arms extended along the body. To the right of this was the skeleton of a child aged 5 or 6, stretched on its right side, facing the woman. The right arm was extended along the body, the left arm bent at the elbow. Between the woman and the child was the (poorly preserved) skeleton of a baby, less than a year old, stretched on its back.

The bones displayed signs of yellow rot (the remains of fabric?) and grass; there were remnants of leather (?) on the bottom of the pit, and of thick felt, coloured with ochre, under the skull. The bottom of the pit had been covered with a rug — painted with ochre. Under the skull of the baby there was a smudge of lilac ochre, 4-5 cm in diameter and 0.5 cm thick.

The radiocarbon date of the grave — 3895 ± 60 BP (Ki-5823) — was determined from the human bones.

A burial of the MPC No. 7/1 (Fig. 10:3), was sunk in the bank of the barrow to the south of the main grave. It was discovered at the depth of 0.5 m from the surface. The edges of the pit were indistinct. The skeleton of an adult man (?) lay in a deep foetal position on its right side, head to the north-west. The arms were bent at the elbows, hands pulled up to the chin. There were traces of brown rot under the bones, and coals at the right shoulder.

The radiocarbon date of the grave — 3610 ± 30 BP (Ki-5827) — was determined from the human bones.

Barrow 8. Barrow was situated 0.6 km to the north-east of barrow 7 (Fig. 1). The bank was heavily ploughed — according to local residents, the barrow's bank had been taken down with a bulldozer by a local collective farm in order to facilitate agricultural work; before that, it had reached the height of 4-5 m. At the time of the excavations, the remainder of the bank was 1.5 m high and 32 m in diameter. The barrow contained nine graves, which were studied during the excavations. The graves had been made in the following order.

The main grave in the barrow was the YC grave No. 8/9 (Fig. 11; 12:1). The discharge from the grave lay in two banks up to 30 cm high. The rectangular pit was 1.9 m x 1.0 m in size and 0.8 m deep from the level of the buried soil. The filling contained the remains of a wooden ceiling.

The skeleton of a man aged 25-35 lay on its back, with its knees raised (legs falling to the right), and arms extended along the body. The bones were sprinkled with ochre, which was particularly intensive on the skull. Between the lowest vertebra and the pelvis there was a flint arrowhead (in a wound).

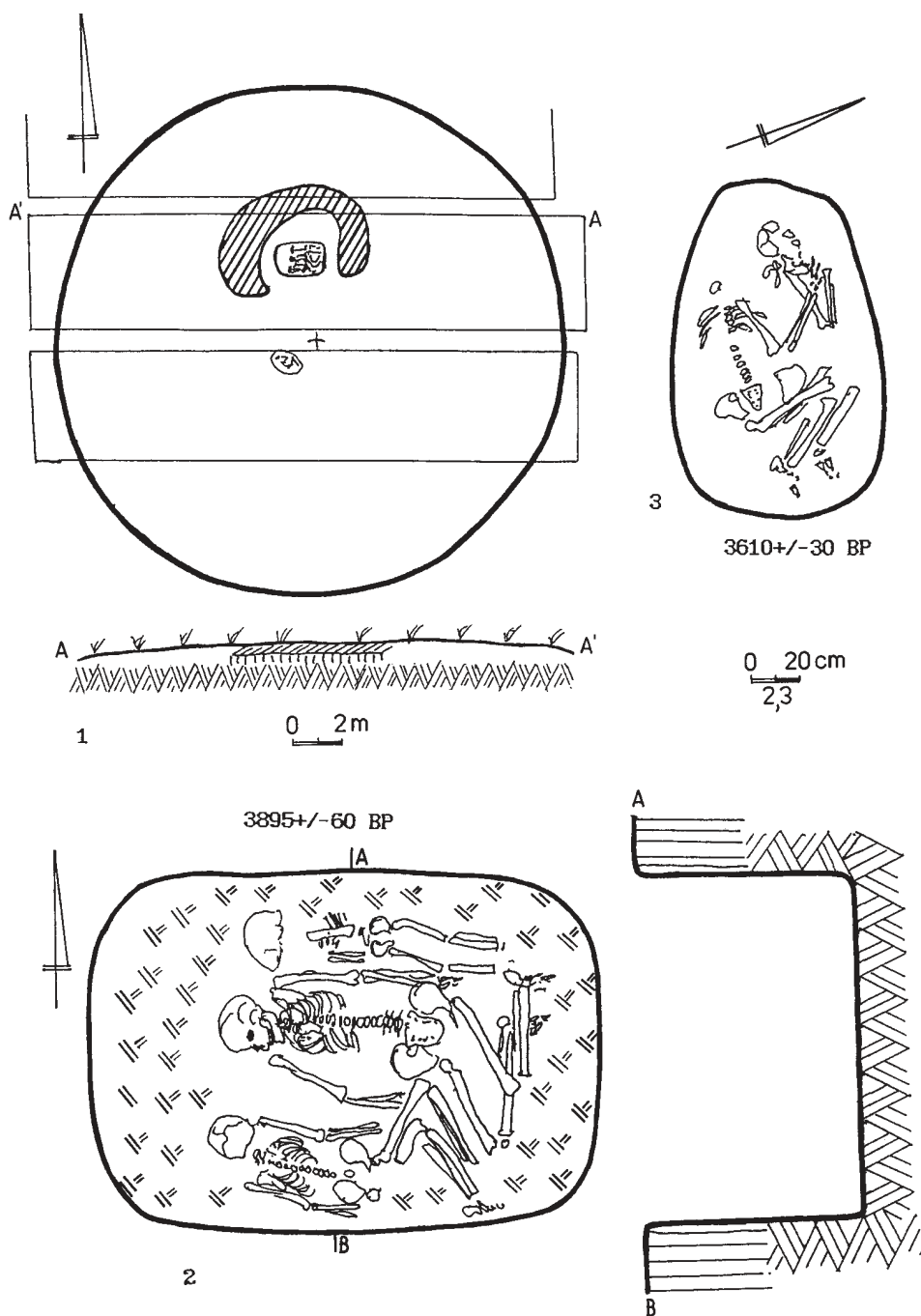


Fig. 10. Myronivka, Kiev Region, barrow 7. 1- plan of the barrow; 2 - grave 7/2; 3 - grave 7/1

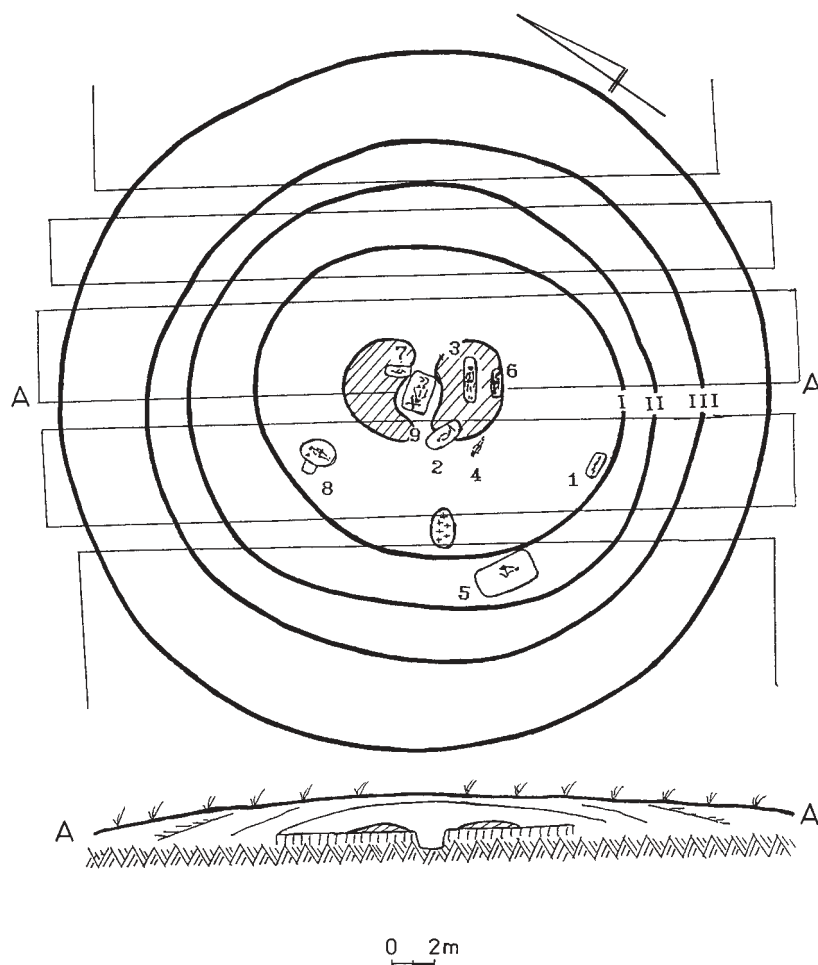


Fig. 11. Myronivka, Kiev Region. Plan of Barrow 8

The arrowhead, made of “smoky” grey, semi-transparent flint, was triangular in shape with a groove at the base; its edges were covered with fine retouch. It was 2 cm long and 1.3 cm wide at the base (Fig. 12:2).

The grave included two fire-beds (Fig. 11). The first, located 0.5 m to the south-west of the pit, contained several small fragments of moulded ceramics. The second was found 3 m to the south-west of the first, and contained a fragment of a glossy black vessel.

A black earth bank (Fig. 11: bank I), 1.2 m high and 14 m in diameter, was made over the grave. Three burials of the MDC were sunk into the bank.

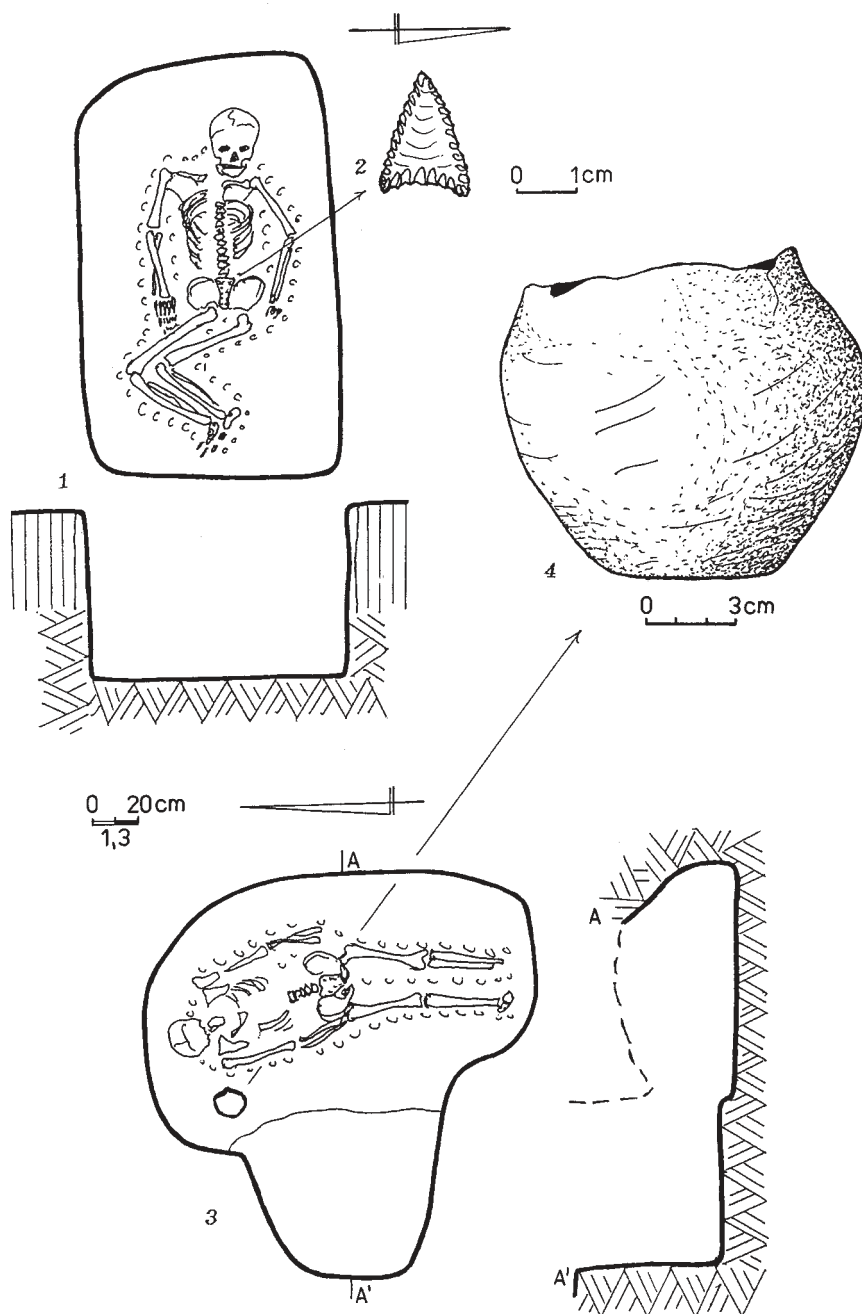


Fig. 12. Myronivka, Kiev Region, barrow 8. 1- grave 8/9; 2 - arrowhead from grave 8/9; 3 - grave 8/8; 4 - vessel from grave 8/8

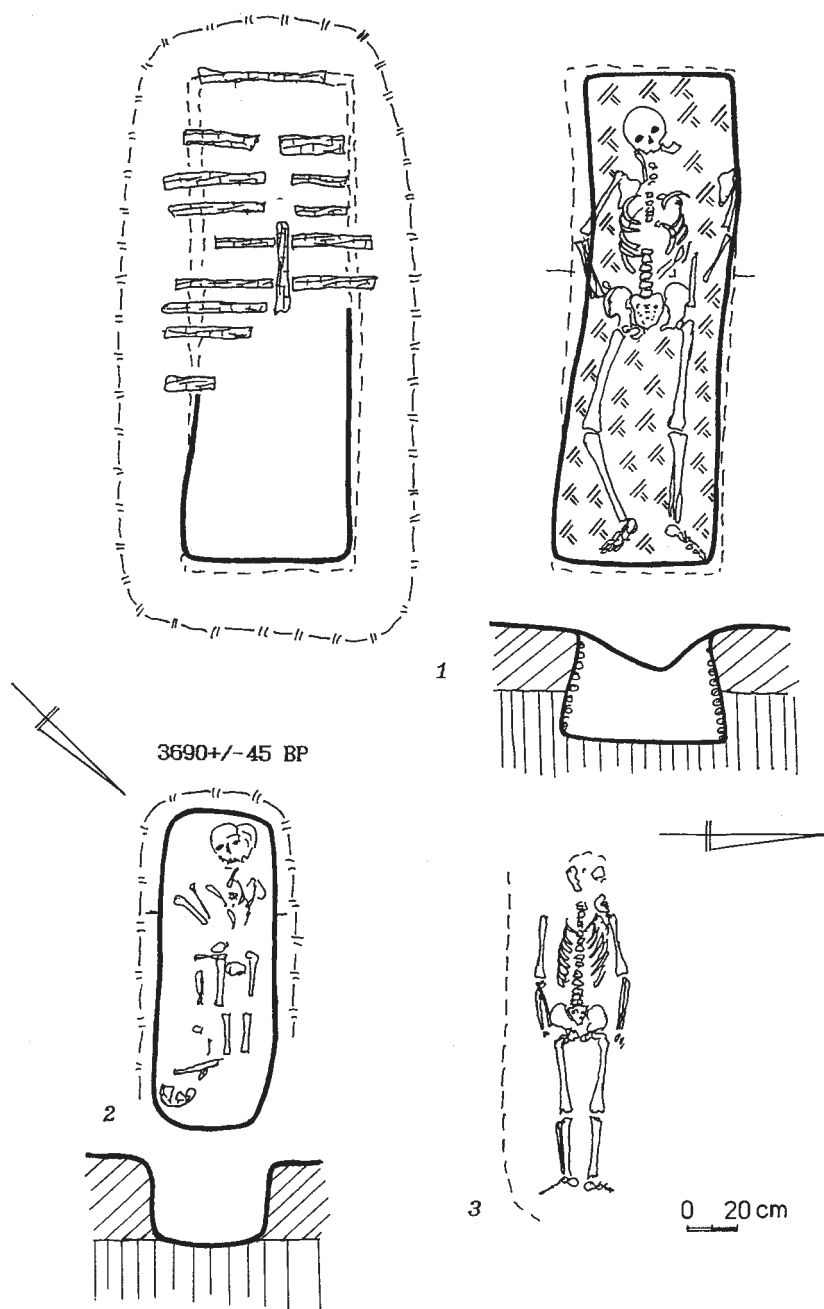


Fig. 13. Myronivka, Kiev Region, barrow 8, graves of the Middle Dnieper culture. 1- grave 8/3; 2 - grave 8/6; 3 - grave 8/4

Grave No. 8/3 (Fig. 13:1), was found 2 m to the south-east of the centre. At the level of the discharge taken from the central grave it was covered with a reed mat, placed on thin (3-6 cm in diameter) wooden rods. The narrow pit was of rectangular form, 1.9 m x 0.6 m in size and 0.45 m deep from the cover level. The long walls of the pit were strengthened with thin wooden bars 0.02-0.03 m long, positioned horizontally and wedged at the corners. The pit broadened out at the bottom and had a trapezium shape in section. The skeleton of a woman ages 25-35 lay stretched on its back, head to the north-east. The arms were extended along the body, hands at the pelvis. On the bottom of the pit, between her legs, near the knees, there was a lump of bright raddle. The bones displayed traces of dark brown rot, ochre-like in places.

Grave No. 8/6 (Fig. 13:2), was found 3 m to the south-east of the centre, 1.6 m deep from the surface. The pit was made in the buried soil; it was rectangular in shape, with rounded corners, 1.25 m x 0.45 m in size, with its long walls oriented along the south-west-to-north-east line. The skeletons of two children aged 3-4 and 6-7 lay stretched on their backs, heads in opposite directions. The skeletons had been partly eaten away by rodents. Under the bones there were traces of light brown rot.

The radiocarbon date of the grave — 3690 ± 45 BP (Ki-5824) — was determined from the human bones.

Grave No. 8/4 (Fig. 13:3), located 3 m to the south of the centre, was made in the first bank of the barrow, 1.3 m deep from the surface. The edges of the pit could not be distinguished. The skeleton of an adolescent lay stretched on its back, head to the west. The arms were extended along the body, hands at the pelvis. Under the bones there was dark brown rot.

These graves were covered with the second bank, of black earth with a light admixture of clay (Fig. 11: bank II), which enlarged the original barrow to 17.4 m in diameter. The height of the bank was impossible to determine, as its top had been ruined.

A burial of the CC No. 8/8 (Fig. 11; 12:3, 4), was sunk into this bank. The clay discharge from the grave was found on the north-western edge of the second bank and was covered with a fine layer of newly-formed soil and by the third bank of the barrow.

An entrance shaft, square in section and 0.7 m x 0.7 m in size was found 4.5 m to the north-west of the centre. It was filled with mainland clay and 3 m deep from the surface.

The entrance to the chamber was located in the north-eastern wall. The bottom of the chamber was 5 cm lower than the entrance shaft. The chamber was of circular shape (1.7 m diameter), and its ceiling had collapsed.

The skeleton of a woman aged 45-50 lay stretched on its back, head to the north. The arms were extended along the body; the left hand was placed at the

pelvis, while the right hand lay on the thigh. A small moulded vessel lay to the side of the right shoulder. Under the bones there was dark brown rot, and the floor under the bones was lightly sprinkled with ochre.

The vessel had rounded sides, a flat bottom and a short straight neck. It was 10 cm high; the diameter of the body was 13 cm, and 6 cm at the bottom (Fig. 12:4). The dough was black and crumbly; the surface ochre-like with dark stains. There were scratches both inside and out.

Later, four burials of the MPC were sunk into the second bank.

Grave No. 8/5 (Fig. 11; 14), was found 8 m to the south-west of the centre. A rectangular pit 2.9x1.6 m and 2.6 m deep measuring from the surface was investigated. It was filled with clay with some chernozem. In the filling material pieces of wood were recorded coming from the structure covering the grave pit. On the bottom, on a thin layer of chernozem, 3-5 cm deep, a skeleton of a man aged 25-35 years lay on its left side, in a flexed position, with the head pointing east. The state of the skeleton's preservation was poor and the bones were covered with a dark-red film.

The radiocarbon date of the burial, namely 3325 ± 50 BP (Ki-5829), was procured from human bones.

Grave No. 8/2 (Fig. 11; 15:1) was found 1,8 m to the south of the centre, 0,8 m deep from the surface of the barrow's bank. The edges of the pit could not be distinguished clearly and had to be traced from the remains of a wooden "sarcophagus". The skeleton of an adult lay in a foetal position on its left side, head to the west. The legs were bent at the knees, with the heels pulled up to the pelvis. The arms were bent at the elbows, the left hand pulled up to the chin. There was a bone buckle near the elbow of the left arm, and traces of brown rot under the bones.

The bone buckle (Fig. 15:1) was oval in shape, pointed, with a large hole in the centre and a small hole at the edge. The buckle was 4.5 cm in diameter, and the large hole 1.8 cm. The surface of the buckle was polished.

Grave No. 8/1 (Fig. 11; 15:2), was located 8.5 m to the south of the centre, 0.8 m deep from the surface of the barrow's bank. The edges of the pit were indistinct. On and under the bones were the remains of a wooden "sarcophagus". The poorly preserved skeleton of an adult lay in a deep foetal position on its right side, head to the east. The wood of the "sarcophagus" was burnt in places on the bottom.

Grave No. 8/7 (Fig. 11; 15:3), was located 1 m to the north of the centre, 1.6 m deep from the surface, in the buried soil. The skeleton of a child aged 9-10 lay in a foetal position on its left side in a wooden "sarcophagus" gouged from a whole tree trunk. The wooden lid of the "sarcophagus" lay immediately on the bones; it had been made from thin "plates", assembled lengthwise.

Over these graves — most probably, originally over grave 8/5 — there was a bank (Fig. 11: bank III) that consisted of two clearly distinct layers: the lower layer of black earth and the upper layer of clay. The clay layer probably served to

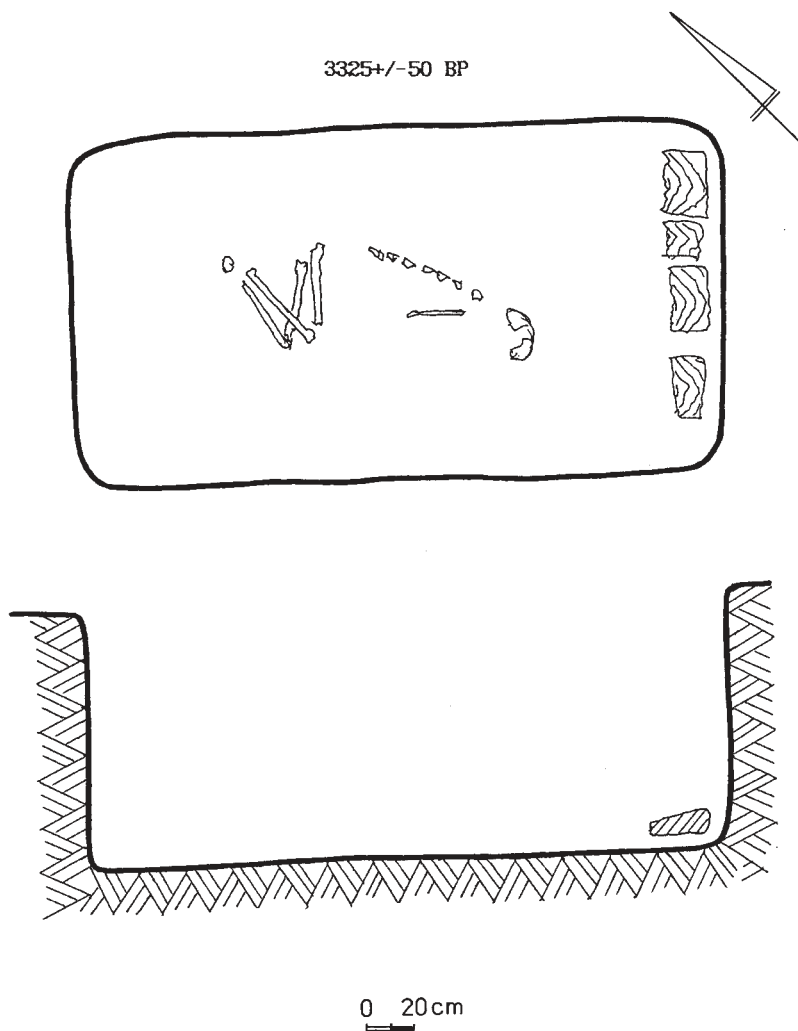


Fig. 14. Myronivka, Kiev Region, barrow 8, grave 8/5

strengthen the barrow surface. The bank enlarged the diameter of the barrow to 26-27 m; its height could not be determined as the top had been destroyed. As was mentioned above, the bank of the barrow was partially taken down with a bulldozer by a local collective farm.

In terms of time, the next barrow of the Myronivka burial site (i.e. the one that followed the construction of the first, the main bank), after the barrows of the YC, is a barrow of the MDC (barrow 6, Fig. 1; 16).

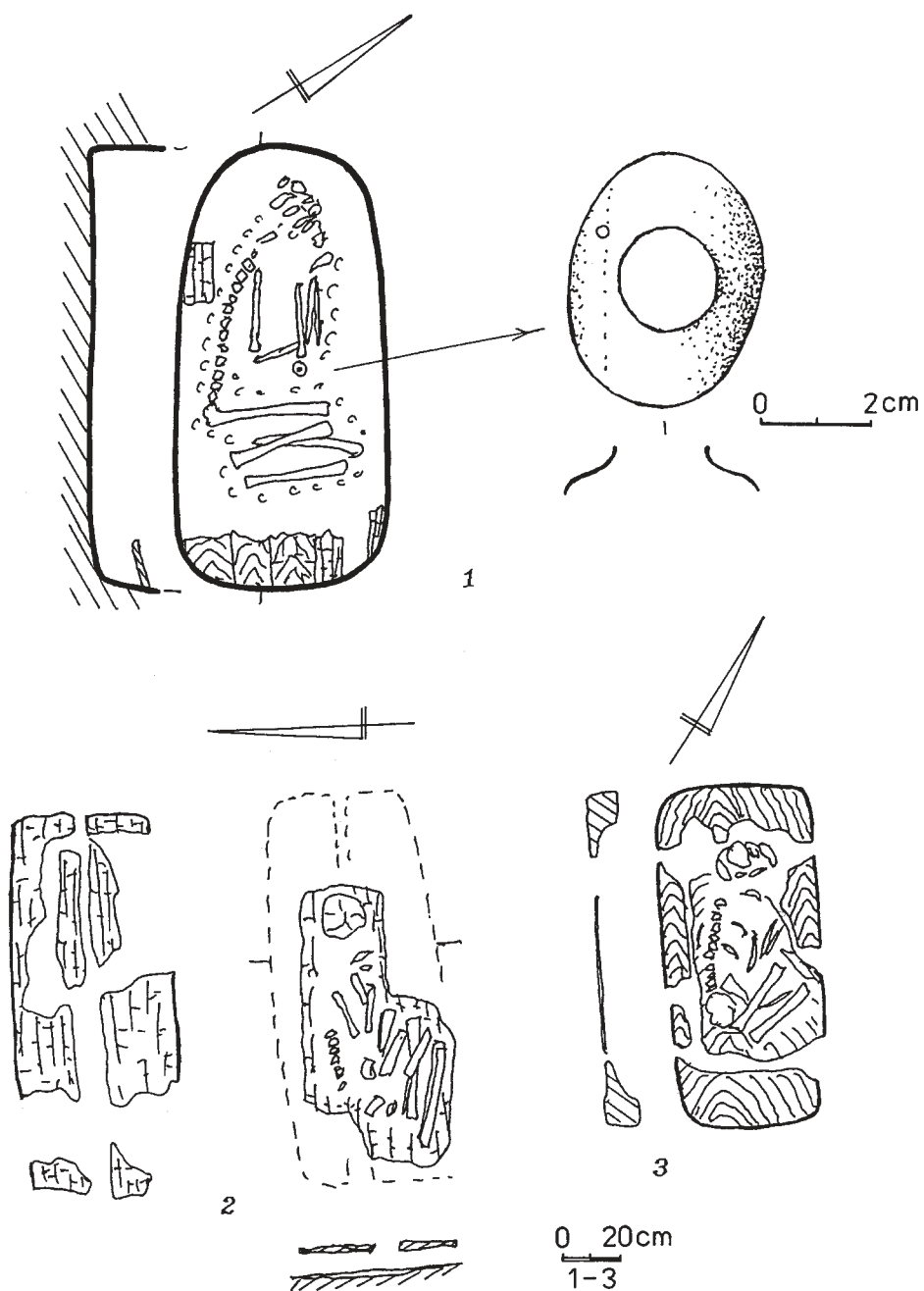


Fig. 15. Myronivka, Kiev Region, barrow 8, graves of the Mnogovalikovi Pottery culture. 1- grave 8/2; 2 - grave 8/1; 3 - grave 8/7

Barrow 6. This barrow was situated 1.4 km to the north-west of barrow 1. Its bank had been heavily ploughed and was hardly visible. It was approximately 16 m in diameter and 0.3 m high. In the centre of the barrow, we found traces of an excavation by robbers (end of the 19th — early 20th century, judging from the ceramics found in the barrow), 6 m x 5 m in size and 0.5 m deep from the surface (the bottom of this pit reached the level of the mainland clay). In the centre of the barrow, at the bottom of the robbers' pit, we found the remains of a burial pit.

The pit (Fig. 16:1) was long and narrow, with rounded corners, 2.3 m x 0.9 m in size, 1 m deep from the surface, with its long walls oriented (with slight deviation) along the east-west line. In the filling of the pit, we found bones of a well-built man aged 30-40; the bones were coloured with ochre. Judging from the location of the remains, the buried body lay in a stretched position on its back, head to the west. A stone axe-hammer was found in the bank near the grave.

The axe-hammer, made of solid black stone (Fig. 16:3), is short (10 cm) and wide (7 cm), with a rounded butt, polished surface, and a cylindrical loop, 2.5 cm in diameter, drilled into it with the help of a flint bore (the inner surface was uneven). The grave, most probably of the MDC, was destroyed in modern times.

The last barrows in this group to be built were two barrows of the MPC.

Barrow 4. Barrow (Fig. 1; 17; 18) was located 30 m to the south-east of barrow 3, and contained three MPC graves. Its bank was heavily ploughed, 0.5 m high, and about 38 m in diameter.

The main grave in the barrow, probably, was grave No. 4/2 (Fig. 17:1; 18:2), located 2.6 m to the west of the assumed centre of the barrow. The rectangular pit, with rounded corners, was 2.4 m x 1.2 m in size, 1.3 m deep from the surface. The skeleton of a woman aged 20-25 lay in a foetal position on its left side, head to the south-east. The bones were in poor condition and, therefore, the position of the arms could not be determined. The bones were coloured with dark raddle. Under the bones there were traces of dark brown rot, black in places. Above the head and at the feet were the remains of wood (from a "sarcophagus"?). The bones and the rot were found on the layer of black earth, 0.2-0.1 m thick, that covered the entire clay bottom of the pit.

Grave No. 4/1 (Fig. 17:1, 2) was located 3.5 m. to the south of the assumed centre, at the level of the buried soil, 0.9 m. deep from the surface. The contours of the pit could not be traced. A skeleton in very poor condition lay in a foetal position on its left side, head to the west, with the right arm extended along the spine, and the left arm pulled to the knees. The skull was coloured with cherry ochre.

Grave No. 4/3 (Fig. 17; 18:1) was found 1 m to the east of the assumed centre, in the buried soil, 0.7 m deep from the surface. The rectangular pit was 1.5 m x 0.9 m in size, with its long walls oriented along the east-west line. The poorly preserved skeleton of a young man lay in a foetal position on its right side, head to the west,

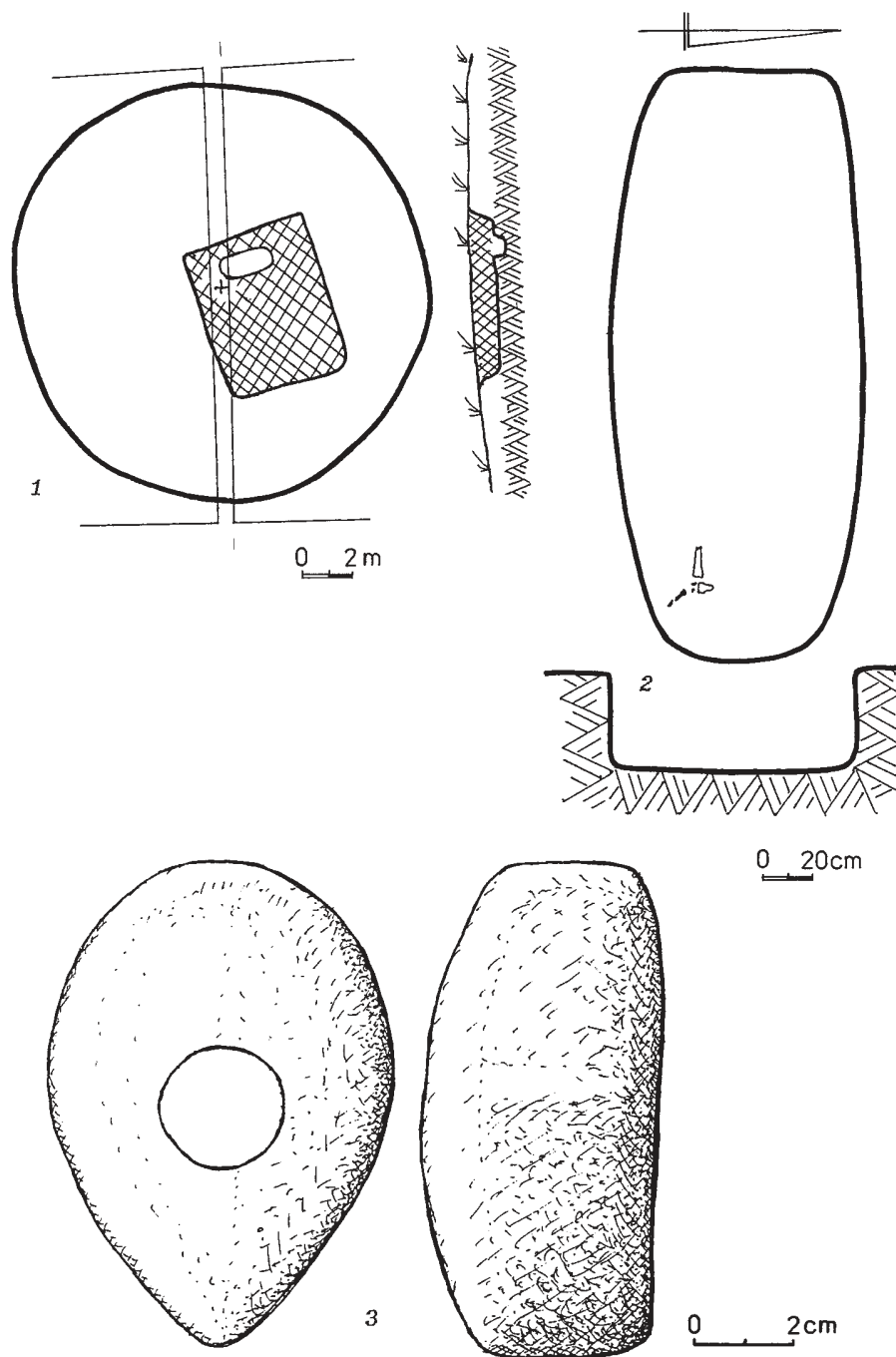


Fig. 16. Myronivka, Kiev Region, barrow 6. 1- plan of the barrow; 2 - grave; 3 - axe-hammer

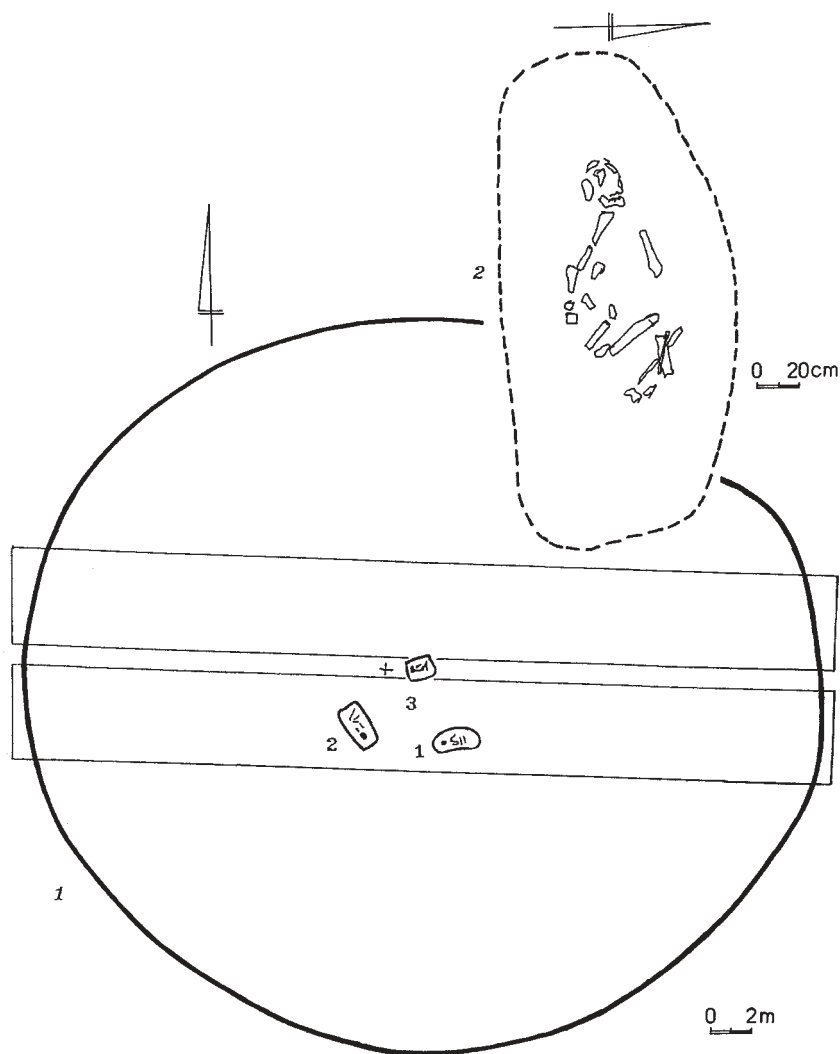


Fig. 17. Myronivka, Kiev Region, barrow 4. 1- plan of the barrow, 2 - grave 4/1

with the arms bent at the elbows, and hands pulled to the face. The bones displayed traces of dark raddle. On the bottom of the pit there was brown rot.

