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

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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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**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 Mnogovalikovoi 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

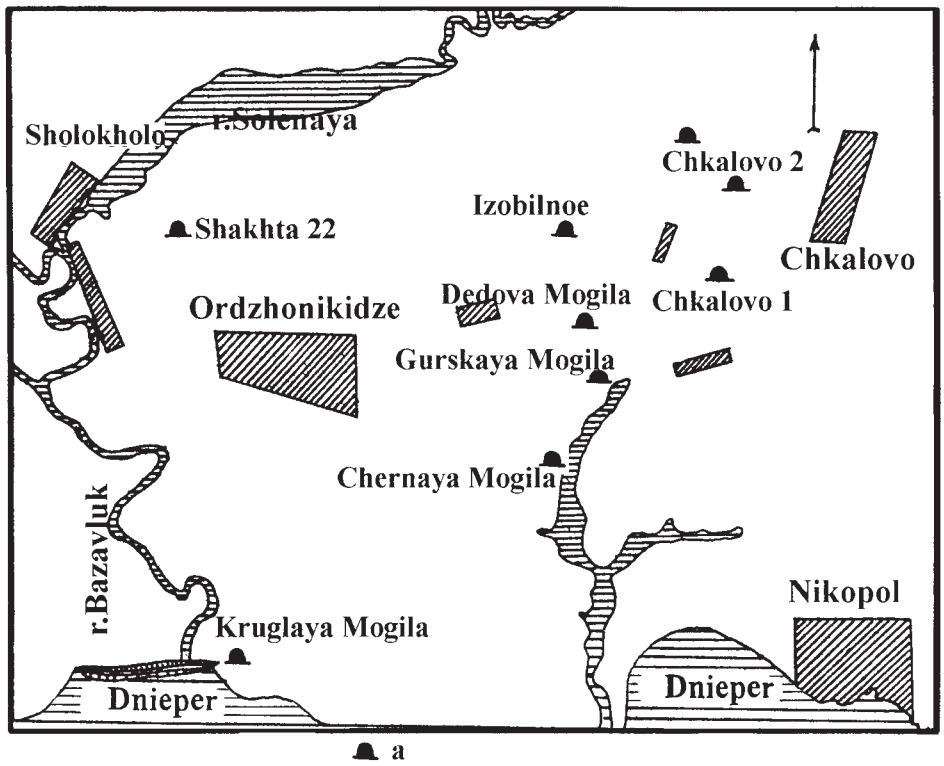


Fig. 1. The circuit of the arrangement of barrow groups near Ordzhonikidze and near Chkalovo in the Nikopol District of the Dnipropetrovsk Region [see Pustovalov 1994]. Legend: a - barrow group

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.

