2 Ceramic Mesolithic, Sub-Neolithic, Para-Neolithic Hunter-Gatherers in Availability Phase: Searching for a Definition for the Obvious

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The Carpathian-Dnieper region spans a wide range of ecological zones, extending from the Black and Azov Sea's coastlines in the south to the steppe, forest-steppe, mixed and deciduous forests in the north, and up into alpine uplands in the Carpathians.[1] Consequently, it's logical to infer that the processes and timelines of Neolithisation differ significantly based on the specific ecological context. Over time, there appears to be a trend towards delayed agricultural colonisation in less fertile or more remote areas. Thus, we can expect the coexistence of Neolithic groups on already cultivated lands and hunter-gatherer groups on the yet unreached territories.

And, actually, seven thousand years ago, the Carpathian-Dnieper region can be subdivided between two social worlds: the world of early farmers and the world of fishermen, hunters, and gatherers.[2] The

1 Marynych 1990.

2 Lillie et al. 2020b; Telegin 1985b; Wechler 2001.

latter we propose to label as para-Neolithic. The societies of the early agricultural world had a common origin. For the first time in Europe, communities of this type emerged in Thessaly and gradually spread deeper into the Balkans and Central Europe, as well as along the Mediterranean coast.[3] This process, called 'Neolithisation', led to radical population changes in large parts of southern and central Europe.[4] Instead, groups of fishermen, hunters and gatherers were heterogeneous, with different economic strategies and probably different social structures.[5]

Early farmers based their economy on agriculture and animal husbandry. They lived a sedentary lifestyle in permanent settlements with permanent houses, structuring and developing the space around them.[6] Their ceramic complexes are mostly clearly divided into tableware and kitchenware, and the raw materials for decorations and tools were often obtained far from the place of use.[7] The social organisation of the early farmers was capable of holding together much larger groups of people than the average among fishermen, hunters and gatherers.[8] Early farmers shared a number of related religious belief systems, often centred on a fertility goddess.[9] Archaeological markers **[fig. 19]** of early farmers in general (but there are important exceptions) include flat-bottomed (sometimes painted) vessels, burial rites bent on their sides, anthropomorphic figurines, which correspond to the sharp- or round-bottomed vessels of fishermen, hunters, and gatherers, buried people stretched out on their backs, and ornaments made of deer, wild boar, bear teeth, etc.[10] Fishermen, hunters and gatherers led a mobile lifestyle.[11] Palaeogenetic studies show that even in terms of genetic makeup, early farmers and hunter-gatherers were mostly different.[12]

This section examines the realm of ceramic hunter-gatherers. Initially, we will examine the current understanding of their cultural diversity (§ 2.1), abstaining from critique for a while. Subsequently, we will cast doubt on its correspondence to past realities, using the

3 Aubán et al. 2015; Bentley et al. 2003; Biagi et al. 2005.

4 Ammerman, Cavalli-Sforza 1971; Mathieson et al. 2018.

5 Gehlen 2010; Gronenborn 1997; Nowak 2007; Zaliznyak 1998.

6 Lüning 1982.

7 Zimmermann 1995.

8 Müller 2016.

9 Hodder 2010.

10 Telegin 1985b.

11 Zaliznyak 2020.

12 Bramanti et al. 2009; Lipson et al. 2017.

well-examined Buh-Dniester culture as a case in point (§ 2.2). These observed patterns may be extrapolated to other regions and cultural aspects (§ 2.3). With the established chronology of sites, we can then draw generalisations about the early spread of ceramics (§ 2.4).

2.1 The Current Typo-Chronological Schemes

The dominance of the cultural-historical approach in local archaeologies has led to understanding the Neolithic of southern Eastern Europe as a mosaic of cultural aspects.[13] From my point of view, this typological grid masks the real state of research in the region. In many cases, a cultural aspect refers only to a characteristic style of ceramics, and there is a lack of reliable information about its correspondence to other elements of material culture. In the future, with the spread of modern research methods, many of the cultural groupings will have to be deconstructed. However, this large-scale task is beyond the scope of this work. In the following, we will try to deconstruct the 'Buh-Dniester culture' as an example of such an approach. Therefore, the following presentation of the cultural map of the para-Neolithic of Ukraine is intended to describe the existing terminology and record the state of research. The author does not aim at an accurate or complete description of these groups and asks the reader to refer to publicly available overviews.[14]

The southwestern part of Ukrainian, and Moldavian forest-steppe was an area of so-called 'Buh-Dniester culture'. Its sites were mostly found along the major rivers: the Southern Buh and Dniester **[figs 20-21]**. Some finds were reported further east – as far as the Prut River valley.[15] At the beginning of the 2010s, about 90 sites and two cemeteries were attributed to this culture.[16] The scatters of finds were interpreted as surface dwellings, while shallow pits of complex shapes filled with archaeological material were interpreted as semi-dugout dwellings.[17] The culture consisted of three to seven stages, the differences between which were quite significant.[18] Flat-bottomed and sharp-bottomed vessels with significant variations in decoration, tempers and the technology of their manufacture have

13 Motuzaite Matuzeviciute 2012; Tovkailo 2020.

14 Kotova 2003; Telegin 1987; Tovkailo 2020.

15 Markevich 1974.

16 Tovkailo 2020.

17 Danilenko 1969; Markevich 1974.

18 Danilenko 1969; Telegin 1977; Tringham 1973.

been recorded.[19] The flint inventory is also distinctive. Some sites yielded lithic assemblages similar to Kukrek, others to Hrebenyky.[20] The Balkan contacts of this culture were especially emphasised.[21]

The area of distribution of the so-called Surskyi (also Surska, Sura-Dnieper) culture is outlined in the most general terms.[22] Pottery of this characteristic appearance has often been found in multi-layered settlements in the Dnieper Rapids region **[fig. 20]**.[23] This is where the sites on Surskyi, Shulaiv, Strilcha Skelya, and other islands are located.[24] Many sites were excavated in the first half of the twentieth century and have questionable stratigraphy. Ceramics of this type have also been found quite far from this region[25] – on the Oril River (Yosypivka), on the Siverskyi Donets (Oleksandriia). It has long been known in the Azov region, in particular at the multi-layered site of Kamyana Mohyla 1.[26] The peculiar Surskyi ceramics have a pointed bottom, made of well-silted clay, sometimes with a temper of crushed shells. Linear incised compositions adorned these pots.[27] Some scatters of finds have been interpreted as dwellings or residential complexes. According to the descriptions, they have somewhat deepened lenses of darker soil saturated with anthropogenic remains – similar to the trampling floors of the Late Palaeolithic sites. Such sites are known on Surskyi and Shulaiv islands.[28] Often, stone vessels are also found at these sites, sometimes with engraved ornaments.[29] A characteristic feature is the variety of bone products, including fishing tools.[30]

The vast territories of forest-steppe and forests were settled by groups with comb-ornamented pottery **[fig. 20]**. D. Telegin united them into Dnieper-Donets culture.[31] This pottery was distributed in Polissia and Volhynia, in the Dnieper Valley, and on the Ukrainian left bank of Dnieper up to the middle reaches of the Siverskyi

19 Haskevych et al. 2020.
20 Gaskevych 2003; Kotova 2003.
21 Tovkailo 2014.
22 Tovkailo 2020.
23 Dobrovolskyi 1949.
24 Kotova 2015.
25 Telegin 1985b.
26 Danilenko 1952.
27 Kotova 2015.
28 Demchenko 2016.
29 Danilenko 1969.
30 Demchenko 2016.
31 Telegin 1968.

Donets. The pots are mostly with pointed bottoms, but there are also remains of flat-bottomed pots and bowls. Tempers in the ceramic paste included grass and sand. Flint axes and trapezes are often found. D. Telegin believed that this population left burial grounds of the Mariupol type.[32] However, there is convincing evidence that a significant part of these cemeteries is associated with groups with slightly different ceramics.[33] Nowadays, many regional styles of this pottery are defined, giving place to multiple cultures determined on the basis of characteristic styles.[34] The particular importance held Volhynian cultural aspect (often equalled to Nieman culture of Poland and Bielorussia)[35] and the Kyiv-Cherkassy aspect in the Middle Dnieper region.[36] They were suspected of participating in contacts with incoming early farmers,[37] but the evidence for interactions has yet to be criticised and validated with modern scientific approaches.

The Azov-Dnieper archaeological culture **[fig. 20]**, often associated with the Neolithic period,[38] holds a prominent position in Ukraine's historical timeline. This culture is marked by an abundance of finely adorned ceramic containers featuring flat bottoms and distinctive 'collar' rims, as well as established settlements and numerous burial sites.[39] Researchers conducted several rounds of dating on human remains found in cemeteries within the Dnieper Rapids region, linked to this cultural context.[40] However, the dates based on human bones are notably earlier than the dates done from deer teeth and other animal bones.[41] This discrepancy can be attributed to a freshwater reservoir effect.

One defining characteristic of this cultural group is the presence of flat-bottomed pots with 'collar rims' that feature a distinctive collar-like thickening, as well as rims that are both obliquely cut and thickened. The ceramic ware from this culture is predominantly adorned with patterns created through the impression of comb stamps. These patterns typically form horizontal rows separated by

32 Telegin, Potekhina 1987.

33 Kotova 2003.

34 Kotova 2003.

35 Okhrimenko 2009.

36 Kotova 2012.

37 Okhrimenko 2009; Tovkailo 2020.

38 Kotova 2003.

39 Kotova et al. 2021; Kotova 2003.

40 Lillie et al. 2020b.

41 Kotova 2018; Lillie et al. 2009.

zigzag or straight lines.[42] Lithic tools comprise fan-shaped endscrapers, 'knives' (blades with convergent semi-abrupt retouch), 'chisels' (*pièces esquillées*), and geometric microliths, typically trapezes, sometimes trapezes with a flat invasive retouch on dorsal surfaces.[43]

The burial customs of the Azov-Dnieper population have been extensively studied, particularly in the context of Mariupol-type burial sites.[44] Deceased individuals were interred in large cemeteries in closely spaced pits, creating long rows of burials. The bodies of the deceased were positioned lying on their backs.

The cultural picture drawn above reflects the previous stage of development of Ukrainian, Moldovan and Russian archaeology.[45] Today, the process of its criticism and reconstruction is already quite active, depending on new dating results, the use of other scientific methods and, above all, the refined excavation methodology.[46]

2.2 Deconstructing 'Buh-Dniester Culture'

'Buh-Dniester culture' is a theoretical construct created to characterise the Neolithic of south-western Ukraine and Moldova. V.M. Danilenko and V.I. Marchevici developed it between 1949 and 1974.[47] The term was coined in 1963. V.M. Danilenko saw 'Buh-Dniester' as an example of typical early farming culture covering the timespan from the appearance of domestic fauna and flora in the region till the beginning of the Eneolithic period.[48] The concept of 'Buh-Dniester culture' was eagerly accepted by the archaeologists in the Soviet Union and abroad.[49] Several authors recognised an important role of Buh-Dniester culture in the Neolithisation of Eastern Europe.[50]

In 1990s with the fall of the Iron Curtain, hard times came to the cultures with their limits corresponding to the modern-day state borders as was the case with the 'Buh-Dniester culture'.[51] Claims of very early agriculture and husbandry came under the scrutiny and,

42 Kotova 2015.

43 Kotova et al. 2021.

44 Telegin, Potekhina 1987.

45 Tovkailo 2020.

46 Dolbunova et al. 2023; Haskevych et al. 2019; Kiosak 2019a; Kiosak et al. 2023c; Kotova 2018; Man'ko 2007; Motuzaite Matuzeviciute et al. 2015.