Barrow 5. Barrow (Fig. 1; 19; 20) was found 0.3 km to the north-east of barrow 4 and contained two MPC graves and a Late Middle Age grave. The surface of the barrow had been ploughed, and the remaining part is 0.4 m high and 22 m in diameter.

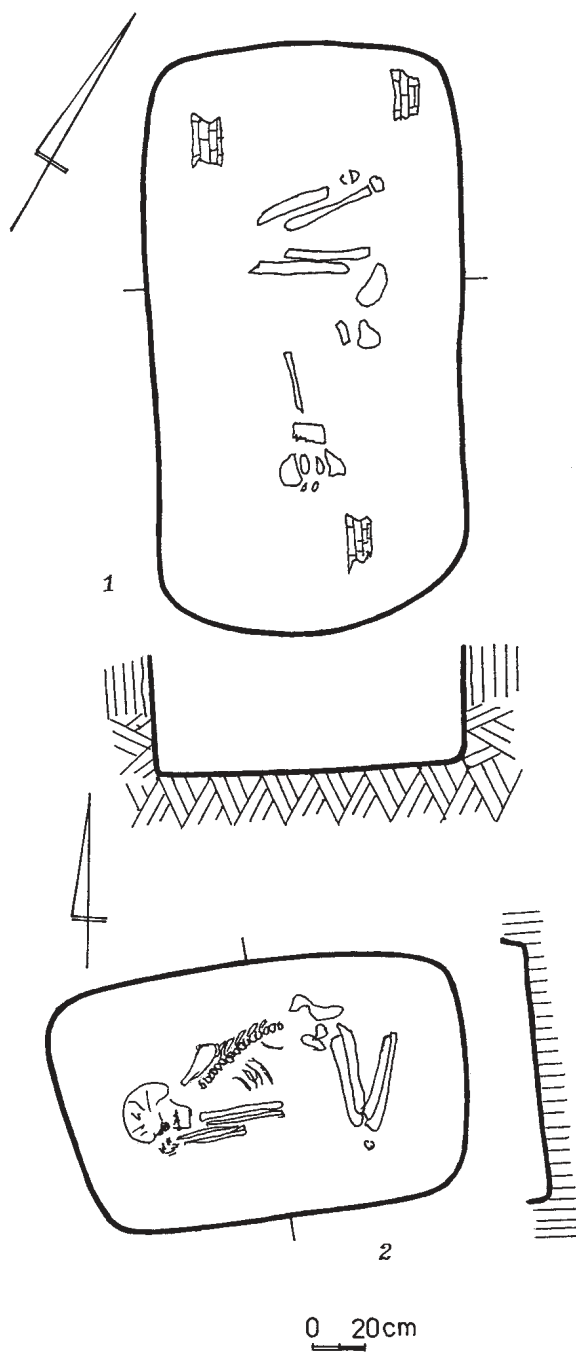


Fig. 18. Myronivka, Kiev Region, barrow 4. 1- grave 4/3; 2 - grave 4/2

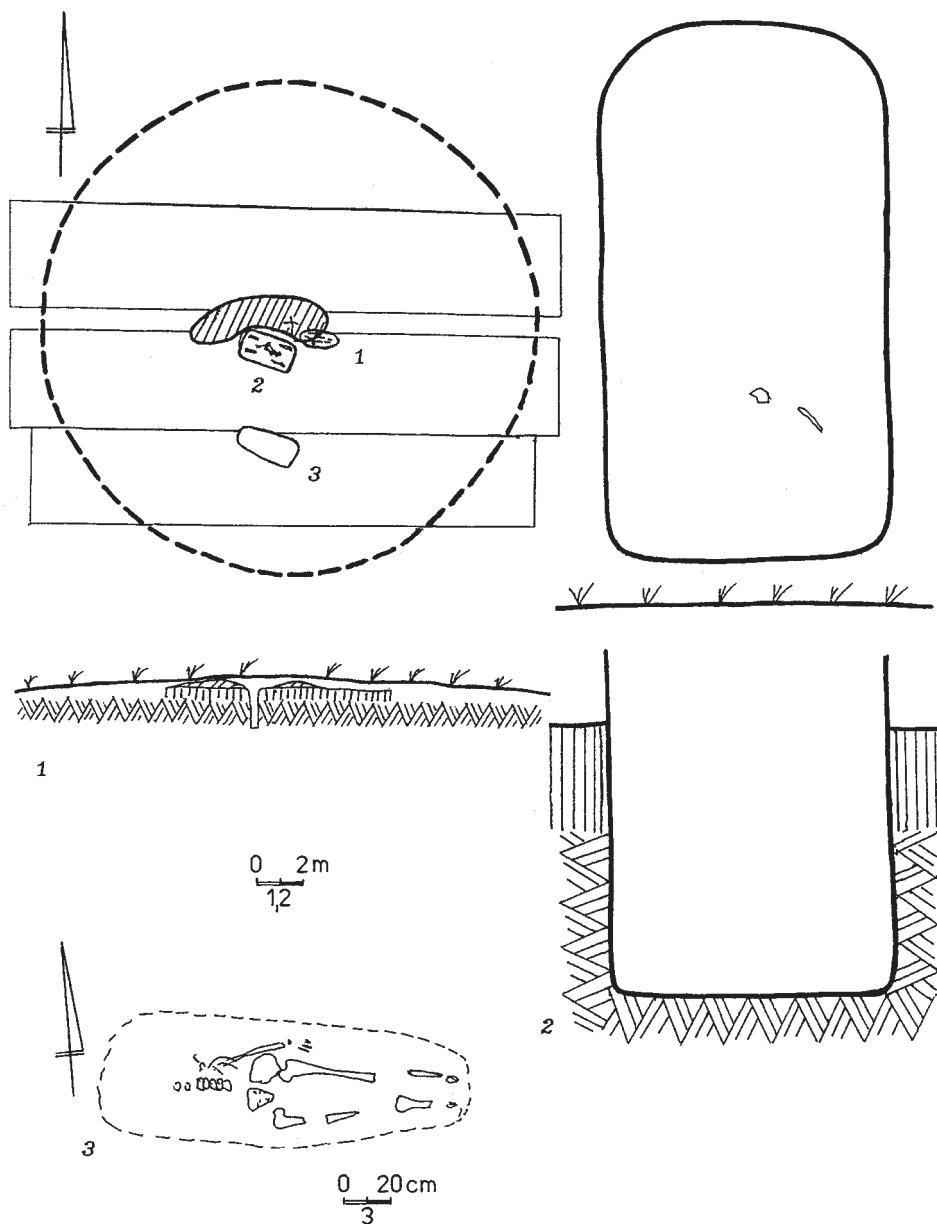


Fig. 19. Myronivka, Kiev Region, barrow 5. 1- plan of the barrow; 2 - grave 5/3; 3 - grave 5/1

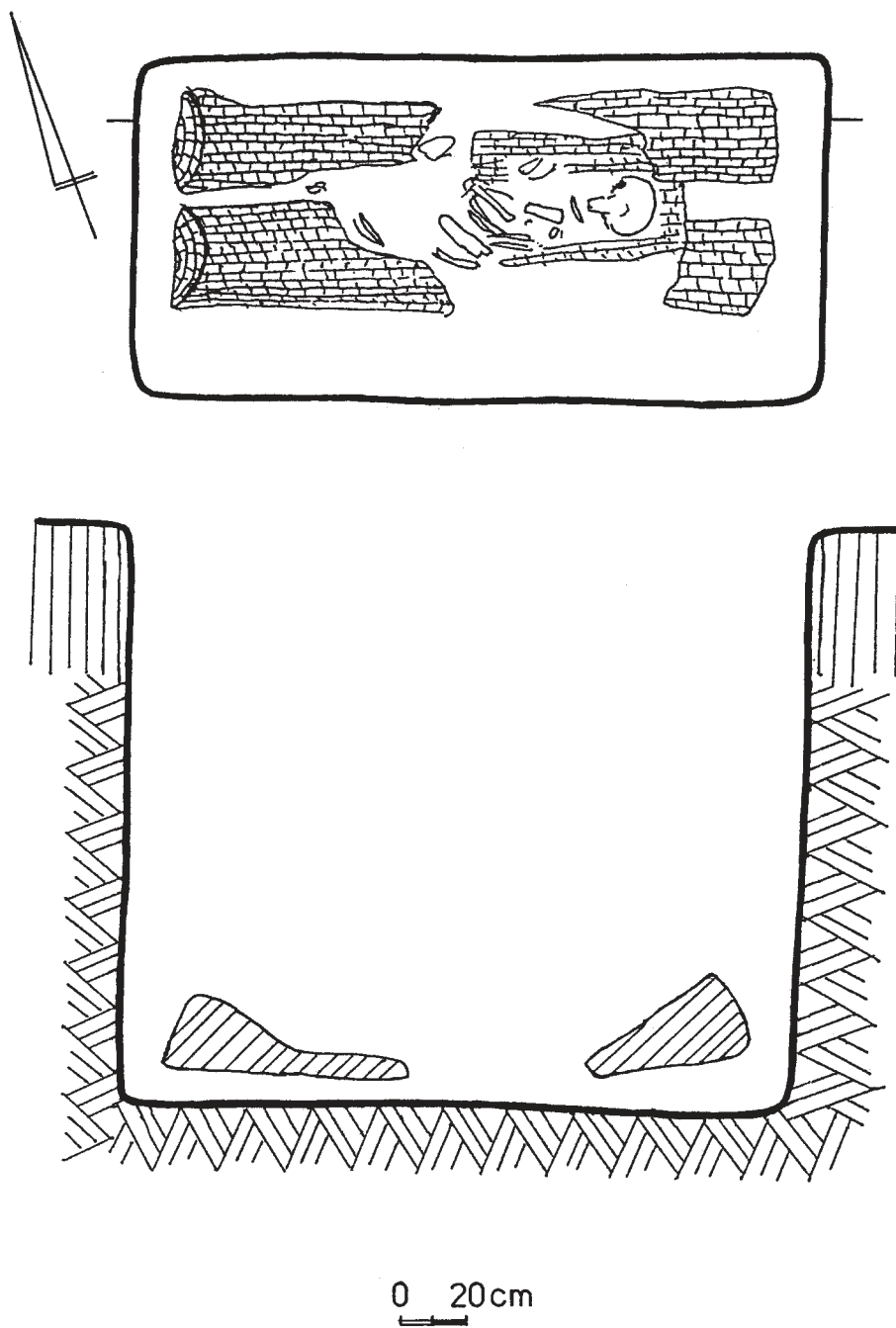


Fig. 20. Myronivka, Kiev Region, barrow 5, grave 5/2

The main grave in the barrow was grave **No. 5/2** (Fig. 19:1; 20), located in the centre. The clay of the discharge taken from the grave lay on the buried soil and formed a bank to the north of the pit, which was also partially filled in with the clay. The pit was rectangular in shape, with clearly distinguishable corners, 2.0 m x 1.0 m in size, 1.8 m deep from the level of the buried soil. Its long axis was oriented along the north-west-to-south-east line. The skeleton of an adult woman (?) lay in a wooden “sarcophagus” in a deep foetal position, slightly arched at the chest, head to the south-east. The arms were bent at the elbows; the left hand was pulled to the knees, while the right hand lay at the right shoulder. The “sarcophagus” had been gouged from a single wooden trunk and covered with two trunks up to 30 cm in diameter.

Over this grave there was a barrow bank, constructed in one stage, and later used to accommodate the sinking of a grave of the MPC **No. 5/3** (Fig. 19:1, 2), which was situated 4 m to the south of the main grave. The pit, in the shape of an arch, was 4.2 m x 2.3 m in size, 1.6 m deep from the surface, with its long axis oriented along the north-west-to-south-east line. The grave had been ruined (robbed?) in ancient times. Small fragments of bones, teeth of a young man (?), and pieces of wood (from the ceiling or the sarcophagus) were found in the filling and at the bottom of the pit.

Grave **No. 5/1** was found 0.4 m to the east of the centre, 0.3 m deep from the surface. The edges of the pit could not be distinguished. The bones were in poor condition, partly ruined by a plough. The body had been positioned stretched on its back, head to the west. In our view, the grave belongs to the late Middle Age (?).

CONCLUSIONS

Summing up this investigation, it is possible to say that the Myronivka barrows produced a stratigraphic column embracing a number of cultures of the Bronze Age which had followed one another in this region over a period of 300 years. A series of radiocarbon dates, determined at Kiev laboratory (Table 1), allows us to calculate the absolute age of these cultures and the duration of their existence in Middle Dnieper region.

Is it important to note that these dates, produced with the help of a new technique, differ substantially from earlier dates (the “Rosava” series, Ki-2730, 2732, 2734, 3036). The approximated new radiocarbon dates for cultures of the Middle Dnieper region, obtained on the basis of the “Myronivka culture”, are as follows (Table 2).

Table 1

Myronivka, Kiev Region of Radiocarbon dates from the Myronivka barrows

No.	Stratigraphic Groups and Cultures	Chronology	
		BP	BC
I.	Yamnaya Culture (Graves 1/8; 1/4; 1/5; 2/1;7/2; 3; 8/9)	4235±60 - 4010±60 - 3895±60	2804±90 - 2522±83 - 2367±88
II.	Late Yamnaya Culture (Graves 1/1; 2/3; 2/4)	3875±60 - 3810±55	2350±95 - 2229±96
III.	Middle Dnieper Culture (Graves 1/6; 1/2; 8/3; 8/6; 8/4; 6) Catacomb Culture (Graves 1/7; 8/8)	3690±45	2048±75
IV.	Mnogovalikovo Pottery Culture (Graves 2/1; 7/1; 8/5; 8/2; 8/1; 8/7; 4/1; 4/2; 4/3; 5/3; 5/2)	3610±30 - 3325±50	1941±49 - 1577±64

Table 2

Chronological framework of the sequence of Bronze Age cultures in the Middle Dnieper Region

Cultures	BP Dates	BC Dates
Yamnaya culture	4200-3900	2800 - 2350
Late Yamnaya culture	3900-3800	2350 - 2200
Middle Dnieper, Catacomb cultures	3700-3600	2050 - 1950
Mnogovalikovo Pottery culture	3600-3300	1950 - 1600

Here, it should be noted that the date of 4200 BP is the only one for the YC in this region, and, therefore, demands further verification. It is also necessary to determine clearly when the CC emerged in the Ros river basin. Furthermore, the datings for the MDC, based on a single radiocarbon date, are preliminary and refer only to the Myronivka group of this culture (which, in our view, deserves to be considered separately). In general, the “cord” monuments of the right bank of the Middle Dnieper area require serious redefinition and a new level of research.

Translated by Maria Ogiyenko

Marzena Szmyt, Ivan T. Chernyakov

RADIOCARBON CHRONOLOGY OF "AKKIEMBETSKIY KURGAN". A PRELIMINARY REPORT

While working on the program of research into the radiocarbon chronology of the area between the Vistula and Dnieper [cf. Klochko, Koško, Szmyt, Problem. . . , in this volume], researchers were attracted by the Dniester drainage because it appeared to be particularly important for the correlation of the cultural phenomena of Eastern and Western Europe. The research carried out so far shows that the area, heavily settled first by Late Tripolye culture and Yamnaya culture groups and later used by the Catacomb culture as well, was reached by Central European groups such as Globular Amphora culture and Corded Ware culture [Chernyakov, Toshchev 1985; Yarovoy 1985; Dergachev 1986; Toshchev 1991; Alekseyeva 1992]. At the same time, there are relics of settlements of populations migrating from steppe expanses located further to the east as, for instance, the Kemi-Oba culture [Subbotin 1995].

It was assumed that the best results would be obtained by analyzing a multi-phase feature whose stratification is well recorded. These conditions were met by the so-called Akkiembetskiy *kurgan* located near the village of Zatoka (Bilhorod Dnistrovskiy District, Odesa Region). Excavations were carried out there by Ivan T. Chernyakov with his team. The investigations revealed that the place had been used many times in the course of prehistory (in particular at the turn of the Eneolithic and the beginning of the Bronze Age) and that it had a well-preserved stratigraphic sequence of layers - successive *kurgan* mounds. At present, a discussion of sources is being prepared for publication in the *Baltic-Pontic Studies*. Here, we wish to present preliminary results of the radiocarbon dating of features (chiefly graves) from the *kurgan*. The following data concerning the stratigraphic and cultural position of the investigated features are working conclusions of I.T. Chernyakov.

The analysis encompassed twenty features: 1 ritual place (so-called temple) and 19 graves belonging to four cultural units, namely the Usatovo group later the TC (ritual place and 6 graves), Kemi-Oba culture (4 graves), Budzhak group (culture)

* Project financed with grant no. 1 H01G01810 provided by the Polish Committee for Scientific Research in 1996-1998.

Table 1

Radiocarbon dates from the Akkiembetskiy kurgan

Lab. no.	Feature	Material	Class of dating	Cultural unit	Stratigraphic group	BP	BC
Ki-6800	Ritual place	Animal bones	IA	Usatovo	I	4170±60	2759±101
Ki-6801	Ritual place	Animal bones	IA	Usatovo	I	4095±65	2600±124
Ki-6802	Grave 6	Human bones	IA	Usatovo	II	4020±65	2539±92
Ki-6803	Grave 6	Human bones	IA	Usatovo	II	4090±60	2590±115
Ki-6804	Grave 9	Human bones	IA	Usatovo	II	3990±60	2491±89
Ki-6805	Grave 10	Human bones	IA	Usatovo	II	3930±55	2387±79
Ki-6806	Grave 7	Wood	IIA	Usatovo	?	3975±55	2479±88
Ki-6807	Grave 7	Human bones	IA	Usatovo	?	3950±60	2402±97
Ki-6808	Grave 7	Human bones	IA	Usatovo	?	3935±45	2399±66
Ki-6809	Grave 23	Human bones	IA	Usatovo	III	3920±60	2379±85
Ki-6810	Grave 24	Human bones	IA	Usatovo	III	3945±50	2398±78
Ki-6811	Grave 1	Trzcina	IA	Kemi-Oba	IV	3900±65	2367±92
Ki-6812	Grave 1	Human bones	IA	Kemi-Oba	IV	3950±60	2402±97
Ki-6813	Grave 2	Human bones	IA	Kemi-Oba	IV	3930±50	2392±72
Ki-6814	Grave 3	Human bones	IA	Kemi-Oba	V	3890±50	2368±80
Ki-6815	Grave 12	Human bones	IA	Kemi-Oba	V	3925±55	2388±78
Ki-6816	Grave 13	Wood	IA	Budzhak	VI	3865±50	2309±89
Ki-6817	Grave 14	Wood	IIA	Budzhak	VI	3920±45	2391±66
Ki-6818	Grave 17	Wood	IIA	Budzhak	VII	3840±65	2298±107
Ki-6819	Grave 17	Human bones	IA	Budzhak	VII	3865±60	2314±97

Lab. no.	Feature	Material	Class of dating	Cultural unit	Stratigraphic group	BP	BC
Ki-6820	Grave 21	Wood	IIA	Budzhak	VII	3760±45	2126±79
Ki-6821	Grave 22	Wood	IIA	Budzhak	VII	3775±60	2160±105
Ki-6822	Grave 22	Human bones	IA	Budzhak	VII	3810±55	2229±96
Ki-6823	Grave 11	Human bones	IA	Mnogovalikovoi Pottery	VIII	3795±60	2215±106
Ki-6824	Grave 15	Human bones	IA	Mnogovalikovoi Pottery	VIII	3745±50	2118±79
Ki-6825	Grave 16	Human bones	IA	Mnogovalikovoi Pottery	VIII	3780±60	2166±107
Ki-6826	Grave 20	Human bones	IA	Mnogovalikovoi Pottery	VIII	3685±45	2046±75

of the Late Yamnaya culture (5 graves) and the Mnogovalikovoi Pottery culture (4 graves). All measurements were carried out at the ^{14}C laboratory State Scientific Center of Environmental Radiogeochemistry of the National Academy of Sciences of Ukraine under the supervision of Dr. Nikolay N. Kovalyukh. The dates were calibrated using the program of B. Weninger [1993]. The results are shown in Tables 1 and 2.

In aggregate, radiocarbon analyses of 27 samples were performed. They contained human bones (from graves; 18 samples) and animal ones (from the ritual place; 2 samples) as well as wood (from graves; 6 samples) and reed (from a grave; 1 sample). Eleven samples were taken from features of the Usatovo group, 5 from Kemi-Oba culture graves, 7 from Budzhak group graves and 4 from the graves of the Mnogovalikovoi Pottery culture. According to a classification of datings, suggested elsewhere, based on the sample contents and context [Czebreszuk, Szmyt 1998; 2000], they belong to classes IA (21 items) and IIA (6 items), i.e. to the highest classes in the category of samples containing short-lived materials (IA) and long-lived ones (IIA).

From the point of view of the standard error size, the series contains datings of medium accuracy. The standard error range is 45-65 radiocarbon years with four datings having errors of 45, 55 and 65 years, five datings having a deviation of 50 years and ten datings having a deviation of 60 years.

To verify the series, two samples from each of six features were sent to radiocarbon analysis. In the cases of the ritual place and grave no. 6, bones were dated in both cases (belonging to the same skeleton from grave 6 and the head of a horse found at the ritual place), the samples from graves 17 and 22 contained separately

Table 2

Group calibration of dates from the Akkiembetskiy kurgan

Stratigraphic group	Cultural unit	Lab. Nos	BC - 2 sigma	BC - 1 sigma
I	Usatovo	Ki-6800, 6801	2880-2490	2820-2580
II	Usatovo	Ki-6802, 6803, 6804, 6805	2850-2300	2610-2340
?	Usatovo	Ki-6806, 6807, 6808	2570-2230	2480-2300
III	Usatovo	Ki-6809, 6810	2550-2210	2460-2300
IV	Kemi-Oba	Ki-6811, 6813	2560-2210	2460-2290
V	Kemi-Oba	Ki-6814, 6815	2520-2200	2440-2280
VI	Budzhak	Ki-6816, 6817	2480-2180	2450-2290
VII	Budzhak	Ki-6818, 6819, 6820, 6821, 6822	2450-2030	2340-2100
VIII	Mnogovalikovo Pottery	Ki-6823, 6824, 6825, 6826	2360-1920	2220-2000
I - III	Usatovo	Ki-6800 – Ki-6810	2850-2260	2610-2310
IV - V	Kemi-Oba	Ki-6811 – Ki-6815	2550-2210	2450-2280
VI - VII	Budzhak	Ki-6816 – Ki-6822	2460-2040	2380-2130
VIII	Mnogovalikovo	Ki-6823 – Ki-6826	2360-1920	2220-2000

bones and wood, from grave 1 bones and reed were dated, whereas from grave 7 human bones were dated twice and reed once. The datings for different samples from the same feature are similar (see Table 1). Only in one case (grave 7) was a dating of a wood sample slightly older than dates procured from bone samples.

All in all, the datings show that the investigated place was intensively used in the 3rd millennium BC, in the period from 2759 ± 101 BC to 2046 ± 75 BC, with the use being especially intensive in 2480-2120 BC (we give dating ranges here at the level of 1 sigma = 68%, for full information see Tables 1 and 2). After taking into consideration the discussed series of dates, the chronology of individual taxa (cultures) looks as follows: Usatovo group - 2610-2310 BC, Kemi-Oba culture - 2450-2280 BC, Budzhak group - 2380-2130 BC, Mnogovalikovo Pottery culture - 2290-2060 BC. The unbroken continuity of datings and the overlapping of their chronological ranges are clearly observable in the case of the named taxa, which may be evidence of the temporal proximity of such cultures as Usatovo and Kemi-Oba, Kemi-Oba and Budzhak, Budzhak and the Mnogovalikovo Pottery culture.

Owing to the surviving stratification of the *kurgan*, it is possible to analyze the cultural-stratigraphic units with a greater accuracy. The datings are related to eight stratigraphic groups, i.e. complexes of features of a similar stratigraphic position. The oldest of those groups (I) is the ritual place of an Usatovo group population.

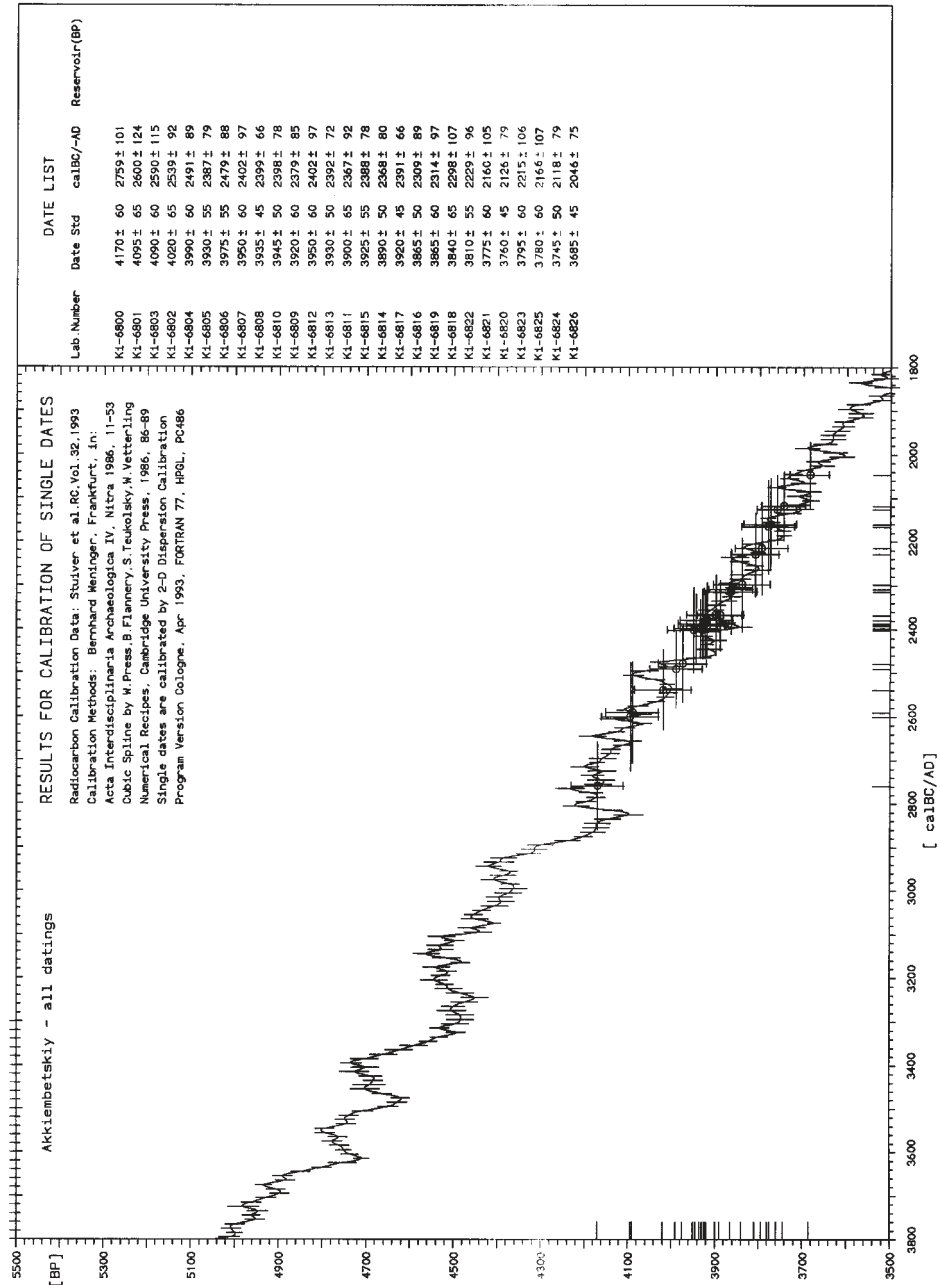
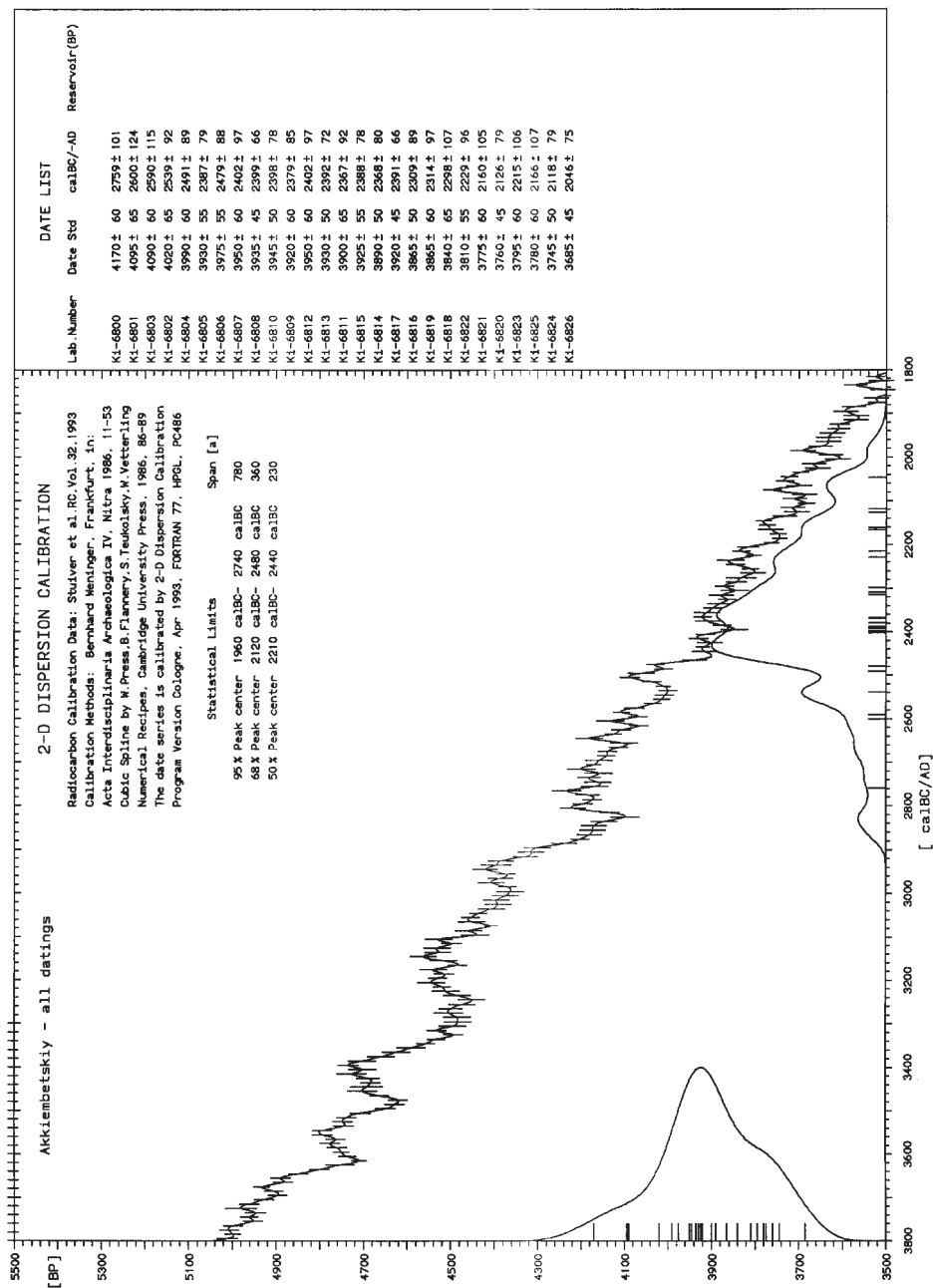


Fig. 1. Calibration of dates procured from the Akkiembetskiy kurgan



Two dates, obtained by analyzing the skull of a horse, point to 2820-2580 BC (in this interval, probably to 2815 BC). The same cultural unit is connected with the next two stratigraphic groups: group II (dates from graves 6, 9 and 10) may be dated to ca 2610-2340 BC and group III (graves 23 and 24) to ca 2460-2300 BC. No exact stratigraphic position was determined in respect of another Usatovo grave (no. 7) dated to 2470 BC. Next two stratigraphic groups are formed by graves of the Kemi-Oba culture. The older one (group IV; graves 1 and 2) may be dated to 2460-2290 BC, while the younger one (group IV; graves 3 and 12) to 2440-2280 BC. Also two other groups comprise graves of the Late YC, specifically the Budzhak group. The older of them (VI) is made up of graves 13 and 14, which can be jointly dated to 2450-2290 BC, while the chronology of the younger one (group VII; graves 17, 21 and 22) falls on 2340-2100 BC. The last of the dated stratigraphic groups (VIII) comprises graves of the Mnogovalikovoii Pottery culture (no. 11, 15, 16 and 20), whose dates jointly mark out the interval of 2220-2000 BC. A more detailed chronological and stratigraphic analysis will be possible only when all the sources are processed.

* * *

As a result of the program mentioned earlier, a series of radiocarbon dates was obtained practically for the whole cultural sequence recorded in the Akkiembetskiy *kurgan*. It should be stressed that it is the first multi-cultural feature so carefully examined in the whole of East European steppes. It will be possible to appreciate in full the undertaken effort when all the sources are presented, which should not take long.

Translated by Piotr T. Żebrowski

Aleksander Kośko

PONTIC TRAITS IN THE MATERIALS OF THE KUJAWY FUNNEL BEAKER CULTURE AND EARLY CORDED WARE CULTURE — A RADIOCARBON PERSPECTIVE

Kujawy, lying where the drainages of the Vistula and Oder meet (Fig. 1), marks the western frontier of the zone of discernible reception of the traits of the Pontic cultural circle. Pontic traits were received there by a chronologically long cycle of cultures beginning in the 6th millennium BC and continued with a special intensity by the Funnel Beaker culture (FBC) (beginning with phase IIIB), the Globular Amphora culture (GAC) and the Corded Ware culture (CWC), i.e. in the Late Neolithic [Kośko 1991].

In this paper we shall focus on FBC and CWC materials, or FBC/CWC ones, that exhibit the traits in question. The joining of these two taxa here is justified by the state of their development ties in Kujawy [Kośko 1997; cf. Kurzawa 1999]. Four complexes of traits were selected (both settlement and grave ones), in the case of which the identification of Pontic traditions seemed to be particularly reliable and taxonomically specific (Fig. 1). A number of complexes were disregarded because of less specific identifications (genetic and cultural) of their sources of inspiration. A. Latkowo, Kujawy-Pomorze Prov., site 5, settlement from phase VA of the FBC (Fig. 2) [Kośko 1990:315; 1996:99, materials under processing]. Rescue excavations (by the Dept. of Polish Prehistory, IP UAM) encompassed a significant portion of the settlement surface that had been uncovered because of a planned industrial investment. A selection of pottery from the layer and floor — of amorphous horizontal outline - of a large feature (semi-dugout ?) was recorded. Within the feature a large amount of pottery was found and a smaller number of animal bones. Among the pottery, fragments of a large amphora dominated. On its lip, an ornament of four lines of impressions of a three-strand cord was recorded together with four lines of zigzag impressions. Underneath, a pattern with zoomorphic motifs of two “herds” of deer is visible. The state of vessel preservation does not allow to fully reconstruct the scene (Fig. 2).

A stylistic and technological evaluation of the vessel clearly indicates its ties with the Radziejów group of the FBC, specifically with phase V [Kośko 1981]. A meager

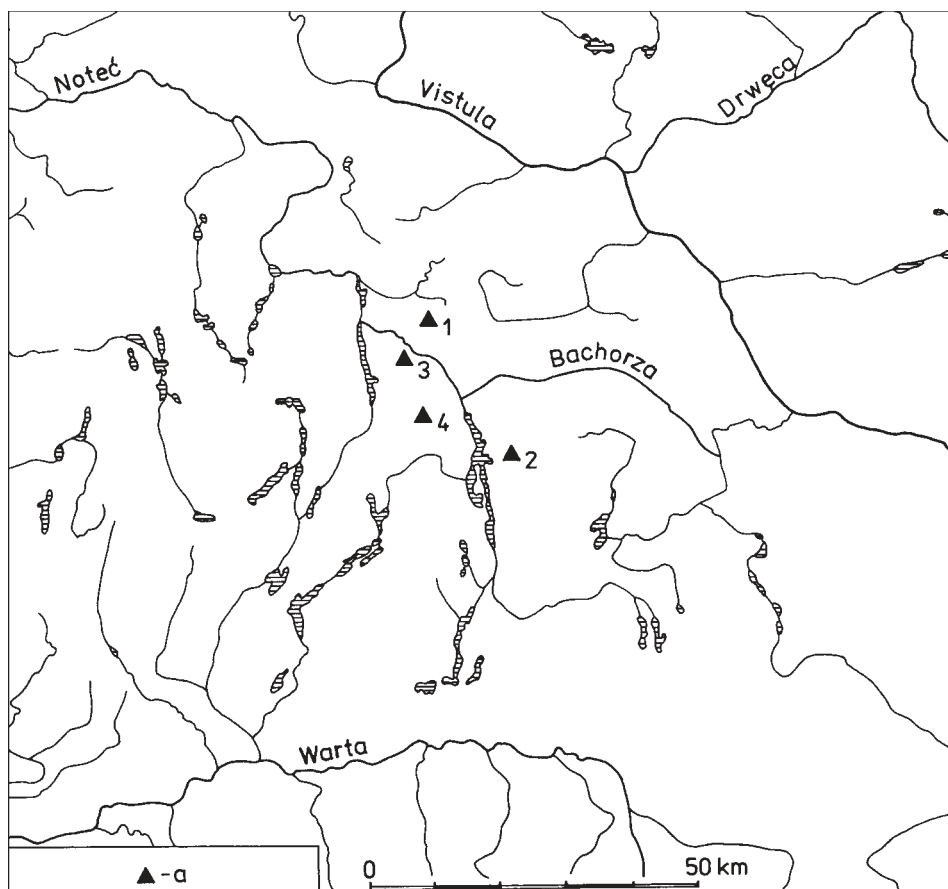


Fig. 1. Kujawy - location of source assemblages displaying Pontic traits discussed in the paper. (a): 1 - Latkowo, site 5; 2 - Opatowice, site 42; 3 - Krusza Zamkowa, site 3; 4 - Bożejewice, site 8

set of stylistic traits prevents any more detailed categorization, but allows one to point to subphase VA. From a sample of animal bones a ^{14}C date was procured: Gd - 4424:4560 \pm 90 BP, i.e. 3225 \pm 145 BC. This dating bears out the relationship of the assemblage with the suggested phase [Kořko 1999].