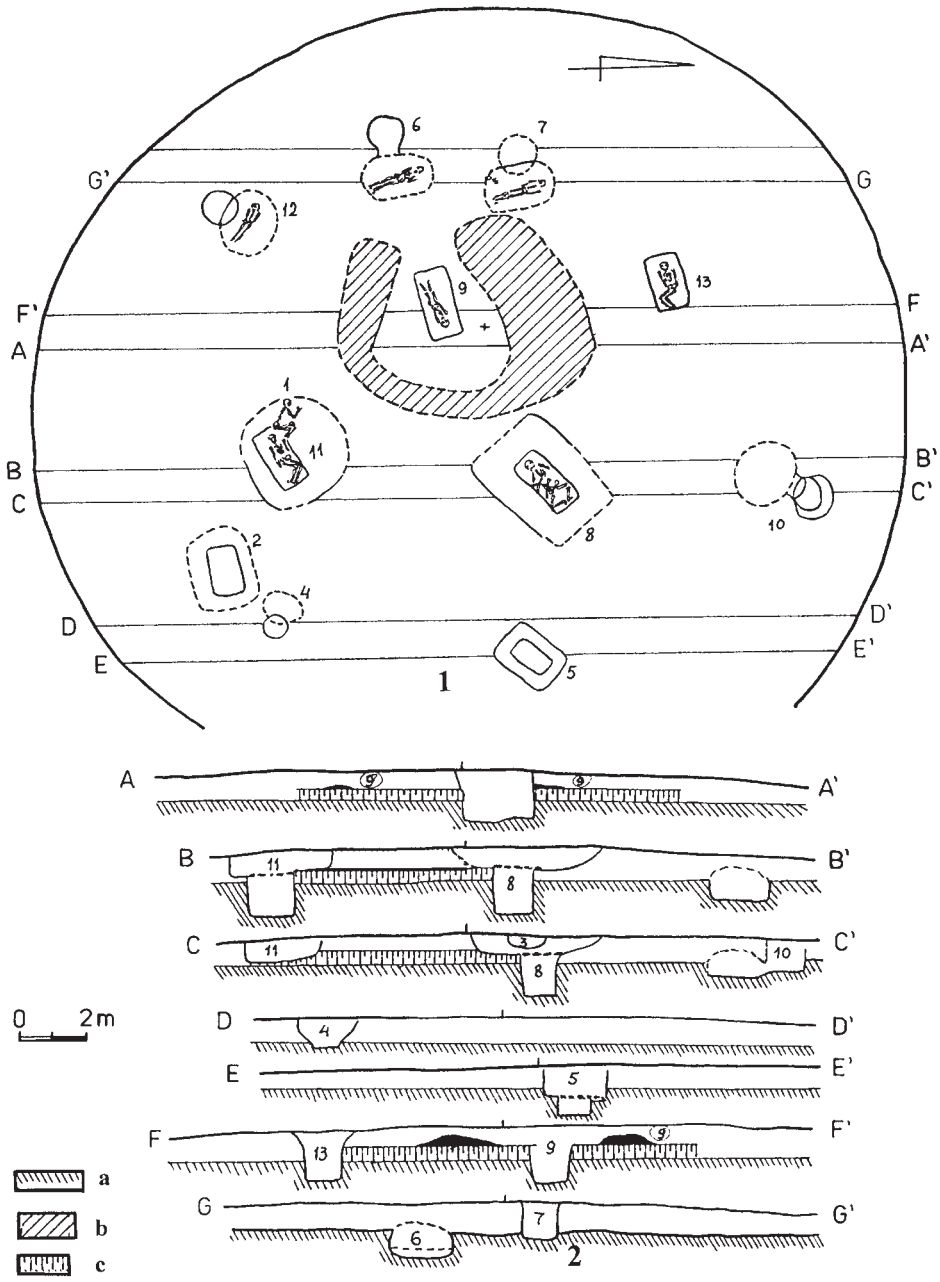


Fig. 2. Chkalovo, Nikopol District, Dnipropetrovsk Region
1 - general plan of barrow 11; 2 - cross-sections of barrow 11. Legend: a - the continent, b - the digging, c - buried chernozem

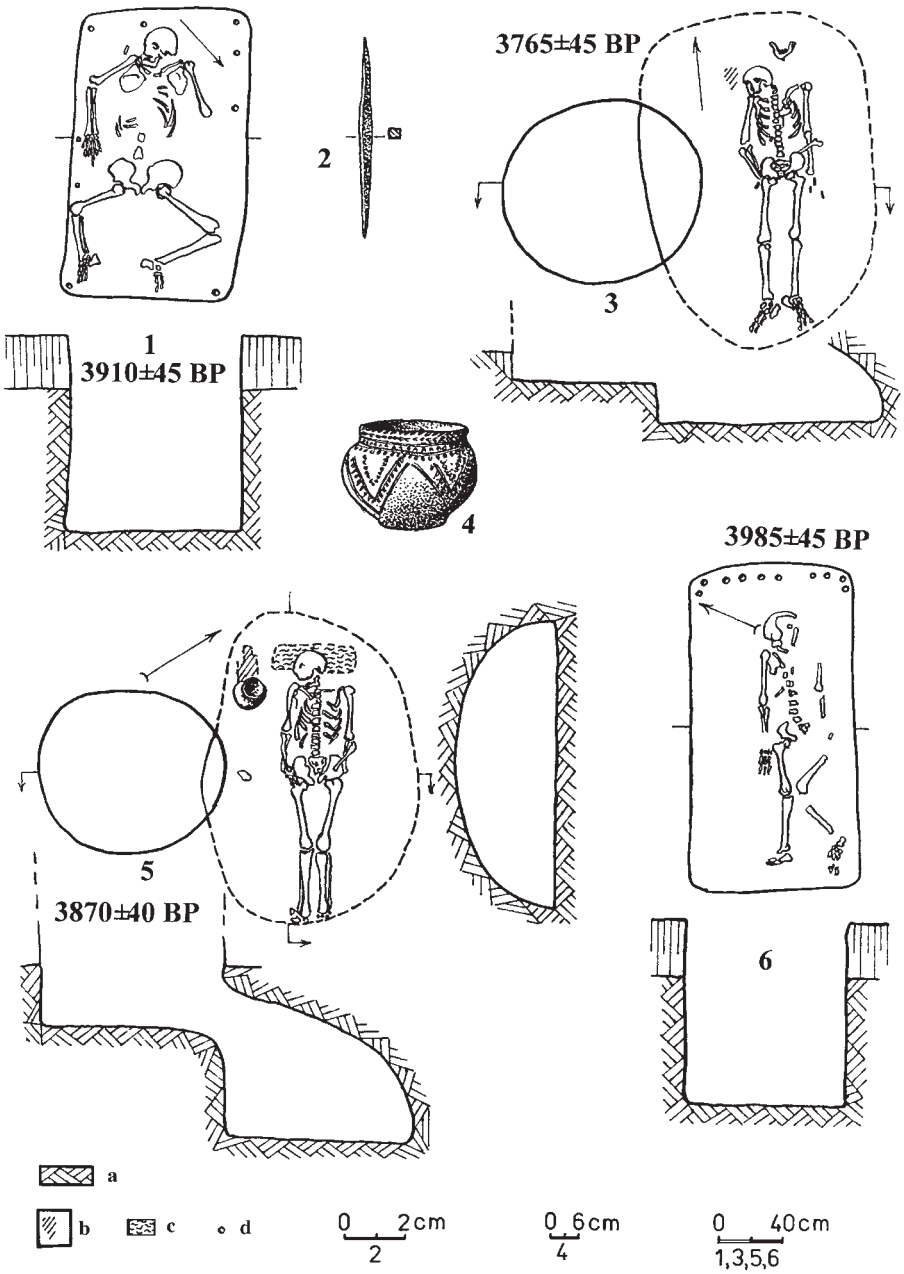


Fig. 3. Chkalovo, Nikopol District, Dnipropetrovsk Region, barrow 11
1 - plane of grave 8; 2 - bronze awl from grave 8; 3 - plan of grave 7; 4 - clay vessel from grave 12; 5 - plan of grave 12; 6 - plan of grave 9. Legend: a - continent; b - ochre stains; c - black remains; d - hollow

*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, 2.8cm 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 l 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