47 Danilenko 1969; Markevich 1974.

48 Danilenko 1969.

49 Sulimirski 1970; Tringham 1971.

50 Comşa 1994; Kozlowski 1989, 136; Tringham 1973.

51 Kohl 1998.

generally, failed.[52] However, despite a notable share of criticism poured out on Buh-Dniester culture on this occasion, it is still perceived as an entity. This generalisation is thought to represents the sites of a certain period of prehistory from valleys of Dniester and Southern Buh rivers.[53] We will try to demonstrate that this is not the case. This section aims at deconstruction of 'Buh-Dniester culture' concept. Its heuristic value is exhausted at the moment. The demolition of the concept of a unified culture for early pottery-bearing groups of the region between the Carpathians and the Southern Buh river opens a new fruitful direction of research – namely, the search for the diversity of the material culture expressions which would surpass artificial limits of 'Buh-Dniester' culture.

Today, the concept of 'Buh-Dniester culture' has become the object of methodological criticism and systematic revision. As a result of recent discussions, several contradictory interpretations of the sites with early ceramics of the Southern Buh and Dniester valleys (late seventh – sixth millennia BCE) have crystallised. There are three leading solutions to the 'Buh-Dniester' problem.

Historically, the first of them was the vision of the 'Buh-Dniester culture' as an entirely early agricultural community associated with ways of the Neolithisation, which were different from a 'mainstream' dry-land dispersal into Balkans and Central Europe. This is how it was reconstructed by V. Danilenko (1969).[54] According to him, the Buh-Dniester culture covers the entire period, from the appearance of the first domesticated animals and plants to the spread of the Eneolithic Early Trypillian groups in the valleys of eponymous rivers. It was formed under the 'eastern' influence, arriving mainly via the circum-Caspian way, and only then underwent 'cultural consolidation' with the Balkan-Danube area of Körös-Starcevo. Hoe and stick farming and cattle breeding played a lesser role than hunting, but were the 'most progressive' branches of the economy.[55] A similar interpretation was proposed by V. Marchevici on the basis of rich materials from stratified settlements of the middle Dniester valley.[56]

At the current level of achievements of Ukrainian Neolithic studies, the concept of V. Danilenko – V. Marchevici was developed by N. Kotova.[57] Relying on the definitions of archaeozoologists and palaeobotanists and radiometric dating methods, N. Kotova suggested

52 Benecke 1997; Motuzaite Matuzeviciute 2020.

53 Tovkailo 2020.

54 Danilenko 1986.

55 Danilenko 1969, 159-61.

56 Markevich 1974.

57 Kotova 2003.

the early (as early as the seventh millennium BCE) appearance of cattle breeding and agriculture on the Southern Buh, along with the most ancient ceramics.[58] She connected the ceramics of the early Buh-Dniester styles with the oldest Neolithic horizons of the Inner Balkans and western Anatolia, seeing analogies in the East Thracian group of Maslidere sites and the Monochrome Neolithic of Bulgaria, the oldest layers of the Grivac and Blagotin settlements.[59] Such an early connection was supposed to be made possible thanks to certain maritime links before the distribution of Criş culture to the east of the Carpathians.[60] Some features of Buh-Dniester ceramics were explained by D. Haskevych by the maritime expansion of early agricultural cultures similar to the Mediterranean Impresso circle.[61]

Recently, the theory of extra-Balkan Neolithisation has received a powerful impetus from the works of A.F. Gorelik, A. Tsybriy and V. Tsybriy, who, although not directly dealing with materials from the region, provided convincing evidence of early Anatolian influence on the sites of the Northern Black Sea region.[62] V.O. Manko reconstructed the Final Palaeolithic and Mesolithic contact systems (cultural and historical communities) between the Middle East and the steppes of Ukraine.[63]

The second approach was to perceive the Buh-Dniester culture as an agricultural culture formed through the dry-land 'Balkan' path of Neolithisation. Namely, D. Telegin stated that LBK and Buh-Dniester cultures represented early farmers in the territory of Ukraine.[64] Perhaps, L.L. Zaliznyak developed this concept in the most detailed way. According to him, the Buh-Dniester culture is a 'barbaric manifestation of the Neolithic of the Danube region'[65] and was formed by the second (of four) waves of 'Balkan newcomers in the forest-steppe of Right-Bank Ukraine'.[66]

According to the third approach, the Buh-Dniester culture is a hunter-gatherer community, possibly under the strong influence of the Balkan-Danube world of early farmers. This possibility was first mentioned by R. Tringham, shortly after the publication of

58 Kotova 2004.

59 Kotova 2009, 170; Kotova 2015, 60-1.

60 Kotova et al. 2021.

61 Gaskevych 2011.

62 Gorelik et al. 2016.

63 Man'ko 2007; Man'ko 2015.

64 Telegin 1977, 88; Telegin 1985b, 114.

65 Monah, Monah 2002; Zaliznyak 1998, 232.

66 Zaliznyak et al. 2013.

V.M. Danilenko.[67] The idea of contact between hunter-gatherers of the Southern Buh and Dniester and early farmers of the Balkans has been fruitfully developed by a number of researchers.[68] M. Zvelebil and M. Lillie summarised these observations in the 'transitional society' model. According to them, the Buh-Dniester people are hunters in the 'availability phase' – in a state of interaction with early farmers, when they are already familiar with the achievements of the Neolithic Revolution, but continue their traditional way of life.[69] O. Larina and V.A. Dergachev developed a similar approach based on the materials of the region between rivers Dniester and Prut.[70] A. Reingruber reconstructed a network of contacts that connected early agricultural and hunter-gatherer communities in the Northwest Black Sea region.[71] Recently, in light of the latest refutations of the presence of imprints of parts of domestic plants on Buh-Dniester ceramics,[72] L.L. Zaliznyak seems to be inclined to this view.[73]

The debate between the proponents of different concepts was conducted along several main 'lines of argumentation'.

The core of the recent discussion on the Buh-Dniester culture was whether the 'Buh-Dniester' people had ever practised agriculture and husbandry. V.M. Danilenko was quite optimistic regarding this question. He published some evidence of husbandry (bones of domestic animals), and agricultural practices (blades with sickle gloss, hoe-like antler implements and grinding stones).[74] Later, his observations were reinforced by analysis of plant imprints on 'Buh-Dniester' potsherds. Three species of wheat and a single species of barley were found.[75] While Ukrainian and Moldovan archaeozoologists[76] mostly identified a certain number of bones from the Buh-Dniester sites as the remains of domestic animals (cattle, pigs, and sheep/goat), their Western European colleagues questioned this interpretation on the grounds of differences in morphometric approach.

Namely, during the 1990s, N. Beneke revised a number of faunal collections from excavations of the 1960s, and also studied materials

67 Tringham 1971, 96-101.

68 Dennell 1983; Dolukhanov 1979; Kozlowski 1989.

69 Zvelebil, Lillie 2000.

70 Dergaciov, Larina 2015; Larina 1994; Larina 2010.

71 Reingruber 2012.

72 Endo et al. 2022.

73 Zaliznyak 2017.

74 Danilenko 1969.

75 Kotova, Pashkevich 2003; Yanushevich 1989.

76 David 1996; David 1997; Zhuravlev, Kotova 1996.

from the 1996-97 works of the joint German-Moldavian expedition on the banks of Dniester river at the sites of Soroca-3, Tătăreuca Nouă 14 and 15. According to him, the 'old' assemblages completely lacked the remains of domestic animals, and the few bones of the latter from the new excavations did not come from sufficiently well-dated contexts. The presence of Eneolithic admixtures cannot be ruled out.[77] He concluded that 'no definitely domestic animal bones are known from a secure context for the re-studied Buh-Dniester materials'.[78] Accordingly, his work did not provide evidence for domestic animals in the Buh-Dniester economy. His results were recently reproduced when studying supposedly 'Neolithic' animal bones from the Dnieper Rapids region.[79]

The remains of cultivated plants have not been identified by flotation at Buh-Dniester sites, although, in fact, flotation was not used very often during excavations. However, every attempt resulted in a recovery of a variety of wild plants' remains while failing to uncover cultivated flora.[80] Similar results came from flotation attempts at other sites of para-Neolithic: Rakushechnyi Yar,[81] sites in Crimea and Eastern Ukraine.[82]

A considerable diversity of cultivated plant species was determined by the imprints of grains and spikelets on ceramics from Buh-Dniester sites.[83] However, there are grounds for doubt here as well. For example, the largest number of imprints was found on the materials of the settlement Sacarovca 1,[84] which, as is now known, does not belong to the Buh-Dniester, but is instead a site of the Criş culture.[85] Some sherds with abundant organic temper are often identified as evidence of Balkan influences or direct Balkan imports in the collections of other Buh-Dniester sites.[86] Therefore, the relevant imprints on these potsherds cannot be definitive proof that the inhabitants of the Southern Buh and Dniester valleys practised agriculture in the period in question or even used wheat and barley for food. Such conclusions require re-examining the sherds with imprints to verify their cultural attribution.[87]

77 Benecke 1997; Wechler 2001.

78 As cited by Wechler 2001.

79 Stupak et al. 2022.

80 Salavert et al. 2020.

81 Dolbunova et al. 2020.

82 Motuzaite Matuzeviciute 2020.

83 Kotova, Pashkevich 2003; Yanushevich 1989.

84 Yanushevich 1989, 609.

85 Larina 1994.

86 Danilenko 1969; Haskevych et al. 2020; Tovkailo 2004; Tovkailo 2014.

87 Kiosak 2016b, 137.

Recently, in the course of the joint research by Japanese and Ukrainian specialists, the imprints on the sherds were reviewed using the replica method followed by scanning electron microscopy. The new work did not confirm the presence of imprints of cultivated plants: some of them turned out to be non-indicative, while others were traces of wild flora.[88] Thus, re-evaluation of pericarp imprints on 'Buh-Dniester' potsherds failed to recover any secure evidence of plant cultivation.[89]

Thus, there is no evidence for the presence of domesticated animals and plants in the Buh-Dniester contexts today. The earliest finds of cultivated plants directly dated by radiocarbon were recovered from Linear Pottery Culture contexts of 53rd century BCE – much later than the expected onset of 'Buh-Dniester culture' in the region.[90] This critique required a re-shaping of our understanding of the 'Buh-Dniester' sites and strongly supports the view that inhabitants of these sites were hunter-gatherers (the third approach from the discussion above), while the evidence of their acquaintance with agriculture and herding is at best anecdotal at the moment.