The zoomorphic pattern does not find any analogy in the FBC nor in the related Radziejów group of the Baden culture (BC) [Kořko 1988:103]. Relatively close analogies to this pattern can be found in the Tripolye culture (TC), where they are dated to phases BIII-CI/CII [Pasek 1949:108; Movsha 1972:16; cf. Jastrzębski 1988:55-68]. A particular abundance of zoomorphic ornaments is found in the “western” zone of the TC, especially in the upper drainages of the Prut, Reut and Dniester Rivers [e.g. Markevich 1981; Movsha 1985:234; cf. contrasting “eastern”

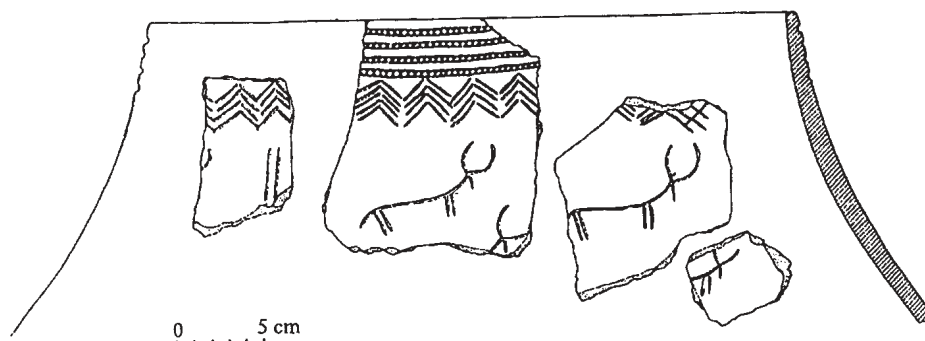


Fig. 2. Latkowo, Kujawy-Pomorzé Prov., site 5. Funnel Beaker culture settlement, phase VA

TC: Kruts 1977:62ff.]. As the result of these findings, it is possible to determine the following synchronization of the taxa: FBC (Kujawy) phase VA (Radziejów group) — TC phases BIII — CI/CII (Zhvaniets group according to T.G. Movsha [1985:232-237]; cf. Zhvaniets — Kuban - Brynzeny type [Jastrzębski 1989:17ff]).

B. Opatowice, Kujawy-Pomorzé Prov., site 42, a settlement of phase IVA/B of the FBC (Fig. 3) [Koško, Szmyt 1993, materials under processing]. The excavations (by the Dept. of Polish Prehistory, IP UAM) covered the whole accessible area of the site. As a result, a small, single-house settlement was unearthed with a significant amount of artifacts, primarily pottery.

The collection of pottery shows traits of a local, Luboń-Papros style, more specifically of their early development stage [Koško 1987:62-64; Koško, Szmyt 1993:176-177]. This classification is supported by the presence — as recessive traits — of late-Wiórek and Mątwy elements [cf. Chachlikowski 1994]. Keeping this in mind, the feature may be dated to phase IVA/B (or possibly beginnings of IVB) of the FBC, placing it in the late segment of the east-ern group. This chronological classification corresponds to the ^{14}C date of Gd - 2764:4460 \pm 80 BP, i.e. 3172 \pm 142 BC.

The stylistic traits of the FBC pottery from site Opatowice 42 may be divided into three genetic groups, namely local Luboń-Papros patterns, BC and hypothetical TC patterns. In the last mentioned case — which is of immediate interest to us here — what is chiefly meant is the use of painted ornaments, in particular of black wood-tar dye [Langer, Koško 1999]. As a result of the latest research, organic dyes may be genetically associated with the drainage of the Upper Tisza whence they must have been adopted — as substitutes for mineral dyes (?) — by the TC societies in the Upper Dniester area. This genetic identification is borne out by the presence

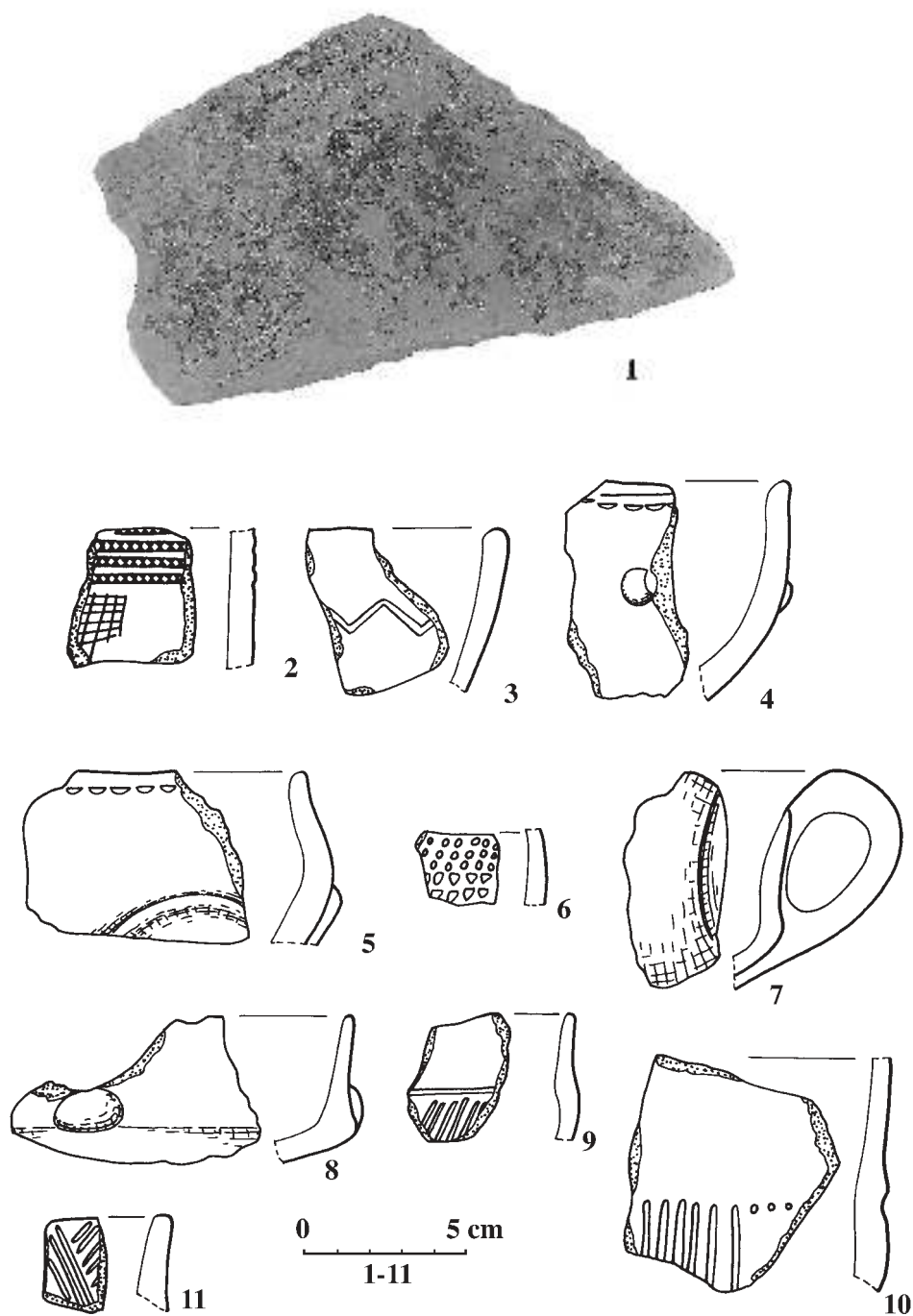


Fig. 3. Opatowice, Kujawy-Pomorze Prov., site 42. Funnel Beaker culture settlement, phase IVA/IVB. A selection of pottery. 1 - pottery fragment with black dye

of “Volhynia” raw-material artifacts in the Opatowice assemblage [without detailed identification of the bed, cf. Konopla 1998], resembling TC artifacts in the manner of their execution.

On the basis of the above observations, the following synchronization of the taxa can be proposed: FBC phase IVA/B (eastern group) — TC “late” phase (possibly C, i.e. domination of the black dye).

C. Krusza Zamkowa, Kujawy-Pomorze Prov., site 3, grave (*kurgan* ?) from phase A of the CWC (Fig. 4) [Koško 1992]. During the investigation of a vast settlement of the Przeworsk culture (by the Dept. of Polish Prehistory, IP UAM) a single burial related to the CWC was discovered (feature 427). In the 100x100x85 cm grave pit a child had been interred (Infant I) lying “supine with a leg drawn up vertically” (? — there are reasons to believe that the corpse was mutilated before the burial). The deceased wore a necklace and a “brassard” placed over the left hand (Fig. 4:2, 3, 6-9). On the grave bottom, to the right of the body, a clay vessel (Fig. 4:1), two flakes made of Baltic and chocolate flint (Fig. 4:4, 5) and a bone awl (Fig. 4:10) made from the tibia of a small ruminant were found. The grave pit was protected at its top with a pile of large cobblestones. At the circumference of a hypothetical mound, in the layer, two vessel fragments, similar technologically to the beaker, were unearthed. The vessels were a beaker and a bowl (Fig. 4:11).

The cultural marker of the burial is the type A beaker considered to be a marker of horizon A of the CWC [for a more detailed discussion see Koško 1997]. The deceased's bones were dated using the radiocarbon method and obtaining the date of Bln - 1812:4395±70 BP, i.e. 2997±101 BC.

While evaluating the place of origin of all the component traits of the assemblage, its complex provenience was stressed. It is a synthesis of many traditions to be found in the area between the Vistula and Dnieper [Koško 1992:89-94]. Among Pontic traits — specifically of the Yamnaya culture (YC) ones — the following can be named:

- grave pit form, i.e. a deep excavation (depth:width=1:1>, taking into account the depth of chernozem humus);
- equipping the deceased with a necklace including dog teeth (atypical for the Pontic region is the presence of amber beads as well);
- “steppe” positioning of the body on its back with legs drawn up;
- protection of the grave “pit” with a stone pile and — which is highly probable — a mound.

There are items that could be added to this list, e.g. traits of the Carpathian CWC — beaker form [Sveshnikov 1974: Fig. 2, 52, possibly 83] or of the late TC (phase CII) — corded-stamp patterns on the bowl found close to the grave [cf. Movsha 1971a].

To conclude, it can be reasonably accepted that phase A of the CWC (Kujawy

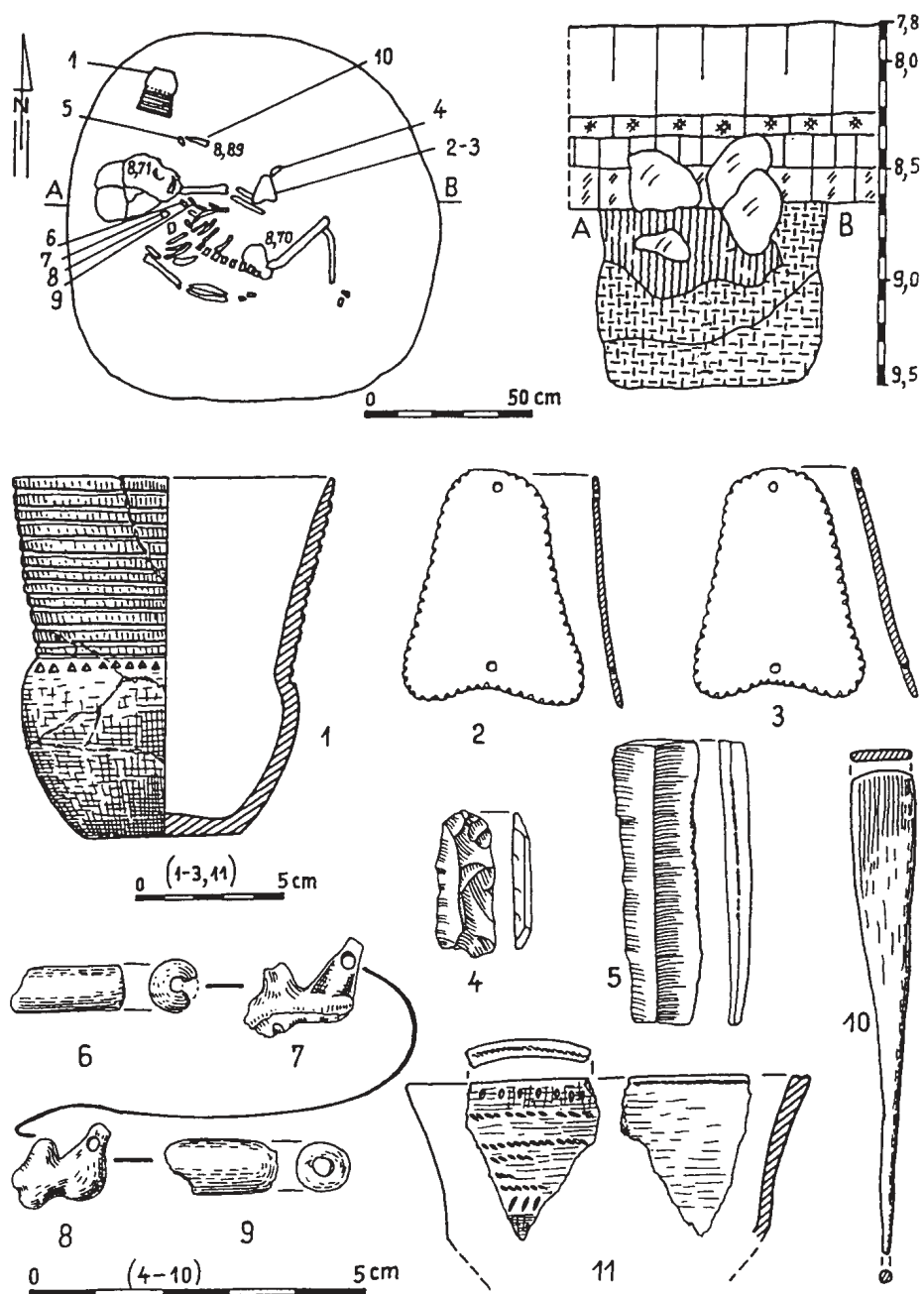


Fig. 4. Krusza Zamkowa, Kujawy-Pomorzé Prov., site 3. Corded Ware culture grave, phase A. 1-10 - from grave pit; 11 - from the mound (?) of a hypothetical *kurgan*)

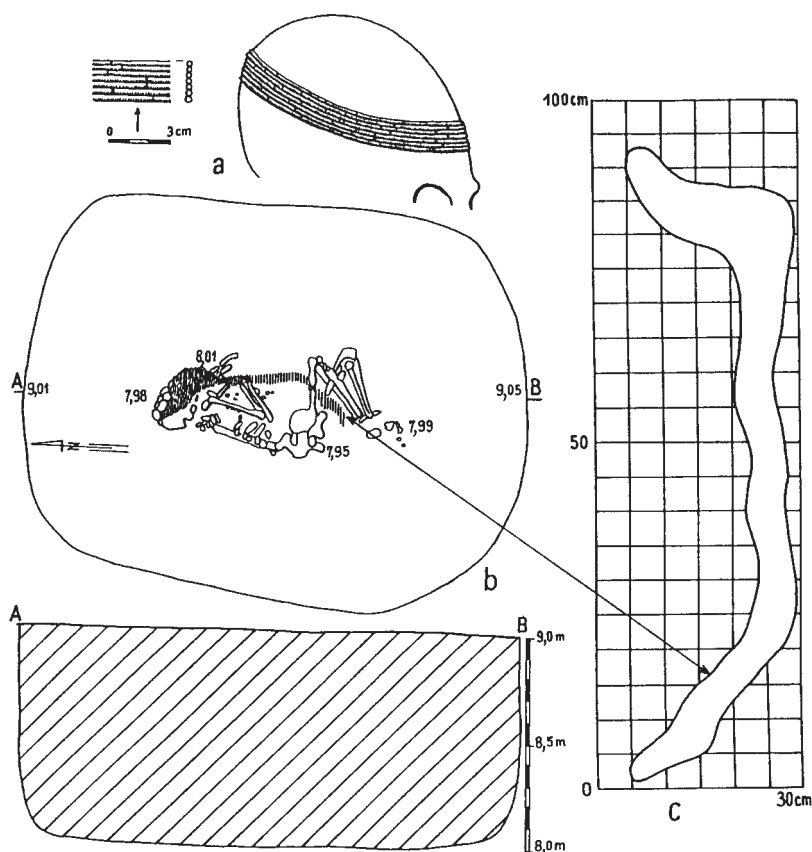


Fig. 5. Bożejewice, Kujawy-Pomorze Prov., site 8. Corded Ware culture grave, early phase

version) was synchronous with the YC and — with lower reliability — with the late TC, phase CII.

D. Bożejewice, Kujawy-Pomorze Prov., site 8, grave-*kurgan* from an early phase of the CWC (Fig. 5) [Koško, Klochko 1991]. The investigations (by the Dept. of Polish Prehistory, IP UAM) focused on the *kurgan* which was distinguishable on the surface. Underneath the mound, a single burial was recorded hypothetically connected with the CWC (feature 32B). In the 245x185x100>cm grave pit, a body of a woman aged 25-30 years had been interred in a slightly flexed position and lying on the left side. The deceased woman wore a diadem made of seven cords of thin copper pipes (2.7-3.0 mm in diameter) fastened to a tape of fabric or leather. On the body, a semi-composite bow was placed having first been charred. In the filling material of the grave pit, about 50 cm over the skeleton, there was

recorded a fragment of “technologically late” FBC or early CWC pottery [cf. Koško 1989:Fig. 22].

The cultural identification of the burial raises a number of doubts. There is no analogy to it in the Central European cultural environment. The sole direct link with the scale of local taxa is the pottery fragment found in the filling material of the grave. It can be considered a general classification clue which is meaningfully supplemented by a radiocarbon date secured from the coals of the charred semi-composite bow. The date, Gd - 888:4140±120 BP, i.e. 2717±153 BC, places the burial at the chronological and development level of the CWC. It cannot be excluded, however, that in this case we deal with a totally exogenous combination of cultural traits where the ceramic marker is a secondary insertion.

When the geographical origins of the burial are considered, it is absolutely clear that they must be in the east. Specifically, the burial relates to the traditions of the societies of the Pontic steppe or forest-steppe such as pre-Yamnaya ones (the oldest ornaments of copper pipes), Yamnaya ones (grave pit form, *kurgan*-type protection of the grave) or generally “nomadic” ones (semi-composite bow) [Koško, Kločko 1987; Koško, Kločko 1991]. A ^{14}C date prefers the YC factor in this register.

CONCLUSIONS

The reported observations suggest a two-level synchronization in the period of 3225±145-2717±153 BC of the following taxa:

- FBC, phases IVA/B — VA (Baltic zone — Kujawy) = TC, phases CI/CII, mainly (Pontic zone) and
- CWC, phase A (Baltic zone — Kujawy) = YC, possibly TC, phase CII (Pontic zone)[see Kločko, Koško, Szmyt, A Comparative. . . , in this volume] .

Translated by Piotr T. Żebrowski

Marzena Szmyt

TRIPOLYE TRAITS IN THE MATERIALS OF CENTRAL (POLISH) GROUP OF THE GLOBULAR AMPHORA CULTURE — A RADIOCARBON PERSPECTIVE

The question of contacts between the Globular Amphora culture (GAC) and the Tripolye culture (TC) societies has occupied scholars for a long time. They have mainly focused, however, on the eastern group of the GAC and the forest-steppe TC structures. The character of relationships between the two units has been assessed in most cases on the unreliable basis of the co-occurrence of the materials of both cultures on the same sites (especially, the presence of GAC ceramics at Tripolye settlements) [e.g. Passek 1949:222; Sulimirski 1959:279; Sveshnikov 1983:18]. Conclusions drawn from such data have led, for instance, to a wrong synchronization of the GAC with stage CI of the TC [e.g. Sulimirski 1959:167; cf. polemics in: Zbenovich 1976:46]. At present, the data is being expanded to include more convincing evidence of the partial contemporaneity of both cultures and direct contacts between their populations [e.g. Movsha 1985a; Szmyt 1999b]. Relying on still rather rare cases of the co-occurrence of GAC and TC traits and the current version of the chronology of both cultures [Videiko, Radiocarbon. . ., in this volume], one may justifiably accept a thesis about (partial?) the contemporaneity of the GAC and Late Tripolye groups of phase CII [Movsha 1985a:29].

As T.G. Movsha [1985a:28] stressed it, between the TC and GAC there had been no neutral zone. There is no doubt that areas occupied by GAC settlement in the forest-steppe zone had been earlier, and at least for some time contemporaneously, occupied by Late Tripolye groups (especially Gorodsk-Kasperovtsy group). What is stressed in this context is the different character of many aspects of life of people of both cultures [Gimbutas 1991]. However, to view the relationships between the societies solely from the point of view of their possible competition (or even strife) [e.g. Sulimirski 1970:166; Zakharuk 1971:179; Zbenovich 1976:46] would be premature.

* Project was financed in part with grant no. 1H011g01810 provided by the Polish Committee for Scientific Research in 1996-1998.

Much less attention has been given to the question of the presence of Tripolye traits within the central (Polish) group of the GAC. The list of possible identifying markers was rather short with the most important being vessel ornamentation with two-strand cord impressions. The acceptance of the hypothesis about the Pontic origin of this type of ornamentation in the Funnel Beaker culture (FBC) [Koško 1981:99-101] led to the conclusion that analogous ornamentation in the GAC had a similar origin (via the FBC) [Koško 1991b:94, Czebreszuk, Szmyt 1992:116-117].

Now, thanks to the most recent results of field research we have an entirely new category of sources testifying to mutual contacts between TC societies and those of the central GAC group. These are vessels with traces of intentional coloring of the outer surface which have been identified within the Kujawy GAC agglomeration [Szmyt 1996a].

1. CATALOGUE OF SOURCES

The sources currently consist of fragments of six vessels recorded at four archaeological sites: Bożejewice 22, Kuczkowo 1, Piecki 8, and Żegotki 2. The pottery has been subjected to physicochemical analyses that helped identify dyes and determine their properties [Langer, Pietrzak 1999; Langer, Szmyt 1999]. The context of each find has been discussed in detail in source publications [Szmyt 1998; 1999a].

A. Bożejewice, Kujawy — Pomorze Prov., site 22, feature A10. In a pit [Szmyt 1999a], a belly pottery fragment was recorded. On its outer surface, a thin layer of dark dye was macroscopically identified (Fig. 1:a). The burning of the fragment prevents any assessment of the technology used to make it. The dye was subjected to physicochemical analyses [Langer, Pietrzak 1999] which showed it to be a highly carbonized substance [“having a low content of organic compounds built of saturated hydrocarbon groups”] whose characteristics differed from those of wood tar or bituminous materials. Nevertheless, the dye was found to have been obtained “in a process similar to that in which wood tar is obtained and used” [Langer, Pietrzak 1999]. The dye was treated with high temperature (most probably the technology of “thermal stabilization of the dye layer”) [Langer, Pietrzak 1999].

B. Bożejewice, Kujawy — Pomorze Prov., site 22, feature A2. In a pit [Szmyt 1999a], a belly pottery fragment was recorded. On its outer surface, a thin layer of reddish-brown substance was macroscopically identified (Fig. 1:b). The vessel had been made according to a formula known as technological group IIIB1 [Szmyt

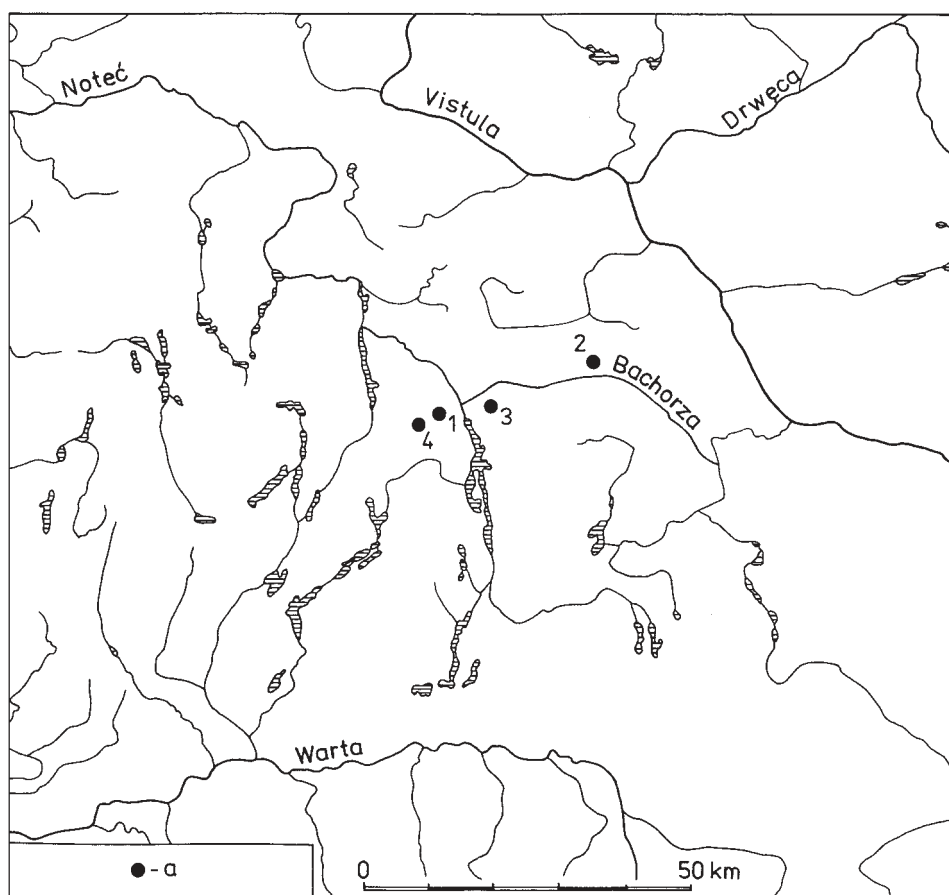


Fig. 1. Location of Globular Amphora culture sites displaying "Tripolye" traits in Kujawy.
1 - Bożejewice, Kujawy - Pomorze Prov., site 22, 2 - Kuczkowo site 1, 3 - Piecki site 8, 4 - Żegotki site 2

1996:26-27], i.e. containing leaning temper consisting of coarse crushed stone and fine and medium grain sand, which are readily visible in the compact fracture. The results of physicochemical analyses showed the dye to be a mineral substance made on the basis of iron oxides "which are transformed into a durable red compound, Fe_2O_3 , known as hematite, when pottery is fired in oxidizing conditions" [Langer, Szmyt 1999]. The dye was spread over a specially prepared beige ground made from ceramic material in the process of firing thanks to appropriate thermochemical treatment [Langer, Szmyt 1999].

C. Kuczkowo, Kujawy — Pomorze Prov., site 1, feature A136. In the upper portions of the deposits covering a ritual feature containing a cattle burial on its bottom

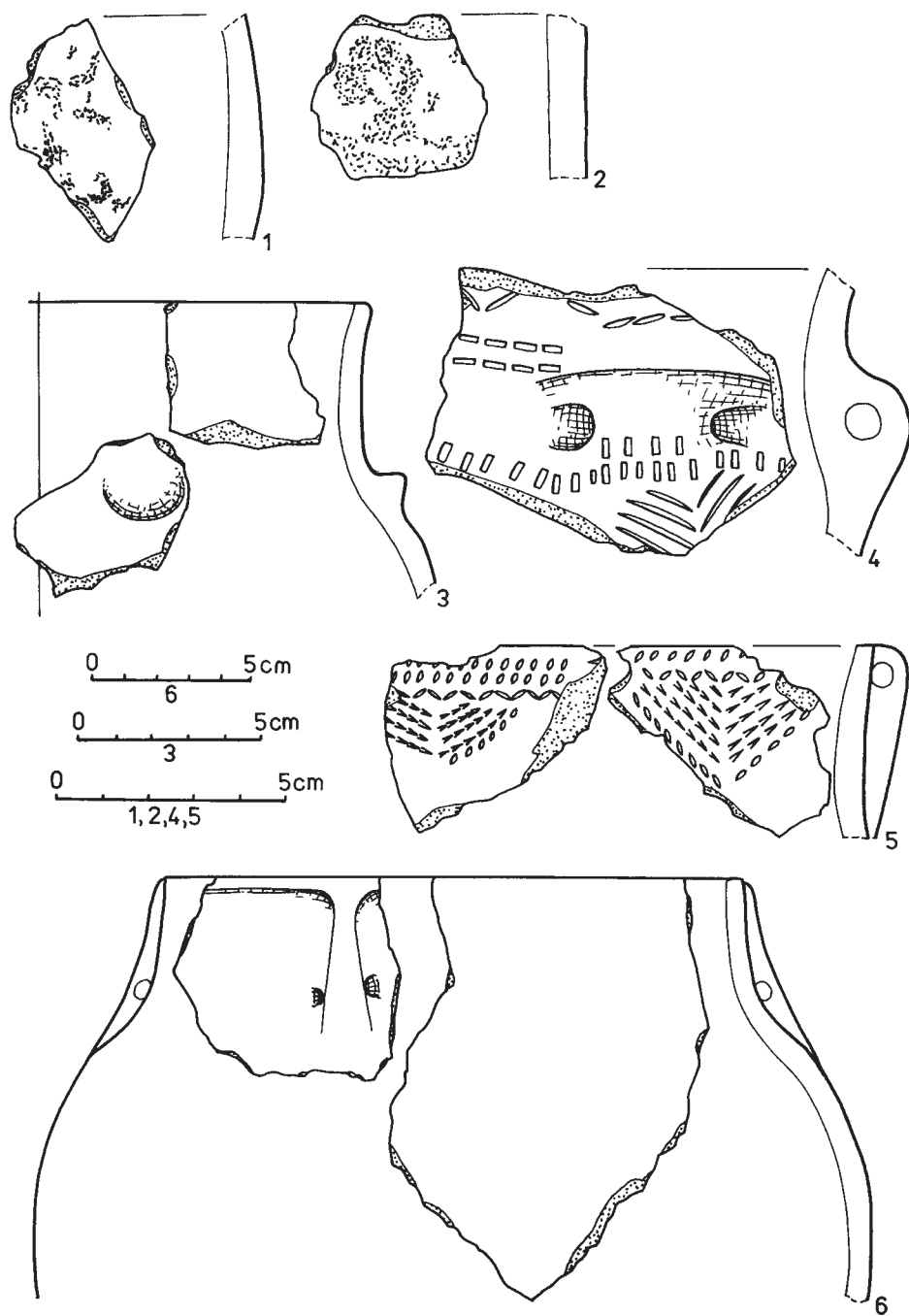


Fig. 2. Bożejewice Kujawy-Pomorze Prov., site 2. A selection of Globular Amphora culture pottery from features A2(1) and A10 (2-9). 1 - fragment with black dye, 2 - fragment with red dye

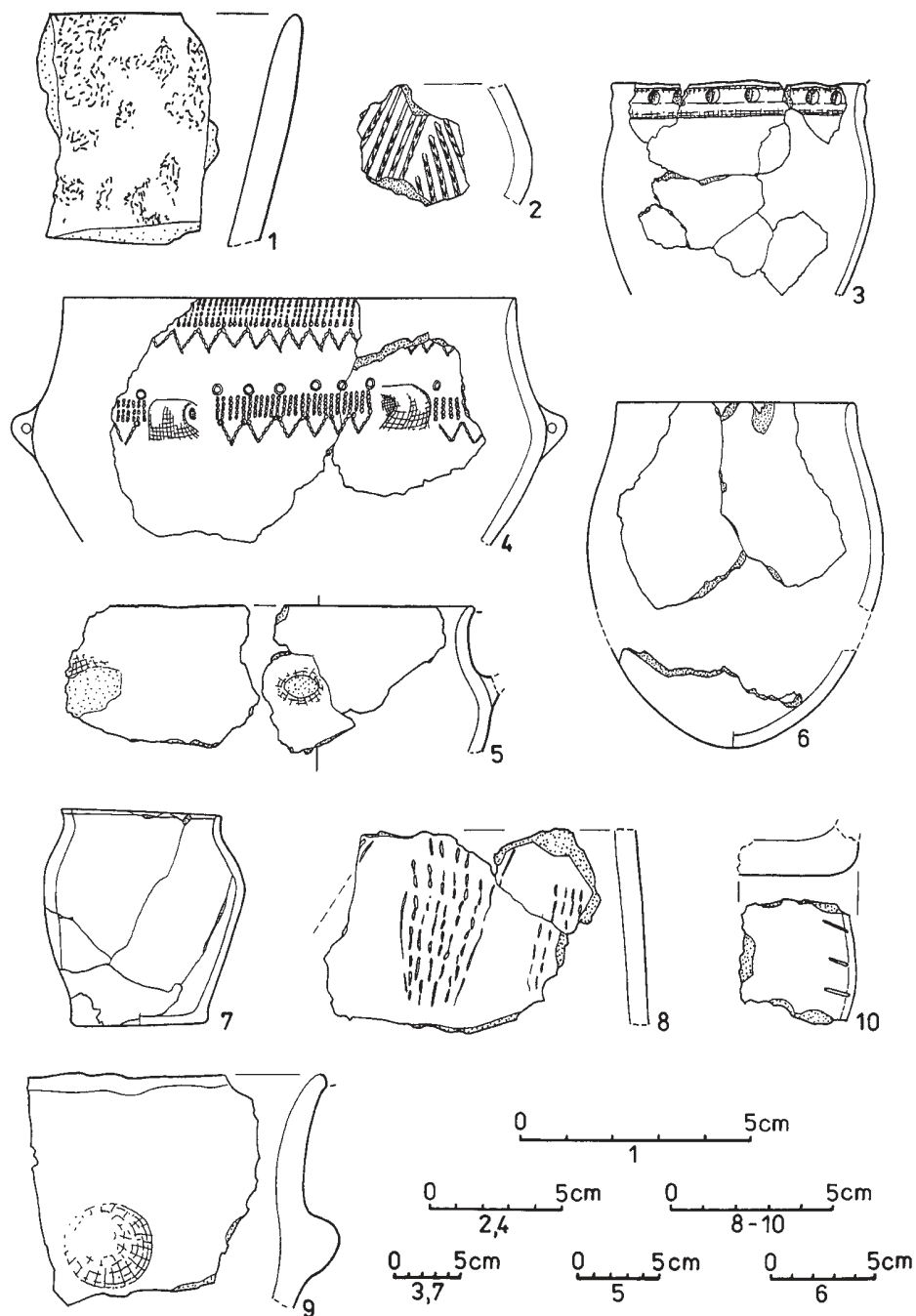


Fig. 3. Kuczkowo Kujawy - Pomorze Prov., site 1. A selection of Globular Amphora culture pottery from feature A136. 1 - fragment with black dye

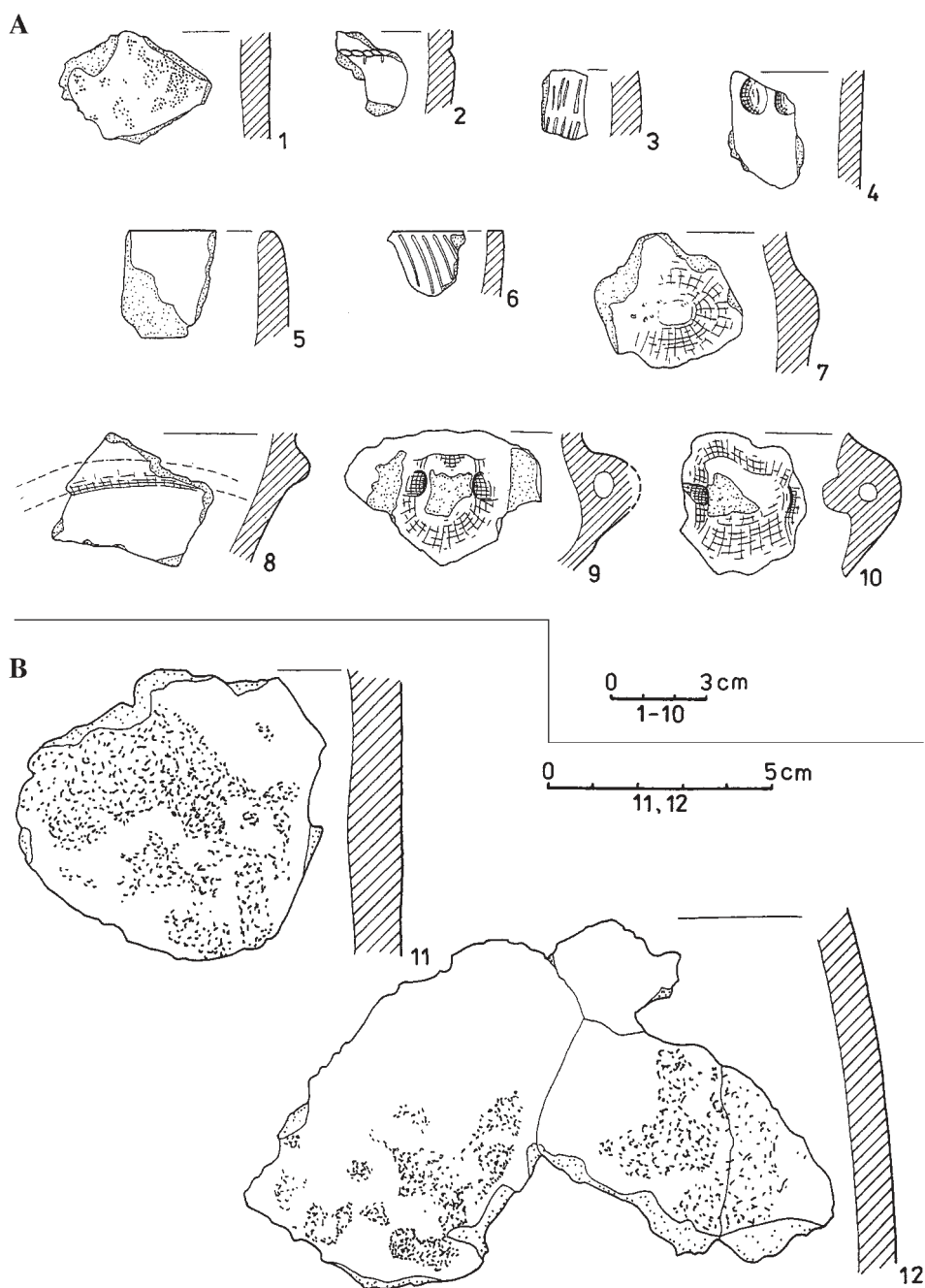


Fig. 4. A. Piecki Kujawy - Pomorze Prov., site 8. A selection of Globular Amphora culture pottery from feature 18. 1 - fragment with red dye; B. Żegotki, site 2, excavation B1a. Pottery fragments with red dye

[Szmyt 1999a], a pottery fragment with a thin layer of black dye on its outer surface was found (Fig. 1:c). The vessel had been made according to a formula known as technological group IIb1 (cf. item B above). The partially preserved rim of the vessel belongs to type 1e [Koško 1981:32-33], i.e. it has straight walls and an arched top. The dye was identified using physicochemical analyses to be analogous to that in the case of fragment A [Langer, Pietrzak 1999].