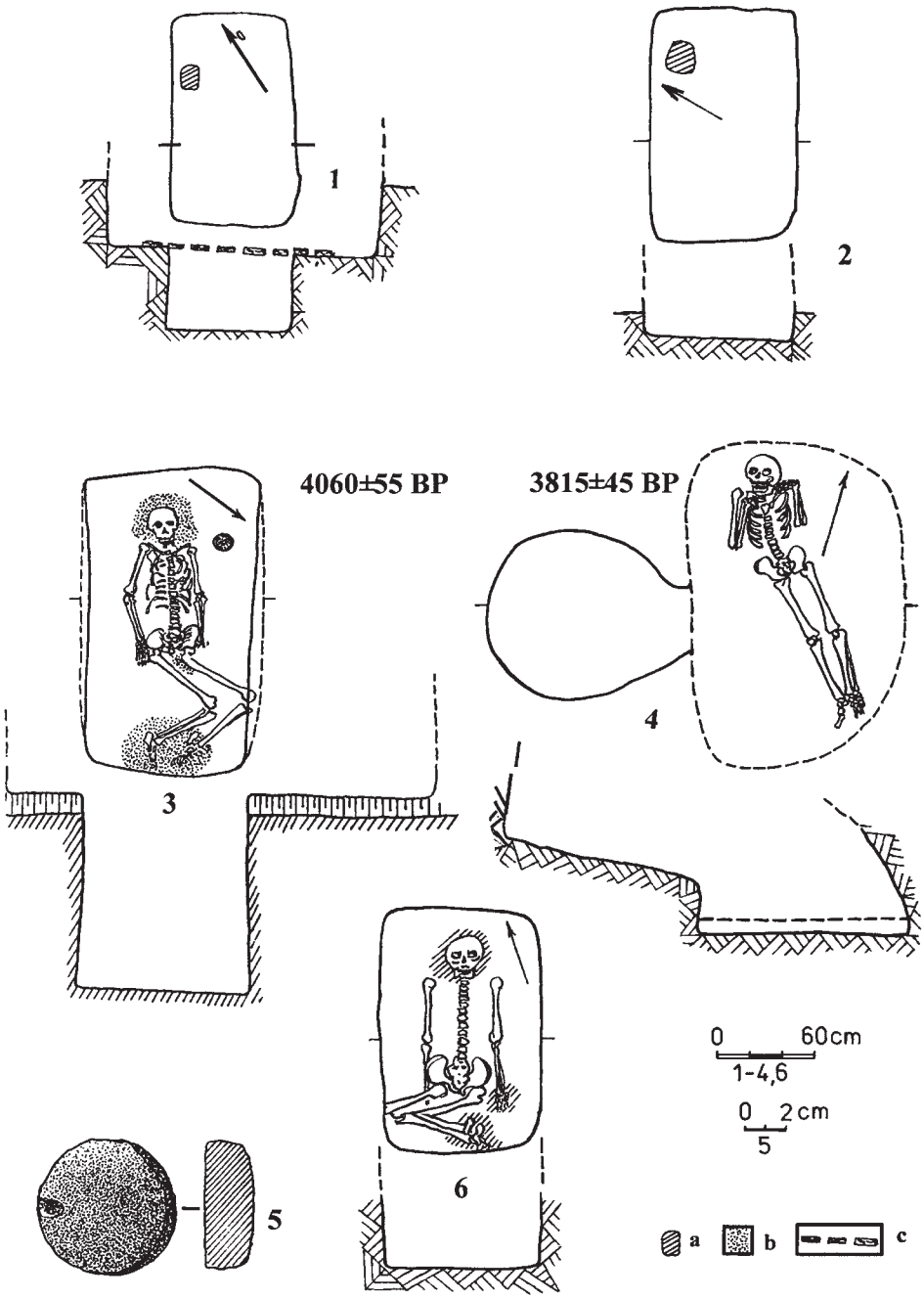


Fig. 4. Chkalovo, Nikopol District, Dnipropetrovsk Region, barrow 11
1 - plan of grave 5; 2 - plan of grave 2; 3 - plan graves 11; 4 - plan graves 6; 5 - fashioned ochre from grave 11; 6 - plan of grave 13. Legend: a - fashioned ochre; b - ochre stains; c - wood

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 comers, 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