Another line of critique proceeds with an argument of post-depositional transformations. Soon after V. Danilenko's excavations, his field observations were questioned. For example, D. Telegin, having studied the materials of excavations on Bazkiv and Mytkiv islands,[91] noted that it was impossible to divide the lower pack of sediments into several horizons, and, therefore, there were no stratigraphic arguments in favour of the existence of the Skybyntsi layer.[92] Modern researchers have gone further in their post-depositional critique of the classic 'Buh-Dniester' sites. N. Kotova, having studied collections and field documentation, concluded that the only genuinely stratified site is Bazkiv Ostriv, where two layers can be distinguished: upper and lower.[93]

D. Haskevych[94] has demonstrated that the excavation methodology and objective post-depositional processes, in many cases, made it impossible to distinguish separate layers on several 'Buh-Dniester' sites. In some cases, it has been convincingly demonstrated that V. Danilenko reconstructed the stratigraphy when the data were insufficient. For example, the Savran layer at Melnychna

88 Endo et al. 2017; Endo et al. 2019; Endo et al. 2022.

89 Endo et al. 2022.

90 Moskal-del Hoyo et al. 2023; Motuzaite Matuzeviciute, Telizhenko 2016.

91 Danilenko 1969.

92 Telegin 1977, 89.

93 Kotova 2003.

94 Gaskevych 2014.

Krucha was identified based on the materials of the 1938-39 surface collection.[95]

Attempts to verify the observations of the mid-twentieth century through new excavations have mostly falsified them. Most of the 'Buh-Dniester culture' sites have been flooded by the waters of the reservoirs, during the construction of which they were discovered and studied. Only Melnychna Krucha, Mykolyna Broiaka, Savran, and Pechera are suitable for study in the valley of the Southern Buh among 'Danilenko's sites'. Excavations of the Pechera site in 2008 (D.L. Haskevych, L. Cherniak, B. Józwiak) showed that as a result of post-depositional processes, finds of different periods were evenly mixed in the cultural deposits.[96]

Similarly, unsatisfactory results were obtained at the new works on the Dniester sites – Soroca 3[97] and Tsekinivka 1.[98] A detailed review of the stratigraphy of Bazkiv Ostriv also revealed the doubtfulness of attributing certain items to a specific complex. However, three layers were identified in terms of depth: Mesolithic and two Neolithic[99] (para-Neolithic in the terminology of this book). Contrary to published data, the Kukrek flint artefacts in the collection of the Bazkiv Ostriv turned out to be brought from another site due to imperfect field documentation and are not related to any of the three horizons of the site.

In this aspect, the search for 'pure', homogeneous accumulations of material among field documentation and collections of V. Danilenko's works looks promising. Such complexes are distinguished among the materials that previously seemed unpromising due to their 'small number' or 'unstratified' nature. D. Haskevych has identified relatively 'pure' contexts at the Hlynske I site, namely Complex 1 with ceramics of the Criş and Pechera aspects and a flint collection devoid of the Kukrek component.[100] However, this work is only at its beginning, and homogeneous para-Neolithic complexes from the Southern Buh valley can be counted on the fingers of one hand.

Another unsolved problem concerns the chronology of the sites attributed to the Buh-Dniester. The dating of the Buh-Dniester sites in 1969-74 was based on 'imports' and typological synchronisation.[101] The Pechera phase corresponded to the Criş-Körös-Starcevo culture

95 Gaskevych, Kiosak 2011.

96 Gaskevych 2013.

97 Wechler 2001; Wechler et al. 1998.

98 Haskevych 2018a.

99 Haskevych et al. 2020.

100 Haskevych 2017.

101 Danilenko 1969; Markevich 1974.

complex, the Samchyntsi phase to the LBK, and the later phases (Savran and Khmelnyk) were tied to the formation of the Early Trypillia. The few radiocarbon dates contradicted the broad dating proposed by V. Danilenko[102] but generally corresponded to the established development picture.[103]

During the 1990s, a series of radiocarbon conventional dates were obtained in the Kyiv laboratory. The samples were selected to represent different phases of the Buh-Dniester culture. As a result, the early period of the Buh-Dniester culture (pre-Samchyntsi) was attributed to the second half of the seventh millennium BCE, and the second (Samchyntsi-Savran) lasted during the first half to mid-sixth millennium BCE.[104]

L. Zalizniak and M. Tovkailo objected to the new chronology of the Buh-Dniester culture. According to them, the early Pechera stage is the result of interaction with the world of the Balkan early farmers of the Criș culture, and therefore, it cannot be dated earlier than the latter. Thus, the development of the Buh-Dniester culture should have been within the sixth millennium BCE.[105] These views aligned with radiocarbon dates, often obtained from charcoal, in laboratories in Berlin and Leningrad before 1991.[106]

D. Haskevich proposed a clear distinction between the 'new' and 'old' chronologies and pointed out that it is hardly methodologically correct to compare different sets of dates within the same analysis.[107] Although internally coherent and correctly reflecting the relative chronology of events,[108] these sets contradicted each other on an absolute chronological scale. According to the 'old' chronology, early Buh-Dniester sites existed within the range of 5880-5550 BCE, and later ones – 5610-4710 BCE.[109]

Nowadays, the chronology of the Buh-Dniester para-Neolithic should have been based on a solid radiocarbon dating database, but it is not the case so far. M. Tovkailo mentions 79 dates ,[110] and we can add eight more to his list **[ST 2-1]**. So, a total of 87 dates provide the chronology of these sites. However, when you start working with this database, it becomes evident that most dates are irrelevant. Some

102 Telegin 1977, 88.

103 Telegin 1987.

104 Burdo 2003; Kotova 2003; Kovaliukh et al. 2007.

105 Tovkailo 2004; Zaliznyak 2005.

106 Tovkailo 2014.

107 Gaskevych 2007.

108 Vinogradova, Kiosak 2010.

109 Gaskevych 2014.

110 Tovkailo 2020.

go far beyond the acceptable chronology of para-Neolithic sites – for example, the two dates for Soroca 3 or the Early Holocene date for Dobrianka 3.[111] In addition, many of the dates come from unknown contexts. Considering the numerous episodes of occupation of the sites on the banks of the Southern Buh and Dniester, any mention of only a cultural layer as a context for sampling is usually meaningless. It indicates that we do not know what was dated. In addition, Mesolithic layers were directly discovered by excavations at several Buh-Dniester sites (Melnychna Krucha, Gard).[112] At some sites, the probable presence of such layers was demonstrated quite strongly by analysis of field documentation (Pechera, Bazkiv Ostriv, Sokiltsi 2).[113] Moreover, most dates are conventional, and radiocarbon dating by AMS has been used only sporadically. Several series of AMS radiocarbon dates have been obtained for sites of the former Buh-Dniester culture.[114]

Furthermore, many of the dates originate from the Kyiv laboratory and were obtained between 1998 and 2008 – thus belonging to a series of dates that have been called into question by numerous instances of inconsistencies in cross-laboratory comparisons.[115] The Kyiv radiocarbon facility has generated a substantial volume of dates since the 1980s. In the early days, the initial Kyiv dates were combined with data from Berlin and Oxford to establish the first reliable absolute chronology schemes for the Ukrainian Neolithic period.[116] Since 1998, the Kyiv laboratory produced numerous dates for the Stone Age of Ukraine and neighbouring regions. These dates were met with mixed reception, with some researchers accepting and interpreting them[117] while others vehemently contested their validity.[118]

Recently, the results of the Kyiv laboratory from 1998-2008 **[fig. 22]** were compared with those of other laboratories (Oxford, Vienna, Poznan, Bern, etc) in dating eight settlements and six burials. The results indicate that 'there were no systematic discrepancies or errors associated with the 'questionable' series from this radiocarbon facility'.[119] However, "a cross-laboratory comparison seems

111 Gaskevych 2014.

112 Kiosak 2019a; Tovkailo 2014.

113 Gaskevych 2014; Haskevych 2018b.

114 Haskevych et al. 2019; Kiosak et al. 2021b.

115 Gaskevych 2007; Gaskevych 2013; Gaskevych 2014; Kiosak et al. 2023c; Rassamakin 2012; Shatilo 2021.

116 Telegin 1985a; Telegin 1987.

117 Burdo 2003; Kotova 2004; Vinogradova, Kiosak 2010.

118 Gaskevych 2007; Tovkailo 2004; Zaliznyak et al. 2013.

119 Kiosak et al. 2023c.

necessary in every conclusion drawn from the inquiries of the Kyiv facility done between 1998-2008".[120] Therefore, only those dates from the suspicious series (1998-2008) from Kyiv that have been verified to some extent by dates from other radiocarbon facilities will be used for further analysis.

Another factor to consider is the limited progress in directly dating pottery sherds between 1998 and 2008.[121] Over the last decade, several series of 'direct' dates for the organic content of Buh-Dniester pottery have been obtained, which seem to prove the antiquity of the first appearance of ceramic in the Carpathian-Dnieper region.[122] Many 'questionable' queries by the Kyiv laboratory were conducted on potsherds without differentiating the nature and source of organic components in the clay paste of archaeological potsherds (so-called total organic carbon content, TOCC).[123] This approach has faced criticism from various perspectives. Averaging the carbon content in organic remains of diverse origins can be highly misleading,[124] the reservoir effect can influence riverine and marine-derived tempers,[125] and it is challenging to exclude the 'old shell' effect in cases where intensive crushed shell temper is used.[126] Direct dates based on the organic content of potsherds were noted to diverge significantly when compared to dates from other materials.[127]

Recently, the Tokyo Laboratory **[fig. 22]** has tried to improve the methodology and eliminate some of the difficulties, namely by identifying contamination with 'old carbon',[128] but other shortcomings of such dating are challenging to account for them completely. In Eastern Europe, the earliest pottery was often crafted from river silts with a natural mixture of decomposed riverine plants. Such selection of raw material could lead to a noticeable reservoir effect.[129] Consequently, radiocarbon chronologies, including those based on Tokyo 'direct' dates on potsherds, often did not correspond to typochronologies in many cases.[130] A more constructive approach could involve

120 Kiosak et al. 2023c.

121 Kuznetsov, Mochalov 2017; Zaitseva et al. 2009.

122 Man'ko 2006; Zaitseva et al. 2009.

123 Meadows 2020.

124 Meadows 2020.

125 Boudin et al. 2009; Boudin et al. 2010.

126 Douka et al. 2010.

127 Kuznetsov, Mochalov 2017.

128 Endo et al. 2022; Haskevych et al. 2019.

129 Kotova 2018.

130 Haskevych et al. 2019.

comparative dating of the food crust and the organic temper from the same vessel, ideally supplemented by dating associated animal bones or other organic materials. Therefore, due to the limited advancement in direct pottery dating, some dates obtained from potsherds may be subject to doubt. For instance, a series of dates for Bazkiv Ostriv and Hirzheve could fall into this category.[131]

A comparison was carried out between Kyiv (1998-2008) and non-Kyiv (recent Kyiv determinations from 2009 onward included) sets of dates for para-Neolithic sites of the Southern Buh valley. In order to summarise datasets, we employed several approaches: direct summation (function Sum in OxCal) and Kernel Density estimates (KDE) models. KDE models produce smooth density estimates, which can help in visualising the distribution of radiocarbon dates without being overly influenced by individual data points or outliers. This smoothness aids in identifying patterns and trends in the dataset.[132] We used KDE-model rather than KDE-plot because the datasets are not constrained prior to modelling in any way **[ST 2-1] [model 2-1]**. The findings revealed a chronological gap of 200-400 years between these two datasets **[fig. 22]**. Kyiv' direct' dates on potsherds constantly yielded dates several centuries earlier than expected or defined by other relevant dates on other datable materials. Tokyo 'direct' dates on potsherds sometimes yielded reasonable results, but mostly, they were distorted by external carbon admixtures. Additionally, when an AMS set of dates was incorporated, they consistently yielded narrower chronological ranges **[fig. 22]**.