D. Piecki, Kujawy — Pomorze Prov., site 8, feature 18. In deposits covering a grave [Szmyt 1998], a fragment of a vessel belly was found. On its outer surface, it bore traits of reddish-brown dye (Fig. 1:d). The vessel had been made according to a formula known as technological group IIb1 (cf. item B above). Physicochemical analyses confirmed the macroscopic identification of the dye which turned out to be a mineral substance having similar properties to those in the case of fragment B. The only difference is the fact that the bright (beige) ground was purposefully spread over the gray ceramic material as an “additional thin layer on the surface of a preliminarily fired vessel” [Langer, Szmyt 1999].

E. Żegotki, Kujawy — Pomorze Prov., site 2, excavation B1a. In the slopewash covering the upper portions of the excavation, underneath a thicker layer of humus [Szmyt 1999a], seven belly fragments of the same vessel were recorded. On its outer surface, a red substance was found (Fig. 1:e). The vessel was made according to the formula known as technological group IIb2, i.e. with temper of coarse broken stone, plant admixture and fine/medium grain sand; its fracture was stratified. One of the fragments was analyzed physicochemically to find out if the macroscopic identification of the dye was correct. It turned out to be a mineral substance of analogous properties to those in the case of fragment B [Langer, Szmyt 1999]. The dye was spread on a brown ground obtained from a ceramic material during the process of firing.

F. Żegotki, Kujawy — Pomorze Prov., site 2, excavation B1a. In the same stratigraphic location as fragment E, remains of another vessel were found. Their outer surface was covered with a red substance as well (Fig. 1:f). The vessel was made according to formula IIb1 (see item B above). In this case, too, physicochemical analyses confirmed the macroscopic identification of the dye which was found to be a mineral substance whose properties were analogous to those of fragment B [Langer, Szmyt 1999].

As it can be seen from the above information, in the analyzed sources organic and mineral dyes were identified. The former were made from materials related to wood tar [Langer, Koško 1986], while the latter were based on iron oxides. Being relatively badly damaged, the colored surfaces prevent identification of any ornamentation patterns. What can only be ascertained is the fact that dyes were used to color edge or belly portions of vessels.

2. CHRONOLOGICAL ANALYSIS

The sources presented in the first part come from settlement (A, B), sepulchral (D) and other ritual (C) features as well as from a “cultural layer” (E, F). In all the cases, it is possible to determine the relative chronology of respective features [Szmyt 1998; 1999a]. In particular, three of them (Bożejewice 22, features A2 and A10 and Kuczkowo 1, feature A136) may be related to phase IIb of GAC settlement according to the Kujawy periodization [Szmyt 1996: 34-35], one (Piecki 8, feature 18) to phase IIIa, while the “cultural layer” from Żegotki 2 may be associated with phases IIb-IIIa. These chronological assessments are borne out and adjusted by a series of radiocarbon datings presented in Table 1.

Table 1

¹⁴C datings related to GAC features containing painted pottery. Calibration using Weninger 1993

No.	Locality	Feature	Phase	Type of feature	Material	Lab. no.	Conv.bp	Cal BC [Weninger 1993]
1	Kuczkowo 1	C2	IIb	ritual	bones	Ki-6920	4525±45	3200±95
2	Kuczkowo 1	C2	IIb	ritual	bones	Ki-6496	4520±45	3203±95
3	Kuczkowo 1	C2	IIb	ritual	bones	Ki-6919	4490±40	3226±98
4	Kuczkowo 1	C2	IIb	ritual	bones	Ki-6921	4480±40	3209±106
5	Kuczkowo 1	A136	IIb	ritual	bones	Ki-6927	4420±55	3010±105
6	Kuczkowo 1	A136	IIb	ritual	bones	Ki-6917	4415±45	3003±81
7	Kuczkowo 1	A136	IIb	ritual	bones	Ki-6929	4400±50	2994±76
8	Kuczkowo 1	A136	IIb	ritual	bones	Ki-6928	4385±45	2977±62
9	Kuczkowo 1	A136	IIb	ritual	bones	Ki-6926	4370±50	2974±62
10	Bożejewice 22	F44	IIb	pit	bones	Ki-6913	4335±40	2946±53
11	Bożejewice 22	A2	IIb	ritual	bones	Ki-6914	4305±45	2929±57
12	Bożejewice 22	A3	IIb	pit	bones	Ki-6912	4275±45	2843±78
13	Piecki 8	16	IIIa	pit	bones	Ki-5681	4270±30	2891±37
14	Piecki 8	13	IIIa	pit	bones	Ki-5680	4230±25	2819±65
15	Piecki 8	18	IIIa	grave	bones	Ki-6513	4105±40	2594±108
16	Żegotki 2	A68	IIIa	pit	bones	Ki-6220	4150±45	2740±101
17	Żegotki 2	A113	IIIa	ritual	bones	Ki-6221	4030±60	2539±81

Bożejewice 22. Both features (A2 and A10) are related to the same settlement phase, identified at the site, to which three datings refer including one from feature A2 (Table 1). A joint calibration [Weninger 1993] of the three datings gives a fully

legitimate result indicating that the settlement was occupied about 2897 BC (1 Σ interval of 3000-2880 BC) [Szmyt 1999a]. It is also this chronology that can be ascribed to the discussed pottery fragments.

Kuczkowo 1. For the bones of an animal buried at the bottom of feature A136, five datings were obtained (Table 1), the joint calibration of which sets the time of ca 3031 BC (1 Σ interval of 3070-2920 BC) [Szmyt 1999a]. Because the fragment of painted pottery was found in the deposits covering the feature, the dating cannot be directly applied to it. On account of the homogenous character of the filling material, it may be accepted that the grave was filled relatively quickly. It means that the dating corresponds to the chronology of the discussed fragment or sets *terminus ante quem* for it. Admittedly, in the zone of the site close to feature A136, no signs of older GAC settlement were found, but such signs were actually found approx. 200 m west of it (feature C2). They are also associated with phase IIb, but with its older segment occurring ca 3230 BC (1 Σ interval of 3300-3110 BC). This result was obtained by calibrating four radiocarbon datings from feature C2 [Szmyt 1999a]. In sum, the most probable chronology of the analyzed fragment fits into the period of 3230-3030 BC.

Piecki 8. The bones of a deceased person, placed on the bottom of a grave (feature 18) were dated producing a date of ca 2594 \pm 198 BC (2700-2490 BC; Table 1). At the site, however, older settlement was recorded belonging to phase IIIa as well [Szmyt 1998]. Some light is shed on its chronology by the concurrent datings of two settlement pits (of features 13 and 16) whose joint calibration marks out the time of ca 2886 BC (1 Σ interval of 2890-2760 BC). The fragment of a painted vessel was recorded in the deposits covering the grave. Hence, it is most probable that the date from the grave is *terminus ante quem* for the fragment, whereas the dates from settlement features are its *terminus post quem*. In other words, the chronology of the fragment lies within the interval of max. 2890-2490 BC (minimum interval: 2760-2700 BC).

Żegotki 2. In the “cultural layer”, in excavation B1a, there occurred materials displaying features associated with phases IIb and IIIa of the GAC [Szmyt 1999a]. ¹⁴C dates are available only for two features associated with the same phase, namely IIIa, but with settlement dating to two different periods: the older one occurring ca 2740 \pm 101 BC and the younger one dated to 2539 \pm 81 BC (Table 1). Consequently, the two dates set *terminus ad quem* for the fragments of painted pottery presented here, i.e. the chronology of the fragments should fall on the younger of the named intervals at the latest.

To sum up all the recounted investigations, it can be said that the hitherto recorded manifestations of the use of dyes in the manufacture of GAC ceramics are related to phases IIb and IIIa, while its absolute chronology covers the period of max. 3230 (Kuczkowo 1) - 2460 (Żegotki 2) BC. A more credible, however, seems to be the interval of 3030-2460 BC. When considered separately, the chronologies

of the use of organic and mineral dyes differ considerably. The former have been identified so far only in phase IIb materials (Kuczkowo 1, Bożejewice 22), while the latter have been recorded in pottery assemblages from phases IIb and IIIa (Bożejewice 22, Piecki 8, Żegotki 2). The absolute chronology may be thus fixed at 3030- 2900 BC (organic dyes) and 2900-2460 BC (mineral dyes).

CONCLUSION

The origins of the ornamentation type of GAC pottery discussed here may be sought only in the TC circle. The chronological findings presented above allow us to synchronize the manifestations of the use of dyes among the societies of the Kujawy GAC with phase CII of the TC [see papers by Videiko, Radiocarbon. . . , Koško, Klochko, Szmyt, A Comparative. . . , in this volume]. Further studies should focus on tracing the transmission routes and mechanisms of this unique technology from Pontic to Baltic communities. At present, the most plausible hypothesis seems to be the one about the transmission through the mediation of Volhynia GAC societies [Szmyt 1996; 1999b]. It must be noted, however, that the chronology of the oldest manifestations of the use of the pottery painting technique in the Kujawy GAC, set above at ca 3030 BC at the latest, precedes the oldest datings for Volhynia GAC structures [Kadrow, Szmyt 1996; Szmyt 1999b]. Furthermore, in the materials of the eastern group of the GAC no traces of dyes have been found. Therefore, it is not entirely impossible that the transmission of the discussed skills involved Kujawy FBC societies among whom the use of dyes (primarily organic ones) reaches back to ca 3600 BC [Langer, Koško 1992]. What is more, as it follows from the data cited in part 2, the traces of the use of organic dyes are on the whole older (associated exclusively with phase IIb and dated to ca 3030-2900 BC), whereas those of mineral dyes are younger (are associated with phases IIb and IIIa and can be dated to 2900-2460 BC). The question, however, calls for more studies.

* * *

The experience so far has indicated that the technologies of spreading dyes on pottery, originating with the TC, were adopted chiefly by FBC societies. [Langer, Koško 1992]. The findings discussed here argue in favor of a wider reception of these technologies than it was thought before. The circle of reception is made still wider by the information about the use of (mineral?) dyes by Old Upland (Małopolska) groups of the CWC (Żerniki Górne, grave 140 and Smroków) [Włodarczak 1998].

Translated by Piotr T. Żebrowski

Jan Machnik

RADIOCARBON CHRONOLOGY OF THE CORDED WARE CULTURE ON GRZĘDA SOKALSKA. A MIDDLE DNIEPER TRAITS PERSPECTIVE

1. INTRODUCTION

Discovered in the early 1970's, the barrows in the southern part of Grzęda Sokalska [Gurba, Wojtanowicz 1974] waited until the late 1980's to be systematically excavated. With the barrows being heavily damaged, the excavations were clearly of a rescue type [Bagińska 1988; Koman, Machnik 1993]. The barrows, numbering a few dozen and occurring in small groups, most often in pairs 200-300 m apart, stretch E-W for about 15 km along the crests of loess hillocks forming (Fig. 1, 2) the divide between the Huczwa and Rzeczyca Rivers (left tributaries of the Bug). The surviving height of the barrows is generally from 0.5 to 2.0 m (in forest) with the diameter oscillating between 10 and 30 m. Next to them, there are single large barrows in this area (which must be younger than the Neolithic) a few meters high and up to 50 m in diameter at the base [Koman, Machnik 1993:41,42; Fig. 1]. So far, twenty-four barrows, in various stages of destruction, have been excavated. In most cases their mounds have barely been preserved. Almost all of them turned out to be *kurgans* of the Corded Ware culture (CWC) from different phases of its existence [Bagińska 1998; Koman 1998]. Some of these *kurgans* included more than one human burial with most of the burials being placed off the *kurgan* center or frequently even at the edge of its mound. They were skeleton inhumations in grave pits, sometimes of a niche type. In some better preserved *kurgans*, a symbolic groove (in two cases a double one), dug into the undisturbed soil, was found underneath their mounds. The groove encircled one of the burials, usually the central one. In a clear majority of graves, both centrally located and placed off center, there were

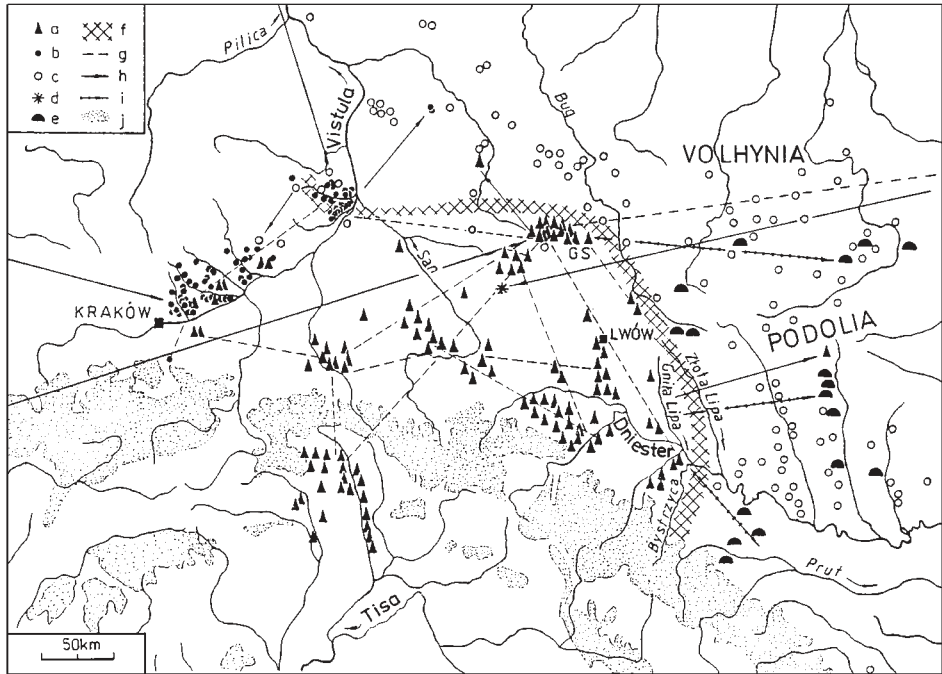


Fig. 1. A general map of single Corded Ware culture graves and their clusters in the interfluvial area of the Upper Vistula, Upper Bug and Dniester Rivers: a - clusters and single CWC kurgans, b - clusters and single flat graves of the Kraków-Sandomierz group of the CWC, c - clusters and single GAC graves, d - site of a presumed MDC grave assemblage (Młodów-Zakęcie), e - kurgans with CWC traits from the late 3rd millennium BC, f - zone separating compact ranges of the CWC and GAC, g - directions of movement of cultural traits (movement of shepherds) within the CWC area between the Upper Vistula, Upper Bug and Dniester, h - directions of far-reaching intrusions into the CWC area between the Upper Vistula, Upper Bug and Dniester, i - directions of the spreading of kurgans with CWC traits in the late 3rd millennium BC, j - main range of the Carpathians and Sudetes, over 500 m above the sea level. Letters GS stand for Grzęda Sokalska.

found numerous grave-goods, including complete vessels. This made it possible to thoroughly analyze, both typologically and stylistically, the cultural content of the kurgans. As a result we have obtained evidence of a great diversity of artifact forms as well as of pottery ornament patterns. The patterns have far-reaching analogies not only within the CWC but also to the Middle Dnieper culture (MDC). This, as well as certain stratigraphic observations and ^{14}C dates are a proof of considerable chronological differentiation between individual kurgans (even neighboring ones) as well as between graves located within them or nearby.

The CWC kurgans on Grzęda Sokalska mark the northern frontier of the compact range of the south-eastern branch of the culture covering the area located on



Fig. 2. Kurgans and traces of Neolithic settlements Funnel Beaker culture in the southern part of Grzęda Sokalska (Podkarpacie Prov.): 1 - Corded Ware culture *kurgans*, 2 - large *kurgans* of unknown chronology, 3 - traces of Neolithic settlements. The map gives numbers of sites discussed in the text with their affiliation to a given locality shown with a line.

the right bank of the Upper Vistula in the west and the Gniła Lipa and Bystrzyca Sołotwiska Rivers in the east (see map). The area also includes certain foothill regions of the Carpathians with the Ondawa and Laborec Highlands in the drainage of the Upper Tisa. To the north and east of the area (Fig. 1), there stretches a zone of the compact range of the Globular Amphora Culture (GAC), for a long time contemporaneous with the branch of the CWC of interest to us here which occupied the area between the Upper Vistula, Upper Bug and Dniester [Kadrow, Szmyt 1993].

The fact that it has been possible in the last decade to excavate such a large number of CWC *kurgans* on Grzęda Sokalska, a considerable number of which have been assigned absolute dates, allows us to investigate this culture better and to study the behavior of its founders in greater detail also in the context of the spatially distant MDC. This is possible because among the excavated CWC graves on Grzęda Sokalska there are some which contained pottery with traits more or less typical of the latter (i.e. MDC). The MDC is also counted among the wide spectrum of cultures with corded wares [Buchwaldek 1986a:11, Fig. 1].

2. GRAVE ASSEMBLAGES FROM GRZĘDA SOKALSKA WITH MIDDLE DNEIPER LINKS

Out of about thirty discovered CWC human burials in the area under discussion, six contained pottery (at least one vessel) with clear Middle Dnieper links. In addition, two other graves contained mortar-like beakers that might be a distant echo of influences coming from that direction. Among the former, two burials clearly stand out with vessels that have very close counterparts, both in respect of form and ornament, in MDC pottery. These are graves nos. 2 and 3 discovered during the excavation of a *kurgan* on site no. 3 at Hubinek in 1997 [Koman 1998]. Both graves (Fig. 3:A, B), dug into the undisturbed soil, were located at the original edge of the mound of the *kurgan* (Fig. 3:A1). In grave no. 1, located underneath the mound (however, not exactly in the center of the *kurgan*), there was a record number of seven vessels, considering what is typical of the CWC. All the vessels were typical only of the said culture (Fig. 3C), specifically of its late phase with one vessel (Fig. 3:C6) displaying clear resemblance to GAC amphorae¹.

Interesting Middle Dnieper traits are particularly clearly visible in one of the two beakers found in grave no. 2 mentioned before (Fig. 3:B1). The walls of the beaker are slightly curved inwards while the bottom section is rounded and has a regularly circular concavity in the bottom. The upper section of the vessel is decorated with three horizontal bands of incised herringbones with the middle band being considerably wider than the other two. The shape of the beaker bears clear resemblance to vessels of the same type (being a certain variety of “hourglass” beakers) in the MDC, for instance to a specimen from grave no. 3 in *kurgan* no. 1 in Khodosovichi and even more specifically to a specimen from grave no. 12 in Strelica on the Upper Dnieper [Artemenko 1967:17, Fig. 4:2, 3]. A less typical of this culture, although appearing in its assemblages, e.g. in Belynets on the Desna [Artemenko 1987:168, Fig. 12:27], is the other specimen from the grave under discussion, i.e. a beaker of a sinusoid profile with a strongly protruding belly whose greatest protrusion is in the lower section of the vessel (Fig. 3:B2). It differs from MDC beakers of this type by the presence of a marked, slightly concave bottom, however small, whereas in its Middle Dnieper counterparts the bottom is not usually marked, being rounded or even convex [Artemenko 1967:87, Fig. 49:6].

The other artifacts from grave no. 2 in Hubinek, i.e. a tetrahedral flint celt, heart-shaped arrowhead, retouched chip, broken flake and a bone punch (Fig. 3:B3-7), occurring in the whole circle of corded ware cultures do not indicate clearly any

¹ In addition, within this *kurgan* (Fig. 3A1), two other features (nos. 5 and 7) were discovered. These are settlement features containing potsherds of painted ceramics of the Volhynia-Lublin culture and the Funnel Beaker culture. In feature no. 7 an unpublished vessel fragment was found (probably of an amphora) decorated in a way characteristic of an older CWC phase. On the edge of the original *kurgan* mound two other graves had been placed (nos. 4 and 6) most probably belonging to the Mierzanowice culture of the Early Bronze Age [Koman 1998:67].

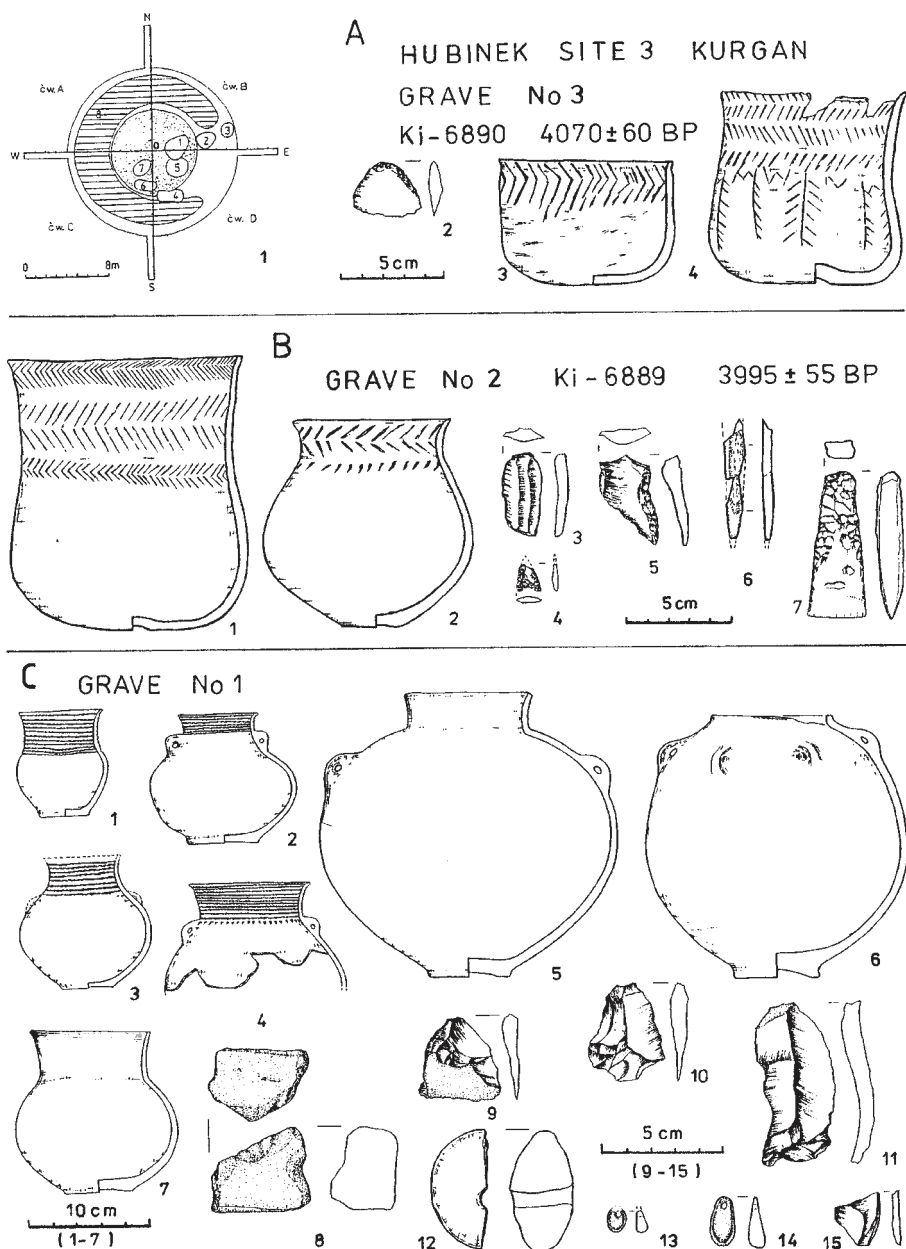


Fig. 3. Hubinek, Podkarpacie Prov., site 3 (A,B,C - *Kurgans*), *kurgan* A, grave no. 3: 1 - *kurgan* outline, 2 - flint, 3, 4 - pottery; *kurgan* B, grave no. 2: 1, 2 - pottery, 3-5, 7 - flint, 6 - bone; *kurgan* C, grave no. 1: 1-7 - pottery, 8 - stone, 9-11, 15 - flint, 12 - clay, 13, 14 - bone. Foll. Koman [1998].

taxonomic unit of the circle. The same can be said about the characteristics of the burial rite observed in the grave (the deceased is placed on his right side in a flexed position, along the SW-NE axis, with the head pointing SW and grave goods placed at his legs and hips) which are common to at least a few units of the said circle, two of them being the CWC between the Upper Vistula, Upper Bug and Dniester [Machnik 1998] and a significant portion of the MDC [Artemenko 1967:82].

In child grave no. 3 at site 3 in Hubinek, both vessels found there (Fig. 3A3, 4) bear a striking resemblance to forms of this type in the MDC. The first of the two is a small beaker (Fig. 3A4) similar to the specimen from grave no. 2 on the same site (Fig. 3B1), but differing from the latter in the fact that the inward indentation of its walls is moved up, which brings it closer to MDC beakers from Syabrovichi and Khodosovichi [Artemenko 1987:167, 168, Fig. 12:32; 13:27] or even to a squattier variety from Jackowica (currently Dolinka) near Vinnitsa [Bydłowski 1905: Tab. II, 2]. Additionally, it is decorated with a combination of patterns frequent in the MDC, namely a horizontal incised herringbone in the upper section of the vessel and a vertical one in its lower section separated by a dotted zigzag. Thus, the patterns cover almost the whole surface of the vessel, as is the case in the majority of beakers of the culture in question. The other vessel from the said grave is a beaker (Fig. 3:A3) with almost straight walls that slightly bend in under the rim. The walls smoothly change into the bottom which is flat only in the middle. The beaker is decorated at the top with a horizontal pattern of a large casual herringbone and an incomplete row of slanting incisions (Tab. Fig. 3:A3). This form type has not found yet any accurate counterparts in CWC assemblages; it refers partially to some specimens of the Kawsko type (a small group of finds from the Upper Dniester) which are believed by some authors to be a manifestation of eastern influences, i.e. of the Yamnaya (Pit Grave) culture (YC) or the MDC [Berniaković 1959; Sveshnikov 1974:33]. From the latter ones, however, our specimen differs in both the shape of the bottom and in the ornament. Kawsko-type beakers (Fig. 8:25, 26), most probably dating from the Early Bronze Age [Machnik 1979], have rounded bottoms and are decorated with horizontal impressions of a thick cord at the top. A closer similarity to our specimen is shown in this respect by certain MDC vessels of this type. What is meant here is, e.g. a beaker from Stretovka with a flattened bottom and a slight narrowing of walls decorated at the top with a horizontal pattern of an incised herringbone [Artemenko 1967:28, Fig. 16:2]. A pattern of a large, casually incised herringbone covering only the upper portion of the vessel, analogous to the specimen from Hubinek, is encountered on a small MDC mug/cup with bulging walls from *kurgan* no. 5 in Ryżanówka². The third artifact from the grave, i.e. the retouched flake of Volhynia cretaceous flint (Fig. 3:A2) has no diagnostic traits. To a certain extent the same can be said about the arrangement of the skeleton of a four-year-old child in grave no. 3 (on its side,

² The vessel, which has not been published yet, is in the collection of the Archaeological Museum in Kraków.

along the E-W axis, with the head pointing E, flexed, with hands bent in elbows and pointing to the face). The arrangement occurs both in the CWC, specifically in the drainage of the Upper Dniester [Sulimirski 1968: Plan 35], and in the MDC [Artemenko 1967:86].

In the neighborhood of the *kurgan* on site 3 in Hubinek, during the excavation of which two graves numbered 2 and 3 were discovered, another *kurgan* was found known as site 4 [Bagińska 1998:70 et al.]. Under the *kurgan*'s mound, traces of a circular groove were found and, to all appearances, a shaft of a niche grave dug in it. Within the space encircled by the groove no grave has been found³. However, on the edge of a claypit, from which soil was taken to make the *kurgan*'s mound, a FBC settlement pit was discovered (Fig. 4:A1). The niche grave might have been dug in the loess undisturbed soil from the shaft cutting into the edge of an already existing *kurgan* mound⁴. Approximately in the middle of the ample chamber of the niche grave (Fig. 4:A2), a man's skeleton lying along the SE-NW axis on its right side with its legs strongly flexed and the head pointing NW was found. In addition, at the southern wall of the chamber, bones of another individual forming a heap without any anatomical order were discovered. Below the legs of the first skeleton and at the same time close to the other one, at the south-eastern wall of the chamber, two large amphorae lay. Two beakers (displaying Middle Dnieper traits as we shall see) were located somewhat further away, behind the back of the first skeleton, on the level of its legs (Fig. 4:A2, 6, 7). Also behind the skeleton's back a stone axe (Fig. 4:A2, 3), two stone celts (Fig. 4:A2, 9, 11) and a sidescraper of Volhynia cretaceous flint (Fig. 4:A2, 4) were found. Another sidescraper of the same material (Fig. 4:A2, 5) lay below the legs, in the proximity of the two amphorae. Next to the toes of the first individual, a small bone chisel was found (Fig. 4:A2, 12). At the east wall, a chip of sandstone and a fragment of pearloyster shell (*Margaritifera margaritifera* ?) were discovered [Bagińska 1998:69].

Taking into consideration considerable scattering of relatively quite numerous artifacts within the grave chamber, it seems that some of them might have belonged to an older human burial. The bones of the older burial might have been moved to the SE wall when a new body was interred. Consequently, the artifacts may not make up a temporally homogeneous assemblage belonging to one individual. We are not able, however, to determine which of the artifacts are older and which are younger. On the other hand, a stone axe (Fig. 4:A3) refers back to older boat axes of the CWC, while a lenticular flint celt (Fig. 4:A8) may be an indicator of a very late horizon of that culture, but also, as we shall see, of the MDC. Tetrahedral stone axes (Fig. 4:A9, 11), which are very rare in the interfluvial area of the Upper Vistula, Upper Bug and Dniester, again would rather refer to the earlier forms of

³ Already before the excavations, the *kurgan* had its mound completely leveled off by ploughing and showed damages caused by fox burrows [Bagińska 1998:69]. Consequently, the central grave may have been completely damaged.

⁴ This is possible under the assumption that the symbolic groove marks the original diameter of the *kurgan*.

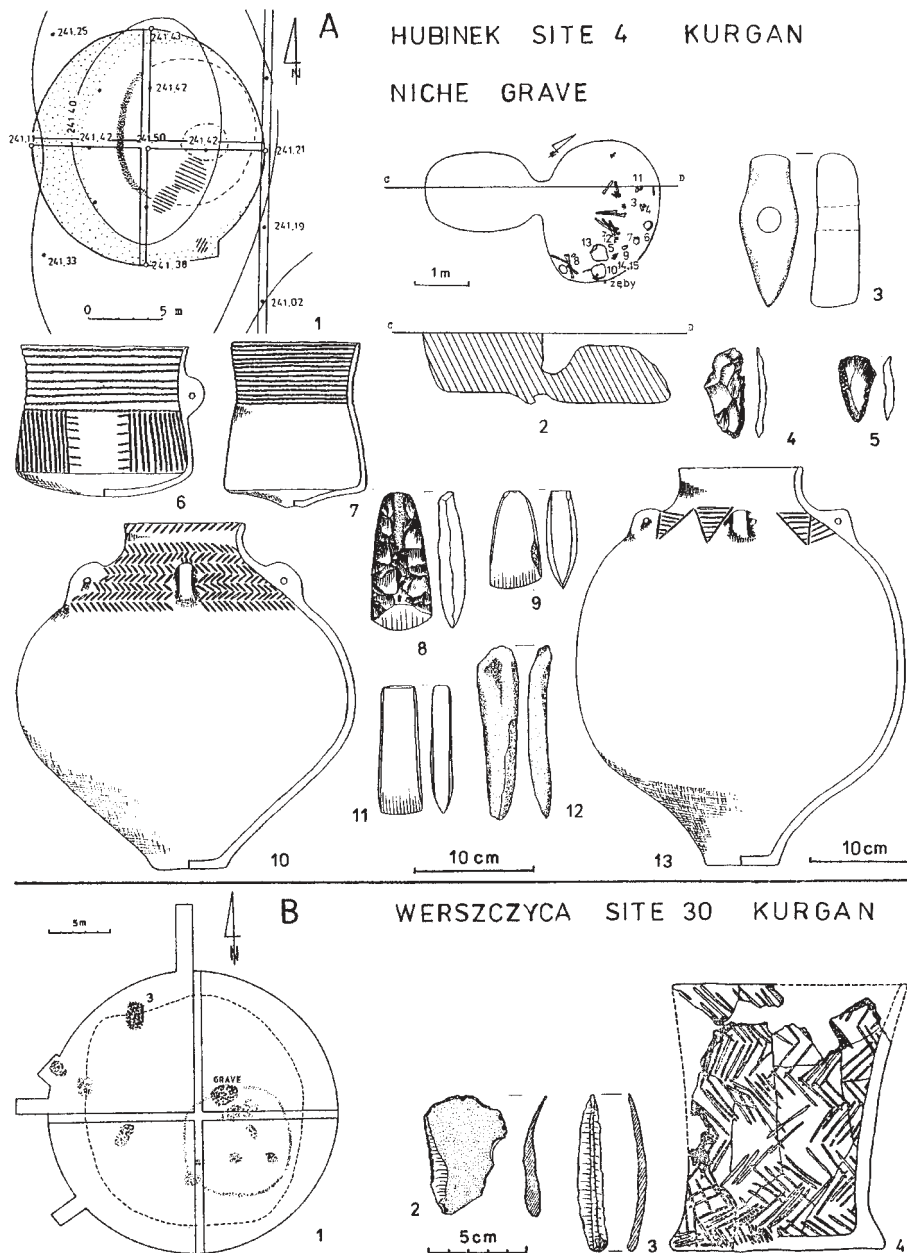


Fig. 4. Hubinek, Podkarpacie Prov., site 4, *kurgan* (A): 1 - *kurgan* outline, 2 - horizontal projection and cross-section of the niche grave, (Arabic numerals on the horizontal projection refer to numbers of artifacts in the figure.) 3, 9, 11 - stone, 4, 5, 8 - flint, 6, 7, 10, 13 - pottery, 12 - bone. Foll. Bagińska 1998. Werszczyca, Lublin Prov., site 30, *kurgan* (B), grave: 1 - *kurgan* outline, 2, 3 - flint, 4 - pottery. Foll. Bagińska [1990].

the said cultures. Other flint artifacts and the bone chisel do not have any diagnostic traits in the chronological sense.

As far as the pottery is concerned, the two vessels located behind the feet of the first skeleton (i.e. the one preserved in the anatomical order), next to the eastern wall of the chamber, are beakers (Fig. 4:A6, 7) having a typical form of classic “hourglass” beakers of the MDC. Several varieties of these beakers are known in the said culture [Artemenko 1964:56, Fig. 18:1; 1967:36, 53, 75, 80, Fig. 25:12; 39:1-4; 44:1, 3, 5, 7-9; 45:2-5, 6; Machnik, Pilch 1997:154, Fig. 8:6-10, 13, 15, 16, 18, 20, 28, 30], of which the most frequent is a squatty, “wasp-waisted” beaker, i.e. strongly narrowed approximately in the middle of its height or slightly higher [Artemenko 1967:36, Fig. 25:12]. Its walls are almost straight or slightly convex in the lower half while the bottom part is wide and bow-like shaped, the diameter of which equals the diameter of the rim and the vessel height frequently exceeds both these values. Sometimes, the bottom is barely marked by a small and regular dent. Beakers of this variety are usually decorated all over its surface, sometimes even including the bottom [Artemenko 1967:96, Fig. 62:9], with the upper part of a vessel being covered with horizontal patterns while the lower one being predominantly covered with horizontal ones, frequently metopically arranged [Artemenko 1967:80, Fig. 45:2, 5]. Curiously enough, one of the small beakers from the niche grave in Hubinek (Fig. 4:A6) almost fully fits the description of the main variety of “hourglass” beakers of the MDC given above. It differs from the latter in that it has a handle and that its ornament, specifically in the upper part of the vessel, is rather simple and made only with a cord while in a clear majority of its counterparts the ornament is made by incision and scratching using rather more complicated patterns [Artemenko 1967:53, Fig. 39:4]. The beaker also lacks a sharp transition between the upper and the lower part, which is clearly marked in a majority of MDC beakers of the variety in question. The transition is quite visible, however, in another, slenderer beaker (Fig. 4:A7) corresponding to a slightly different variety of “hourglass” beakers, i.e. with slightly convex walls in the lower part of a vessel, represented in one of the *kurgans* of the culture under discussion located near Khodosovichi [Artemenko 1964:56, Fig. 16]. On our specimen, a simple ornament of horizontal cord impressions covers only the upper part of the vessel, which is very rare in its Middle Dnieper counterparts.