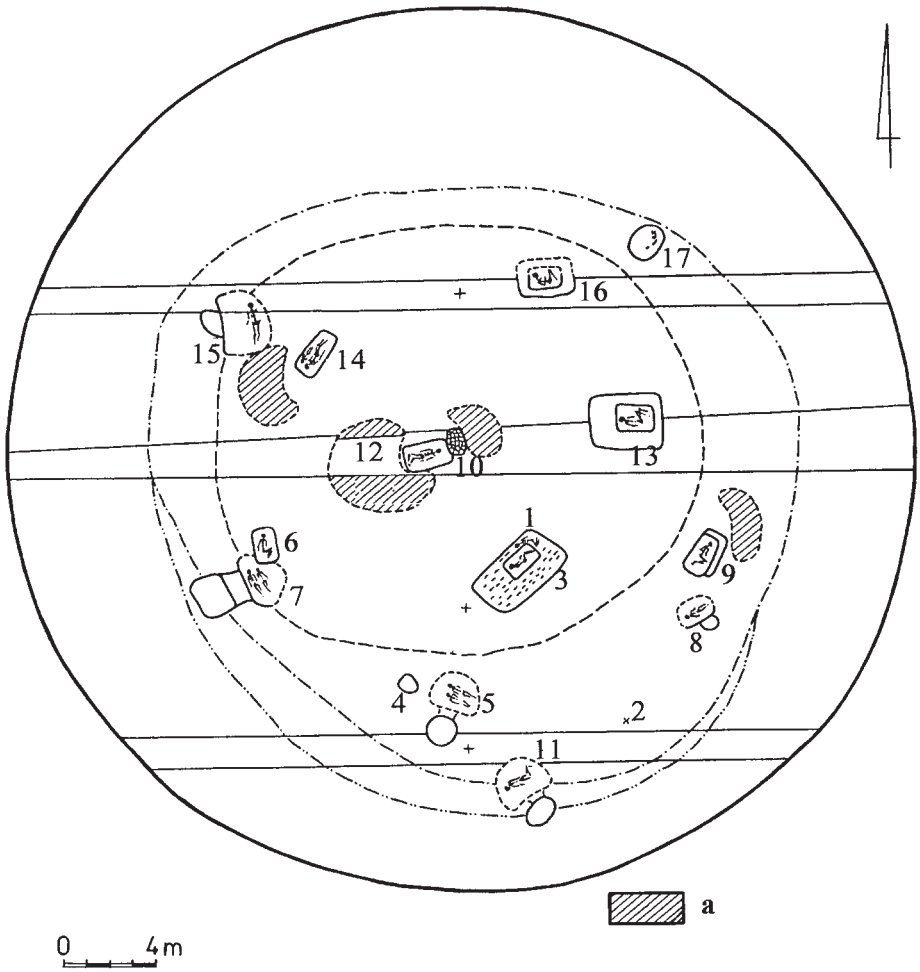


Fig. 5. General plan of barrow 2, Shakhta 22 group, Nikopol District, Dnipropetrovsk Region
Legend: a - grave outlet

pit, with rounded comers, 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.

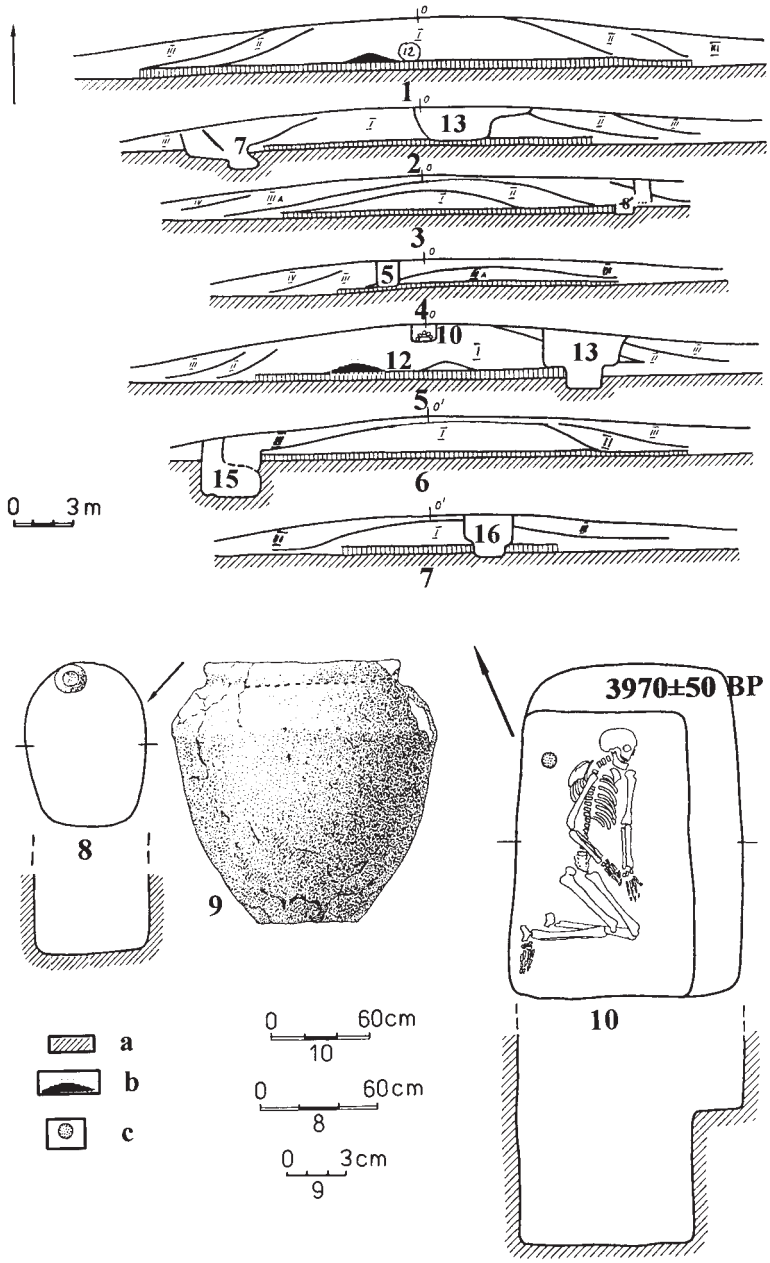


Fig. 6. Group Shakhta 22, Nikopol District, Dnipropetrovsk Region barrow 2.
1-7 - cross-section of barrow 2; 8 - plan of grave 4; 9 - pottery vessel from grave 4; 10 - plan of grave 9.
Legend: a - continent; b - ochre; c - piece of ochre