So, when these dubious dates (evident outliers, Kyiv dates of 1998-2008 not validated by cross-laboratory comparison, 'direct' dates on TOCC of potsherds) are excluded, the remaining dataset includes only 24 reliable dates **[fig. 23]**. When modelled with the Kernel Density Estimate tool of OxCal 4.4.4 software, they are clearly divided into two blocks, each of which forms one of the peaks of the plot: around 6000-5400 BCE and roughly 5050-4600 BCE **[fig. 23: B]**. These blocks are even more evident if we leave only bone and charcoal dates **[fig. 23: C]**. The period of lower density corresponds to the time when LBK groups expanded into the region. Several dates fall within this minimum on the KDE-model graph, so we cannot state the complete abandonment of the region by hunter-gatherers during this time. However, their presence is evidently less attested than before and afterwards.

The picture that emerges is entirely unexpected and does not fit well with the model of ceramic hunter-gatherers influenced by Balkan Neolithic cultures. The emergence of para-Neolithic groups in

131 Haskevych et al. 2019; Man'ko 2006.

132 Bronk Ramsey 2017.

the region somewhat precedes the spread of the Criş culture population **[fig. 23]** (see chapter 3 for a detailed discussion). At the same time, the spread of the LBK was accompanied by a decrease in the intensity of habitation at hunter-gatherer sites, followed by an increase when the LBK declined. Therefore, it would be surprising if these two significant chronological blocks of para-Neolithic sites did not have peculiarities in their material culture. Thus, we should expect the Buh-Dniester para-Neolithic to be divided into, at least, two cultural aspects: pre-LBK and post-LBK.

Let us consider in detail the dated sites of 'Buh-Dniester' para-Neolithic. The sites dated exclusively by 'direct' dates on potsherds or exclusively by 'Kyiv dates' of suspicious series are excluded from consideration.

The site of the Bazkiv Ostriv stood on the island of the Southern Buh River near the village of Skybyntsi, Vinnytsia region. It was excavated by V. Danilenko in 1959 on an area of over 300 m^2. The para-Neolithic finds formed several scatters of potsherds, lithic tools, animal bones and *Unio* mollusc shells.[133] V. Danilenko interpreted this site as stratified with layers of the Skybyntsi, Pechera and Samchyntsi phases of the 'Buh-Dniester culture'. N. Kotova re-analysed the preserved collection and identified two layers: early and late.[134]

Recently, a detailed analysis of the site's stratigraphy based on field documentation was carried out by D. Haskevych. Based on the analysis of the number of finds marked on the site's plan separately for several small zones identified within its boundaries, he assumed that the cultural layer of the site contained three horizons of increased concentration of finds – two with para-Neolithic ceramics and one with no ceramics, probably, Mesolithic.[135] Bazkiv Ostriv has 14 radiocarbon dates reported by now. Seven dates were made on animal bones and antlers in Kyiv laboratory, and six more are 'direct' dates on potsherds. A single date on charred residues attached to the potsherd validates one of the 'direct' dates. Each series of dates is somewhat unreliable, taken on its own, but when treated jointly, they cross-validate each other to a certain extent.

Five Kyiv dates of Bazkiv Ostriv **[fig. 24]** fell into the seventh millennium BCE and could belong to pre-ceramic Mesolithic habitation. Two latter dates reasonably correspond well with a single date done on the potsherd of a Skybyntsi phase vessel, indicating an episode of human activity at the site around 5650-5400 BCE. Two other dates were done on organic inclusions in the potsherd and the organic residue attached. They are the latest encompassing 5250-4850 BCE.

133 Danilenko 1969, 62-70.

134 Kotova 2003.

135 Haskevych 2018b.

Unfortunately, dates combine poorly. While their asynchrony is highly unlikely, this discrepancy indicates a methodological problem with this dating effort. D. Haskevych noted: 'Differences in the nature of the ceramics of the reconstructed horizons of the remaining zones were absent or were not recorded due to the loss of most of the finds'.[136] Instead, there was a significant mixing of materials that were attributed to different phases of 'Buh-Dniester culture'. Thus, despite significant progress in understanding the Bazkiv Ostriv chronology, we still cannot use its materials to substantiate a correlation between potsherds decorated in a certain style and other categories of material culture.

The sequence of Melnychna Krucha was characterised above in chapter 1, when treating its Mesolithic stratigraphic units. Stratigraphic unit 2 was found at a depth around -160 and 180 cm from the conditional zero in a layer of yellow light sandy loam (horizons P(h)k and Pk according to Zh. Matviishyna **[fig. 5]**). The SU2 consists of four separate zones in planum **[fig. 25]**: SU2b is a scatter of flint-knapping activities **[fig. 25: A]**, SU2a is a zone of disturbed sediments closer to the river **[fig. 25]**: D, SU2c is a scatter of freshwater molluscs' shells **[fig. 25: C]**, and SU2d is a zone of cultural layer with dispersed finds in the very east of the excavated zone **[fig. 25: I]**.

The zone SU2b is marked by the waste from the decortication of one or two nodules of honey and light grey flint with a white-red cortex and the manufacture of a series of blades. Numerous primary and semi-primary flakes record the decortication of the raw material '*in situ*'. The single-sided, single-surface nucleus **[fig. 26: 21]** was used for the blades production. The sub-conical nuclei are small, with a single platform, for blades and flakes with careless knapping around the entire perimeter of a core.

The purpose of the knapping was a 12-20 mm wide blade of rather irregular outline. The set of tools includes retouched flakes and blades **[fig. 26: 25-26]**. The retouch is mostly marginal, small, partial and irregular. Most end-scrapers are made on the sides of flakes. Some end-scrapers are made on ends of blades and of flakes. There are blades with convergent semi-steep retouch on both sides **[fig. 26: 17]**. The trapeze is made by two oblique truncations with steep, regular retouch.

This scatter of lithic debris was dated using two animal bone samples. The dates cover the range 5975-5790 calBCE **[ST 1-2]**.[137] These dates are in fact synchronous with the dating from the antler T-shaped axe from the scatter of freshwater molluscs' shells nearby. The T-shaped axe is 23.5 cm long and 7.5 cm high **[fig. 27]**.

The shells' scatter yielded two pottery sherds and a fragment of a vessel's rim **[fig. 28: 9]**. The latter has a slightly bent rounded edge, a light

136 Haskevych 2018b.

137 Kiosak et al. 2021b; Kiosak, Salavert 2018.

grey well-smoothed outer surface and a dark grey inner surface. The sherd's fracture is grey, lumpy, and of uniform firing. There is a mica temper. On a rather steep bend to the shoulders, the remains of decorations are preserved – depressions made with a comb stamp. This piece finds analogues in the finds traditionally attributed to the late stage of the 'Buh-Dniester culture'.[138] The three above-mentioned dates from this layer that contains pottery, even if rarely, are quite consistent and can be combined in the timeslot 5834-5727 calBCE (2σ, [ST 1-2] [fig. 29]).

Another T-shaped axe [fig. 27: 2] was found in an area of the dispersed finds of para-Neolithic in some 20 m to the east of shell scatter. It yielded somewhat younger date of 5736-5651 calBCE (2σ).

A radiocarbon date was also obtained for another scatter of para-Neolithic finds at Melnychna Krucha, located 150 meters from the main excavation area described earlier. It remains uncertain whether these finds represent separate habitation episodes within the same site or two distinct sites. This new area was designated Melnychna Krucha - R4 and produced Trypillian painted pottery, as well as Seredny Stog II style ceramics from the subsequent Eneolithic epoch, dating to the late fifth to early fourth millennium BCE (see § 3.4 for a detailed discussion). These ceramics were primarily found above a scatter of chipped stone and animal bones associated with para-Neolithic potsherds [fig. 28: 1-8], without a sterile interlayer between them. The para-Neolithic horizon was identified at depths of -120 to -145 cm. The only radiocarbon date, obtained from an animal bone, was calibrated to a range of 4973-4836 calBCE (2 sigma) [ST 1-2] [fig. 29].[139] The chronology of this promising site requires verification by the serial dating.

Mykolyna Broiaka [fig. 21: 6] is situated on Chornyi Tashlyk, an eastern tributary of the Southern Buh river. From 1928 to 1932, the site was studied by P.V. Harlampovych. Under the conditions of Soviet repressions, the researcher disappeared after January 1933.[140] Only preliminary information about Mykolyna Broiaka was published then.[141] The collection of those years is lost. In 1955, V. Danilenko opened a small excavation and several test trenches (about 50 square metres in total) on the site. Finds from these works form the basis of modern ideas about the material culture of the site. Its pottery is attributed to the Savran style. The site is treated as one of the latest para-Neolithic sites from typo-chronological point of view.[142]

138 Kotova 2015; Tovkailo 2005.

139 Kiosak 2019a.

140 Yanenko 2016.

141 Kozubovsky 1933.

142 Tovkailo 2005.

Mykolyna Broiaka yielded two distinct dates. The earlier date, spanning from 5719-5620 calBCE, 2σ, comes from a scatter of finds at a depth of -280 cm designated as 'dwelling 1' by the excavator.[143] Above this, at a depth of 268 cm, an animal bone was dated to 4678-4493 calBCE, 2σ (Be-18270). The legacy date from animal bone, produced in a Kyiv laboratory, falls between these two AMS-dates **[fig. 30]**. The analysis of field documentation allowed us to identify two successive layers of unknown chronology.[144] However, these layers were not separated in the publication of the site.[145] Given the late relative position of this site within the Buh-Dniester para-Neolithic, it is especially important to determine the nature of its upper layer.

Puhach 2 **[fig. 21: 18]** is located on the slope of the left bank of the Southern Buh. M. Tovkailo excavated it in 1983-85 over an area of 655 m^2.[146] Finds of the Mesolithic, para-Neolithic, Eneolithic and Late Bronze Age were discovered. The cultural layer containing para-Neolithic and Early Trypillian pottery and other items was located at a depth of 2.05-2.4 m. The para-Neolithic ware of the site is ornamented in the Savran style. The first date of the site was done in the late 1980-ies in Kyiv laboratory and fell into the early fifth millennium BCE (Ki-3030, 5920 ± 60 BP). Then, the site received six dates of the dubious Kyiv series (Ki-6648-49, Ki-6656-57, Ki-6678-79), which fell into the first half of the sixth millennium BCE and had not been confirmed by new dating. Recently, the site was dated to 4686-4503 calBCE, 2σ by a single AMS date on a tooth of a deer coming from a depth of 2.4-2.5 m. This date is later than the Ki-3030 conventional date[147] and could be related to the Early Trypillian habitation as well as to the para-Neolithic stratigraphic unit. Thus, a para-Neolithic occupation may have taken place at Puhach 2 in the first half of the fifth millennium BCE. However, due to the apparent presence of Early Trypillian findings, the homogeneity of its complex remains open for discussion.

Shumyliv-Cherniatka. The site is located on the high floodplain of the left bank of the Southern Buh River between villages Shumyliv and Chernyatka, Vinnytsia region. It was excavated by V. Danilenko in 1960 with an area of 300 m^2. Several scatters of para-Neolithic and Early Trypillian materials lay at a depth of 0.5-0.8 m in a layer of dense grey-green loam. The site is attributed to the Savran phase

143 Danilenko 1969.

144 Polischuk, Kiosak 2018.

145 Danilenko 1969.

146 Tovkailo 2005.

147 Tovkailo 2004; Tovkailo 2014.

of the 'Buh-Dniester culture'.[148] Its collection includes approximately equal proportions of para-Neolithic and Early Trypillian potsherds.[149] A single vessel from the site obtained a pair of dates: on TOCC of the potsherd and organic residues stuck to it. The dates are consistent and encompass 4723-4491 calBCE, being roughly contemporaneous with the Early Trypillian dispersal in the region (see chapter 3 for further discussion).