The two large amphorae (Fig. 4:A10, 13) lying in the SE part of the chamber of the niche grave in Hubinek, close to the heap of human bones found at one of the chamber walls, are not typical of the MDC. However, the ornament covering the upper part of one of them (Fig. 4:A10) and consisting of dense, horizontally incised herringbones is frequently encountered on different types of beakers in grave assemblages of this culture. Due to its shape, the amphora must be subsumed under type IIb (according to J. Machnik’s classification) known, apart from Grzęda Sokalska, from different regions of the CWC, in particular from Małopolska loess

area [Machnik 1966]. The other amphora (Fig. 4:A13), being a variety of the same type, is related to some specimens from Germany [Bagińska 1988:75,76].

The majority of other artifacts found in the grave have no distinctive character since they are encountered both in the CWC and MDC. The stone celts, represented in the grave under discussion by two different types (Fig. 4:A9, 11), while being extremely rare in the interfluvial area of the Upper Vistula, Upper Bug and Dniester and only sporadically found in the grave assemblages from the areas on the Middle and Upper Dnieper [Artemenko 1967:50] are a common component of CWC grave-goods in the Alps-Sudeten Zone [Buchvaldek 1986a].

It is worth mentioning in this context that one of the two amphorae (Fig. 4:A13) from the niche grave on site 4 in Hubinek has certain analogies in Central Germany. Whereas MDC graves were very frequently furnished with river mollusk shells, such shells have not been found so far in CWC graves between the Upper Vistula and Dniester [Artemenko 1967:81]. One such shell piece was found in the discussed grave.

For the purpose of analyzing cultural traits, the arrangement of the body in the niche grave is of little importance. The form of niche grave itself, however, has not been registered so far in the MDC, whereas in the CWC it occurs not only in the Kraków-Sandomierz group, of which it is quite typical, [Machnik 1966, Włodarczak 1998], but also in some CWC *kurgans* on Małopolska loess highlands, e.g. in Pałecznicza near Proszowice [Liguzińska-Kruk 1975] and ever more often on Grzęda Sokalska⁵.

Summing up the discussion of the niche grave in the *kurgan* on site 4 in Hubinek, the following can be said. Most probably, we deal here with two human burials that took place some time apart. The skeleton, possibly of a man, preserved in an anatomical order and lying in the middle of the grave chamber, would belong to an individual placed second in the grave after moving aside the bones remaining of a human body that was placed there earlier and for which, in this case, the grave chamber had been dug. It seems less probable that the last mentioned body was placed in the grave in the state it was found at the same time as the interment of the other body (arranged in the position consistent with the prevailing rite) after it had been exhumed from another place [Bagińska 1998:75]. In any case, taking into account the fact that remains of two individuals were found in the grave, it is quite possible that some grave-goods belonged to one of them while the remaining ones to the other. A dividing criterion could be the location of individual objects either closer to the anatomically arranged skeleton or to the heap of bones at the SE wall of the niche. From this point of view both beakers displaying Middle Dnieper traits (Fig. 4:A6, 7), the stone axe and two stone celts would belong to the former while the two amphorae and the flint celt to the latter. Adopting, however, the

⁵ In the 1998 excavation season, two other niche graves, placed on the edge of a CWC *kurgan*, were discovered on Grzęda Sokalska. Personal communication from Wiesław Koman M.A. for which I am very grateful.

order of interment of the two individuals suggested above as being more probable, both amphorae would have to be taken to be older than the beakers, which is not impossible from the typological and chronological points of view, as is taking all the four vessels to be contemporaneous.

In another earth mound on Grzęda Sokalska located approx. 4 km to the W of the *kurgans* discussed above (Fig. 2), namely in *kurgan* no. 2 on site 2 in the locality named Łubcze, a grave was discovered [Koman 1990] in which two of the three vessels found there display Middle Dnieper traits. The grave, designated as no. 2, was dug into one (inner) of two symbolic grooves encircling the central pit (Fig. 5:A1) located underneath the mound of a heavily ploughed-over *kurgan*. On the bottom of this grave, a skeleton of an adult individual placed on its right side along the E-W axis was found, with its head pointing W and slightly flexed legs, with the left hand bent in the elbow and placed on the chest while the right one was raised in the direction of the face [Koman, Machnik 1993:44, Fig. 3A]. At the skeleton's feet, three vessels were placed (Fig. 5:A4-6) including the two beakers mentioned above (Fig. 5:A4, 5). Behind the deceased's back, at his knees, a plano-convex celt of Volhynia cretaceous flint (Fig. 5:A2) was located while at the pelvis a bone chisel (Fig. 5:A3) was discovered. The first of the mentioned beakers (Fig. 5:A4) could be a variety of slender specimens of MDC "hourglass" beakers, e.g. from the already cited graves of this culture in Strelitsa [Artemenko 1967:95, Fig. 61:3], if it were not for its pointed bottom part ending in a marked, very small and flat bottom. This shape of bottom parts is, however, characteristic of other, more pot-like vessels in the MDC [Artemenko 1967:66, 126, Fig. 62:5; 76:14], which in their case may be taken to be a result of an impact of the Yamnaya culture⁶. A typical trait of the MDC is the zone arrangement of ornament on the beaker in question (Fig. 5:A4) stressed by incised lines separating the patterns of horizontal incised herringbones and closed at the bottom with a band consisting of a double zigzag being, as it were, a simplified version of the pattern of the scaled interlaced triangles. The other beaker from the discussed grave (Fig. 5:A5), of which only the lower half has survived, is clearly a variety of squattier, MDC "hourglass" beakers; it is also zone-decorated but in this case with impressions of a thin cord making rather wide horizontal bands (Fig. 5:A5). This type of decoration while being rather rare in the MDC [Artemenko 1967:75, Fig. 44:2] is typical of the proto-Mierzanowice culture [Kadrow, Machnik 1997]. The large amphora accompanying the beakers (Fig. 5:A6) represents a type that is

⁶ However, one must remember that beakers similar to the discussed specimen from Łubcze, however having a slightly wider bottom and a less bulging lower part, but decorated in a very similar way (patterns of incised, horizontal herringbones separated by horizontal bands of grooves), are also known from Jutland [Siemen 1991:92, Fig. 1B11]. These similarities, exhibited also by other beaker forms, not to mention type A amphorae [Machnik, Pilch 1997: 164], existing between the south Scandinavian and south Baltic zones, on one part, and the drainage of the Middle and Upper Dnieper, on the other part, must be related to the fact that it was from the first area and across the Lowlands that the oldest CWC traits spread (together with population migrations) towards the Dnieper giving rise to the MDC or even the Fatyanovo culture bordering on the MDC in the NE. To this possibility attention was also drawn by Prof. Aleksander Koško at the annual seminar in Igołomia in February of 1999.

quite common on Małopolska loess soils [Włodarczak 1998:43, Fig. 1] and in the CWC, in particular in its earlier chronological phases. The plano-convex celt of an irregularly lenticular cross-section (Fig. 5:A2) belongs to the type known from both CWC *kurgans* (mostly from older ones) and MDC grave assemblages. It does occur in the latter culture, though only in some of its chronological phases [Artemenko 1967:43, Fig. 29:4]. Accompanying the vessels in the discussed grave, the bone chisel (Fig. 5:A3) is an artifact of an intercultural character. As far as the form of the grave is concerned, i.e. the position of the deceased and the arrangement of grave-goods, although the burial does not differ from some graves in CWC *kurgans*, especially older ones, it has many traits in common with MDC graves. In the latter culture we know of graves with a similar arrangement of hands to that in Łubcze and with vessels placed at the deceased's feet while the remaining grave-goods (frequently including axes) are deposited behind the skeleton's back [Artemenko 1967:81, 83].

The stratigraphic situation in *kurgan* no. 2 on site 2 in Łubcze (Fig. 5:A1) seems to indicate that grave no. 2 could have been dug into the edge of already existing *kurgan* raised over centrally located grave no. 1 encircled by at least one internal groove marking the original base of this rather small barrow. As far as the other groove is concerned, one may not totally reject the presumption [Koman 1999:13, 14] that it was made after grave no. 2 had been excavated, hence before the possible enlargement of the whole *kurgan*, i.e. of its mound. In any case, the central grave had to be placed in the *kurgan* earlier than grave no. 2. The central grave contained remains of a heavily damaged skeleton ? oriented along the E-W axis, similarly as it seems to grave no. 2, and was equipped with three vessels (Fig. 5:B1-3), displaying traits of a rather early CWC phase, and a tetrahedral flint celt (Fig. 5:B4). It is worth mentioning already here (it shall be discussed later) that the stratigraphic relations of both graves discussed above fully agree with absolute dates obtained for them. Grave no. 2 with vessels displaying traits related to MDC pottery is, in the light of these dates, younger than the central grave by at least half a century (Table 1).

About 4 km to the W of the discussed *kurgan* in Łubcze (Fig. 2), in a heavily damaged barrow (no. 2) on site 22 (Fig. 5:C) in Nedeżów, two human burials, located in the center of the barrow, one over the other, were found [Bagińska 1996]. In the lower grave, oriented E-W, there were found, apart from the remains of a skeleton of a young individual placed, as it seems, on its side in the flexed position [Bagińska 1996:63], only a flat celt with a rectangular cross-section (Fig. 5:D2) made of Volhynia chalk flint and a retouched flake of the same material (Fig. 5:D1). The upper grave contained remains of a skeleton, most likely of an adult man, placed on his right side in the flexed position with the head pointing W and the face turned S [Bagińska 1996:59]. At the eastern wall of the rectangular grave chamber, a large amphora was found (Fig. 5:C3) while near the SW corner a flint celt was unearthed (Fig. 5:C9). Slightly further away from it, already close to the

Table 1

Specification of radiocarbon dates obtained for grave assemblages from the *kurgans* on Grzęda Sokalska containing MDC traits or for features (also mainly graves ones) stratigraphically related to these assemblages.

No.	Site	Lab. No	BP	BC (Calib 3.0.3)
1	Hubinek, site 3, grave 2	Ki-6889	3995±55	1σ 2581-2455 1.0
2	Hubinek, site 3, grave 3	Ki-6890	4070±60	1σ 2855-2820 .16 2662-2635 .12 2627-2550 .43 2549-2491 .29
3	Łubcze, site 2, kurgan 2, grave 2	Ki-6298	4160±50	1σ 2872-2852 .12 2824-2800 .13 2777-2713 .37 2708-2657 .28 2641-2623 .10
4	Łubcze, site 2, kurgan 2, grave 1	Ki-6297	4210±60	1σ 2888-2858 .19 2816-2693 .78 2677-2668 .04
5	Nedeżów, site 22, kurgan 2, grave 1	Ki-6894	4020±55	1σ 2588-2463 1.0
6	Nedeżów, site 22, kurgan 2, grave 2	Ki-6895	3940±50	1σ 2487-2392 .70 2386-2338 .30
7	Łubcze, site 37, grave 3	Ki-6300	4050±55	1σ 2837-2828 .04 2618-2472 .96
8	Łubcze, site 37, grave 1	Ki-6299	3920±45	1σ 2464-2392 .62 2387-2337 .38
9	Wereszczyca, site 1, kurgan 1, grave 2	Ki-6301	4305±45	1σ 3016-2995 .15 2926-2879 .85
10	Wereszczyca, site 30, feature 3	Ki-6891	4125±50	1σ 2863-2810 .30 2746-2725 .11 2698-2589 .59

N wall of the grave, a small beaker was discovered while the remaining objects, i.e. another celt (Fig. 5:C5), a retouched flake tool and other flint goods (Fig. 5:C5-8, 10, 11), were found in the NE corner [Bagińska 1996:61]. Whereas one of the two vessels found in the grave, namely the amphora, shows certain analogies to the amphorae of the late (III) phase of the CWC in Bohemia [Buchvaldek, Koutecký 1970:110, Fig. 49:1; Tab. II), in the other one a clear impact of the MDC can be detected. What is primarily meant here is not the form itself of this flower-pot-like beaker, although a certain analogy to it is supplied by a specimen with two symmetrical handles from Grechaniki on the Middle Dnieper [Artemenko 1967:75,

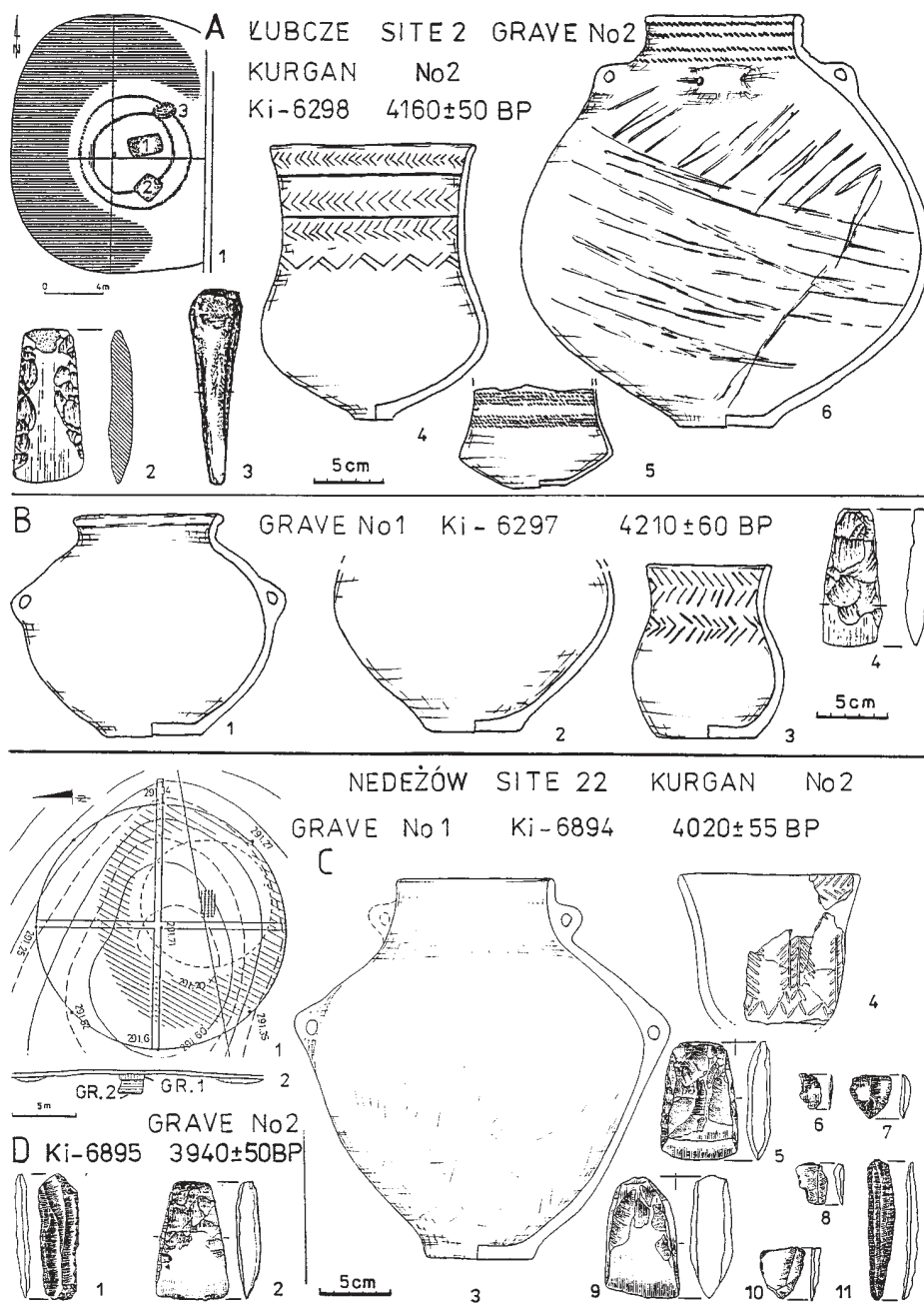


Fig. 5. Żubcze, Lublin Prov., site 2, *kurgan* no. 2 (A, B - graves): A - grave no. 2: 1 - *kurgan* outline, 2 - flint, 3 - bone, 4-6 - pottery; B - grave no. 1: 1-3 pottery, 4 - flint. Foll. Koman, Machnik [1993]. - Nedeżów, Lublin Prov., site 22, *kurgan* 2 (C, D - graves): C - grave no. 1: 1 - *kurgan* outline, 2 - *kurgan* cross-section, 3, 4 - pottery, 5-11 - flint; D - grave no. 2: 1, 2 - flint. Foll. Bagińska [1996].

Fig. 44:2], but rather an ornament typical of this culture covering the whole surface of the vessel and consisting of horizontal herringbone patterns (on the top part of the vessel) as well as vertical ones and a zigzag closing it from below (Fig. 5:C4). Of particular importance is the pattern of a double, vertical herringbone which is one of the decorative traits of MDC beakers. However, on the last mentioned vessels it usually occurs in a more developed form incorporating vertical lines in the middle [Artemenko 1967:27, 96, Fig. 14:3; 62:9]. The flint artifacts from the discussed grave are of more inter-cultural character. The same can be said of the form of the grave itself, its orientation and the arrangement of the skeleton [Bagińska 1996:61, Fig. 3].

The modest grave-goods found in the lower grave (no. 2) consisting of a tetrahedral flint celt (Fig. 5:D2) and a flint tool (Fig. 5:D1) of the same Volhynia raw-material do not have any distinctive traits and may come from, despite the fact of their earlier placement in the *kurgan* than the upper grave no. 1, the same chronological phase of the CWC. This may be confirmed, as we shall see below, by the absolute dating of both burials.

Only a distant analogy, from the typological point of view, to the “hourglass” MDC beakers may be mortarpot-like specimens from graves discovered in another two *kurgans* on Grzęda Sokalska, i.e. on sites 1 and 30 in Werszyczka [Bagińska 1990; 1997]. The *kurgans* were located in the space between the barrow in Nedeżów and the already discussed *kurgans* from Łubcze (Fig. 2). The small beaker from the first of these sites (Fig. 6:A4), almost completely covered with a compact pattern of horizontal incised herringbones, was found in grave no. 1 oriented E-W and encircled by a symbolic groove [Bagińska 1997:50 ff.]. In the eastern part of this grave poorly preserved leg bones were found while the grave-goods (including the beaker) were located in its western and central parts [Bagińska 1997:50]. Besides the beaker, the grave-goods comprised a small undecorated amphora of the “older type” (Fig. 6:A5), a stone axe (Fig. 6:A2) of type VI (according to J. Machnik’s classification) and a broken flake of Volhynia chalk flint (Fig. 6:A3). Three other graves were discovered in this barrow, of which one, i.e. grave no. 2, was placed under the mound, close to the center of its apex that was preserved until the beginning of excavations (Fig. 6:A1). The grave, oriented also along the E-W axis, was, in the opinion of the discoverer of this *kurgan*, dug into the groove encircling grave no. 1 [Bagińska 1997:50]. The grave-goods of the deceased, of whom only few bones have survived, comprised a small slender beaker (Fig. 6:B1) finding an analogy to its ornament form in some specimens from Germany [Bagińska 1997:51], a large amphora with two handles (Fig. 6:B2) of the type of the so-called Central European horizon [Machnik 1979:342 ff.] and a boat axe (Fig. 6:B3) reminiscent of specimens subsumed by K. Struve [1955] under type A. A crucial issue (to which we shall return) is the very early dating of the other grave which supposedly is stratigraphically younger than grave no. 1 with the mortar-like beaker [Bagińska 1997:50]. The remaining two features, designated by the discoverer of the *kurgan*

in question as graves no. 3 and 4 [Bagińska 1997:50], due to their modest artifact inventory (Fig. 6:C, D) cannot contribute much to this discussion. The first of them (grave no. 3), located on the southern edge of the *kurgan* mound, contained fine remains of two human skeletons, as it seems, a bone pendant (Fig. 6:C1) and a ring made of round-section wire (Bagińska 1997:50). The other one, grave no. 4, is a small oval feature dug into the groove encircling grave no. 1. Inside, three human vertebrae and a tetrahedral celt made of Volhynia cretaceous flint (Fig. 6:D1) were found. The celt was discovered lying partially in the contents (?) of the groove.

On the other site in Werszyczka (site 30), in a *kurgan* seriously disturbed by many dug-ins, including modern ones, and with almost completely flattened mound (Fig. 4:B1), a symbolic groove was detected that must have once encircled a totally damaged central burial [Bagińska 1990:20 ff.]. Into the groove, a grave was dug in, oriented along the ENE-WSW axis, containing poorly preserved bones of a human skeleton. Inside, besides two flint artifacts (Fig. 4:B2, 3), a flower-pot-like beaker was found (Fig. 4:B4). The beaker has a strongly widened bottom part and is completely covered - from the lip rim to the bottom edge - with incised lines making chaotic patterns of large horizontal herringbones (Fig. 4:B4). They resemble somewhat the ornament on the already cited MDC beaker from *kurgan* no. 55 in Jachowica [Bydłowski 1905, Tab. II 2].

Among different features discovered within the archaeological excavation encompassing the discussed *kurgan* and its immediate surroundings, a trapezoidal pit, later designated as no. 3, was exposed. It was located outside the original range of the mound (Fig. 4:B1) and contained a large pile of animal bones, mostly cattle's [Bagińska 1990:23]. The feature was dated using the radiocarbon method, which shall be discussed below. However, there are no data to determine its relation, including temporal one, to the above discussed grave and groove. It could have preceded the raising of the barrow over the presumed (not surviving) central grave, surrounded by the groove or it could have been contemporaneous to or younger than the grave.

Finally, to complete the review of the assemblages containing MDC traits on Grzęda Sokalska one must mention grave no. 3 in the *kurgan* on site 37 in Łubcze (Fig. 2). The grave, ¹⁴C dated, must have been placed on the edge of the barrow (Fig. 7:A1) and contained bones of two or three individuals forming a pile 90 cm in diameter. Among them there were items that must have been grave-goods (Fig. 7:C1-5), namely: a beaker (Fig. 7:C5), flint implement (Fig. 7:C1), copper ring made of flattened wire with overlapping ends (Fig. 7:C2) and two bone pendants (Fig. 7:C3, 4) [Bagińska 1997:45]. The beaker has a slightly marked protrusion (relief strip) and is decorated with dense, horizontal and incised herringbones on its upper part (Fig. 7:C5). What strikes the viewer is the disproportionately small bottom of this artifact, which may be, together with the whole form and ornament, a certain analogy to some MDC vessels [Berezańska 1971:168, Fig. 12:24, 27].

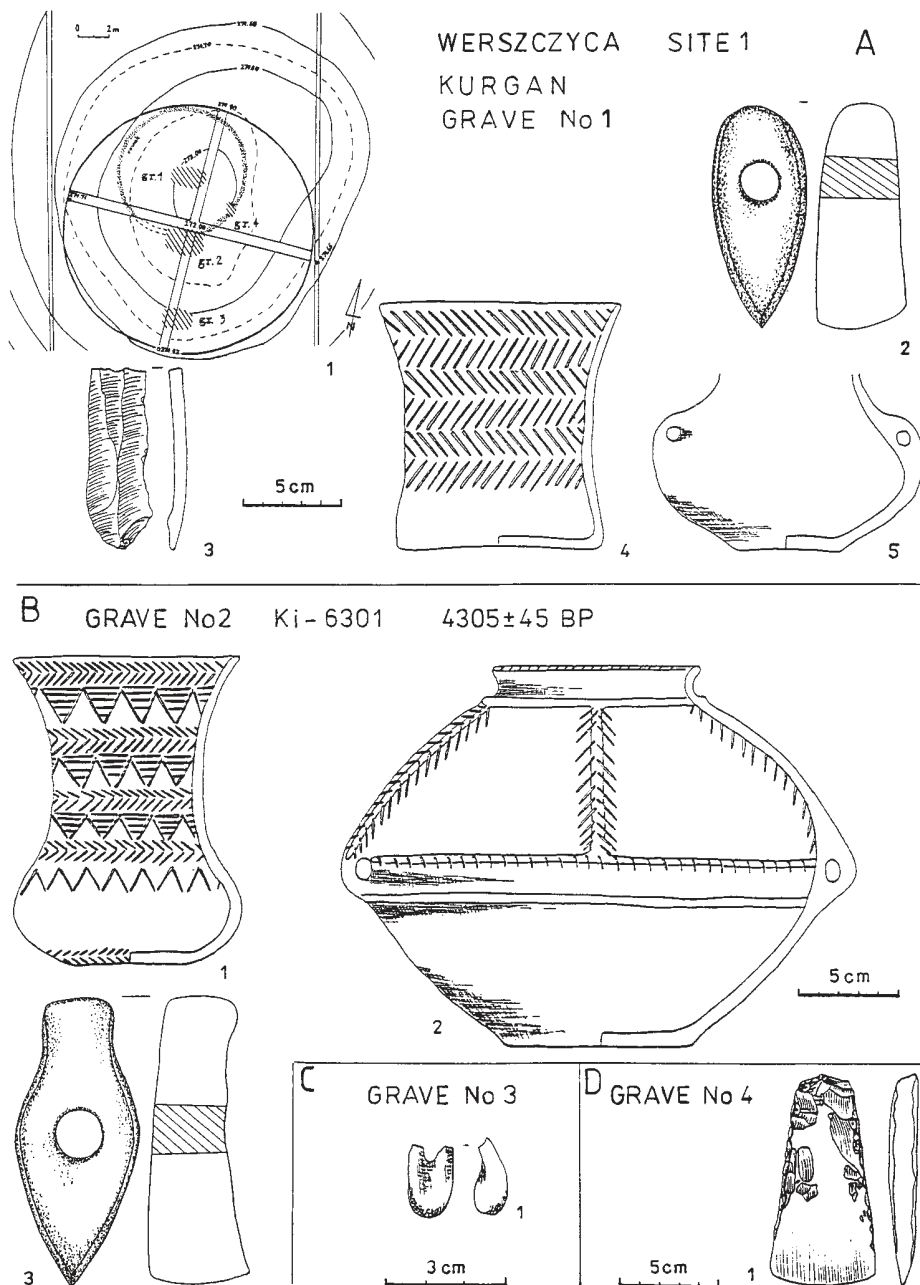


Fig. 6. Werszczyca, Lublin Prov., site 1, kurgan (A, B, C, D, - graves): A - grave no. 1: 1 - kurgan outline, 2 - stone, 3 - flint, 4-5 - pottery; B - grave no. 2: 1, 2 - pottery, 3 - stone; C - grave no. 3: 1 - bone; D - grave no. 4: 1 - flint. Foll. Bagińska [1997].

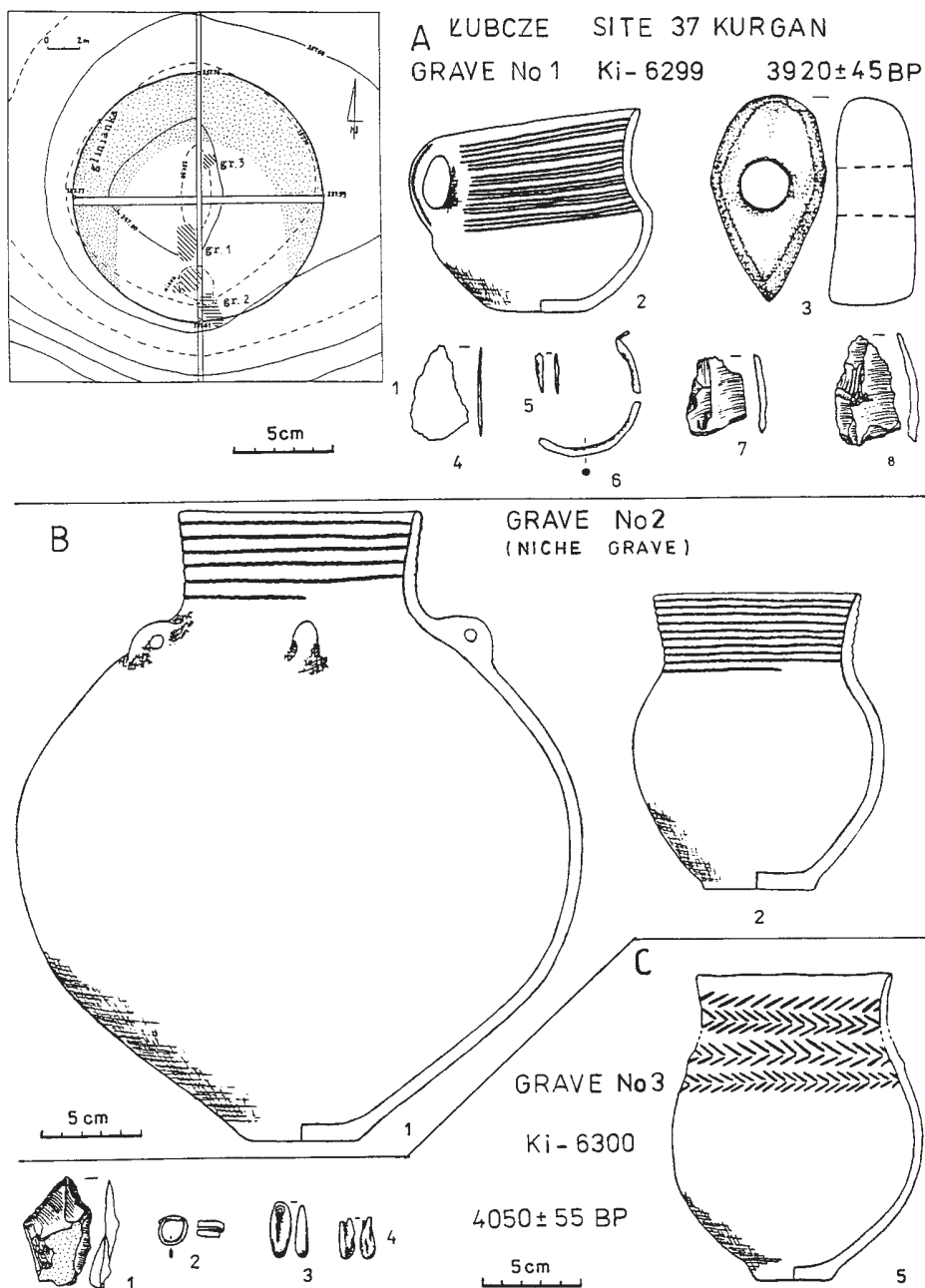


Fig. 7. Żubcze, Lublin Prov., site 37, *kurgan* (A, B, C, - graves): A - grave no. 1: 1 - *kurgan* outline, 2 - pottery, 3 - stone, 4-6 - copper, 7, 8 - flint; B - grave no. 2: 1, 2 - pottery; C - grave no. 3: 1 - flint, 2 - copper, 3, 4 - bone, 5 - pottery. Foll. Bagińska [1997].

In this context, of certain importance may be the copper ring of hammered-out wire found in the discussed grave. Ornaments in the form of simple rings are known from some, mostly younger, CWC graves [Kempisty 1978:73, Fig. 88; 1982:68], but are made of wire of round cross-section and only their ends are flattened. In the MDC, however, ornaments are often encountered, as for instance in Strelitsa or in a locality called Proletariat, that are made of completely beaten-out wire [Artemenko 1967:37, 38, Fig. 26:1; 27:1].

In the discussed *kurgan*, the mound of which has been completely flattened, no central grave has been found. None of the two remaining human burials can be taken to be one. The most centrally located grave no. 1 (Fig. 7:A1), dated by the radiocarbon method, belongs to the proto-Mierzanowice culture while the other (Fig. 7:A2-8), located clearly off-center, was a niche grave containing two vessels (Fig. 7:B1, 2) and dating, as it seems, to a rather late CWC phase.

3. CATEGORIES OF GRAVE ASSEMBLAGES DISPLAYING A MIDDLE DNEIPER CULTURE TRAITS ON GRZĘDA SOKALSKA

From the above review of the grave assemblages on Grzęda Sokalska, which to a lesser or greater degree display Middle Dnieper traits, we can see that the assemblages can be divided into three categories. The first category comprises two assemblages from graves no. 2 and 3 in the *kurgan* on site 3 in Hubinek (Fig. 3:A, B). In this category all vessels do not differ radically, either in form or ornament, from MDC pottery. The second category is made up of three burials, i.e. grave no. 2 in *kurgan* no. 2 on site 2 in Łubcze (Fig. 5:A), grave no. 1 in *kurgan* no. 2 on site 22 in Nedeżów and the grave on site 4 in Hubinek (Fig. 4:A), in which beakers of definite Middle Dnieper traits occur together with vessels typical of the CWC. Finally, the third category includes also three assemblages, i.e. grave no. 1 in the *kurgan* on site 1 in Werszczyca, the grave on site 30 in the same locality (Fig. 4:B) and grave no. 3 in the *kurgan* on site 37 in Łubcze (Fig. 7:C) in which the mortar-like beakers (Fig. 4:B4; 6:A4) and the sinusoid-profile beaker (Fig. 7:C5) were found. The last category only vaguely reminds us of the MDC pottery.

It has been found that in the case of the first two categories, the graves from which the assemblages come cannot have been central graves or, in any case, the oldest in a given *kurgan*. At times, as in the case of graves no. 2 and 3 on site 3 in Hubinek, they were actually placed on its border (Fig. 3:A1). The same certainly applies to another two assemblages, i.e. grave no. 3 in the *kurgan* on site 37 in Łubcze (Fig. 7:A1) and the grave in the *kurgan* on site 30 in Werszczyca (Fig. 4:B1) included in the third category. An exception would be the assemblage from grave

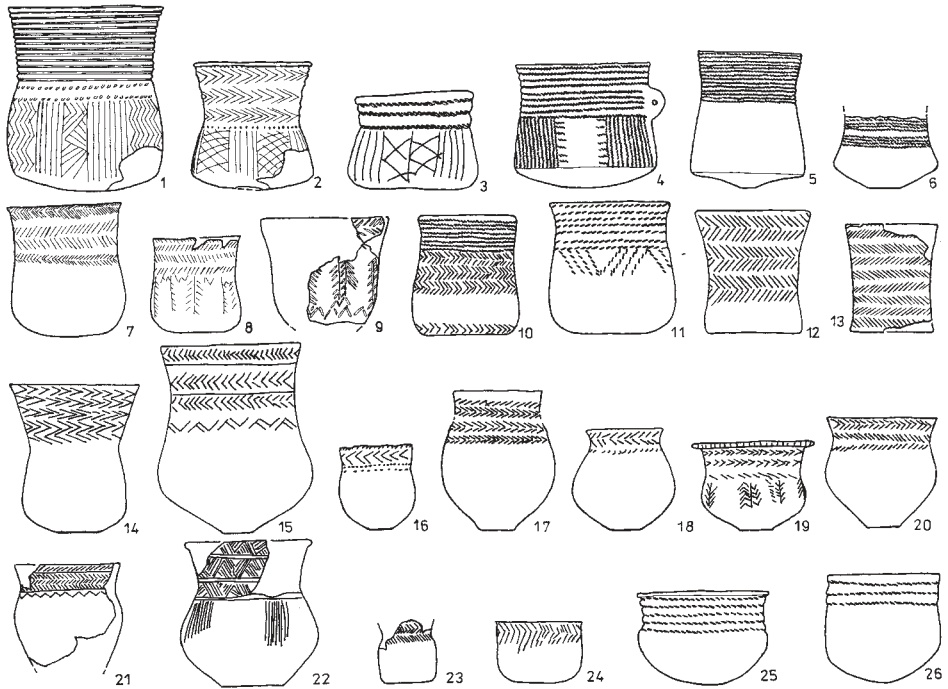


Fig. 8. Typology of vessel forms exhibiting Middle Dnieper culture traits to a various degree from the interfluvial area of the Upper Vistula, Upper Bug and Dniester: 1-3 - Młodów-Zakęcie near Lubaczów, 4-5 - Hubinek, site 4 (Grzęda Sokalska), 6, 15 - Łubcze, site 2 (Grzęda Sokalska), 7, 8, 18, 24 - Hubinek, site 3 (Grzęda Sokalska), 9 - Nedeżów, site 22 (Grzęda Sokalska), 10 - Łukawica near Narol, 11 - Side near Sambor, 12 - Werszczyca, site 1 (Grzęda Sokalska), 13 - Wola Węgierska near Przemyśl, 14 - Kryłos near Halich, 16 - Kołokolin near Rohatyn, 17 - Łubcze, site 37 (Grzęda Sokalska), 19, 20 - Komarov near Halich, 21, 23 - Koniusza near Kraków, 22 - Kobiela near Opatowiec, 25, 26 - Kawsko near Drohobich.

no. 1 in the *kurgan* on site 1 in Werszczyca if it was accepted following I. Bagińska [1997] that the surrounding groove did actually mark the original base of the whole *kurgan*, which raises certain justified doubts as we shall see below.

From the typological point of view, vessels having clear CWC traits and co-occurring with those displaying MDC analogies in assemblages included in the second category represent rather the younger phases of the former culture. There is no contradiction between categorizing them in this way and other accompanying artifact categories. This remark can be cautiously applied also to the assemblages of the third category⁷.