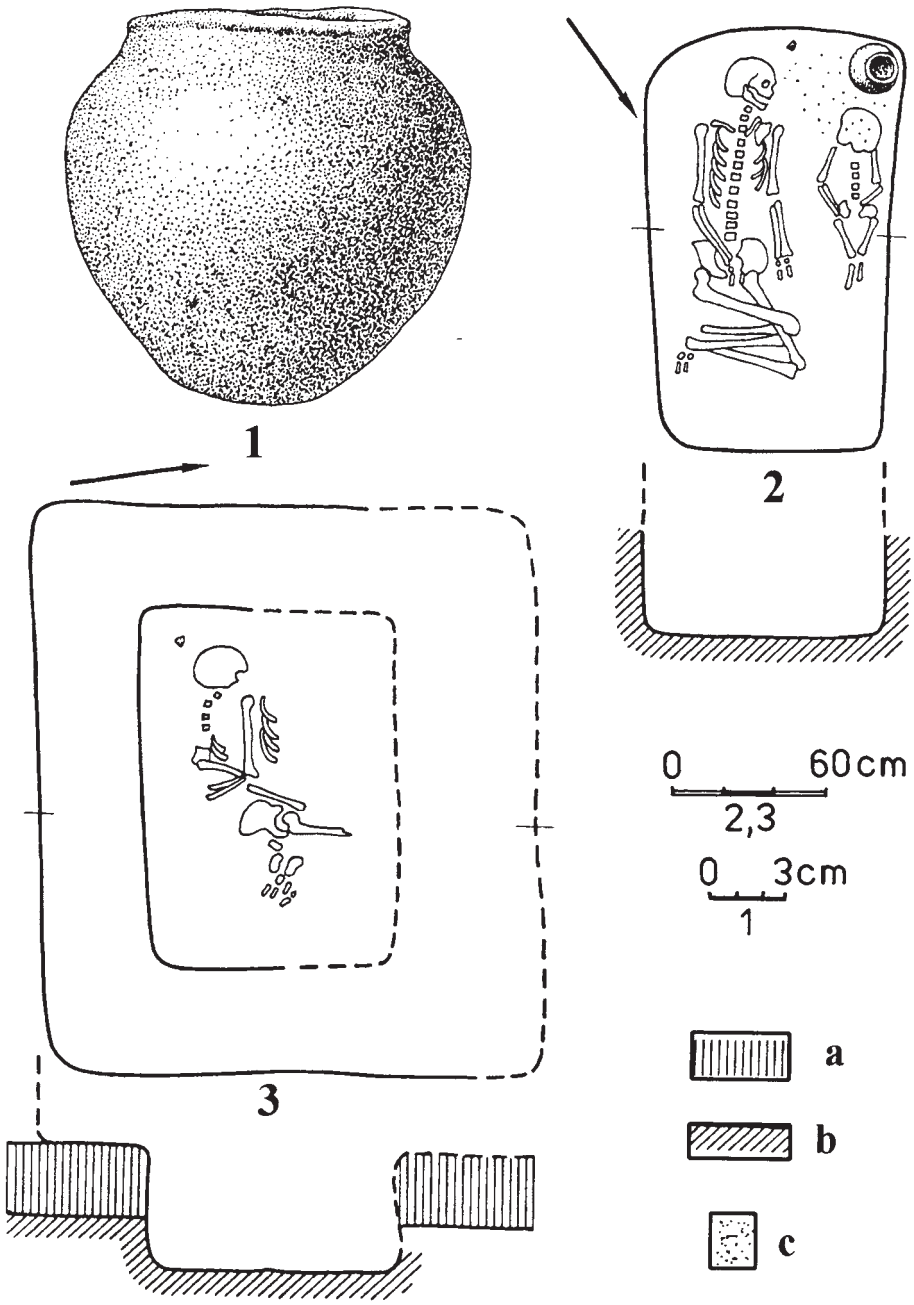


Fig. 7. Group Shakhta 22, Nikopol District, Dnipropetrovsk Region barrow 2
1 - vessel from grave 14; 2 - plan of grave 14; 3 - plan of grave 16. Legend: a - ochre; b - buried chernozem; c - continent; d - small goat hooves

*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 min 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