The site of Tătăreuca Nouă 1 **[fig. 21: 20]** 5 was discovered in 1996 by V.A. Dergachev, K.-P. Wehler and O.V. Larina. It was investigated in 1997 by a joint German-Moldovan expedition on an area of 150 square metres. The settlement is located on the right bank of the Dniester River. In addition to the Neolithic layer, the site includes materials of the Late Trypillia and Iron Age.[150] The para-Neolithic layer contains Buh-Dniester culture materials. However, in addition to them, the layer contains a significant proportion of ceramics, the origin of which is attributed to the carriers of the north-eastern para-Neolithic and Neolithic cultures of Ukraine: Strumel-Gastiatin, Volhynian Culture and LBK.[151] The ceramics of the LBK is represented by 54 mostly small fragments from about 14-16 vessels. These potsherds are a rather peculiar complex of pottery, combining both the classical traditions of this culture and traditions related to the late phases of the 'Buh-Dniester' culture. The site received three relevant dates. Two were done on organic residue stuck to a single potsherd. They can be combined and jointly encompass 5472-5067 calBCE, 2σ, KIA-3705 a and b. An antler fragment was dated from the same layer, yielding an age of 4895-4676 calBCE, 2σ (KIA-4160). Thus, the site's chronology can be understood in several ways: 1. Dates refer to the late LBK occupation, and the Buh-Dniester site remains undated; 2. The dates fix a joint occupation of the site by an LBK group and para-Neolithic hunter-gatherers; 3. Dates relate to a post-LBK period and are connected with a group of hunter-gatherers living on a place of an LBK site. None of these hypotheses seems preferable at the moment.

Two Berlin charcoal dates have been known for quite some time for sites from the Dniester valley: Soroca-2 and Soroca-5 **[fig. 21: 16-17]**. The former (Bln-586) covers the 5990-5480 calBCE, 2σ, while the latter, Bln-589, covers the 5625-5224 calBCE, 2σ. The wide standard deviation hinders comparison of these dates with other dates. These interesting sites require further serial dating to update their chronology.

148 Danilenko 1969, 121-5.

149 Haskevych et al. 2019.

150 Wechler et al. 1998.

151 Larina 2006.

Thus, today, the number of reliably dated homogeneous complexes of 'Buh-Dniester' culture is negligible. On their basis, it is impossible to characterise the material culture typical for the population of this territory in the 'Buh-Dniester' period (or rather periods, as was shown above). Accordingly, the very existence of the 'Buh-Dniester culture' as a reliable taxon of archaeological classification becomes problematic.

'The Buh-Dniester culture' consists of six 'ceramic' phases according to V. Danilenko, five according to V. Marchevici, and three according to D. Telegin and R. Tringham.[152] Some have their distribution areas, which only partially coincide with the Buh-Dniester area.[153] The flint inventory was also variable: artefacts of the Kukrek cultural tradition disappeared at the beginning of the Late Period[154] or were present among the finds of the Savran phase.[155] Nowadays, several complexes of the early period (Pechera phase) have exclusively 'geometric' lithic complexes, while most collections have a 'Kukrek' appearance.[156] However, is it not the result of post-depositional processes? After all, Mesolithic layers, unnoticed by V. Danilenko, have recently been identified on Bazkiv Ostriv[157] and Melnychna Krucha.[158] Mesolithic materials are present in Dobrianka 3[159] and Gard.[160] In any case, these facts show that we do not know how ceramic wares, flint artefacts and bone tools correlate. And, therefore, we have no grounds to call them a 'culture' – "certain types of remains that are constantly found together, […] a complex of related features [of material culture]".[161]

On the other hand, the unity expressed in the unfortunate, in our opinion, term 'Buh-Dniester culture' does exist, but its characteristic features lie in a different aspect – in the economy and adaptation to the resource-rich river valleys.

The Buh-Dniester people embraced a unified way of life, despite variations in ceramic designs. V.M. Danilenko frequently utilised lifestyle characteristics to associate specific sites with the 'Buh-Dniester culture'. He identified these traits as the proximity of settlements

152 Danilenko 1969; Markevich 1974; Telegin 1977; Tringham 1971.

153 Gaskevych 2011.

154 Kotova 2003.

155 Tovkailo 2005.

156 Gaskevych 2003.

157 Haskevych et al. 2020.

158 Kiosak 2019a.

159 Zaliznyak et al. 2013.

160 Tovkailo 2014.

161 Childe 1929, v–vi.

to rapids and rifts along riverbanks, the inhabitation of islands and low-lying regions of floodplains, and a consistent internal arrangement of encampments. This lifestyle epitomised a 'riverine' existence centred around the abundant resources of the Southern Buh and Dniester rivers.[162] Utilising these resources involved recurrent visits to favoured locations along the riverbanks, resulting in the establishment of complex, stratified sites. Consequently, there was a notable degree of re-deposition and mechanical mixture of artifacts from various periods of human occupation within a given area.

Even regardless of the outcome of the long-running debate about the presence of domesticated animals and plants in the economy of the Buh-Dniester people, it is already clear that the carriers of early ceramics from the valleys of the Southern Buh and Dniester were not early farmers in the modern sense of the word. After all, the Neolithic way of life is not only about domestic animals and plants. It is a complex of closely related features, among which a sedentary way of life, permanent houses, settlement-type sites, and numerous evidences of fertility cults of a particular type play an important role.[163] All these components are lacking in the Buh-Dniester para-Neolithic. Therefore, complexes with early ceramics from the valleys of the Southern Buh and Dniester cannot be attributed to the Neolithic period. Hunters, gatherers and fishermen lived at these sites. They were mobile groups that, despite their early acquaintance with pottery,[164] continued to lead a lifestyle radically different from the adaptation patterns of their neighbours, the early farmers.[165]

The term 'para-Neolithic', proposed for the communities of northern Europe and the Baltic Sea basin, is a good description of this state.[166] This term describes hunter-gatherer communities, often with pottery, that existed simultaneously with Neolithic communities in the adjacent regions. Although there are arguments against the use of this term,[167] its use in the Circumbaltian area has a long tradition. It is well suited to the probable structural similarity of the Buh-Dniester communities and Baltic hunter-gatherer and fishers groups.

The Buh-Dniester para-Neolithic is located at the intersection of the world of fishermen, hunters and gatherers of Northern and Eastern Europe and the world of early farmers of the Balkans and Central

162 Danilenko 1969, 90, 150.

163 Whittle 1996.

164 Kotova 2015.

165 Demchenko 2016; Kiosak 2014.

166 Kempisty 1982; Nowak 2007.

167 Werbart 1998.

Europe. It has a frontier character in the sense of M. Zvelebil.[168] The boundary of the expansion of early agricultural cultures has mainly been shifted to the east by studies of the last quarter of a century.[169] In particular, it has repeatedly crossed parts of the alleged area of the Buh-Dniester people. For example, the former Buh-Dniester sites of Sacarovca 1 and Selişte are reasonably attributed to the eastern-most manifestations of the late Criş culture.[170] The LBK once limited its area to the Zbruch River (clearly following the state borders after the 1921 Riga Peace Treaty).[171] Now it is known that it spread to both the Prut-Dniester and Buh-Dniester interfluve, with its first sites discovered in the valley of the Southern Buh[172] and on its eastern bank (Zhakczyk 3).[173]

The diversity of cultural manifestations in the decoration and morphology of pottery is a characteristic feature of Northern and Eastern Europe in the sixth-fifth millennia BCE. This pottery is predominantly pointed or round-bottomed, decorated with incised, often comb or pitted ornamentation.[174] At this time, unified flat-bottomed ware was spreading in Central and Southern Europe. The first distribution area, 'in general', is associated with societies based on fishing, hunting and gathering (in its various forms), and the second with the world of early farmers. The structure of the two ceramic complexes is also radically different: early agricultural ware is usually well divided into kitchen and table ware, while the ceramics of hunter-gatherer communities are mostly uniform in this respect.[175] There were different models of the functioning of tableware in the everyday life of these two groups of societies.

In this context, the problem of the Buh-Dniester ceramic styles is directly linked by many researchers to the problem of the origin of the Buh-Dniester para-Neolithic as a whole.[176] Given the dubious correlation of different types of Buh-Dniester ceramics with each other and with the rest of the material culture of the region's para-Neolithic sites, this approach is obviously insufficient. In this case, the origin of the ceramic styles and the nature of society which produced them are different problems.

168 Zvelebil, Rowley-Conwy 1984.

169 Dergaciov, Larina 2015; Kiosak 2017; Saile 2020.

170 Larina 1994.

171 Markevich 1974.

172 Kiosak 2014; Kiosak 2017.

173 Peresunchak 2018.

174 Piezonka 2015.

175 Courel et al. 2021.

176 Haskevych et al. 2020; Kotova 2015; Tovkailo 2014.

Archaic ceramics, as recently established, spread across Eurasia quite early and without connection with the agricultural-pastoral way of life.[177] Accordingly, the people of the Buh-Dniester para-Neolithic could have adopted ceramics from various sources – from the Criş culture,[178] from the Thracian Neolithic by sea,[179] from their eastern neighbours – hunters and gatherers.[180] The diversity of Buh-Dniester pottery may be related to the different sources of its origin. The flat-bottomed ware, rich in organic temper, can be logically linked to Balkan influences (both of the Criş and other early farming societies, as V. Danilenko, L. Zaliznyak, M. Tovkailo argued),[181] and ceramics with comb ornamentation (primarily of the Samchyntsi style) to eastern influences as V. Danilenko supposed,[182] or to the maritime expansion of early and yet unknown 'Eastern Impresso' cultures as suggests D. Haskevych.[183] The Savran style of pottery (flat-bottomed, mostly decorated with incised lines, but also with comb decoration) has much in common with Azov-Dnieper ceramics[184] and may have been formed together with it as a result of a single cultural impulse.

The heterogeneity of the sources of the Buh-Dniester ceramic complex has been noted by many researchers, starting with V. Danilenko.[185] L. Zalizniak attributed the pointed-bottom ceramic ware to local features difficult to explain by the Balkan influence.[186] D. Haskevych showed the spread of elements of the Samchyntsi style far beyond the area of the 'Buh-Dniester culture'.[187] N. Kotova believes that the Pechera and Samchyntsi-Savran sites have different origins and 'a minimum of continuity in traditions'.[188] In the context of the diversity of sources of the para-Neolithic ceramic styles of the Southern Buh and Dniester, it is natural to assume the diversity of the local population.

So what do we know so far about 'Buh-Dniester' para-Neolithic? Basically, not that much. There were some fishers, hunters, gatherers equipped with pottery with blurry chronology and little-known

177 Dolbunova et al. 2023; Kuzmin 2002; Piezonka 2015.

178 Tovkailo 2020.

179 Gaskevych 2011; Kotova 2009.

180 Dolbunova et al. 2023.

181 Danilenko 1969; Tovkailo 2014; Zaliznyak 1998.

182 Danilenko 1969.

183 Gaskevych 2011.

184 Kotova 2003, 8.

185 Danilenko 1969.

186 Zaliznyak 1998.

187 Gaskevych 2011.

188 Kotova 2015, 65.

material culture – para-Neolithic or sub-Neolithic. Some of them lived in the early sixth millennium BCE – Melnychna Krucha SU2, Soroca 2, the lower layer of Mykolyna Broiaka. Others lived between 5600 and 5400 BCE, in synchroneity with the settlements of the Criş culture 100-150 km to the west (Soroca 5, several dates of Bazkiv Ostriv, TKA-80731 and related Kyiv dates). Finally, the third group of sites is associated with the end of the sixth – beginning of the fifth millennium BCE (the upper layer of Mykolyna Broiaka, Tătăreuca Nouă 15, Puhach 2, Shumyliv-Cherniatka).

