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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 archaelogical cultures and sites are standarized to the English literature on the subject (e.g. M. Gimbutas, J. P. Mallory). In the case of a new term, the author's original name has been retained.
3. The spelling of names of localities having the rank of administrative centres follows official, state, English language cartographic publications (e.g. *Ukraine, scale 1 : 2 000 000*, Kiev: Mapa LTD, edition of 1996).

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Viktor Klochko, Aleksander Kośko, Marzena Szmyt

A COMPARATIVE CHRONOLOGY OF THE PREHISTORY OF THE AREA BETWEEN THE VISTULA AND DNIEPER: 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, Kośko, 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].

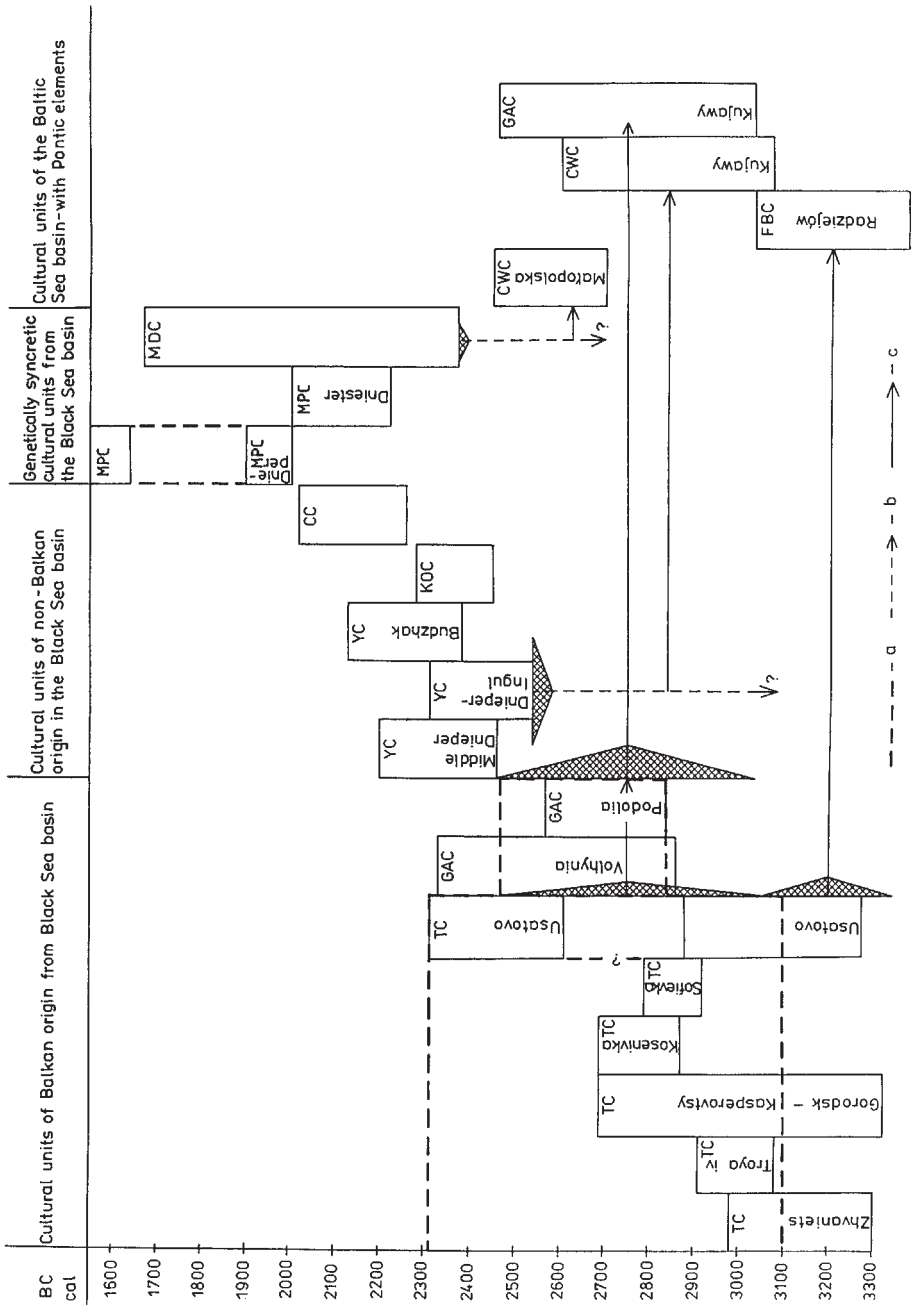

Fig. 1. Synchronization of cultural units between the Vistula and Dnieper from 3150-1850 BC based on radiocarbon dates. a - general chronology of phase CII of the TC and GAC b - possible expansion directions of the chronological ranges of specific units c - impact directions of Pontic zone cultural units

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-Gorodyszcze; 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. Ti 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).

2.1. YAMNAYA CULTURE

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, Kośko, 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 DNIEPER 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. DNIEPER-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 Mezhlimanskiy *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 [Kośko, 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 Σ 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 [Kośko, 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 Kośko, 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, Kośko, 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 DNIEPER

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 (Latkowo 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 kultury, 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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