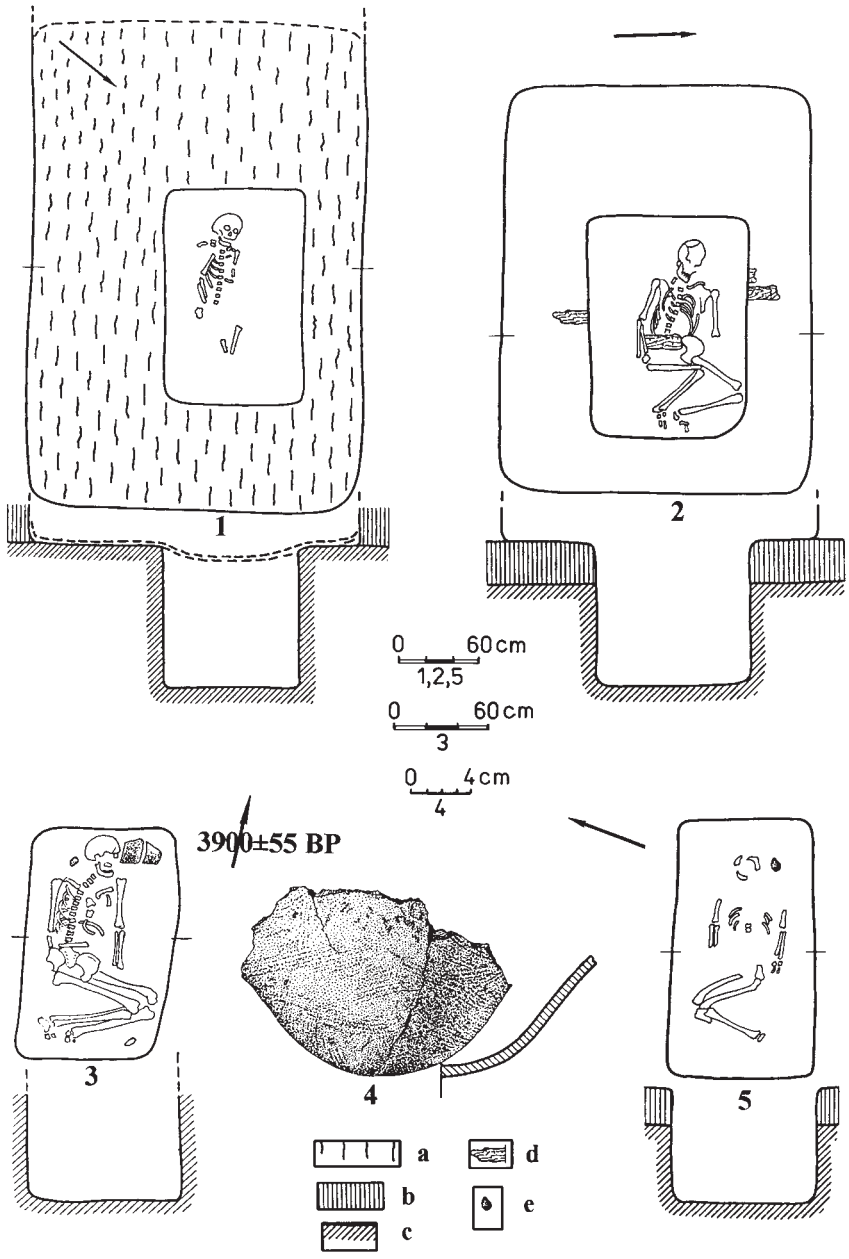


Fig. 8. Group Shakhta 22, Nikopol District, Dnipropetrovsk Region barrow 2
1 - plan of grave 3; 2 - plan of grave 13; 3 - plan of grave 6; 4 - fragment of vessel from grave 6; 5 - plan of grave 12. Legend: a - cane; b - buried chernozem; c - continent; d - wood; e - ochre

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±45 | 2316-2190<br>2164-2144 | 2452-2432<br>2402-2370<br>2358-2130<br>2074-2052 |
| Chkalovo | Ki-6608a | 11/6 | CC | 3770±50 | 2278-2228<br>2206-2132<br>2078-2048 | 2390-2388<br>2334-2070<br>1998-1986 |
| Chkalovo | Ki-6610 | 11/7 | CC | 3765±45 | 2276-2246<br>2204-2130<br>2080-2046 | 2314-2300<br>2298-2032 |
| Chkalovo | Ki-6610a | 11/7 | CC | 3750±45 | 2270-2260<br>2202-2122<br>2086-2040 | 2284-2028<br>1998-1984 |
| Chkalovo | Ki-6827 | 11/8 | YC | 3910±45 | 2460-2390<br>2388-2334 | 2550-2542<br>2490-2276<br>2240-2238<br>2236-2204 |
| Chkalovo | Ki-6571 | 11/9 | YC<br>1 | 3985±45 | 2540-2522<br>2504-2456 | 2610-2598<br>2588-2396<br>2380-2344 |
| Chkalovo | Ki-6571a | 11/9 | YC<br>1 | 4035±50 | 2608-2600<br>2586-2470 | 2862-2816<br>2694-2676<br>2668-2456<br>2418-2412 |
| Chkalovo | Ki-6828 | 11/9 | YC<br>1 | 3960±50 | 2562-2528<br>2498-2448<br>2436-2400<br>2374-2354 | 2576-2312<br>2304-2294 |
| Chkalovo | Ki-6828a | 11/9 | YC<br>1 | 4010±50 | 2574-2514<br>2508-2454 | 2854-2822<br>2658-2642<br>2622-2448<br>2436-2400<br>2376-2352 |
| Chkalovo | Ki-6572 | 11/11 | YC | 4060±55 | 2850-2824<br>2656-2644<br>2620-2488 | 2866-2810<br>2754-2724<br>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<br>2660-2640<br>2624-2394<br>2382-2338 |
| Chkalovo | Ki-6829 | 11/11 | YC | 3900±55 | 2460-2314<br>2302-2296 | 2552-2542<br>2492-2198 |
| Chkalovo | Ki-6829a | 11/11 | YC | 3990±50 | 2574-2516<br>2508-2456 | 2840-2834<br>2616-2332<br>2384-2336 |
| Chkalovo | Ki-6609 | 11/12 | CC | 3870±40 | 2452-2430<br>2404-2368<br>2364-2282 | 2458-2270<br>2260-2202 |
| Chkalovo | Ki-6609a | 11/12 | CC | 3800±50 | 2310-2308<br>2294-2138 | 2450-2432<br>2402-2370<br>2358-2124<br>2086-2040 |
| Shakhta 22 | Ki-6833 | 2/6 | YC<br>4 | 3900±55 | 2460-2314<br>2302-2296 | 2552-2542<br>2492-2198 |
| Shakhta 22 | Ki-6834 | 2/9 | YC<br>3 | 3970±50 | 2568-2524<br>2502-2452<br>2430-2402<br>2370-2360 | 2584-2314<br>2302-2296 |
| Shakhta 22 | Ki-6834a | 2/9 | YC<br>3 | 3930±50 | 2470-2390<br>2388-2332 | 2566-2524<br>2500-2300<br>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