2.3 East of the Dnieper: Refining the Chronology of Pottery Hunter-Gatherers

Moving further east, we enter a different region – the Dnieper Valley, which is rich in archaeological sites, and the region between the Dnieper and the northern shore of the Sea of Azov. The 'Neolithic' sites of this region have served as the archaeological basis for many theories of the early and unusual Neolithisation of southern Eastern Europe.[189] Therefore, we will examine the available archaeological data regarding their chronology.

For a long time, the Surskyi archaeological culture was believed to be the oldest Neolithic (para-Neolithic in the terminology of this book) culture in Central Ukraine and east of the Dnieper. According to the accepted scheme, the sites of its first period should have emerged in the Dnieper Rapids region in the late seventh millennium BCE, in order to spread to the region north of the Sea of Azov in the early sixth millennium BCE. Thereafter, the Surskyi sites continued their development in parallel with the development of another population – the carriers of the Azov-Dnieper culture. The latter emerged in the early sixth millennium BCE and lasted until the beginning of the fifth millennium BCE, when the first Eneolithic communities appeared in the region.[190] To date, the available radiocarbon dates are either insufficient to support these optimistic chronological estimates or directly contradict them.

The earliest period of 'Surskyi culture' was defined on the basis of radiocarbon dates. Typological considerations suggested that the earliest sites of Surskyi culture should be Vynohradnyi, Kodachok and Surskyi 1 **[fig. 31: 13, 16-17]**. However, the earliest dates were obtained for the site of Surskyi 2 **[fig. 31: 13]** which convinced N.S. Kotova to modify the proposed periodisation.[191]

189 Danilenko 1969; Gorelik et al. 2016; Kotova 2009.

190 Kotova et al. 2021; Tovkailo 2020.

191 Kotova 2015.

The chronology of sites with Surskyi pottery is supported by dates of several series:

1. conventional dates on bones obtained in the Kyiv radiocarbon facility;
2. conventional dates on potsherds, also from Kyiv;
3. dates on human bones from cemeteries of Dnieper Rapids, both from Kyiv and Oxford;
4. novel series of AMS dates on animal bones from stratified sites of the North Azov region.

The first group of dates belongs to the same 'suspicious' series from the Kyiv radiometric laboratory as the dates for the so-called 'new' chronology of the southern Buh para-Neolithic (see § 2.2) and those of the Early Trypillia (see § 3.4). All the criticisms discussed above also apply to these dates in the region east of the Dnieper. As demonstrated above, we can confidently assert that there were no systematic discrepancies or errors associated with the radiocarbon series at this facility. However, due to numerous inconsistencies, suspicious Kyiv dates should only be used when they were confirmed by cross-laboratory validation.[192] Moreover, as discussed in the previous section, the stratigraphies of numerous pivotal sites in the Buh-Dniester region have proven to be more intricate than previously understood. Mesolithic horizons have been identified at some sites and this fact has helped to elucidate the presence of some exceptionally early dates. Similar findings were observed in Eastern Ukraine, specifically at the Kamyana Mohyla 1 site, where a series of Mesolithic stratigraphic layers were identified before the first instances of 'ceramic-bearing' habitation (See chapter 1). Furthermore, the direct dates on the TOCC of potsherds cannot be trusted. There are several 'direct' dates for Surskyi-style potsherds: from Popov Mys, Strilcha Skelia and Ihren 8 **[fig. 32]**.

The well-established chronology of the Dnieper Rapids cemeteries[193] requires additional research to establish links between the burial goods of cemeteries and assemblages of residential sites. Otherwise, the sequence of cemeteries has no implications for the region as a whole. Moreover, the problem of identifying Surskyi burials in these sacred areas of long-term use is far from being unambiguously solved. The burials are mostly without burial goods, and the search for cultural attribution is often arbitrary based on the logic of 'who else could these burials belong to?'. However, such reflections implicitly assume the equity of culture and people behind it, which is far from evident in the case of Surskyi-type ceramics and

192 Kiosak et al. 2023c.

193 Lillie et al. 2020a.

other categories of material culture whose association remains to be proven.

Thus, hopes for establishing a chronology rest on the few homogeneous complexes for which AMS radiocarbon dating is available. The notion of homogeneity is relative and refers to the absence of overt foreign cultural and temporal impurities. Given the considerable doubts about the reliability of the established cultural and historical scheme, there is a danger of a logical circle. Therefore, in the current state, the chronology of Surskyi ceramic style can be established only in the most general terms.

Three sites yielded Surskyi style potsherds and the dates of the late seventh mill. BCE: Surskyi 2 **[fig. 31: 13]**, Semenivka 1 **[fig. 31: 1]** and Kamyana Mohyla 1 **[fig. 31: 2]**.

The case of Kamyana Mohyla 1 was discussed in details in chapter 1. The late seventh millennium BCE dates were posed in correspondence with the Late Mesolithic lenses of the layer C of this site.[194]

The Surskyi 2 site is situated in the southeast part of the Surskyi island on the Dnieper River. It was excavated by V.M. Danilenko in 1946 and yielded a complex stratigraphic picture.[195] There were 'Late Neolithic' (Eneolithic nowadays) layers of Seredny Stog 2 type. They were underlain by 'final Early Neolithic' layers severely disturbed by periodical flooding. The lowest level was found under sediments brought by flooding, namely those of sterile sand. This layer contained a habitation complex: several shallow pits of irregular shape filled with dark sand, charcoals, fragmented bones, and chipped stone implements. The Surskyi potsherds represented 2-3 vessels and were far from being numerous. The lithic inventory had 'archaic features'. These features include conical cores with regular scarring patterns, numerous burins on blade fragments, backed bladelets, also combined with truncations. In our opinion, it resembles the lithic assemblages of Kukrek cultural tradition or even Kukrek *sensu stricto*. Such an assemblage was attested in clearly Mesolithic (without associated potsherds and bones of domestic animals as well as remains of cultivated plants) at the sites of Melnychna Krucha and Kamyana Mohyla 1 (see chapter 1).[196] The latter sites brought a set of dates comparable with the pair of dates for the lowest layer of Surskyi 2. Thus, we can hypothesise that there was a Mesolithic habitation on the site of Surskyi, which was not recognised by the excavator. Two radiocarbon dates from Surskyi 2 site (Ki-6691, 7245 ± 60 BP and Ki-6690, 7195 ± 55 BP, **[ST 2-2] [fig. 32]**)[197] are consistent with this interpretation.

194 Kiosak et al. 2022.

195 Danilenko 1950; Danilenko et al. 1957.

196 Kiosak 2019a; Salavert et al. 2020.

197 Kotova 2015.

The site of Semenivka (Semenovka) 1 yielded the most important stratigraphic sequence in the region east of Dnieper and north of the Azov Sea. In 1991 and 1992, Nadezhda Kotova and Oleg Tuboltsev investigated this site, located near Melitopol in the Zaporizhzhia Region.[198] The site is situated on the first terrace of the right bank of the Molochna River **[fig. 31: 1]**. The excavated area covers 276 m^2. The site revealed a sequence of layers from the Mesolithic to the Middle Ages, with an overall depth of 2 meters. However, during construction activities, most of the upper layers were removed, leading to the preservation of Mesolithic and some pottery-bearing cultures (Surskyi, Azov-Dnieper) in certain zones, while other areas suffered from contamination due to the destruction of the upper layers with the following re-deposition of their content on the surface of the lower stratigraphic units.

Within these mixed sediments, an exceptional Eneolithic collection of the Skelia phase of the Serednyi Stog culture (initially classified as part of the Skelianska culture) was discovered. Subsequent re-analysis of the site helped establish a stratigraphic unit with Serednyi Stog materials in the southern part and another group of Eneolithic materials attributed to the Dereivka culture in the eastern part of the site.[199]

The excavations at Semenivka 1 revealed three distinct stratigraphic units in the lower, well-preserved part of the sequence. The lowest layer was the Mesolithic, found beneath sterile soil layers 35-60 cm thick in excavation squares 34b, 35, and 36 of excavation pit 1. The sterile soil horizon was thinner in other squares, and some Mesolithic admixture in the upper units was anticipated. Radiocarbon dating of auroch's bone from the Mesolithic unit yielded a date of 8058 ± 55 BP, UA-42032.[200]

The layer immediately above the Mesolithic was termed 'Neolithic' (para-Neolithic here). It was identified in squares 1-6 of excavation pit 2 and was located in the yellow loam at depths ranging from 140/170 to 150/180 cm (depending on the local topography). This layer contained over 200 potsherds, originating from at least 22 vessels. The pottery was tempered with plant remains, crushed shells, and sand. The vessels exhibited pointed bottoms and were categorised into bowls (vessels without necks) and those with well-defined necks. They were adorned with pits, pinches, incised lines, and, on occasion, short (2-3 teeth) comb imprints. Additionally, fragments of stone vessels were found in this stratigraphic unit. The lithic industry here was oriented toward blade production. Tools, constituting 27%

198 Kotova, Tuboltsev 1996.

199 Kotova 2008.

200 Kiosak et al. 2023c.

of the assemblage, included end-scrapers (on the ends of blades and on flakes, oval, circular, and other variations), burins (simple and multifaceted types), etc. The microlithic complex comprised geometric (trapezes) as well as non-geometric (backed points on microblades, oblique points) microliths. N. Kotova included this assemblage into her first period of the Surskyi culture.[201]

The upper layer was attributed to the second period of the Azov-Dnieper culture, according to N. Kotova. At least nine vessels were represented by potsherds. They were crafted from clay paste, tempered with sand, and sometimes mixed with crushed shells. These vessels featured rounded bodies, flat bottoms, and rims with protruding 'collar' extensions. Their decoration included triangular and rectangular pits, incised lines, and comb imprints. One vessel displayed a complex composition of stripes filled with comb imprints. The lithic assemblage in this layer primarily consisted of blades and tools made from blades and large flakes. Furthermore, a fragmented polished stone axe was discovered in this layer.[202]

The Semenivka 1 site's dating relies on a combination of stratigraphic observations and a series of radiocarbon dates.

Radiocarbon dating of animal bones from the lower (Surskyi) stratigraphic unit at Semenivka 1 [ST 2-3] [fig. 33] placed this particular layer within 6358-5625 calBCE (2σ). An outlier was identified in the earliest date (Ki-7679, 7285 ± 70 BP) based on OxCal software analysis, while the other three dates presented a continuous sequence spanning from 6083 to 5625 calBCE (2σ). The pairs of dates (1: Ki-6689 and Ki-6688, and 2: Ki-6688 and Ki-7678) could be combined, but Ki-6689 and Ki-7678 were mutually exclusive, failing the χ^2 test. The first pair was successfully combined, aligning with the timeslot of 5988-5841 calBCE (2σ), and the second with 5969-5718 calBCE (2σ). Additionally, the only AMS date (sample Poz-137920, 7010 ± 40 BP, Bos sp. bone [fig. 33]) corresponded well with the combination of Kyiv dates Ki-6689 and Ki-6688 (the 'first pair' mentioned earlier), possibly coinciding with both intermediate dates for this stratigraphic unit, though not necessarily with the earliest and latest Kyiv dates from this unit. Consequently, most anthropogenic remains in the lower layer were deposited during the first quarter of the sixth millennium BCE.