⁷ Caution of this remark is absolutely justified in the case of grave no. 1 on site 1 in Werszczyca because the amphora accompanying the beaker (Fig. 6:A5) represents a type believed to be quite early in the CWC [Machnik 1966:12, Tab. XXIV 4a].

4. GRAVE ASSEMBLAGES CONTAINING MIDDLE DBIEPER CULTURE TRAITS ON GRZĘDA SOKALSKA IN THE LIGHT OF ^{14}C DATES

In the ^{14}C Laboratory of the National Academy of Science of Ukraine in Kiev, absolute dates for thirteen features, including twelve human burials from the excavated *kurgans* on Grzęda Sokalska, have been obtained from bones by the ^{14}C method. In this series, eleven dates coincide with expectations, in one case (grave no. 2 in *kurgan* no. 1 on site 1 in Werszczyca) a slightly older date than expected has been obtained, whereas in another case (grave no. 2 of the late Mierzanowice Culture (MC) on site 25 in Nedeżów [Bagińska 1992] a date considerably departing from the recorded chronology of that culture has been procured [Kadrow, Machnik 1997]⁸. Out of eight grave assemblages showing Middle Dnieper traits, five have been assigned absolute dates, including both placed by us in the first category, two out of the three belonging to the second category and one of the three included in the third category. This is already a sufficient number making it possible to determine the approximate time of depositing these assemblages on Grzęda Sokalska and, consequently, to define their place in the general CWC chronology in the area between the Upper Vistula, Upper Bug and Dniester Rivers.

Already at the first glance one can see (Fig. 9-18) that there are no major time differences between individual assemblages with Middle Dnieper traits belonging to all three categories. Both assemblages of the first category (Fig. 3:A, B) can be safely dated to the period between 2600-2500 BC with one of them, i.e. grave no. 3 on site 3 in Hubinek (Fig. 3:A), probably having been deposited closer to the lower (older) limit of the time interval or even slightly preceding it. Another perfect fit into this interval is scored by one of the two assemblages, i.e. grave no. 1 in *kurgan* no. 2 on site 22 in Nedeżów (Fig. 5:C) assigned by us to the second category as well as the only dated assemblage of the third category, i.e. grave no. 3 on site 37 in Łubcze (Fig. 7:C). Hence, we already have four assemblages of different category originating roughly from the same time horizon. Any chronological differences between them could not have been longer than a few dozen years or even less. Only one assemblage of the second category, i.e. grave no. 2 in *kurgan* no. 2 on site 2 in Łubcze (Fig. 5:A), has been assigned a BP date older by ca 100 years than the above-mentioned assemblages. Taking into consideration, however, the character of the bar graph (produced by the OxCal program) offering a wide legitimate choice of the moment of the origins of this deposit, it is absolutely acceptable that they took place in ca 2650 BC (Fig. 13). This date would be close to the lower limit of the chronological interval adopted for other assemblages exhibiting Middle Dnieper traits and already dated by the radiocarbon method. A certain corroboration of the date is offered

⁸ The date, Ki-6302 4270 ± 60 BP, in no way corresponds to the dating by the radiocarbon method of the whole MC, not to mention its classic and late phases.

by the presence in this assemblage of a small beaker decorated with horizontal bands of multiple impressions of a thin cord (Fig. 5:A5) in a manner typical of the proto-MC [Kadrow, Machnik 1997:18].

The absence of an absolute date for the “third” assemblage, i.e. the niche grave in the *kurgan* on site 4 in Hubinek (Fig. 4:A) classified under the second category, makes it difficult to determine its chronology. Nevertheless, relying on the amphora found in it and similar in shape (Tab. 4:A13) to that from the above-named grave in Łubcze (Fig. 5:A6), taking also into account its ornament finding certain analogies in younger CWC graves in Germany, it can be accepted that this “assemblage” is roughly contemporaneous with the latter one⁹.

In a similar situation as the niche grave in the *kurgan* on site 4 in Hubinek, one may find two assemblages of the third category, i.e. the grave on site 30 in Werszczyca (Fig. 4:B) and grave no. 2 on site 1 (Fig. 6:A) in the same locality, that do not have absolute dates. The mortarpot-like beakers found in both graves are believed, as it has already been mentioned, to be vessels typical of rather younger CWC phases. This is confirmed by a recently obtained date from 3920 ± 80 BP to ? for a grave located underneath a *kurgan* in Wola Węgierska on the Dynów Upland from which comes a mortarpot-like beaker of the same type as the discussed specimens from Grzęda Sokalska [Machnik, Sosnowska 1998:11, Fig. 11a]. Therefore, the interpretation of the stratigraphic arrangement in the *kurgan* on site 1 in Werszczyca (Fig. 6:A1) seems to be unreliable. Under this interpretation, grave no. 1 containing the same beaker would have to be older than grave no. 2, dated to 4305 ± 45 BP, dug into the groove encircling the first grave. At least this is what follows from a drawing published by J. Bagińska [1997:47, Fig. 2B]. Considering the fact that the date of grave no. 2 is among the oldest in the CWC in Europe, we would have to accept in such a case that grave no. 1 with a mortarpot-like beaker is even older, which is untenable vis-à-vis our current knowledge of this culture. Thus, we deal here either with an error in the dating of grave no. 2 or with a wrong interpretation of the sequence of placing these two burials in the *kurgan*. If we accepted a different sequence, namely that the symbolic groove circumscribing grave no. 1 was dug later than grave no. 2 - such cases are frequent in the MDC [Artemenko 1967:81] or even in the CWC [Machnik 1966:343] - then the ^{14}C date obtained for the latter could at least approximately reflect its actual chronology. In this case, however, one would need to prove that it is the groove that was dug into the contents of grave no. 2 and not vice versa as the investigator of the *kurgan* believes. In this situation, to attempt to determine the time of depositing both assemblages of the third category with mortarpot-like beakers one would rather need to take into account the current knowledge on the chronology of this vessel form within the CWC supported by the latest absolute dating from Wola Węgierska. The dating seems to indicate to a still

⁹ If it was also accepted that both beakers with Middle Dnieper traits (Fig. 4:A6, 7) found in the grave were part of grave-goods buried together with the deceased after moving aside the bones of a person placed in the niche earlier, to whom both amphorae belonged, it would *ipso facto* mean that the beakers were younger than the amphorae.

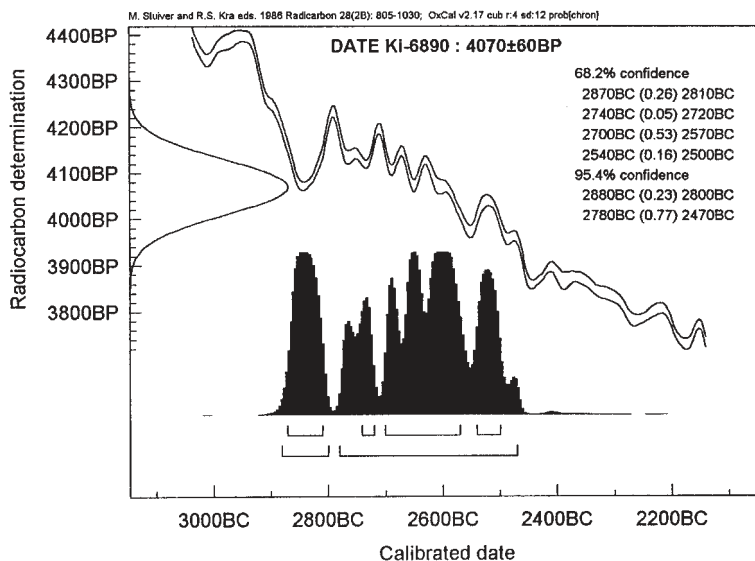


Fig. 9. Hubinek, Podkarpacie Prov., site 3, *kurgan*, grave no. 3, bar graph of calibrated radiocarbon dates (foll. OxCal).

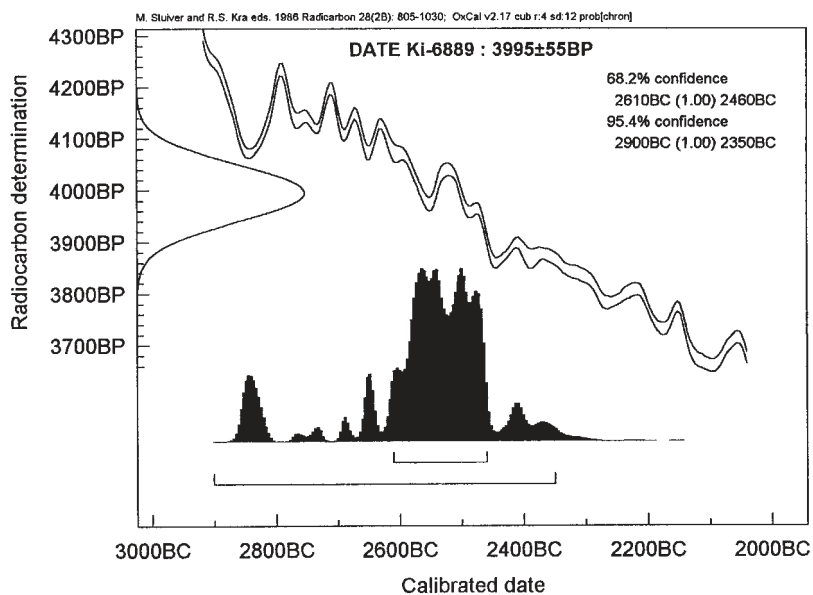


Fig. 10. Hubinek, Podkarpacie Prov., site 3, *kurgan*, grave no. 2, bar graph of calibrated radiocarbon dates (foll. OxCal).

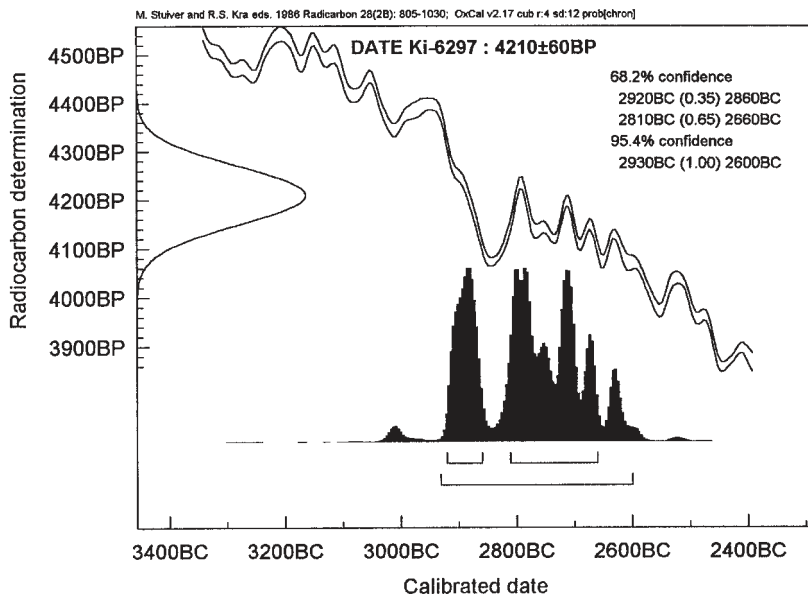


Fig. 11. Łubcze, Lublin Prov., site 2, *kurgan* no. 1, grave no. 1, bar graph of calibrated radiocarbon dates (foll. OxCal).

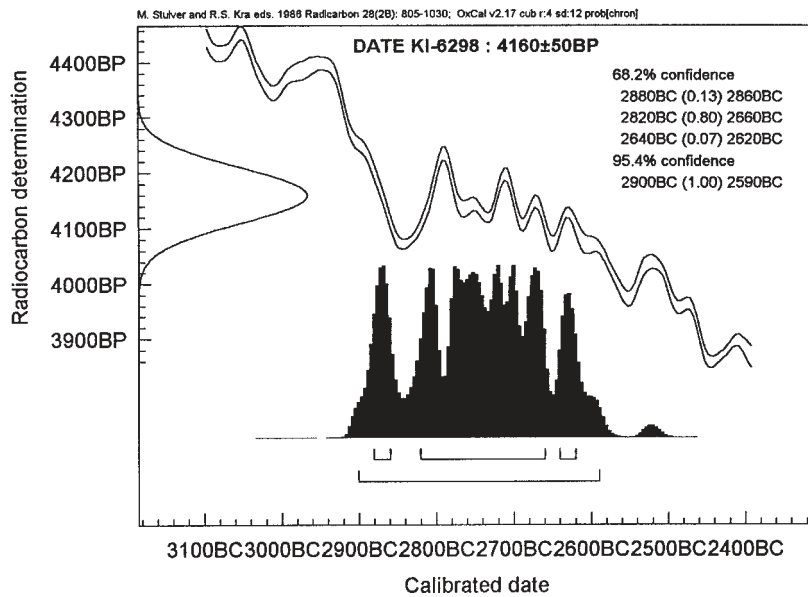


Fig. 12. Łubcze, Lublin Prov., site 2, *kurgan* no. 2, grave no. 2, bar graph of calibrated radiocarbon dates (foll. OxCal).

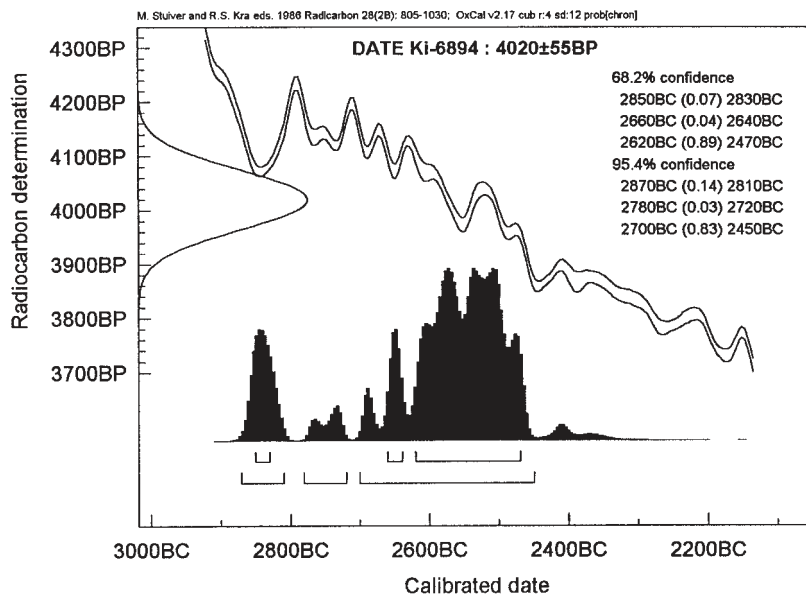


Fig. 13. Nedeżów, Lublin Prov., site 22, *kurgan* no. 2, grave no. 1, bar graph of calibrated radiocarbon dates (foll. OxCal).

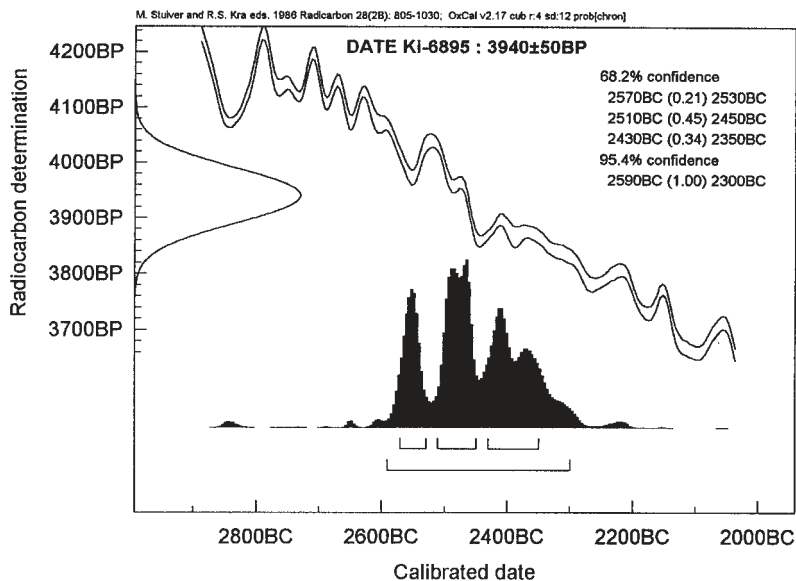


Fig. 14. Nedeżów, Lublin Prov., site 22, *kurgan* no. 2, grave no. 2, bar graph of calibrated radiocarbon dates (foll. OxCal).

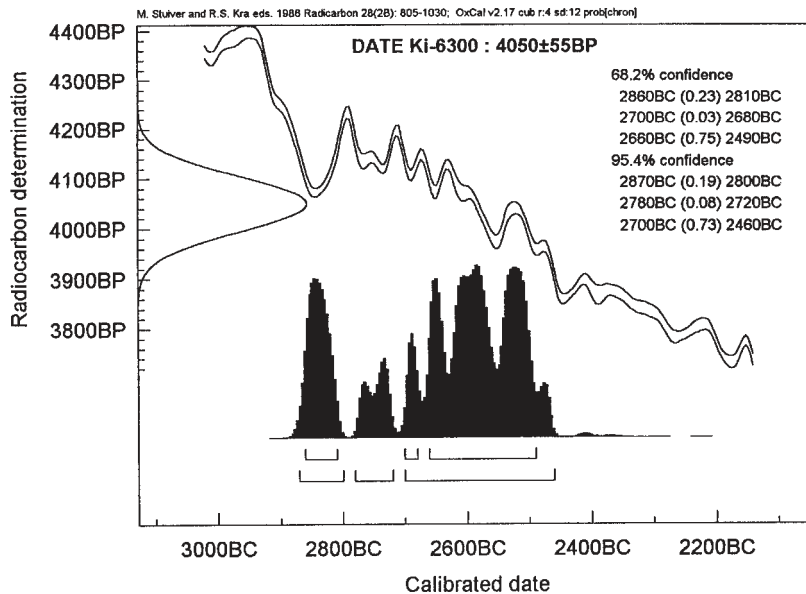


Fig. 15. Łubcze, Lublin Prov., site 37, *kurgan*, niche grave no. 3, bar graph of calibrated radiocarbon dates (foll. OxCal).

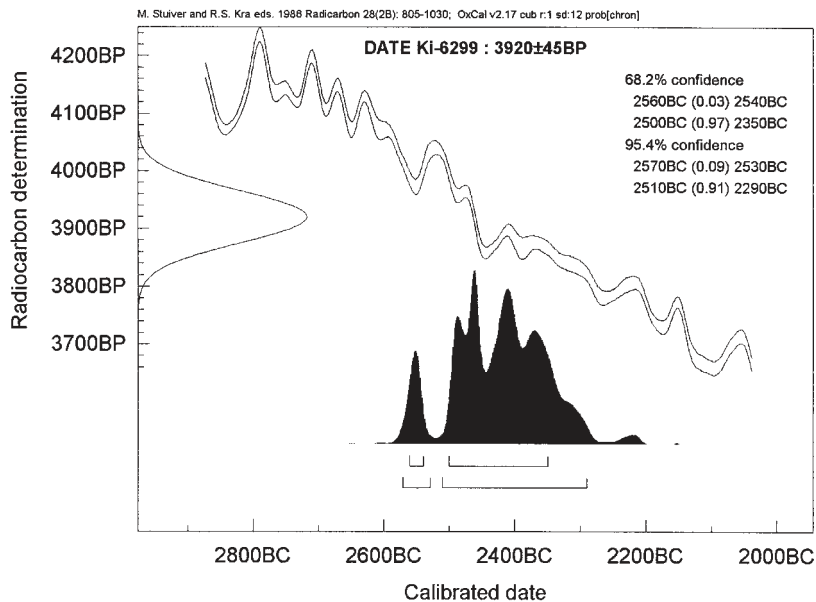


Fig. 16. Łubcze, Lublin Prov., site 37, *kurgan*, grave no. 1, bar graph of calibrated radiocarbon dates (foll. OxCal).

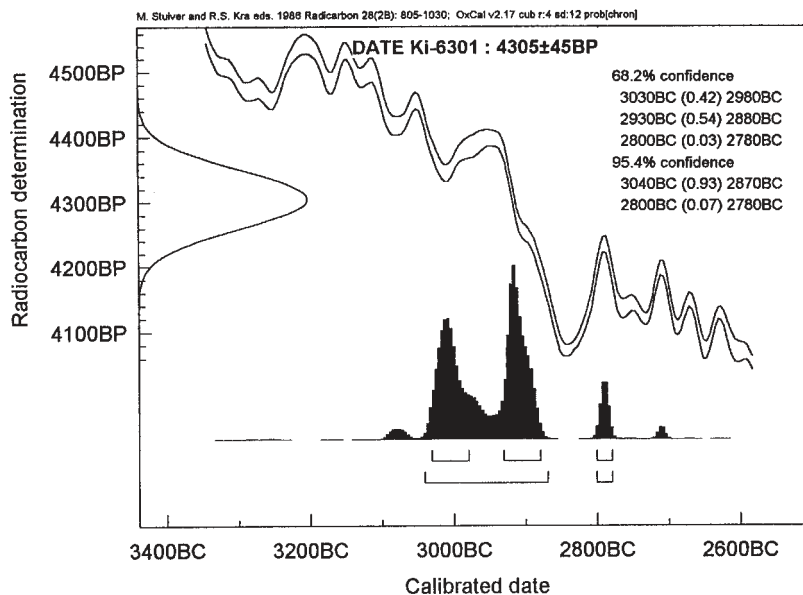


Fig. 17. Werszcyca, Lublin Prov., site 1, *kurgan* no. 1, grave no. 2, bar graph of calibrated radiocarbon dates (foll. OxCal).

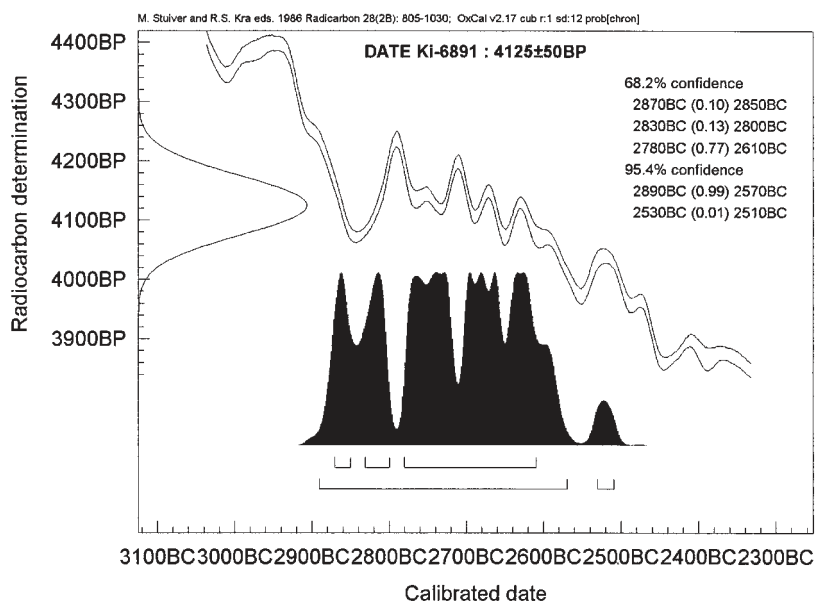


Fig. 18. Werszcyca, Lublin Prov., site 30, *kurgan*, pit no. 3, bar graph of calibrated radiocarbon dates (foll. OxCal).

later period (ca 2400 BC) from the upper limit of the time interval (2600-2500 BC) set by the ^{14}C dates obtained for the assemblages with Middle Dnieper traits on Grzęda Sokalska.¹⁰

A general conclusion that comes to mind after making the above analytical review of dates referring to pertinent grave assemblages and after analyzing their stratigraphic positions in the excavated *kurgans* is that the Middle Dnieper traits contained in them should be synchronized with the relatively late period of the CWC development extending not earlier than the very decline of the first half of the 3rd millennium BC in the area between the Upper Vistula, Upper Bug and Dniester Rivers. Consequently, it would be the period of a fully developed Kraków-Sandomierz group of the CWC on the loess soils of the Małopolska Uplands [Włodarczak 1998:38, Fig. 3] and most probably it would coincide with phase IIIa or even the beginning of phase IIIb of that culture in Moravia [Šebela 1991].

5. OTHER ASSEMBLAGES IN THE AREA BETWEEN THE UPPER VISTULA, UPPER BUG AND DNIESTER RIVERS CONTAINING MIDDLE DNEIPER TRAITS

The graves on Grzęda Sokalska are not the only ones containing Middle Dnieper traits in the vast interfluvial area. Quite recently, an assemblage of artifacts, most likely grave ones, has been discovered in Młodów-Zakęcie near Lubaczów [Machnik, Pilch 1997] which includes three classic MDC hourglass beakers [Machnik, Pilch 1997:148, Phot. 1] displaying technological characteristics typical of the pottery of that very culture. The vessels and accompanying objects, i.e. a large stone boat-shape axe, a flint celt with an irregular lenticular cross-section, heart-shaped bow arrowheads and other artifacts made of the same raw-material leave no doubt that the assemblage was deposited by MDC people far away from their home territory (Fig. 1). A detailed stylistic analysis of the vessels, especially of the large beaker [Machnik, Pilch 1997:146, Fig. 2], seems rather to indicate to a possibility of relating this deposit to a quite early period of CWC existence in this area [Machnik, Pilch 1997:156-159]. Thus, it would come earlier, or even much earlier, than the Middle Dnieper assemblages on Grzęda Sokalska, including those assigned by us to the first and second categories. Besides, it shows “purer” MDC traits (with respect to form, ornamentation and technology) than the latter, not to mention the vessels from the assemblages of the third category. It is so far the only assemblage of its kind in the area in question, beyond the compact range of the MDC. In the

¹⁰ Also a late ^{14}C date, namely 1850 ± 100 bc (later than the grave in *kurgan* 1 in Wola Węgierska), was assigned to grave K in Łukawica near Narol in Roztocze [Machnik 1966] containing a “flower-pot” beaker of certain MDC reminiscences [Machnik, Ścibior 1991:54, Fig. 6:3a]. The accuracy of this date, however, should be treated with caution because it was obtained very early in Berlin without appropriate documentation.

area, however, several grave assemblages, including pottery exhibiting to a variable degree Middle Dnieper traits, are known. They have been inventoried and briefly characterized while working on the already mentioned deposit in Młodów-Zakęcie [Machnik, Pilch 1997:159-164]. We can see among them specimens that are very similar in shape and ornament to respective MDC forms as well as vessels (flower-pot beakers) which are only reminiscent of the MDC impact in the western direction (Fig. 8). Among the former ones the most important are: an “hourglass” beaker from a grave placed secondarily in a *kurgan* in Kryłos near Halich [Sulimirski 1968:135, 136, Fig. 11:15; Sveshnikov 1974:44, Fig. 9:21], two wide-orifice beakers from *kurgans* in nearby Komarov [Sveshnikov 1974:44, Fig. 9:1, 5; Machnik, Pilch 1997:160, Fig. 9: 4, 5], a small beaker from a side grave in *kurgan* II in Kołokolin near Rohatyn [Sulimirski 1968:141, Plate 7:7; Machnik, Pilch 1997:160, Fig. 9:24], two beakers from feature no. 11 (possibly a grave) in Koniusza near Kraków [Tunia 1979:70, Fig. 18a, b] and a beaker from a grave in Kobiela near Opatowiec [Ścibior 1990:143, Fig. 1a]. Together with the last mentioned item, a boat-shape axe of an older type was found [Ścibior 1990:144, Fig. 2a], which may indicate a quite early origin of that burial. Vessels with hardly legible Middle Dnieper traits include, as we already know, “flower-pot” beakers narrowed at the top and having wide bottoms preserved intact in *kurgan* K in Łukawica near Narol, in graves (flat?) in Nowosiółki near Przemyśl and Side near Sambor [Machnik, Pilch 1997:160, Fig. 9:6, 10, 15]. Out of these artifacts, only the beaker from Łukawica is ornamented in a manner similar to the patterns prevailing in the MDC [Machnik 1966: Tab. XXIV 2a].

As of today we do not have any certain premises for accurate dating of the majority of the listed finds exhibiting Middle Dnieper traits and originating in places other than Grzęda Sokalska in the interfluvial area under discussion. All we can say is that, save the deposit from Młodów, the degree of their similarity to the Middle Dnieper pottery is comparable to that which we observed in the assemblages - especially of the second and third categories - on Grzęda Sokalska. What is more, some of these finds (Kryłos and possibly Koniusza, too) were, as was the case on Grzęda Sokalska, placed within CWC *kurgans* that had been raised earlier or in their immediate vicinity. Hence, it may be accepted that also a majority of these finds fit into the chronological limits set on the basis of ^{14}C dates referring to the assemblages displaying Middle Dnieper traits on Grzęda Sokalska. Consequently, this would mean 2600- 2500 BC.¹¹ However, this would not apply to a classically Middle-Dnieper assemblage from Młodów (Fig. 8:1-3) which must be older from the lower limit of that time interval. It may also be older, but with much lower certainty, than the above-mentioned finds from Kobiela and Koniusza.

¹¹ Except for “flower-pot” beakers which in most cases seem to come from (as it is suggested by the ^{14}C dates relating to the barrow in Wola Węgierska and the grave in Łukawica) a still later period.

6. CONCLUSIONS

As we have seen the grave assemblage from Młodów is undoubtedly an incidental occurrence in the interfluvial area. Therefore, it must be considered a result of a single intrusion into the area controlled by CWC societies (Fig. 1). Its incidental character follows from the existence of a wide zone separating the territories of the compact range of the CWC and MDC (on their south flank) and occupied by a GAC people [Sveshnikov 1983]. It must have been a significant barrier preventing any direct contact across the upland zone of the interfluvial area of the Middle Dnieper and the Upper Dniester Rivers between the first two cultures, after all so genetically close to one another.¹² The significance of the barrier must have declined together with the weakening of the GAC settlement, its disintegration and complete disappearance from the areas lying to the east of Gniła Lipa (western part of Podolia). Judging by a long series of dates obtained for the GAC in Volhynia and Podolia [Kadrow, Szmyt 1996b; Szmyt 1998], its lifetime was drawing to an end beginning with the middle of the 3rd millennium BC. Thus, we have here a striking coincidence between the ¹⁴C dates concerning the discussed assemblages exhibiting Middle Dnieper traits on Grzęda Sokalska and a majority of such assemblages from the late period of the GAC in Volhynia and Podolia [Szmyt 1998:228, 229].

It follows that a clear intensification of MDC influences, most probably due to the influx of groups of people not only to Grzęda Sokalska but to the whole interfluvial area, took place during a crisis and disappearance of the GAC, which until then blocked any such migrations in the areas lying to the east of Gniła Lipa [Machnik 1979b:57]. Now, these areas became fully accessible to people of the late or even decline CWC from the interfluvial area of the Upper Vistula, Upper Bug and Dniester Rivers (Fig. 1). Earlier such expansion was hardly possible, except for incidental intrusions, e.g. a *kurgan* in Lisieńczyce on the Upper Zbrucz, or completely impossible due to the presence of the GAC. The expansion is evidenced by *kurgans* and other graves showing decline traits of the CWC, e.g. in Kaczanówka and Nowosiółki in Podolia [Bedłowski 1930] and Siwki in Volhynia [Sulimirski 1968:164], coming from the times when in the western part of the interfluvial area, primarily on the loess soils of the Małopolska Uplands, the culture underwent a transformation resulting in a rapid spread (also in the eastern direction) of early MC traits [Kadrow, Machnik 1997:30, Fig. 7].

Translated by Piotr T. Żebrowski

¹² A lot seems to indicate that these ties existed for a long time, especially between the south Baltic zone and the drainage of the Upper Dnieper [Machnik, Pilch 1997. See also footnote 6].

Vadim L. Lakiza

RADIOCARBON DATING OF THE CORDED WARE CULTURE FROM THE NIEMEN RIVER BASIN. A GRAVE FROM PARKHUTY, SITE 1, THE GRODNA REGION

Only two graves of the Corded Ware culture (CWC) had been known in the Niemen river basin until the beginning of the 1990s: one in Krasnoselski flint mine on the Ros river bank (Fig. 1:3) [Charniauski 1963; 1997], and the other on the left bank of the river Shchara on the territory of Rusakova site 2 (Fig. 1:2) [Charniauski 1997]. A new settlement dating to the Neolithic and Bronze ages — Parkhuty 1 — was discovered by the author of this paper on the right bank of the Shchara river — a large tributary of the river Niemen — in 1994 (Fig. 1:1). The monument is located one kilometre to the north of the village of Parkhuty, in the District of Diatlava, Grodna Region (Fig. 2). It occupies a sandy dune, 60m long, 50 m wide and 3 m high, above the level of floodlands (Fig. 3). Flint articles and fragments of vessels of the Neolithic and Bronze ages can be found on denudations and along the whole territory of the dune, with a high concentration on the southern edge of the hill.

1. SETTLEMENT INVESTIGATION

In 1995-1996, in the upper southern part of the settlement, the excavated area covered 86 km² (Fig. 3). The cultural layer, of a heterogeneous grey colour, 0.4-1 m thick, composed of fine-grained sand, was damaged by ploughing and by the sinking of pits. 19 features of different periods were recorded: pits, burnt out patches of earth (features No. 8, No. 18), and a grave (feature No. 14) (Fig. 4). The cultural layer is rich in archaeological finds. More than 4,000 split flints and tools, fragments of vessels, stone artefacts, and small bones were found.

Omitting a detailed description of the material discovered, which was done in another article [Lakiza 1999], we will dwell on some prominent issues. Among the

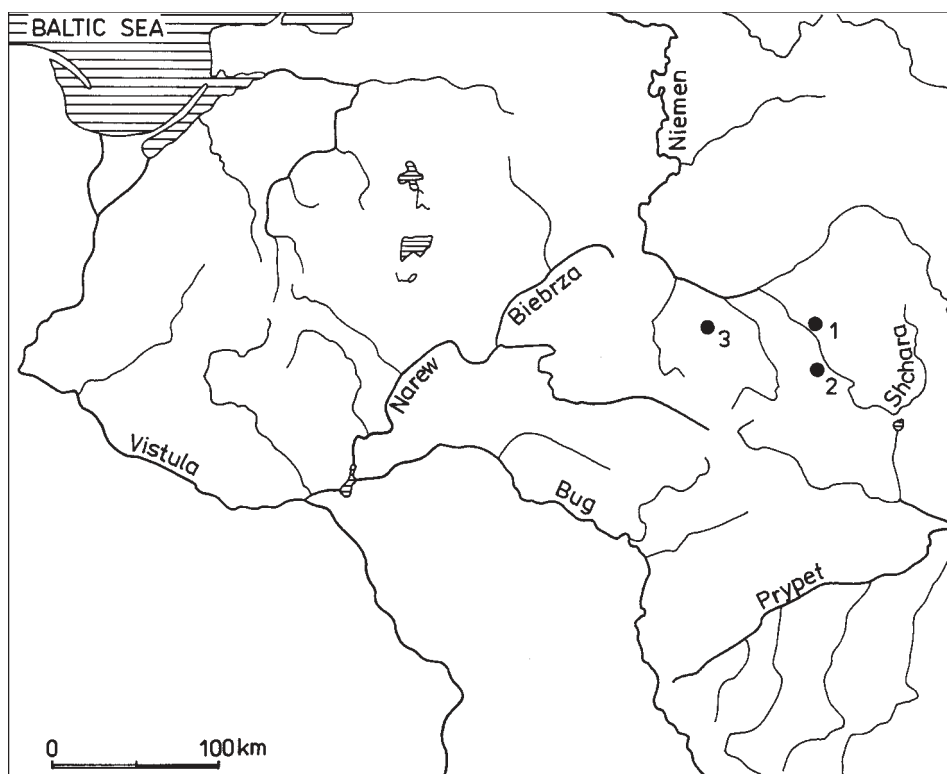


Fig. 1. Location of the Corded Ware culture graves in the Niemen basin (1 - Parkhuty; 2 - Rusakova; 3 - Krasnoselsk).

fragments of vessels identified, 79% belong to vessels of the Niemen Neolithic culture. This culture is represented by material of all three periods: Dubichay, Lysaya Gora, Dobriy Bor (Fig. 5:1-5) [Lakiza 1999].

The latter, according to the leading researcher of the culture in the Niemen river basin M.M.Charniauski, may date back to the first half of the second millennium BC [Charniauski 1979:78]. Fragments of ceramics of the Bronze Age (20%) (a traditional Belarus scheme of cultural-chronological division is used) [Charniauski, Kryvaltsevich 1993:96; Kryvaltsevich 1997:288-290] belong to the CWC (Fig. 5:6-8, 10-17) and Trzcinec culture (Fig. 5:18-23). The flint artefacts revealed are difficult to synchronise with either culture in particular because of the mixed cultural layer. Some samples of arrowheads, knives, sickles and scrapers could probably be defined as rather late in comparison with the rest of the material (Fig. 6).