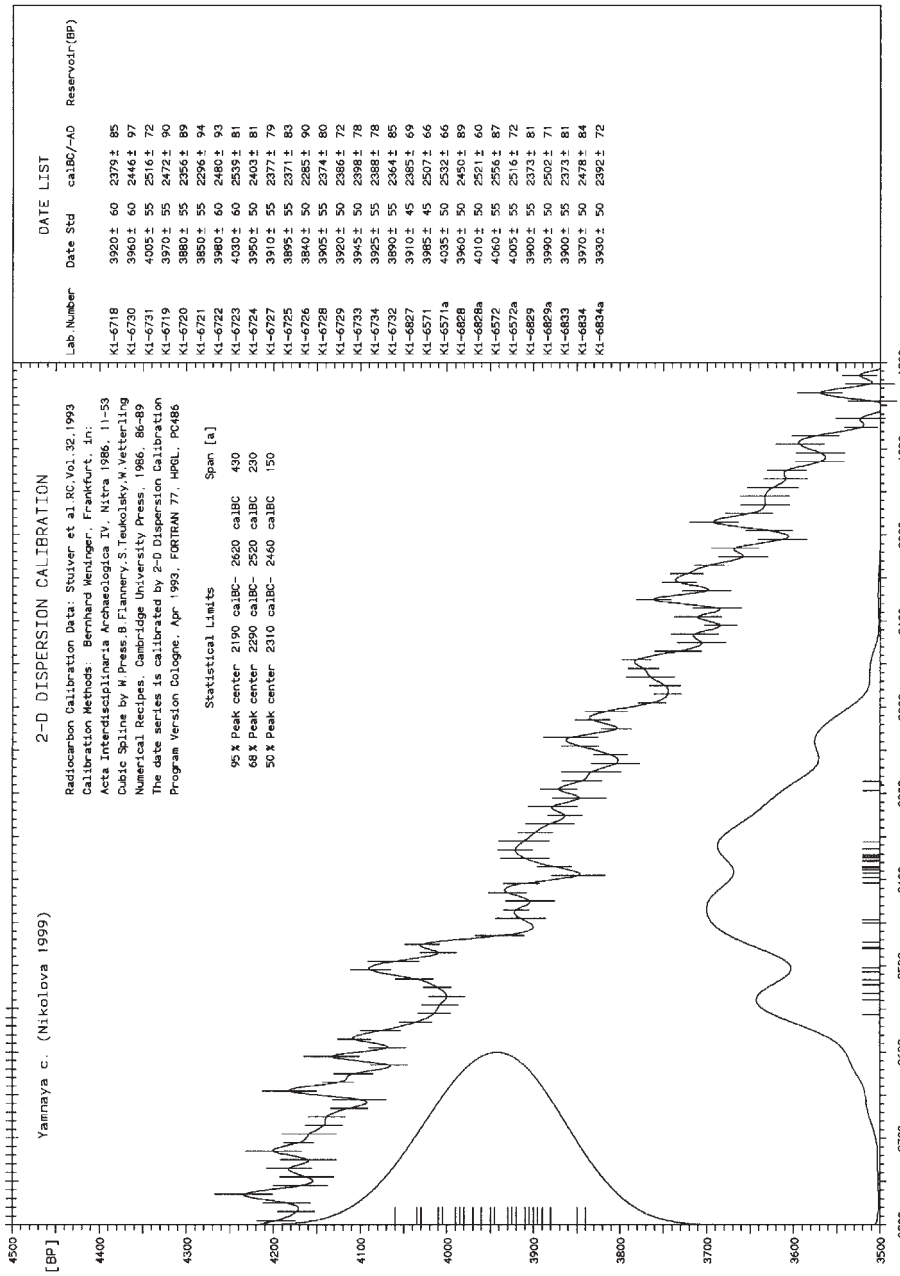


Fig. 9. Radiocarbon dating of the Yamnaya culture [using Weninger 1993 calibration]

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-l08]. 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).

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-66l0, 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±45 | 2231±81 |
| Ki-6608a | 11/6 | 3770±50 | 2135±92 |
| Ki-6610 | 11/7 | 3765±45 | 2131±82 |
| Ki-6610a | 11/7 | 3750±45 | 2117±75 |
| Ki-6827 | 11/8 | 3910±45 | 2385±69 |
| Ki-6571 | 11/9 | 3985±45 | 2507±66 |
| Ki-6571a | 11/9 | 4035±50 | 2532±66 |
| Ki-6828 | 11/9 | 3960±50 | 2450±89 |
| Ki-6828a | 11/9 | 4010±50 | 2521±60 |
| Ki-6572 | 11/11 | 4060±55 | 2556±87 |
| Ki-6572a | 11/11 | 4005±55 | 2516±72 |
| Ki-6829 | 11/11 | 3900±55 | 2373±81 |
| Ki-6829a | 11/11 | 3990±50 | 2502±71 |
| Ki-6609 | 11/12 | 3870±40 | 2320±83 |
| Ki-6609a | 11/12 | 3800±50 | 2217±87 |
| Ki-6833 | 2/6 | 3900±55 | 2373±81 |
| Ki-6834 | 2/9 | 3970±50 | 2478±84 |
| Ki-6834a | 2/9 | 3930±50 | 2393±72 |