Moving on to the upper (Azov-Dnieper) stratigraphic unit at Semenivka 1, several animal bones were dated in the Kyiv laboratory. The obtained dates presented some contradictions. One date (Ki-7675, 6360 ± 70 BP, 5475-5210 calBCE, 2σ) agreed with the multiple dates from various laboratories for sites belonging to the second period of Azov-Dnieper culture.

201 Kotova, Tuboltsev 1996.

202 Kotova, Tuboltsev 1996.

However, three other dates (Ki-7672-74) were notably later, dating to approximately 4656-4056 calBCE (2σ), "corresponding to the chronology of Eneolithic cultural groups".[203] Thus, the dating results proved that the Azov-Dnieper stratigraphic unit (in the squares 1, 4, and 6) was contaminated by materials of the upper layers (Eneolithic), removed by the heavy construction technique prior to excavations.

The AMS date (Poz-137919, 6480 ± 40 BP **[fig. 33]**) was done on a canine of *Canis* sp. from Azov-Dnieper stratigraphic unit. This date falls within 5524-5336 calBCE (2σ) and aligns reasonably well with the Ki-7675 date. By combining these two dates, we arrive at a calibrated range of 5479-5332 calBCE (2σ), and this combination is valid based on the χ^2 test (df=1 T=2.2 at the 5% significance level, 3.8 overall).[204]

Hence, it is plausible to infer that the main habitation of this layer likely occurred during the third quarter of the sixth millennium BCE. It is worth noting that there appears to be a gap of 300-600 years between the Semenivka 1 site's upper and lower layers.

While the list of the homogenous complexes of Surskyi culture is short (the lower layer of Semenivka 1 and the undated lower layer of Strilcha Skelia[205] probably being the only such complexes), it is not the case for the Azov-Dnieper culture, which is represented by several well-defined sites also in the stratigraphic sequences.

In 1989-90, Nadezhda Kotova and Yuriy Rassamakin conducted an archaeological investigation at the Chapaevka site, located near the village of Chapaevka in Tokmak District, Zaporizhzhia Region.[206] Subsequently, another excavation took place in 2019.[207] This site is situated on the northern slope of a cape on the right bank of the Molochna River. The area of 160 m^2 was excavated.

The site revealed a single layer associated with the Azov-Dnieper culture covered by more than a meter of sterile sediments. Notably, the lithic complex comprised an elevated percentage of macro-blades and blades, no cores, some chips resulting from retouching endscrapers, and a high prevalence of tools.[208] The tool assemblage included retouched blades, some with convergent semi-abrupt retouch, and 'fan-shaped' end-scrapers.[209]

There were potsherds from a single high bowl exhibiting imprints of a short comb stamp. Additionally, there may have been one more

203 Kiosak et al. 2023c.

204 Kiosak et al. 2023c.

205 Kotova 2003.

206 Kotova, Rassamakin 2001.

207 Kotova et al. 2021.

208 Kotova et al. 2021.

209 Kotova et al. 2021.

vessel with a similar decoration, although the shape of this second vessel remained unspecified.[210]

A pair of radiocarbon dates from Kyiv was acquired for animal bones extracted from the cultural layer. These dates are consistent and can be calibrated to the range of 6023-5669 calBCE (2σ) or even combined within 5977-5736 calBCE (2σ). In contrast, newly obtained AMS dates, derived from fragments of large herbivore bones originating from the cultural layer and situated several meters away from the Kyiv-dated samples, are notably younger, falling within the range of 5203-4718 calBCE. While these new dates cannot be statistically combined (as indicated by a failed χ^2 test), there is a period in which they might coexist, namely, 4934-4847 calBCE, 2σ **[fig. 34]**.[211]

Considering the stratigraphic context, it appears plausible that these dates should be combined despite the statistical challenges mentioned earlier. Furthermore, the presence of a radiocarbon 'plateau' during the late sixth millennium BCE impacts the earlier date, extending its calibration well into the sixth millennium BCE. Consequently, the date from the early fifth millennium BCE appears more plausible in this context.

In light of the re-dating of the Chapaevka site, the palm of the earliest site for the Azov-Dnieper moves to the Rozdolne (Razdolnoe) site further to the east **[fig. 31: 5]**. This archaeological site has yielded several stratigraphic units that shed light on the early ceramic traditions in the West Meotic region. The site is situated on the banks of the Kalmius River.[212]

The early complexes of Rozdolne (dating back to the sixth – fourth millennium BCE) are scatters of lithic tools, fragmented bones and potsherds separated in stratigraphy and in plan. N. Kotova proposes to interpret them as traces of short-duration small camps.[213] One of these complexes included accumulations of *Unio* shells, flint tools, animal bones, and a fragment of comb-ornamented ceramic ware. Radiocarbon dating of a cow mandible places the age of this camp between 5604 and 5514 calBCE (or 6609 ± 49 BP, Ua-42031 **[fig. 34]**). The ceramic paste of the Neolithic potsherd was tempered with sand and decorated with oblique comb imprints, creating horizontal rows.

The lithic complex of Rozdolne is microlithic. A notable feature of this collection is the high percentage of retouched tools, suggesting an emphasis on the final stages of flint-working. Artefacts in this

210 Kotova et al. 2021.

211 Kiosak et al. 2023c.

212 Kotova et al. 2017a.

213 Kotova et al. 2021.

assemblage include a 'knife-like blade' (over 10 cm long),[214] with a fractured distal end and regularly retouched sides, along with five blade fragments,[215] a flake, a fragment of a rejuvenated blade core, an end-scraper with a burin detachment, and end-scrapers on flakes and blades. Some of these end-scrapers exhibit distinctive features, such as a convex scraper front on the side of a flake with ('Oskol type'),[216] as well as circular and sub-circular varieties.

The second early complex at Rozdolne was located approximately 100 meters from the first one.[217] It yielded ceramics with comb imprints and band ornamentation,[218] a shard with oval impressions,[219] and a pot with a low neck featuring a complex design comprising 'walking comb imprints', incised lines, and oval impressions.[220] Additionally, flint tools and a fragment of an axe made from local raw materials were discovered in this stratigraphical unit.

Radiocarbon dating of animal bones from this layer yielded the following results: 6550 ± 80 BP (Ki-8002), 6490 ± 80 BP (Ki-8001), and 6475 ± 80 BP (Ki-8000), **[ST 2-4]** **[fig. 34]**.[221] These dates place the age of this para-Neolithic camp between 5460 and 5430 calBCE. However, they are again the Kyiv dates of the 'suspicious' series and, thus, require a cross-laboratory comparison. Notably, the fragments of the cow's jaw from this complex produced two somewhat younger dates when analysed at the Uppsala laboratory in Sweden: 6428 ± 37 BP (Ua-41433) and 6310 ± 38 BP (Ua-41434). These dates can be combined into a range of 5371-5313 calBCE (χ^2-Test: df=1 T=4.9(5% 3.8)).

Similar results were brought to light from layer D, the Azov-Dnieper layer of the Kamyana Mohyla site (see chapter 1). It obtained four radiocarbon dates on animal bones: a single AMS date BE-21066, 6171 ± 27 BP and three conventional dates Ki-4023-25. They encompass the timeslot 5474-4839 calBCE (2σ). When modelled, the age of layer D encompasses 5472-4950 cal BCE, 2σ and is very consistent with the chronology of Rozdolne and Semenivka 1 Upper layer.

A series of burials from several cemeteries have been attributed to the Azov-Dnieper period with sufficient evidence, including the associated Azov-Dnieper ceramics.[222] These burials were extensively

214 Telegin 1976.

215 Kotova et al. 2021, fig. 5: 2-7.

216 Telegin 1976.

217 Kotova et al. 2017a.

218 Kotova et al. 2021, fig. 7: 2, 3, 5.

219 Kotova et al. 2021, fig. 7: 4.

220 Kotova et al. 2021, fig. 7: 1.

221 Kotova et al. 2017a.

222 Kotova 2015.

dated in the Kyiv laboratory and elsewhere, so the requirement for cross-laboratory comparison is met here.[223] However, as the human bones were dated, the outcome was likely influenced by a reservoir effect.[224] Therefore, their age is likely to be distorted, but to what extent – without an accurate natural science basis, any guess will remain a guess. So far, these dates (Kyiv and Oxford) form a dense series encompassing 5350-5000 calBCE **[fig. 35]**.

A somewhat later pair of dates (Kyiv and Poznan) comes from Lysa Hora cemetery **[fig. 31: 15]**. In 1959, O. Bodianskyi investigated the Lysa Hora (Lysaya Gora) cemetery, situated on the left bank of the Dnieper River. A layer of soil enriched with ochre was identified at a depth of 70-90 cm, covering an area of around 21 m^2. Within this layer, the researcher discovered potsherds, human and animal bones, shells, flint and bone tools. Notably, the ochre-rich layer contained several individual graves, five pits with collective burials, and traces of other ritual activities.[225] This cemetery can be attributed to the second phase of the Azov-Dnieper culture.[226]

The Lysa Hora cemetery featured three distinct groups of burials arranged in a stratigraphic sequence. The earliest group consisted of six supine burials, all oriented to face southeast. In the intermediate layer, researchers uncovered five pits containing multiple partial inhumations. The third layer comprised partially burnt skeletons scattered above pit 3.[227]

The Kyiv laboratory received a radiocarbon date from a human bone from pit 4, yielding an age of 5890 ± 70 BP (Ki-8181 **[ST 2-5]** **[fig. 35]**). Subsequently, two additional dates were obtained from the Poznan Radiocarbon Laboratory. A date pertained to the partly burnt skeleton 17, which was found above pit 3.[228] It yielded an age of 6010 ± 40 BP and, when combined with the Kyiv date on human bone, suggested the age of the cemetery between 4988-4784 calBCE, 2σ. These dates support a younger pair of dates from Chapaevka, thus placing the demise of Azov-Dnieper culture well into the fifth millennium BCE.

Interestingly, a similar date (4949-4799 BCE) was obtained for a skeleton from the Dereivka cemetery. This individual (I3719, burial 102) exhibited a genetic ancestry closely related to the northwestern Anatolian Neolithic, making it a noteworthy example of early farming

223 Lillie et al. 2020a.

224 Kotova 2018; Lillie et al. 2009.

225 Bodianskyi 1961.

226 Kotova 2015.

227 Bodianskyi 1961; Kiosak et al. 2023c.

228 Kiosak et al. 2023c, fig. 5.

ancestry from the fifth millennium BCE.[229] While the Dereivka cemetery encompassed burials from various periods, Azov-Dnieper culture tombs were notably prevalent.

Thus, it is doubtful that the sites with Surskyi type of pottery appeared in the late seventh millennium BCE. The later date, most likely the first quarter of the sixth millennium BCE is much more probable, considering the current evidence. The long persistence of this type of pottery is very questionable and lacks sufficient radiometric evidence to support it.