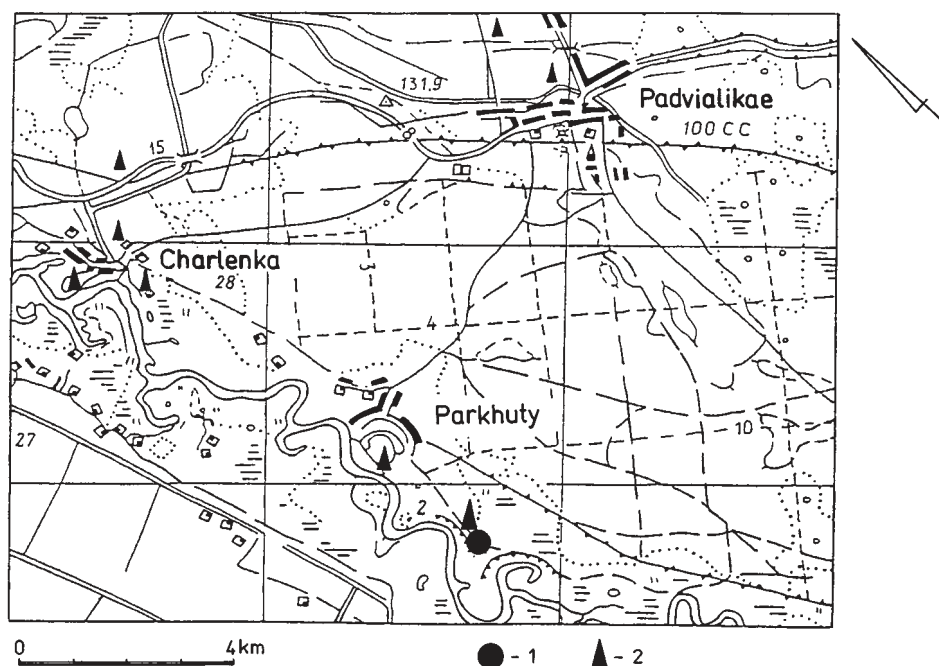


Fig. 2. Location map (1 - a grave at Parkhuty site 1, Grodna Region; 2 - monuments of the Stone and Bronze ages)

2. GRAVE STRUCTURE

Traces of the grave (a dark-grey humus spot with dimensions of 1.54 x 1.7 m) were found 0.5-0.6 m below the present day ground level of the dune. Further excavations revealed a one-body tomb with burial implements (Fig. 4; 7:1). It was located 1.62 m deep in a round pit (Fig. 4: feature No14). The pit, narrowing towards its bottom, gradually acquired a rectangular outline with curved corners. Its dimensions diminished to 0.4-0.5 x 1.3 m. It was oriented along the north-west axis (along the SE-NW line) (Fig. 7:1). The filling of the grave pit, from the level of 0.6 m below the present day ground level, was excavated in conventional layers of 0.1 m, with the preservation of its western part for stratigraphical observation (Fig. 7:2). We can trace back the layers with the following characteristics: 0.6-0.7 – 1.1 m — dark grey; 0.7-1.1 – 0.8-1.34 m — dark with a brownish shadow; 0.8-1.34 – 1.5m — light yellow-grey fine-grained sand; 1.5-1.62 — ashy-grey humus with small charcoals and dark patches (Fig. 7:2, 3).

Ten layers were extracted. In nine of them, 118 split flints and 44 fragments of

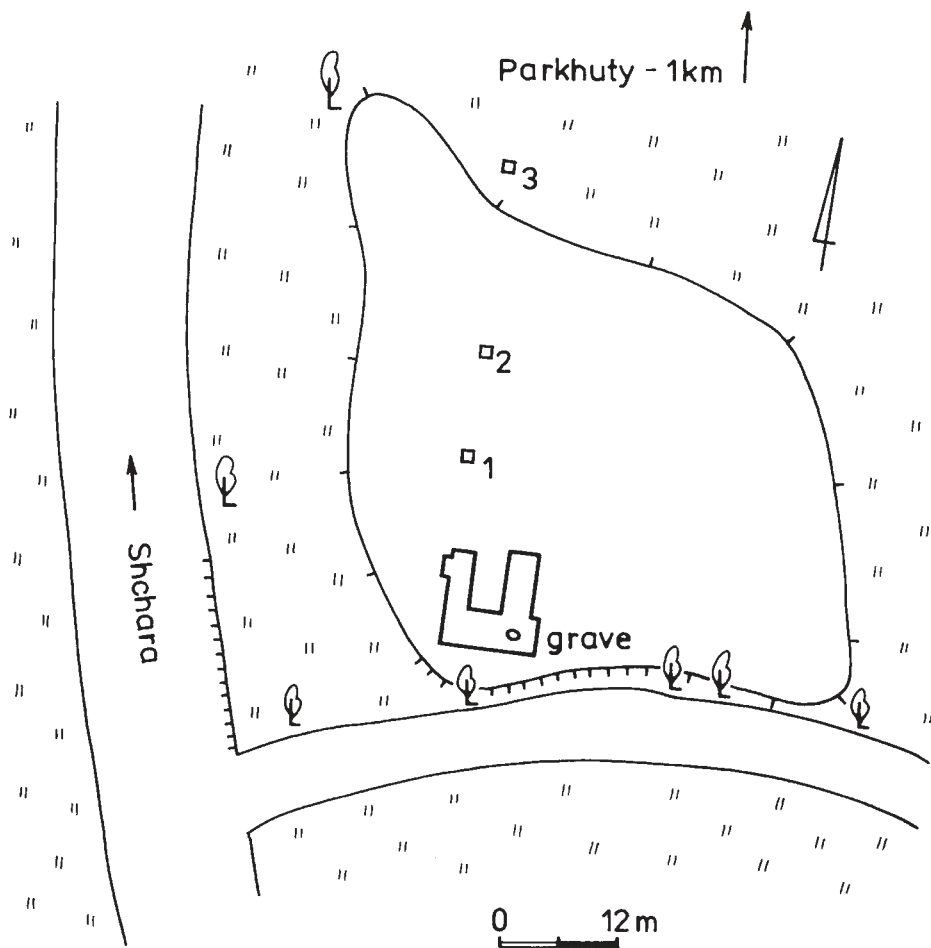


Fig. 3. Parkhuty site 1, Grodna Region. Schematic layout.

ceramics of the Niemen Neolithic culture and Early Bronze Age were discovered. We can observe a decrease in the number of finds in the sixth-ninth layers, which correspond to the yellow-grey colour of the filling (subsoil). In the tenth layer, a small flint splinter, two minor fragments of Niemen ceramics, small charcoals and various grave goods were found. The skeleton was not preserved. A stone axe with a hole and an intact flat-bottomed bowl, lying on its side, with its neck to the north, were oriented along the south-north axis; the distance between them was 0.5-0.6 m. A flint slab was also found in this section (Fig. 7:1; 8:1-3)

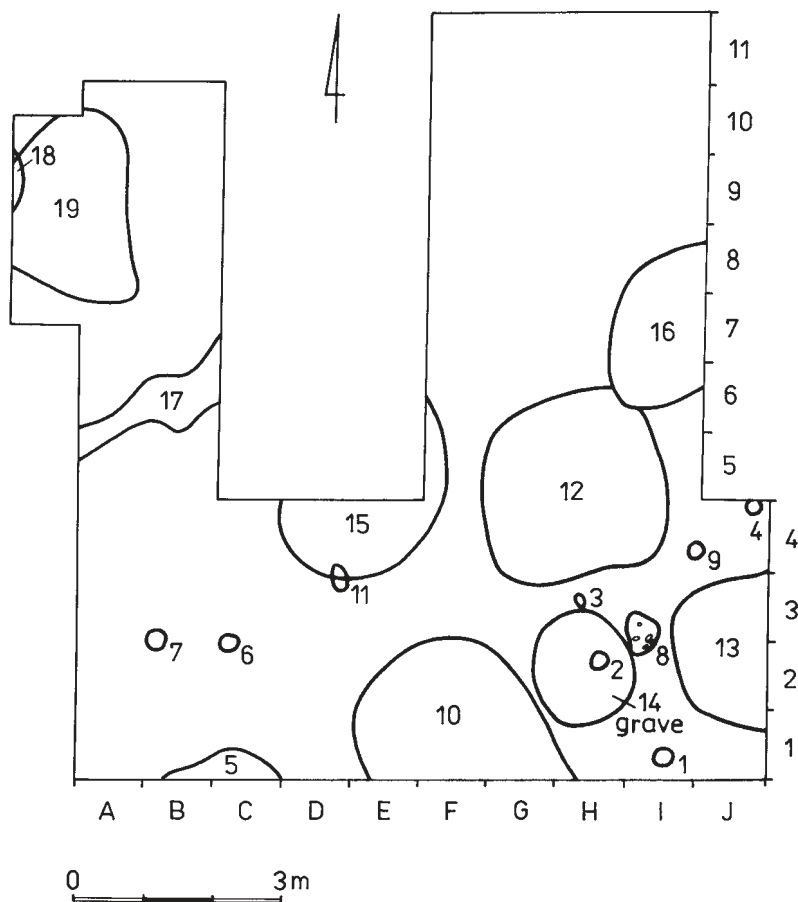


Fig. 4. Parkhuty site 1, Grodna Region. Plan of the grave location in the excavation site.

2.1. BURIAL IMPLEMENTS

a. The flat-bottomed bowl has a globular belly, with a narrowed neck gradually widening into a high cone-shaped halo (Fig. 8:1). The halo brim is uneven, and sharpened in places. Dimensions: 12-13 cm high, the bottom 6 cm in diameter, the diameter of the halo is 13-14 cm, the diameter of the belly 12-13 cm. Thus, the maximum diameter of the bowl is that of the belly. The walls are 3-5 mm thick. The

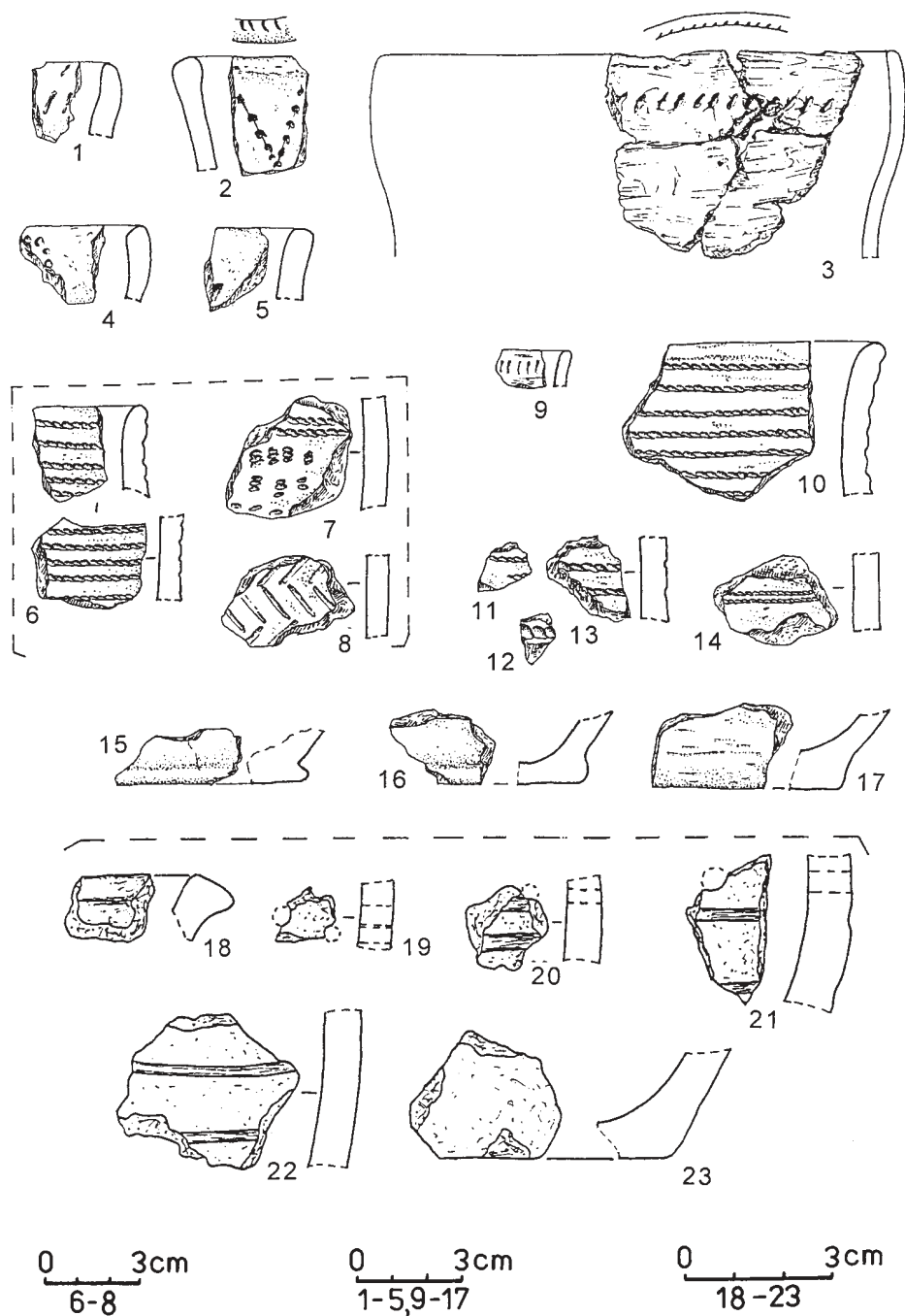


Fig. 5. Parkhuty site 1, Grodna Region. Fragments of ceramics (1-5, 9 - the Niemen culture; 6, 7, 8, 10-17 - the Corded Ware culture; 18-23 - the Trzciniec culture)

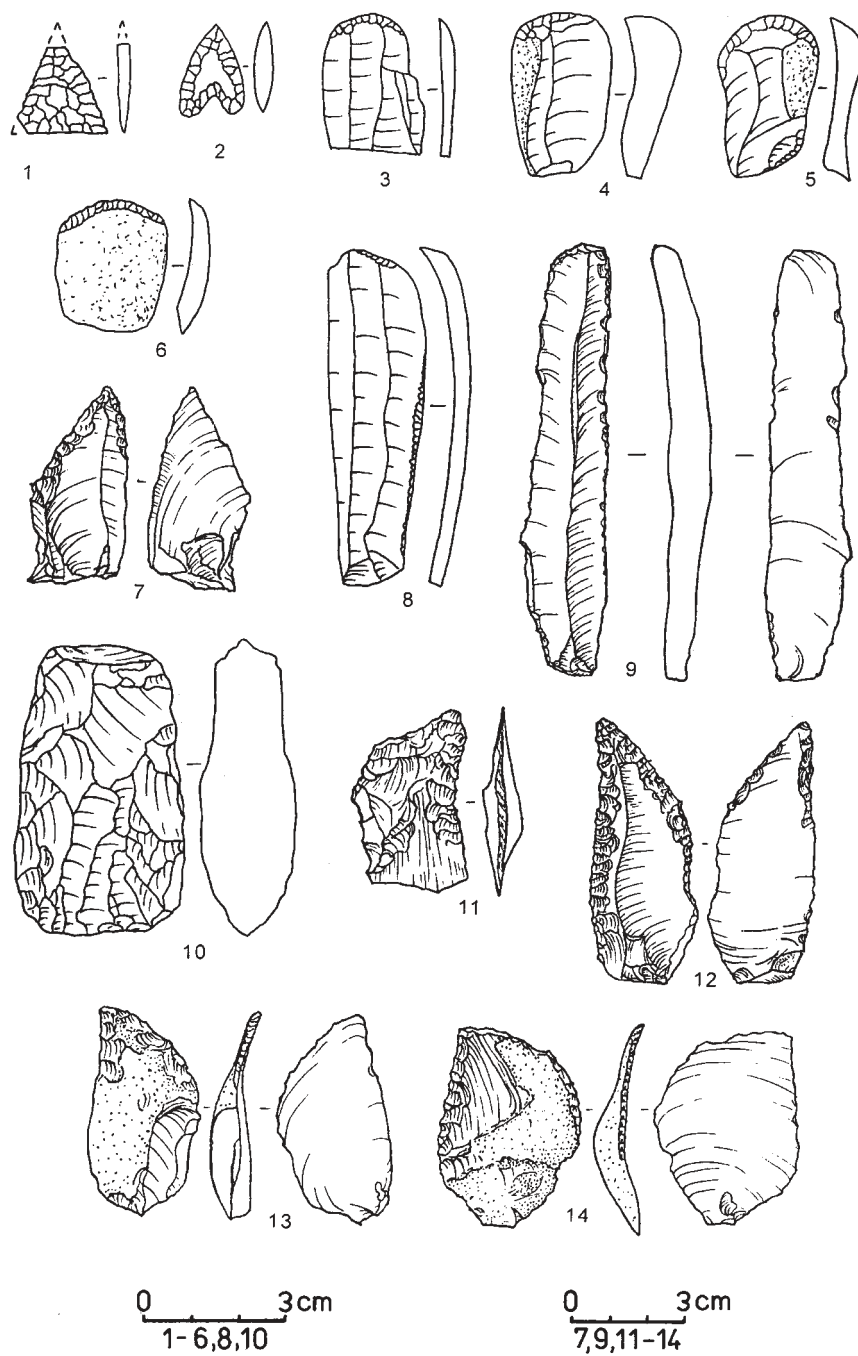


Fig. 6. Parkhuty site 1, Grodna Region. Flint implement (1,2- arrowheads; 3-6 - scrapers; 7-9 - knives; 10 - flint axe; 11-14- sickles)

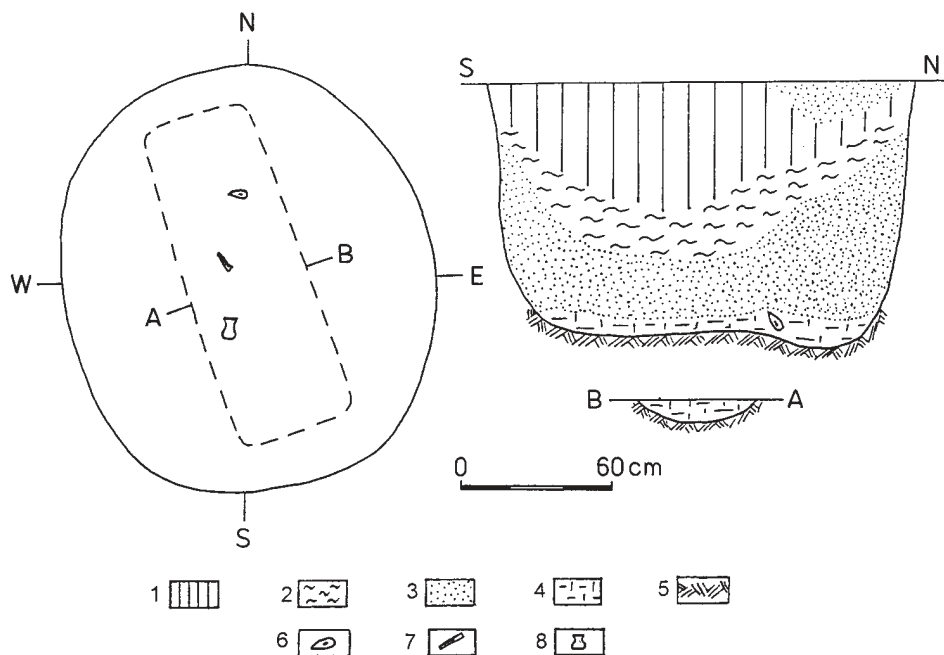


Fig. 7. Parkhuty site 1, Grodna Region. Feature No 14 - grave (1 - plan of the grave, 2 - cross-sections of the grave; 3 - cross-section of the grave bottom). Legend: 1 - dark-grey; 2 - dark-brown; 3 - yellow-grey fine-grained sand; 4 - ashy-grey with small charcoals; 5 - subsoil layer; 6 - stone axe with a hole; 7 - flint blade; 8 - bowl

outer surface of the bowl is of a light grey-brown colour, with darker patches. It is almost smooth, but with barely visible traces of smoothing. The inner surface is roughly polished. At the junctions of clay ribbons on the inner surface of the neck and halo, the wall surface is uneven. The dough of the bowl is of an admixture of sand and charcoals.

b. The axe is made of grey-green stone. Dimensions: 11 cm long, 4.5 cm wide, 3.5 cm thick; the diameter of the cone-shaped hole is 2.1-2.3 cm. The hole is made almost in the centre of the axe. The surface of the find is carefully polished. It has a diamond-shaped face, rectangular cross-section with curved angles, and a distinct, almost rectangular butt (Fig. 8:2).

c. The broken flint blade is 6.5 cm long and 2 cm wide (Fig. 8:3). It is unretouched, with no signs of being used. The blade is made of light grey Baltic flint.

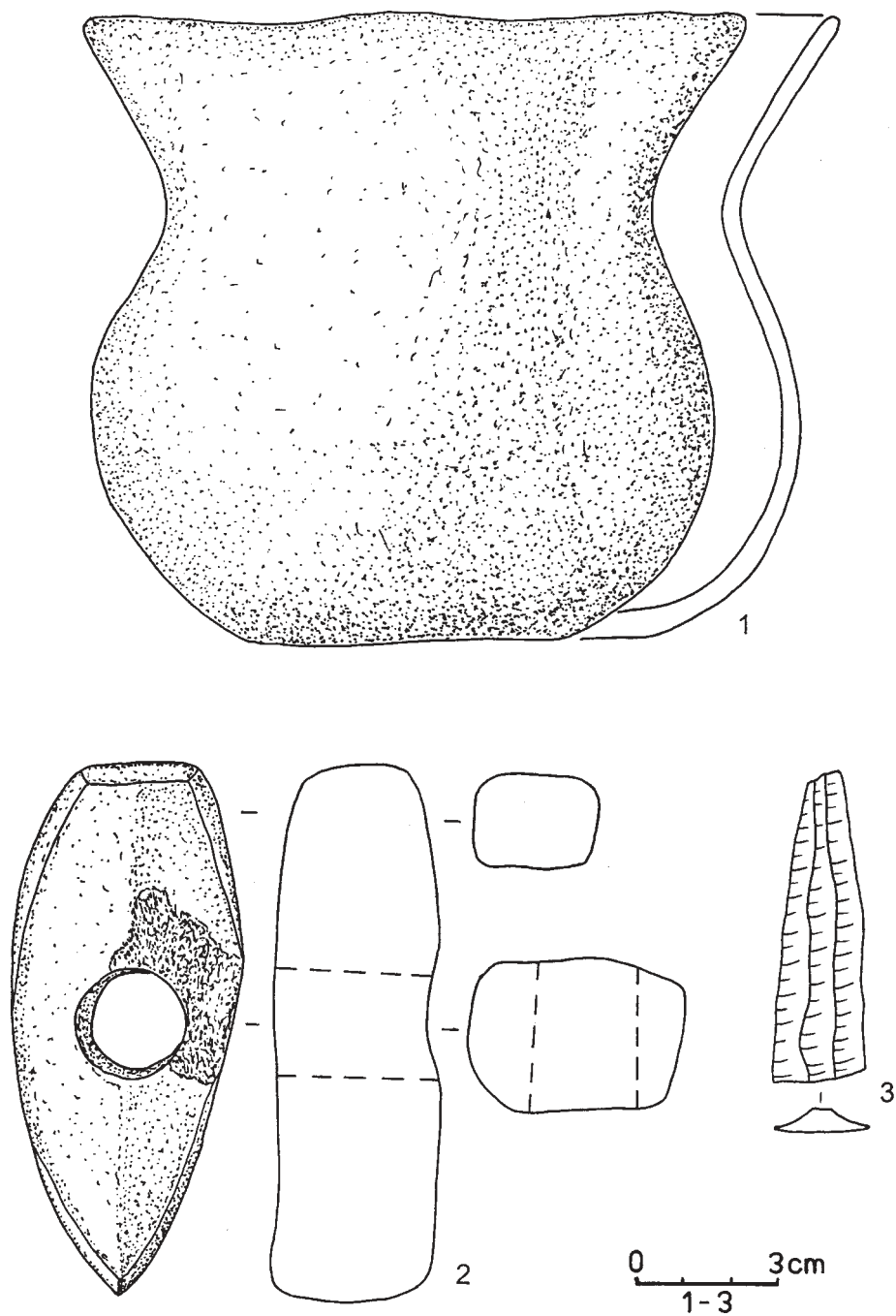


Fig. 8. Parkhuty site 1, Grodna Region. Grave implement (1 - bowl, 2 - stone axe with a hole, 3 - flint blade)

3. ANALYSIS OF THE GRAVE. CHRONOLOGY

The excavated grave was found at the upper edge of the settlement territory. The individual grave was made according to the burial ritual of inhumation.

The cross-section of the tomb presents an ashy-coal layer at the very bottom, followed by a layer of yellow subsoil, which covered the deceased, and traces of a wooden cover (Fig. 7:2). It is difficult to surmise the location of the deceased, since the skeleton was not preserved. Nevertheless, having analysed the placement of the grave goods and the dimensions of the tomb, and using the data from neighbouring territories, we can speculate that the grave was of a man lying in a foetal position on his side. Such graves in the territory of a settlement is a wide-spread phenomenon for Late Neolithic monuments in Baltic countries [Rimantienė 1984; 1994; Girininkas 1990:99-101], and in Poland [Machnik 1966; Ścibior, Ścibior 1992], and also for Bronze Age monuments of the forest zone of Europe [Artemenko 1967:128-135; Charniauski 1997:308-309]. In the opinion of many researchers, a stone axe with a hole should be defined as an attribute peculiar to the grave of a man [Artemenko 1967:82-83; Kraynov 1972:38-39].

The most crucial culture-determining elements of the grave are considered to be the stone axe with the hole and the bowl. They also solve the problem of the dating of the tomb. The stone axe with the hole is typologically related to I and II types, according to the classification of J. Machnik, made on the basis of finds from the territory of Poland. Such axes occur widely in the majority of the graves of the CWC; they date to the third — the beginning of the second millennium BC [Machnik 1966:41-48]. Finds from Parkhuty site 1 also have analogies among butt hammer-shaped axes of the Fatyanovo culture [Kraynov 1972:38-61], in cemeteries of the Middle Dnieper culture (MDC) near Khodasavichy and Stralitsa [Artemenko 1963:40; 1967:Fig. 14]. Such axes were also widespread at the end of the third — the first half of the second millennium BC in the Niemen basin. [Charniauski, Lakiza 1995:46- 59].

It was not possible to find precise analogies to the bowl from the grave in terms of all three indicators (morphological, technological and the pattern of ornamentation).

Close analogies may be encountered in the CWC in Poland. The pottery from graves at Bosutów, Zesławice, and Książnice bear some resemblance to the bowl from Parkhuty in terms of morphological features [Machnik 1966: Tab. II, IV, XV, XXVII]. In particular, one of the grave bowls discovered on site 59 near Złota has practically the same dimensions and technological peculiarities [Ścibior, Ścibior 1992:Fig. 3.]. J. Ścibior and J.M. Ścibior ascribe this bowl, ornamented with impressions of a cord, and with a flared, cone-shaped neck, to the type II b specified

by J. Machnik, and synchronise it with a central European horizon of the CWC, pointing out the presence of some archaic features.

Some analogies to the bowl in question were found in burial complexes of the Battle-axe culture in Estonia [Yanits 1952:55-57] and Latvia [Moora 1952:3-9]. In Lithuania, where, at the end of the third — the first half of the second millennium BC, the Baltic Coastal culture (Rzucewo culture) was formed, flared-neck rounded bowls with an admixture of sand in dough were widely used, as, for example, was an ornamented vessel with a narrowed neck and high halo from the Sventoi site [Rimantiene 1984: 316- 317, Fig. 104].

M.M. Charniauski also finds analogies to the burial bowl from Krasnoselski flint mines in the territory of the south-eastern Baltic countries [Charniauski 1963; 1997: 308-309, Fig. 111]. This vessel, with a “fir-tree” ornament underneath the edge of the lip, is rather like the bowl from Parkhuty site 1 in terms of its technological (almost smooth surface, dough with an admixture of coarse-grained sand) and morphological features (11 cm high, a diameter at the bottom of 6 cm, walls 5 mm thick) (Fig. 9:1). M.M. Charniauski considers the discovered grave to be linked with the “corded ware” of the Niemen basin influenced by the Rzucewo culture [Charniauski 1996:83; 1997:308-309].

We cannot but mention the resemblance of the bowl from Shchara to the ceramics of the MDC. Our find is similar to the bowls of type III specified by I. Artemenko, but with some differences. Those bowls he revealed in a grave near Khodasavichy and dated to the late phase of the aforementioned culture [Artemenko 1963: 40; 1967: 15, 105]. A range of monuments from the Upper Niemen and upper reaches of the Shchara have been subject to the influence of the MDC. For example, the dimensions and S-shaped cross-section of the vessel from the grave in Rusakova, site 2 (Fig. 9:2) bear a resemblance to the bowls from Krasnoselski and Parkhuty site 1 and they are similar to some ceramic forms from north-eastern Poland and western Lithuania. Ornaments of cut triangles, however, are more characteristic of the MDC [Charniauski 1997:309; Fig. 111].

As a brief typological analysis justifies, the burial complex Parkhuty site 1 should undoubtedly be linked with a circle of CWC. It should also be noted that the majority of analogies were found in the territory of Poland and Baltic countries or within a Circum Baltic Circle of CWC. However, a more definite cultural interpretation of the grave, as well as of the majority of monuments with corded ware in the Niemen river basin, is currently in process. One should bear in mind that in the late Neolithic and early Bronze ages, the Niemen basin is considered to have been a specific contact area of various cultures; monuments from the area have shown traces of the Niemen culture (Dobriy Bor type), the Globular Amphora culture, the Rzucewo culture, and the MDC.

The chronology of the grave from Parkhuty site 1 is determined on the basis of ^{14}C dating made at the ^{14}C laboratory of the State Scientific Center of Environ-

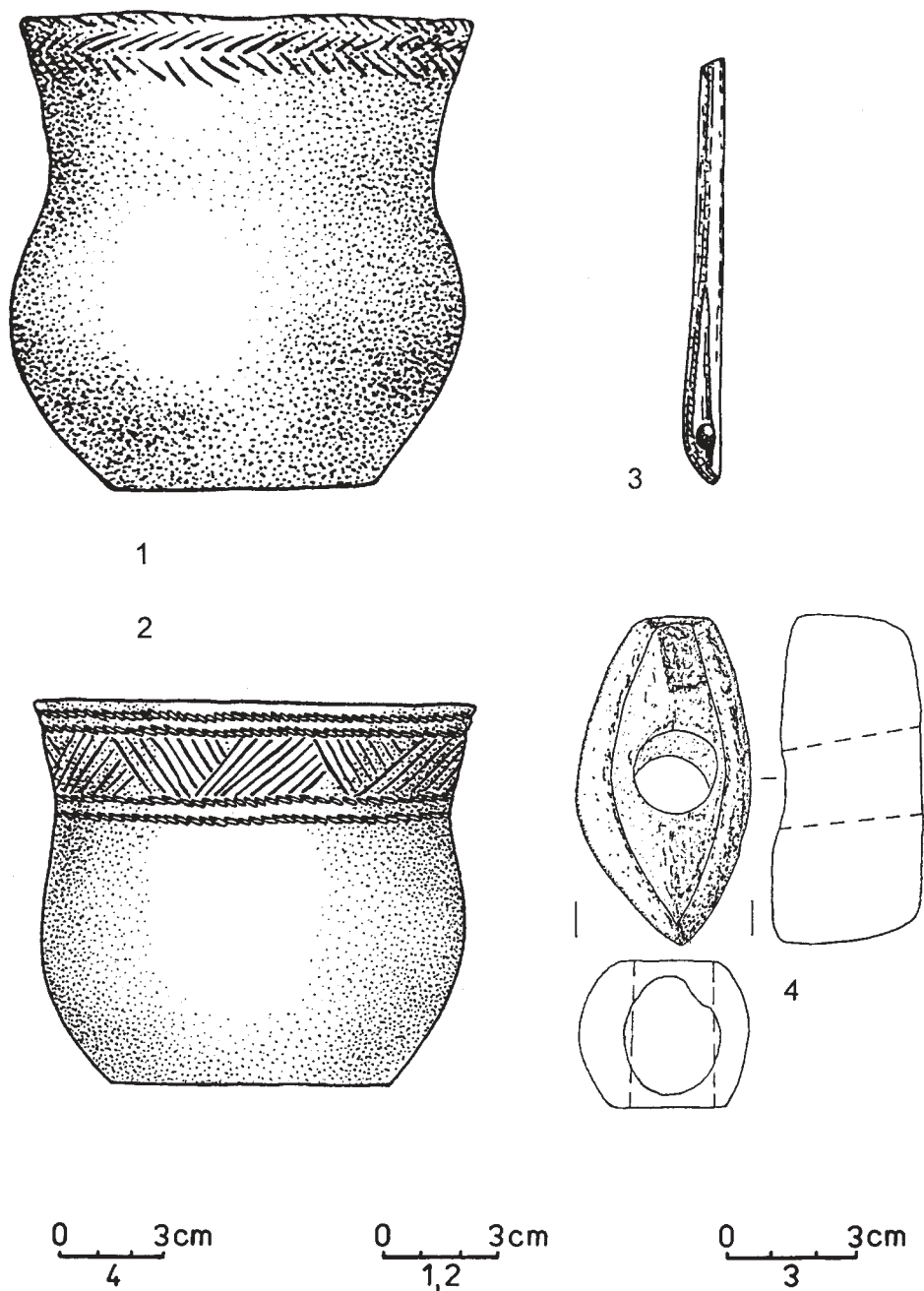


Fig. 9. Grave implement from the Corded Ware culture grave at Rusakova site 2 (2 - bowl; 4 - stone axe with a hole) and from the grave in Krasnoselsk flint mines (1 - bowl; 3 - bone needle)

mental Radiogeochemistry (National Academy of Sciences of Ukraine). The results obtained are shown in the following Table 1.

Table 1

Parkhuty site 1 - the dated complex

No.	Site	Material	Lab. No	Date		
				BP	Cal BC	
					1-sigma	2-sigma
1	Parkhuty 1 grave (feat. No. 14)	Fragment of grave vessel with admixture of charcoals in its dough	Ki-6212	3665 \pm 40	2126-2084 2042-1972	2138-1922

Thus, the individual grave discovered in Parkhuty site 1 is preliminarily ascribed to the CWC of the Niemen river basin and dated to the period of the third and second millennia BC (according to calibration dates).

Translated by Marina Lakiza

Viktor Klochko, Aleksander Koško, Marzena Szmyt

**A COMPARATIVE CHRONOLOGY OF THE PREHISTORY
OF THE AREA BETWEEN THE VISTULA AND DNEIPER:
3150-1850 BC**

Presented in this volume of the *Baltic-Pontic Studies*, the study of the comparative chronology of the cultural units found in the area laying between the Vistula and Dnieper (from another perspective - in the physiographic borderland between the East and West of Europe) supplies only a fragment of necessary identifications. What is not dealt with is the question of polylinearism of cultural changes and the problem of “peripheral” manifestations of the “long chronology” [cf. Klochko, Koško, Szmyt, Problem. . . , in this volume].

The aim of this paper is to critically assess the achieved state of exploration from the point of view of both its taxonomic completeness and interpretation range of individual datings or their series following from the current state of knowledge on the theory of radiocarbon chronometry. As a final product, we intend to present current possibilities of historical (calendar) correlations of cultural units found in the area between the Vistula and Dnieper (3150- 1850 BC) together with the exposition of “unexplored grounds”.

1. CULTURAL UNITS OF BALKAN ORIGIN FROM THE BLACK SEA BASIN

The presented papers have documented the chronometry of two taxa: (1.1) Tripolye culture (TC) in its CII stage and (1.2) Globular Amphora culture (GAC).

1.1. THE LATE (CII) STAGE OF THE TRIPOLYE CULTURE

Dates have been obtained (35 new ones) for the following spatial units/groups (or types) of the TC: Zhvaniets, Troyaniv, Gorodsk-Kasperivtsy, Sofievka, Kosenivka and Usatovo (Fig. 1). Together with earlier datings [e.g. Telegin 1977; 1985; Patokova et al. 1989; Wechler 1994] we have ample source material of 46 radiocarbon datings.

The time span of all the 46 dates oscillates between 3841 ± 148 BC and 2379 ± 85 BC while their joint calibration sets the interval of 3080-2420 BC. However, the series of dates includes datings secured from samples containing different organic materials, such as charcoals, bones (including burnt ones), shells and organic deposits (so-called “nagar”). If the analysis is restricted to “short-lived” samples, the results will be slightly different, i.e. 2950-2360 BC.

The spatial diversification of the analyzed samples makes for the fact that the most reliable picture is provided by a detailed analysis of the calibration of dates for individual taxonomic units and sites [all calibrations foll. Weninger 1993]. Out of several currently available spatial divisions of the Tripolye area in its CII stage [e.g. Dergachev 1980; Chernysh 1982; Movsha 1985b; Kruts 1997], we mainly follow T. Movsha's proposal.

1.1.1. ZHVANIETS GROUP

This group is localized in the drainage of the Middle Prut and Dniester Rivers [Movsha 1985b:232-235]. In T.G. Movsha's opinion, the main development stage of the unit falls on phase CI and only its decline partially overlaps the limits of phase CII [Movsha 1985b:254-255].

The five dates (all new ones) that are at our disposal come from Zhvaniets-Shchovb site [Videiko, Radiocarbon. . . , in this volume]. They split into two time horizons — two older ones group around ca 3200 BC while the three younger ones are close to ca 2960 BC. Furthermore, the older stage is determined by the datings of bone samples (Ki-6745, Ki-6743), while the younger one is defined by bone (Ki-6744) and charcoal datings (Ki-6754 and Ki-6753). In this case, “charcoal” datings do not make older a chronology set by other datings, therefore they can be taken to be relatively reliable. The objection follows from the fact that one of the dates (Ki-6753) refers to charcoals collected from an embankment, while the location context of the other (Ki-6754) is not known (no information on the location of the charcoal cluster is given) [Videiko, Radiocarbon. . . , in this volume].