Table 3

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

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

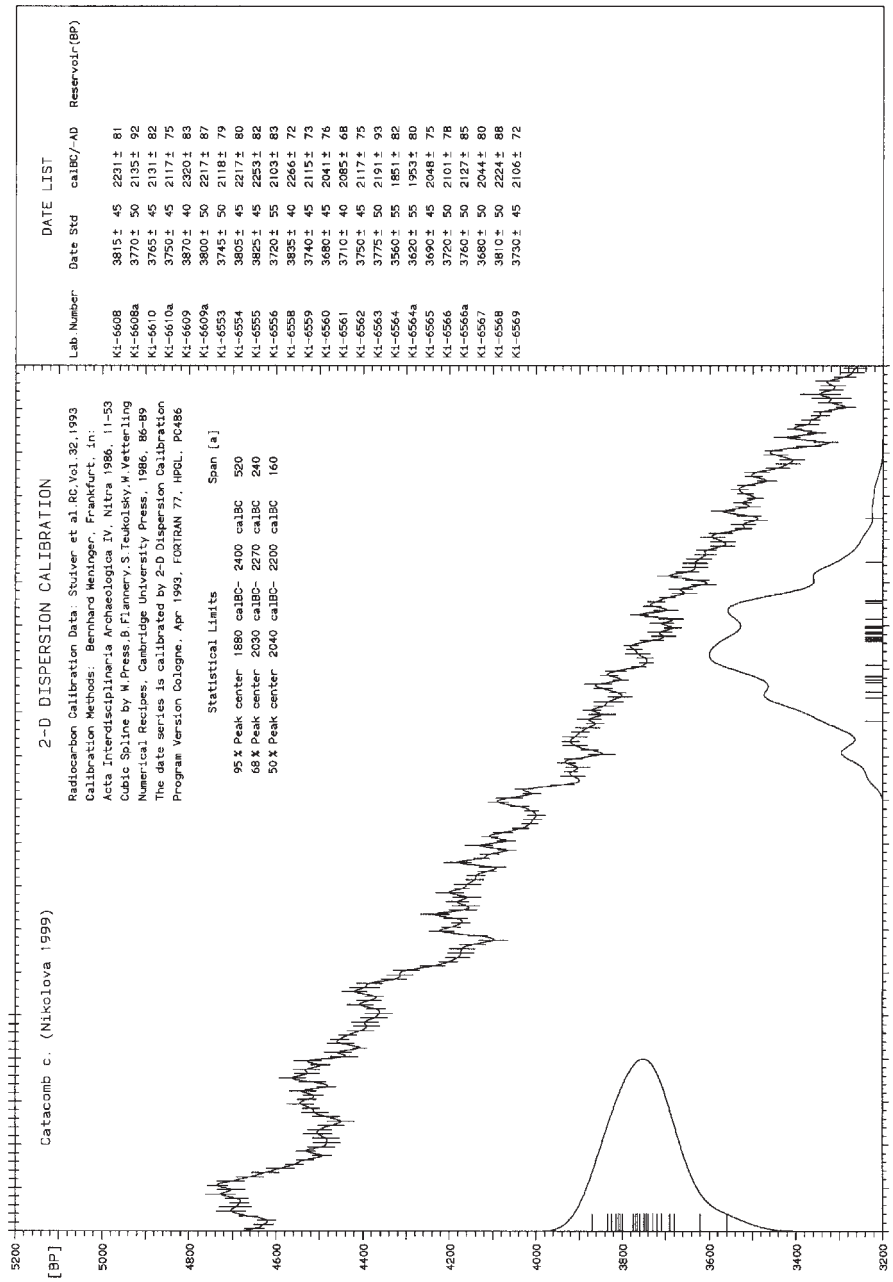


Fig. 10. Radiocarbon dating of the Catacomb culture [using Weninger 1993 calibration]

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 arid 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,

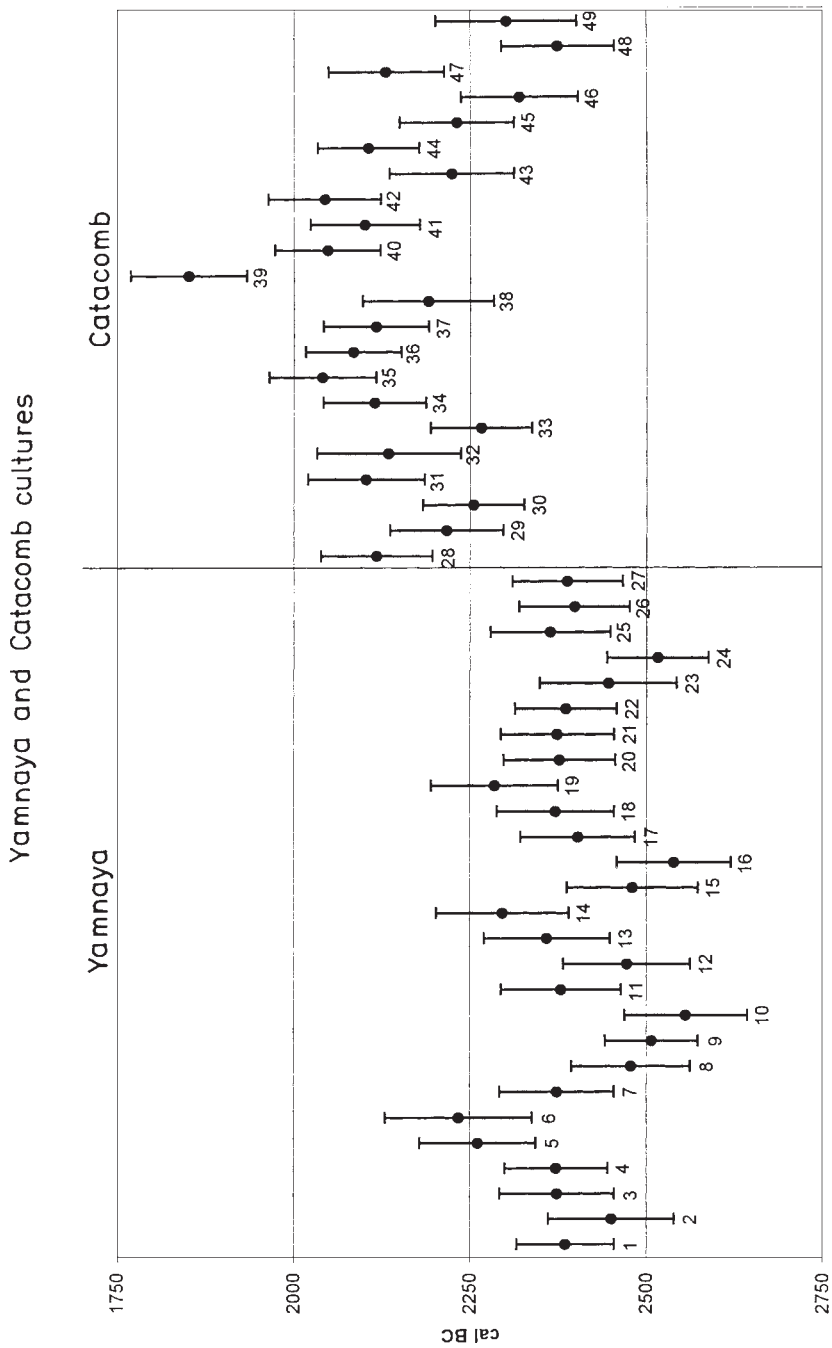


Fig. 11. Radiocarbon dating of the Yamnaya and Catacomb cultures [using Weninger 1993 calibration]

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.

## 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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