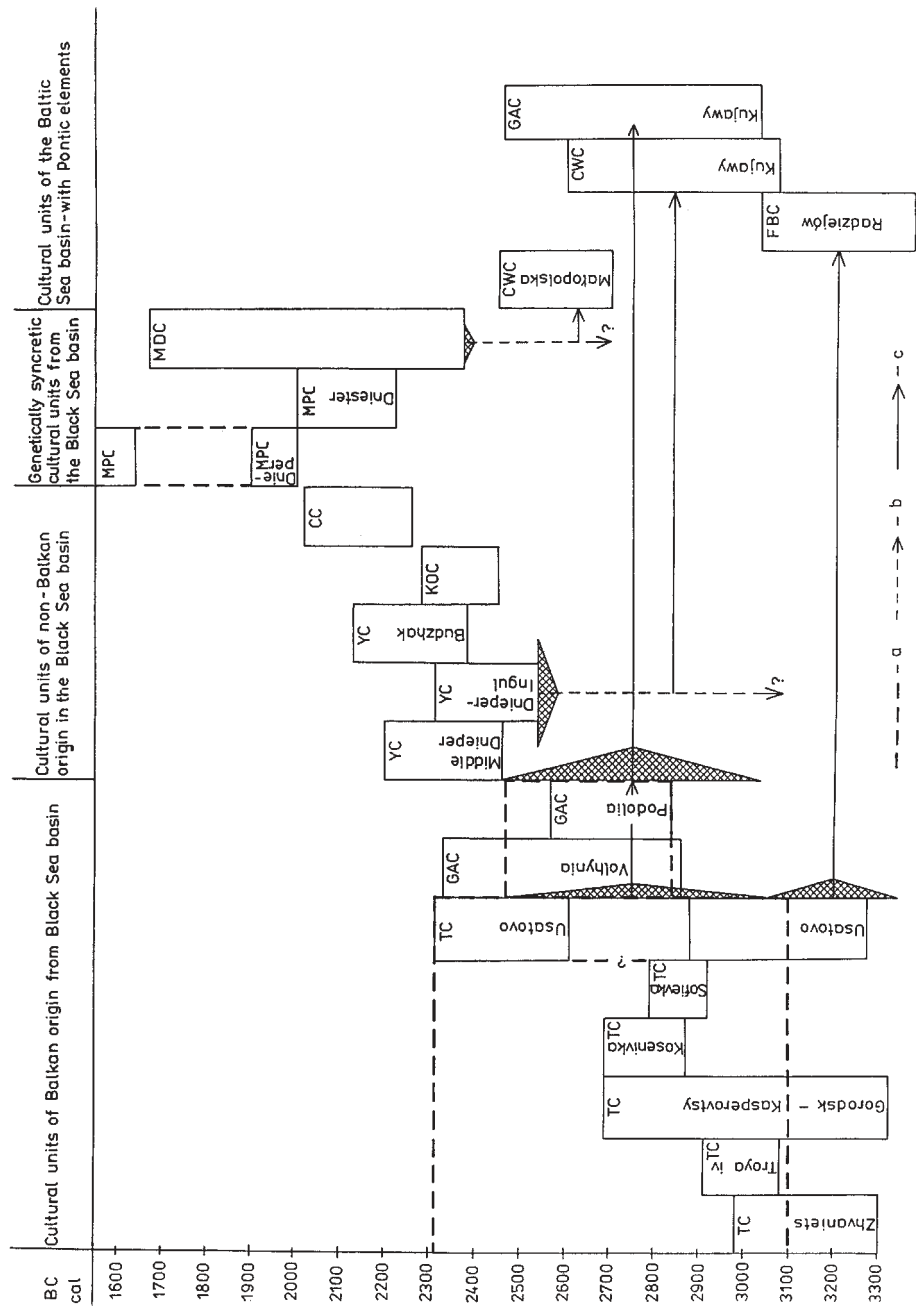


Fig. 1. Synchronization of cultural units between the Vistula and Dnieper from 3150-1850 BC based on radiocarbon dates. a - general chronology of phase CII of the TC and GAC b - possible expansion directions of the chronological ranges of specific units c - impact directions of Pontic zone cultural units

The datings from Zhvaniets taken together set the interval of 3300-2980 BC (Fig. 1).

1.1.2. TROYANIV GROUP

The territory of the group covers the drainage basins of the Pripet's southern tributaries, the Teterev, Sluch and Horyn, i.e. eastern Volhynia [Movsha 1985b:237]. The group is believed to have preceded the Gorodsk group [Dergachev 1980:200]. The period of the greatest activity of the Troyaniv group took place in stage CI with only its decline supposedly coinciding with the emergence of the structures of CII [Dergachev 1980].

From the site in Troyaniv, three datings have been obtained for single bones collected in dwelling-type features [Videiko, Radiocarbon. . ., in this volume]. They mark out the interval of ca 3080-2910 BC. However, the datings coincide with one another, which may be interpreted as an indicator of the same stage of site occupation that may have taken place around 2950 BC (Fig. 1).

1.1.3. GORODSK-KASPEROVTSY

This unit is distinguished by T. Movsha in the area previously occupied by earlier units, namely Zhvaniets and Troyaniv groups [Movsha 1985b:237-242]. In V. Dergachev's division, some of its sites (from the Southern Bug, Dniester and Prut) are subsumed under Gordineszty group [Dergachev, Manzura 1991: Tab. 1]. Of the dates at our disposal, six datings can be linked to the Gorodsk-Kasperivtsy group. Two of them come from the northern part (Gorodsk; 1 new dating) and the other four from the southern part (Sandraki, Tsviklovtsy, Gorodnica-Gorodyszczce; 3 datings are new).

Of the two "northern" dates, one was formerly obtained for samples that must have contained charcoals (GrN-5090), while a new one was procured from a shell sample collected during old excavations (Ki-6752) [Videiko, Radiocarbon. . ., in this volume]. There is no information on the location of all samples and their contexts. A joint calibration of the three dates indicates the period of 3350-3100 BC, while the dating of the shell sample fits into the period of 3212 ± 100 BC (Fig. 1).

Dates from Sandraki were procured from bone samples coming from a single dwelling feature [Videiko, Radiocarbon. . ., in this volume]. They together set the

period of 2860-2690 BC. Nevertheless, they may relate to a single settlement phase taking place ca 2710 BC.

The dating from Tsviklovtsy was obtained for burnt bones collected probably from a grave during old excavations [Videiko, Radiocarbon. . . , in this volume]. The dating indicates the period of 2450 ± 89 BC (Fig. 1). The value of the dating, in the context of previous datings and the character of the whole site [Movsha 1964; 1965], seems to be rather too low.

The combined analysis of all the six dates permits us to place the Gorodsk-Kasperivtsy group in the period from 3320 to 2690 BC with the beginning and end of this sequence being uncertain.

1.1.4. KOSENIVKA GROUP

The group is localized in the area between the Southern Bug and Dnieper Rivers [Movsha 1993]. The chronology of this group is associated with stages CI and CII [Kruts, Ryzhov 1985:54; Movsha 1993]. Ascribed to this group, the settlement in Vilkhovets [Videiko, Radiocarbon. . . , in this volume] supplied four dates (all from bone samples found in pit 1). They mark out the interval of 2870-2690 BC. In all likelihood, they are connected to a single settlement phase occurring about 2870 BC (Fig. 1).

1.1.5. SOFIEVKA GROUP

It is believed to be the latest stage of the Tripolye culture in the Middle Dnieper area [Kruts 1977:109-138; Movsha 1985b:246-259; Dergachev 1980, Videiko 1995]. For three cemeteries of the Sofievka type (Sofievka, Zavalovka and Krasny Khutor), eight ^{14}C dates were secured from samples of different materials (burnt bones, carbon deposits, coals) [Kovalyukh, Videiko, Skripkin 1995; Kadrow 1995]. The consistency of the datings of different samples should be emphasized, which is of utmost importance for the interpretation of dates concerning so controversial a source as burnt bones. It is necessary, however, to continue work on the dating of the said unit using other materials.

The oldest group of three dates was obtained for the cemetery in Sofievka, where burnt bones and — in one case — charcoals were analyzed. The “coal” date fits between those for the bones. When combined, the three dates set the interval of 3010-2770 BC.

The younger datings from Sofievka coincide with two dates from the cemetery in Zavalovka (both date samples of burnt bones). They indicate the period of 2920-2650 BC.

The youngest series of dates from the cemetery in Krasny Khutor partially overlaps the datings from Sofievka and Zavalovka. In two cases we deal with datings obtained for samples of burnt bones and in one case for a sample of carbon deposit. Taken together, the three dates indicate the interval of 2870-2570 BC.

In the mentioned time range, following from the analysis of all the eight samples, the interval of 2920-2790 BC is the most credible one [Kadrow 1995] (Fig. 1).

1.1.6. USATOVO GROUP

The Usatovo series comprises 11 new dates from the “Akkiembetskiy *kurgan*” [Szmyt, Chernyakov, Radiocarbon..., in this volume]. They were procured from eight bone samples and one wood sample coming from six graves. In addition, two dates from the same *kurgan* concern a ritual feature where a horse's skull has been deposited. All the dates fit into the period of 2610-2310 BC. The dating of the wood sample fits into the middle of the sequence, thus there are no reasons for questioning it.

However, old datings of “long-lived” materials (Mayaki, Usatovo, Danku) indicate a much earlier period of 3270-2880 BC. The discrepancy between the old and new datings seems to be caused by different materials subjected to the radiocarbon analysis — the old datings may be flawed by the “old-wood effect”. It is hard to tell whether the discrepancy shows real time differences between the discussed complexes, if it is assumed that the Usatovo group functioned over a long period of time [Dergachev 1980]. The issue calls for more research and more control radiocarbon dates (Fig. 1).

1.1.7. CONCLUSION

Putting together all the presented information, one may set the maximum time limits for stage CII at 3100/2950-2400/2300 BC. Out of the discussed groups, Gorodsk-Kasperivtsy, Kosenivka and Sofievka had survived until the beginning of the 3rd millennium BC, while Usatovo structures may have lasted as late as to 2300 BC.

As it has been already stressed, the current picture of the chronological and spatial diversification of phase CII structures calls for more study, in particular for more series of “short-lived” samples with well explored settlement contexts.

1.2. GLOBULAR AMPHORA CULTURE

The current series of dates for GAC settlement in Volhynia and Podolia comprises 12 datings from nine sites [for an earlier version see Kadrow, Szmyt 1996b; for a full analysis see Szmyt 1999b; 2000].

1.2.1. VOLHYNIA

Out of seven dates concerning the GAC in Volhynia, six were obtained by dating human bones from graves and one by dating animal ones from a settlement pit.

Tovpyzhyn. In a cist grave, remains of one man aged 40-50 years were found. Two dates were procured (Ki-5011 and Ki-5010), a joint calibration of which pointed out to the period around 2895 BC.

Ozdiv. In a grave lacking any stone structures, remains of three individuals (two adults and a child) were discovered. For the bones of one of the individuals, the date (Ki-5919) of 2740 ± 103 BC was obtained. The grave can be taken to have been filled only once. Thus, the date corresponds to the “moment” of interment.

Ivanye. In a cist grave, remains of two persons were found (an older and a younger man). For the bones of one of the individuals, two dates were obtained (Le-5021 and Ki-5141) whose joint calibration points out to ca 2570 BC. The dating may refer to one of the two episodes of grave filling.

Suyemtsy II. In a cist grave, remains of five individuals were unearthed. From the bones of one of them, the date (Ki-6930) of 2399 ± 66 BC was procured. The description does not provide enough information to conclude whether the grave was used only once or a number of times.

Peresopnitsa. In a settlement pit, very rich ceramic materials were found. Animal bones from its contents were dated obtaining the result (Ki5075) of 2382 ± 74 BC.

The discussed datings from Volhynia fit into the interval of 2860-2330 BC (Fig. 1).

1.2.2. PODOLIA

All the dates from Podolia were secured from human bones found in graves. **Vorvulintsy.** In a cist grave, remains of six people were found. For the bones of one of them, the date (Ki-5008) of 2788 ± 98 BC was obtained. The date indicates only one of several possible episodes of the grave use.

Loshniv. In a grave, remains of four people were found. For the bones of one of them, the date (Ki-5006) of 2741 ± 106 BC was obtained. The description does not provide enough information to conclude whether the grave was used only once or a number of times. It has to be concluded that the date refers to one of several possible episodes.

Khartonovtsy II. In a cist grave, remains of five people were discovered. From the bones of one of them two dates (Ki-5586 and Ki-5587) were procured. They indicate a period about 2500 BC. The grave must have been used a number of times, while the datings refer to only one episode.

Dovge. In a cist grave, remains of three individuals were discovered. For the bones of one of them, the date (Ki-5009) of 2544 ± 84 BC was obtained. The grave may have been used as many as three times. Hence, the date indicates only one of several possible episodes.

The datings from Podolia fit into the interval of 2840-2570 BC (Fig. 1).

1.2.3. CONCLUSION

Fig. 1 shows all the datings concerning the GAC in Volhynia and Podolia. They all lie within the period of 2830-2470 BC. Generally speaking, the datings from Volhynia cover a longer period than those from Podolia (Fig. 1).

2. CULTURAL UNITS OF NON-BALKAN ORIGIN IN THE BLACK SEA BASIN

The papers cited above record new data concerning the absolute chronology of the three taxa: (2.1.) the Yamnaya culture (YC), (2.2.) Kemi-Oba culture (KOC) and (2.3.) Catacomb culture (CC).

In the literature, there can be found a long series of ^{14}C datings which have been secured in the last 35 years from different YC grave assemblages [e.g. Telegin 1977; 1985]. The spread of datings is quite considerable — about 4800-3500 BP in the extreme. Yet, the majority of them cluster between 2600/2500-1900/1800bc [Telegin 1977:12-13; 1985]. The series is characterized by all the flaws which have been mentioned earlier [Klochko, Koško, Szmyt, Problem... , in this volume]. This is why our program attached particular importance to the dating of YC complexes, especially those in the western part of the culture's compass, i.e. between the Dnieper and Dniester Rivers. For the sake of the study, three "test areas" were chosen: a forest-steppe one in the southern part of the right-bank Middle Dnieper area and two steppe ones of which one was located between the Ingul and Dnieper and the other on Budzhak.

The new series of dates is based on the analysis of 45 samples [see papers: Klochko, Radiocarbon...; Klochko, Kruts, Radiocarbon...; Nikolova, Radiocarbon dates...; Szmyt, Chernyakov, Radiocarbon... — all in this volume]. The dated material consisted mainly of human bones from burials (39 cases) and, only by way of supplement, of other materials (wood in six cases).

2.1.1. MIDDLE DNEPER AREA

Myronivka. Radiocarbon analyses were made to examine bones from four burials and wood recorded in another grave [Klochko, Radiocarbon... , in this volume]. Out of five dates, one (Ki-6741) is clearly aged, which must be related to the so-called old wood effect. Thus, it has to be left out of further analyses. The remaining four ("bone") dates lie within the period of 2450-2200 BC (Fig. 1).

Talyanky. Bones from four YC graves were dated obtaining four results [Klochko, Kruts, Radiocarbon... , in this volume]. The dates are consistent with the stratigraphic positions of individual burials and form a sequence fitting into the interval of 2460-2250 BC (Fig. 1).

2.1.2. DNEPER-INGUL AREA

From the *kurgans* in the area of Ordzhonikidze (Chkalovo, Shakhta) and Golovkovka, 29 samples of human bones from YC graves were sent to radiocarbon analyses [Nikolova, Radiocarbon dates...; Radiocarbon dating..., in this volume]. The obtained dates mark out 1 Σ interval of 2540-2310 BC. In most cases the datings agree with stratigraphic observations, although several significant discrepancies were noted [see Nikolova, Radiocarbon dating..., in this volume]. After calibration, at least three groups of dates were obtained separated by intervals of 70-60 years (Fig. 1). The youngest datings coincide with the oldest dates for the CC in the same area (see part 2.6).

2.1.3. BUDZHAK AREA

The discussed sources come from the Akkiembetskiy *kurgan* [Szmyt, Chernyakov, Radiocarbon..., in this volume]. Seven samples taken from five graves, identified as belonging to the Budzhak group (culture) by the author of the study, were dated. The analyzed material was either human bones (graves 17 and 22) or wood (graves 13, 14, 17, 21, 22). The sequence of dates is consistent with the stratigraphic position of individual graves. The oldest of the dates, procured from wood (from grave 14 — Ki-6817), is older than the next one (from grave 17 — Ki-6819), procured by analyzing bones, by almost 75 years. The remaining datings of wood samples (e.g. from graves 17 and 22) are in principle consistent with the “bone” dates (or even younger). For this reason, we believe this series to be generally reliable. All the datings lie within the 1 Σ interval of 2380-2130 BC (Fig. 1).

2.1.4. CONCLUSION

Generally speaking, the series of datings concerning the YC on the Dnieper and Dniester Rivers presented in this volume lie within the period of 2550-2130 BC. At the same time, however, we do observe differences within this chronological bracket (Fig. 1). The earliest dates (we consider only those obtained for bone samples) — from about 2550 BC — come from the Middle Dnieper area (the region of Ordzhonikidze and Myronivka, somewhat later of Talyanky). The oldest datings from the Lower Dniester area (Akkiembetskiy *kurgan*) are over 150 years younger.

A similar situation is observed in the case of the latest datings. On the Dnieper, they fall between ca 2285 BC (Ordzhonikidze) and 2230 BC (Myronivka), while on the Lower Dniester, they cluster around 2130 BC.

The data presented in the cited papers [Nikolova, Radiocarbon dates...; Radiocarbon dating...; Klochko, Kruts, Radiocarbon...; Klochko, Radiocarbon... — all in this volume] allow us to at least partially verify the grounds for distinguishing “classic” and “late” YC graves. A comparison of datings for features classified in this way on the basis of burial characteristics (Fig. 1) shows that the classification is only partially chronologically viable.

2.2. KEMI-OBA CULTURE

Until recently only one ^{14}C date for the KOC, obtained for the Mezhlinskii *kurgan* [Korovina 1974:209; Shchepinskiy 1985], has been known. The radiocarbon analyses of samples from the Akkiembetskiy *kurgan*, mentioned here several times already and located at the mouth of the Dniester, produced five datings for four graves associated with the KOC [Szmyt, Chernyakov, Radiocarbon..., in this volume]. All of them were secured from short-lived materials (human bones, reed in one case). The dates are very close to each other (2402 ± 97 BC - 2367 ± 92 BC). They fit into the interval of 2450-2280 BC (Fig. 1). The dating results are borne out by the stratigraphic position of the burials, i.e. between an older stage associated with the Usatovo group (see part 1.1.6) and the younger one of the YC (see part 2.1.).

2.3. CATACOMB CULTURE

Radiocarbon datings for the CC have been relatively few until recently [Mallory 1977; Telegin 1992; Mallory, Telegin 1994; Aleksandrovskiy et al. 1997]. Moreover, the dated features are for the most part situated in the eastern expanses of the territory occupied by the CC.

The papers by E. Kaiser and A. Nikolova included in this volume bring 24 new datings for the so-called Ingul group of the CC from the right-bank steppe Dnieper area [Kaiser, Radiocarbon...; Nikolova, Radiocarbon dating... — all in this volume]. All the datings were secured from samples containing human bones. The features selected for the radiocarbon analyses gave us a chance to verify the obtained results because of the stratigraphic arrangements into which the CC graves were fitted.

Generally speaking, when analyzed together, the new dates for the CC mark out the interval of 2260-2020 BC. Hence, the presented datings are a record of a relatively short, but intensive stage of CC settlement in the area in question.

The series shows no significant differences between datings concerning the so-called Ingul and Donets groups of the CC. Work on the radiocarbon chronology of the CC should be continued with special attention being paid to the early assemblages of this culture from Donbass as well as to the so-called “Yamnaya-catacomb” or “early catacomb” ones.

3. GENETICALLY SYNCRETIC CULTURAL UNITS FROM THE BLACK SEA BASIN

3.1. MNOGOVALIKOVOI POTTERY CULTURE

Belonging to the circle of steppe and forest-steppe cultures, the Mnogovalikovoi Pottery culture (MPC) is taken to be the final link of the CC [Bratchenko, Shaposhnikova 1985]. The more the research into its metallurgy and relationships with the Trzciniec culture is advanced, the stronger is the conviction about the need to analyze it as a segment of the Carpathian-Danube Early Bronze Civilization [Koško, Klochko 1998].

The investigated cemetery complexes supplied six datings for graves associated with the unit. They are situated amid the forest-steppe landscape of the right-bank part of the Middle Dnieper area (Myronivka) [Klochko, Radiocarbon..., in this volume] and at the mouth of the Dniester (Akkiembetskiy *kurgan*).

The two features from Myronivka have radically different chronologies: the older dates back to ca 2000-1900 BC (1941 ± 49 BC), while the younger one to ca 1640-1510 BC (1577 ± 64 BC). Whereas the sequence of four graves from the Akkiembetskiy *kurgan* fits into the interval of 2220-2000 BC (from 2215 ± 106 to 2046 ± 75 BC).

Taken together, the datings place the beginnings of MPC settlement relatively early. In the western portions of the steppes (on the Dniester), it began ca 2220 BC, while in the forest-steppe Middle Dnieper area, the settlement started ca 2000/1900 BC (Fig. 1). In the latter zone, the unit survived until the beginnings of Early Trzciniec structures (Eastern Trzciniec culture), which are represented by the older assemblages from the cemetery in Malopolovetske dated to 1600-1500 BC [Kovalyukh et al. 1998].

Connected with the Black Sea basin, the Middle Dnieper culture (MDC) has very complex origins, which makes it difficult to incontrovertibly assign it to either of the two cultural circles distinguished earlier, namely Balkan or extra-Balkan one. On a larger scale, this is true also for the whole circle of cultures with corded ware [cf. Buchvaldek 1986b], but in the case of the MDC, the problem of the contribution of YC and then CC traditions is one of the most pressing issues [cf. recently Serdyukova 1996].

At present, we have at our disposal a long series of radiocarbon datings for the MDC [see papers by Kryvaltsevich, Kovalyukh, Radiocarbon...; Klochko, Radiocarbon... — all in this volume]. Together with the only old dating of charcoals from a grave in Bielynets [Artemenko 1985:373] the series consists of 19 dates.

The analysis of MDC dates, coming from sites situated in the drainage basins of the Middle Dnieper, Pripets and Desna, shows that they all lie within the interval of 2370-1670 BC (Fig. 1). However, it must be noted that the ^{14}C datings concern samples of different nature, for instance, charcoals (including those being the effect of the organic temper added to the ceramic body), bones and carbon deposits. As in the example of the series of TC dates discussed earlier, the results of the analysis will be different if we limit ourselves to the dating of “short-lived” samples (bones, carbon deposits). Then, the interval will cover the period from 2140 to 1590 BC. A dynamic view of the changes occurring within the MDC is secured only by the analysis of datings from individual sites.

Prorva 1. An MDC cemetery, without any *kurgans*, has supplied eight ^{14}C datings so far [see Kryvaltsevich 1996 and Kryvaltsevich, Kovalyukh, Radiocarbon..., in this volume]. Collected from graves, the analyzed samples consisted of charcoals (grave 1 - two dates, grave 2 — two dates, grave 18, grave 20), bones with no traces of burning (grave 10) or carbon deposit (grave 10). All the datings lie within the 1 Σ interval of 2760-2170 BC and show that the cemetery was used for a long time. This is also confirmed by the stratigraphy of the site [Kryvaltsevich, Kovalyukh, Radiocarbon..., in this volume]. However, certain doubts may be raised by the chronology of the oldest interval which is set by two “coal” dates from grave 1 [Kadrow, Szmyt 1996b]. Taking into consideration the similarity of ornamentation between vessels found in graves 1 and 10 [Kryvaltsevich 1996: Fig. 5:1 and Kryvaltsevich, Kovalyukh, Radiocarbon..., in this volume: Fig. 3:1] and the proximity of two dates from each pair (Ki-5140 and Ki-6206), it must be concluded that the most reasonable interpretation is to associate both graves with the same phase of cemetery use taking place about 2550 BC. In the case of younger graves, we have only “coal” dates, hence the time when the cemetery ceased to be used is not certain.

Prorva 2. In the case of another MDC cemetery, we have only one date concerning

charcoals from grave 1 [Kryvaltsevich, Kovalyukh, Radiocarbon. . . , in this volume]. Its calibration marks out the interval of 3870 ± 93 BC. Taking into account the nature of the dated sample, the suggested hypothesis is currently difficult to verify.

Hodasavichi (Siargeeva Gryva). In respect of grave 2 from *kurgan* 3, one dating has been obtained marking out the interval of 2283 ± 81 BC. The sample contained human teeth. Observations made by I.I. Artemenko show that the grave was the second one in a sequence of burials discovered in *kurgan* 3 [Artemenko 1964]. As a whole, the *kurgan* cemetery investigated on the site has been dated until now to the late stage of the MDC [Artemenko 1987:37]. The dating points out to the necessity to amend, at least partially, the hitherto prevailing chronological classification.

Aziarnoye 1. In contrast to the rest of dated MDC sites, here we have a settlement dated to the late stage of this culture [Kryvaltsevich 1999]. The ^{14}C analysis was used to determine the age of two samples of carbon deposit found on MDC vessels. Being similar, the results can be jointly calibrated marking out the $1\ \Sigma$ interval of 1910-1760 BC.

Strelitsa. The cemetery was investigated in the 1960s by I.I. Artemenko [Artemenko 1976b]. At present, we have five ^{14}C datings of materials from these investigations. Due to insufficient records, it is not possible to define with any certainty the context of the dated samples which consisted of human and animal bones and objects made of bone [Kryvaltsevich, Kovalyukh, Radiocarbon. . . , in this volume]. When analyzed together, the datings from Strelitsa bear out the late chronology of the cemetery [Artemenko 1987:37]. The interval set by them extends from 1860 to 1680 BC.

Myronivka. A single ^{14}C date was obtained for human bones from grave 6 in *kurgan* 8 [Klochko, Radiocarbon. . . , in this volume]. It must be noted that in none of the three graves in this *kurgan*, classified as MDC ones, were any grave-goods found. Their cultural classification is based solely on the analysis of burial forms. The date marks out the interval of 2048 ± 75 BC. The chronology of the grave is confirmed by its position in the sequence of burials unearthed during the exploration of the *kurgan*.

4. CULTURAL UNITS OF THE BALTIC SEA BASIN — WITH “EAST EUROPEAN” ELEMENTS

Three groupings, in which cultural traits from the Pontic circle were recorded, have been included. Among them are: (4.1) the Old Upland CWC, (4.2) the Radziejów group of the Funnel Beaker culture (FBC) together with the materials of the early Kujawy Corded Ware culture (CWC) and (4.3) the Kujawy group of the GAC. It is also admissible to identify the second of the named groupings allowing for a greater share of CWC traits.

4.1. OLD UPLAND CORDED WARE CULTURE — WITH PONTIC ELEMENTS

A new quality is brought into the study of the origins and development of the Małopolska CWC by the results of the investigations carried out in the area lying between the upper courses of the Vistula, Bug and Dniester Rivers, specifically on Grzęda Sokalska in southeastern Poland (Fig. 1). There have been recorded a number of CWC grave assemblages containing certain MDC elements (especially observable in the form and ornamentation of pottery). Furthermore, grave features entirely related to the MDC have been found as well [Machnik, Pilch 1997 and Machnik, Radiocarbon. . ., in this volume]. At present, we have first ^{14}C datings for assemblages in which MDC traits have been identified. The series comprises five datings secured from human bones. Since the archaeological context of each dating has been presented in detail by J. Machnik [Radiocarbon. . ., in this volume], we shall focus now only on their significance against the backdrop of the MDC datings from the Dnieper drainage presented earlier.

The dates vary from 2754 ± 99 to 2502 ± 77 BC. A joint calibration of all the five dates marks out the interval of 2700-2450 BC. The context of the finds permitted us to narrow down the interval to ca 2650-2500 BC with the majority of datings fitting into the period of 2600-2500 BC. At the same time, the analysis of traits of these assemblages for which ^{14}C analyses cannot be made justifies a hypothesis that the oldest of them may be dated to the period preceding the 2650/2600 BC division [Machnik, Radiocarbon. . ., in this volume].

Against the background of the MDC datings from the area of the Middle Dnieper discussed earlier, the chronology of MDC traits between the Upper Vistula and Bug is relatively early. However, while interpreting this observation one must remember that we do not have any ^{14}C dates for the early stage of the MDC. Hence, the problem calls for more research.

4.2. RADZIEJÓW GROUP OF THE FUNNEL BEAKER CULTURE, AN EARLY LOWLAND CORDED WARE CULTURE — WITH PONTIC ELEMENTS

A complex of four FBC-CWC assemblages, in which traits of the TC (Radziejów group) or the YC (early Lowland-Kujawy CWC) have been observed with a various degree of probability, offers a chance for their chronometric (radiocarbon) synchronization.

The assemblages of the Radziejów group of the FBC which contain elements associated with the TC and which are presented here [Koško, Pontic. . ., in this volume] represent phases IVA/IVB (Opatowice 42) and VA (Latkowo 5). In respect of them, we have three radiocarbon datings of charcoal samples taken from settlement

features. In general, the dates can be taken to be reliable with certain reservations about the older dating from Opatowice. Taken together, they mark out the interval of 3370-3030 BC.

The two assemblages of the early CWC from the Lowlands (precisely from Kujawy), i.e. Krusza Zamkowa 3 and Bożejewice 8, with analogies to the Black Sea steppes (YC) [see Koško, Pontic..., in this volume] may be dated to ca 3100-2900 BC (2997 ± 101 BC — Krusza Zamkowa) and 2870-2660 BC (2717 ± 153 BC — Bożejewice). Their joint calibration sets the interval of 3070-2600 BC.

Taking into account the datings of the late TC (phase CII) discussed earlier, the “Tripolye” traits in the Radziejów group should be rather related to the interlude between phases CI and CII or possibly to the early period of phase CII (3100/2950-2400/2300 BC) (Fig. 1).

In the case of the YC, the hypothetical steppe analogies of the source materials of the early CWC in Kujawy should be synchronized with an early period, i.e. placed on the scale of its development on the Dnieper before about 2550 BC (Fig. 1).

4.3. KUJAWY GROUP OF THE GLOBULAR AMPHORA CULTURE — WITH PONTIC ELEMENTS

Discussed elsewhere in this volume, the elements that are genetically related to the TC, namely the use of organic and mineral dyes in pottery making, were recorded at four GAC sites in Kujawy [Szmyt, Tripolye..., in this volume]. On the scale of relative chronology they may be associated with phase IIb (Kuczkowo 1, Bożejewice 22) and IIIa (Piecki 8, Żegotki 2) of the GAC. A detailed analysis of ^{14}C dates and their relation to the discussed materials made it possible to determine the chronological bracket in which the said elements occurred in Kujawy to be 3030-2460 BC.

Upon referring the above assessments to the periodization of the TC, they may be synchronized with its phase CII; what's more, with almost the whole period of its existence which has been determined using radiocarbon dating.

5. THE DIVISION MARKED BY THE TRZCINIEC SYNTHESIS OF CULTURES IN THE BORDERLAND BETWEEN THE EAST AND WEST OF EUROPE

As it is shown in the introduction, the formation of a cycle of cultures associated with the Trzciniec Horizon (TH) sets the upper cutoff point of the period of interest to us here [Klochko, Koško, Szmyt, Problem..., in this volume]. This is why we

shall discuss the question of the TH radiocarbon chronometry only as a set of conclusions relying on the data published in an earlier volume of the *Baltic-Pontic Studies* [Kovalyukh et al. 1998; Makarowicz 1998].

From the point of view of this study, the following findings seem to be important:

- a) In the area lying between the Vistula and Dnieper, the earliest TH datings come from the Lowlands of the Baltic Sea drainage basin (Kujawy) and concentrate between 2000-1850 BC.
- b) Towards the end of this period, the TH is also identified in the area of old Uplands, in the Upper Vistula drainage.
- c) The beginnings of the TH in the Dnieper drainage can be dated now to ca 1600 BC.

The above conclusions indicate that the TH reached a macrospatial dimension — binding the cultural environments of the Vistula and Dnieper drainages — between 1850 and 1600 BC.

6. POSSIBILITIES OF HISTORICAL (CALENDAR) CORRELATION OF CULTURAL UNITS OCCURRING BETWEEN THE VISTULA AND DNEPER

While assessing the possibility of correlation, we should exercise extreme caution. This is so because of certain doubts concerning the accuracy and integrity of the radiocarbon chronology of individual taxa. The problem is vividly illustrated by asynchronisms in YC and MDC datings and “Baltic” adaptations of their traits which are clearly older! (Fig. 1). The simplest interpretation of this fact is that the set of analyzed samples did not include any assemblages representative of the early stages of development of these units.

Keeping the above remarks in mind, we would rather limit ourselves to drawing a general outline of the “correlations” taking as a point of departure the Pontic periodization of the period of 3150-1850 BC. In the “Black Sea zone”, it corresponds to the period of transition between the Eneolithic and the Bronze Age. The following series of divisions can be distinguished: 3150/3100 BC, 2800/2700 BC, 2550/2500 BC, 2200/2100 BC and ± 1800 BC (Fig. 1). These points allow us to establish a sequence of four subperiods in the period of prehistory of the area on the right bank of the Dnieper which is of interest to us here. The sequence is as follows:

- A. 3150/3100-2800/2700 BC — domination of late TC structures (phase CII)
- B. 2800/2700-2550/2500 BC — Pontic exodus of the GAC into the territory of the decline TC surviving until ca 2700 BC. This dividing line is crossed only by the Usatovo group (?). Beginnings of YC infiltration and MDC development (?).

- C. 2550/2500-2200/2100 BC — the development (“invasion” according to M. Gimbutas) of “pastoral” YC societies and the Kemi-Oba culture. The decline (partial retreat to the west?) of the GAC and the beginnings of CC development. Further development of the MDC.
- D. 2200/2100-±1800 BC — the development of the CC and MDC. The emergence of the MPC.

The above outline is only a specification of a sequence of cultural units (for which we have ^{14}C datings) with any references to the current historical interpretations of the discussed stages of cultural change purposefully reduced to a minimum.

The Pontic traits recorded in the Baltic Sea drainage basin correspond either to sub-period A (Łatkowo 5, Opatowice 42, Kuczkowo 1, Bożejewice 22) or subperiod B (Krusza Zamkowa 3, Grzęda Sokalska, Bożejewice 8, Piecki 8, Żegotki 2), i.e. they fit into the period of 3150/3100-2550/2500 BC.

Departing from a “precise correlation”, i.e. based on a corpus of ^{14}C datings presented in this volume of the *Baltic-Pontic Studies*, it is worthwhile to attempt to synchronize the above distinguished subperiods with the radiocarbon chronology of the sequences of taxa from the settlement and cultural mesoregions of the Vistula drainage. The two most thoroughly researched mesoregions of this area are loess soils near Kraków in Małopolska [Kruk, Milisaukas 1983; Ścibior 1992; Włodarczak 1998; Włodarczak, Kowalewska-Marszałek 1998; Krzak 1989; Machnik, Ścibior 1991; Kadrow, Machnik 1997] and Kujawy [Czerniak et al. 1991; Czebreszuk 1996; Czebreszuk, Szmyt 1998; Szmyt 1999a; Czebreszuk et al. 1999].

- A = Małopolska: FBC — phases Bronocice IV and V (a part); Złota culture; CWC — phases I and IIa
Kujawy: FBC — phases IVB, (a part) and VB (a part); GAC — phase IIb; CWC — phase 1 (a part)
- B = Małopolska: FBC — Bronocice phase V (a part); Złota culture; CWC — phases IIb and IIb/IIIa
Kujawy: FBC — phases IVB (a part) and VB/C, VC; GAC — phase IIIa (a part); CWC — phases 1 (a part) and 2 (a part)
- C = Małopolska: CWC — phases IIIa and IIIb; Mierzanowice culture — phase I; Bell Beaker culture
Kujawy: FBC — phase VC (a part); GAC — phase IIIa (a part) and IIIb (a part); CWC — phases 2 (a part) and 4 (a part); Iwno culture — phase 1 and 2 (a part)
- D = Małopolska: Mierzanowice culture — phases II and III
Kujawy: GAC — phase IIIb (a part) and IIIc; CWC — phase 4 (a part); Iwno culture — phases 2 (a part) and 3

CONCLUSIONS

The presented findings bring a tentative order to the taxonomic outline of the area lying between the Vistula and Dnieper between 3150-1850 BC. Any further research — apart from obvious objectives like its verification and particularization as well as systematic recording of archaeological (typological) synchronizers of both cultural areas (in particular in the Black Sea basin) — should focus on the taxonomic problems outlined above. They primarily concern:

- exceedingly broad (?) chronology of the Usatovo group of the TC,
- too late (?) a chronology of the YC expansion into the right-bank Dnieper area,
- too late (?) a chronology of the beginnings of the MDC.

The list may be expanded to include the question — excluded from this volume — of the radiocarbon dating of the reception of the catacomb grave on the Upper Vistula [Kempisty 1978: Fig. 291; Machnik 1979a:392-397], which seems to be too early for the CC chronology framework.

All these questions, having a direct bearing on the synthesis of the borderland between the European “East” and “West”, call for more research.

ABBREVIATIONS

AO	– Arkheologicheskiye otkrytya, Moskva.
AJA	– American Journal of Archaeology, New York.
BPS	– Baltic-Pontic Studies, Poznań.
EA	– Eurasia Antiqua, Berlin.
FPP	– Folia Praehistorica Posnaniensia, Poznań.
KSIA	– Kratkiye soobshcheniya Instituta Arkheologii, Moskva.
KSIA AN USSR	– Kratkiye soobshcheniya Instituta Arkheologii AN USSR, Kiev.
KSIIMK	– Kratkiye soobshcheniya Instituta Istorii Materialnoy kul'tury, Moskva.
KSOGAM	– Kratkie Soobshcheniya Odesskogo Gosudarstvennogo Arkheologicheskogo Muzeya, Odessa.
MIA	– Materialy i issledovaniya po arkheologii, Moskva.
NA IA NANU	– Naukovy Arkhiv Instituta Arkheologii Nacionalnoi Akademii Nauk Ukrainu, Kiev.
SA	– Sovetskaya Arkheologia, Moskva.
SpA	– Sprawozdania Archeologiczne, Kraków.
ZFA	– Zeitschrift für Archäologie, Berlin.

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Orders regarding B-PS should be addressed directly to the Editorial Office (Baltic-Pontic Studies, Institute of Prehistory, Św. Marcin 78, 61-809 Poznań, Poland).
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The publications is carried out within the research project No. 1H01G05912 (in part No. 1H01G01810) financed in the years 1997–1999 by the Committee for Scientific Research and supplied with funds of the Ministry of National Education and Adam Mickiewicz University Foundation.

ISBN 83-86094-06-0
ISSN 1231-0344