Recent re-dating of the Chapaevka site has raised questions about the previously accepted chronology of the early phases of the Azov-Dnieper culture, which was believed to have commenced in the early sixth millennium BCE. New AMS dates have shown that it is not the case. The series of dates, obtained from the Kyiv and Uppsala laboratories, focused on the early Azov-Dnieper complexes at the Rozdolne site. These dates firmly establish the presence of this cultural aspect by the mid-sixth millennium BCE. Furthermore, a date from a lower stratigraphic layer at Semenivka 1 offers a *terminus post quem* (the earliest possible date) for the Azov-Dnieper stratigraphic unit at that site, aligning it with the third quarter of the sixth millennium BCE according to another new date. These new findings position the Azov-Dnieper culture as a contemporary of the western Linear Pottery culture in the eastern region.

The chronology of the Lysa Hora cemetery sheds fresh light on the timing of the later phases of the Azov-Dnieper aspect. These phases extend well into the fifth millennium BCE, suggesting that the Azov-Dnieper culture likely played a significant role in the formation of the Steppe Eneolithic.

2.4 The Problem of the Earliest Pottery in the North Pontic Steppes: A Brief Overview of the State-of-Art

Pottery was introduced in southern Eastern Europe in at least two ways: through the Balkans and Central Europe with migrating early farmers and from the east within the hunter-gatherer *milieu*. In the latter case, the Far East is the primary region of origin,[230] while there are several assumptions about the exact region from which the pottery first spread through the study area.[231] All of them are quite distant from the study area, so the concept of generalised 'eastern' route fits the range of issues raised by this section. The hypothesis

229 Mathieson et al. 2018.

230 Kuzmin 2002.

231 Dolbunova et al. 2023; Gorelik et al. 2016.

of a maritime route for the appearance of the first ceramics on the northern shores of the Black Sea has also been proposed, but so far, the evidence is indirect.[232]

The issue of the spread of ceramic ware among hunter-gatherers has significant pan-European implications. Thus, it concerns the nature and originality of the communities of 'ceramic hunter-gatherers' of the Baltic and Northern Europe and the lowlands of Poland and Belarus.[233] Until recently, direct dating programmes pointed to a relatively early appearance of ceramics in Eastern Europe – as early as the seventh millennium BCE.[234] However, given that the dating of pottery based on the organic carbon content of a sample can be wildly inaccurate,[235] these estimates have had to be revised. According to a recently completed major project, the earliest ceramics enter southern Eastern Europe only after 6000 BCE.[236] The earliest dates for pottery in the study area were obtained north of the Caspian Sea at the site of Baibek, ~5900 calBCE. Considering the rejection of extremely early age estimates for the pottery found in the lowest layers of the Rakushechny Yar site,[237] the sites of the northern Azov region (Semenivka 1) appeared to yield unexpectedly early evidence for this innovation.[238]

Modelling spatiotemporal data by the same project's team suggests that the 'eastern' wave of ceramic dissemination should have extended to the Dnieper rapids, the Lower Dnieper Region and the Southern Buh valley around 5750-5500 BCE.[239] However, the chronology of several complexes, supported by fairly reliable modern AMS dates derived from short-lived materials, predates the anticipated timing. Namely, the dating of the lower layer at Semenivka 1, which places it in the early part of the sixth millennium BCE, contradicts this expected chronology as well as the chronology of SU2 of Melnychna Krucha.[240]

This observation can face criticism on several grounds. Firstly, sites like Baibek, Kairshak, and others from the Caspian region

232 Gaskevych 2011; Kotova et al. 2021.

233 Piezonka 2015.

234 Zaitseva et al. 2009; Zaliznyak et al. 2013.

235 Meadows 2020.

236 Dolbunova et al. 2023.

237 Dolbunova et al. 2020.

238 Kiosak et al. 2023c.

239 Dolbunova et al. 2023.

240 Kiosak et al. 2023c.

and the Don River's Valley[241] have established robust chronologies through extensive dating programs. In contrast, Melnychna Krucha and Semenivka 1, although dated with the assistance of AMS, lack a comparably extensive series of dates. Re-evaluation of their chronology could result in a shift towards younger estimates, especially given that we are dealing with relatively short timeframes that were previously considered challenging to precisely date using radiocarbon method. On the other hand, despite their limitations, the available dates (comprising 4 AMS dates for MK SU2 and 1 AMS date along with 4 conventional dates for Semenivka 1) still support the initially proposed ages for these sites.

In addition, the ceramic collection of Rakushechnyi Yar was considered to be a reference and to contain the oldest ceramic finds in the region.[242] Consequently, many typological schemes of relative chronology used the materials of the lowest layers of Rakushechnyi Yar as a starting point for the typological development of ceramics. Accordingly, given the significant shift in the dating of this starting point, these schemes are equally 'younger'. However, as we have seen repeatedly, natural science data (such as radiometric dating) can significantly alter schemes of relative chronology based on typological considerations, especially in the absence of a statistically significant archaeological seriation and the dubious homogeneity of most complexes.

The ceramic finds from SU2 of Melnychna Krucha are sufficiently rare and fragmented to make their connection with the dated stratigraphic unit questionable. Nevertheless, they were found in clear stratigraphic conditions with no visible signs of cultural layer disturbance that would explain their hypothetical downward displacement. Furthermore, there are no other para-Neolithic units above SU2, only Eneolithic and Bronze Age units, for which such ceramics are not typical. In Semenivka 1, the abundance and diversity of the ceramic assemblage from the lower layer leaves little doubt about the relationship between the sherds and the rest of the material in this layer.

In support of this point, we note that the sites of the first stage of ceramic distribution according to the above model – Baibek and Kairshak 3 – have a date that is slightly later than expected according to the model, while the site of the next stage – Cherkasskaya 5 – has a date that is slightly ahead of the expected date according to the model **[figs 35-36]**.[243] At the same time, if we abstract from the model, the dates of all three sites are actually simultaneous – and close to the dates of Melnychna Krucha SU2 and Semenivka 1. Thus, early

241 Dolbunova et al. 2023.

242 Kotova 2015; Telegin 1977.

243 Dolbunova et al. 2023.

ceramics were discovered in large areas of southern Eastern Europe at approximately the same time – in the first quarter of the sixth millennium, and the rate of its spread was higher than expected.

Thus, several sites with early ceramics scattered hundreds of kilometres apart were dated to the first quarter of the sixth millennium BCE. However, this is precisely the picture we have systematically encountered when trying to date the spread of early farmers, agriculture and herding.[244] This picture of the simultaneity of the earliest manifestations of a particular innovation was explained in other ways: planned long-distance migration, explosive spread, leap-frog colonisation, significant development of intercommunal exchange networks, etc. So why do we deny such explanations for hunter-gatherers? After all, the proposed spatio-temporal model[245] is implicitly based on the assumption that ceramics did spread as an idea by diffusion. However, hunter-gatherer communities were not that simple at all.[246] They were complex enough to move hundreds of kilometres within their annual cycle, to communicate over distances of thousands of kilometres. Thus, perhaps, the observed chronological discrepancy is not a matter of errors in the chronology of Melnychna Krucha and Semenivka 1. But it results from a need to take into account other more complex social mechanisms of the spread of early ceramics among hunter-gatherers than the slow diffusion of an innovative idea from carrier to carrier. These mechanisms will explain the virtually simultaneous appearance of ceramics from the northern shore of the Caspian Sea to the northern shore of the Black Sea.

2.5 Conclusion

Thus, para-Neolithic groups emerged in the study area in the early sixth millennium BCE. They are recorded in the valleys of the Southern Buh and Dniester, as well as in the Dnieper Valley and between the Dnieper and the Sea of Azov. The grid of archaeological cultures that describes these sites may undergo radical changes as the understanding of the archaeological record improves. For the most part, the cultures correspond to ceramic styles, while their relationship to other elements of material culture remains questionable. The spread of the first ceramics in the region is a rapid process that is difficult to explain by the spread of an innovative idea. Ceramics spread in several local variants at once. Rather, we should talk about other

244 Biagi et al. 2005; Dolukhanov et al. 2005; Forenbaher, Miracle 2005.

245 Dolbunova et al. 2023.

246 Kelly 1995; McCall, Horowitz 2014.

more complex social mechanisms: the migration of ceramic-making groups, and/or supercommunal-level networks for the exchange of things and people.

In the Southern Buh valley, after the decline of the LBK, there was a resurgence of para-Neolithic sites, which flourished for several centuries before the expansion of Early Trypillian groups, possibly partially coexisting with early farmers, both earlier and later.

Figures

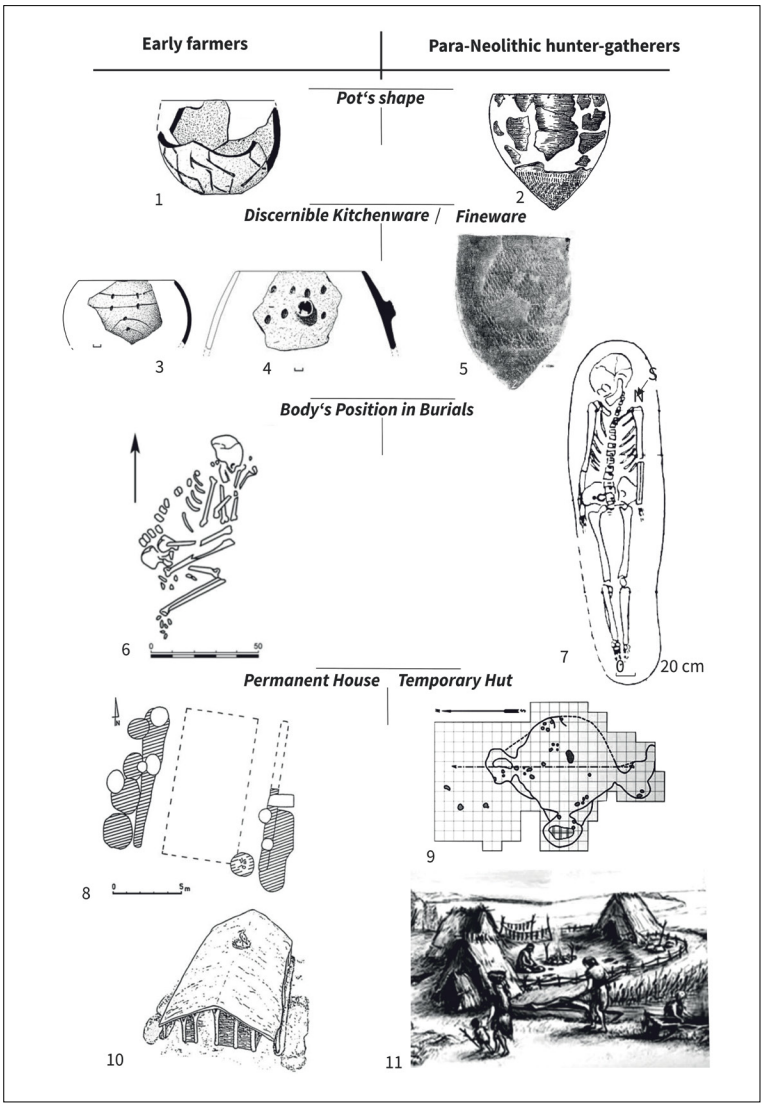

Figure 19 Archaeological markers of early farmers versus ceramic hunter-gatherers. 1, 3, 5: Kiosak 2019; 2, 5: Kotova 2015; 6: Haskevych 2018; 7: Telegin, Potekhina 1987; 8, 10: Lenartovich 2011; 9, 11: Demchenko 2016. Collage by the Author

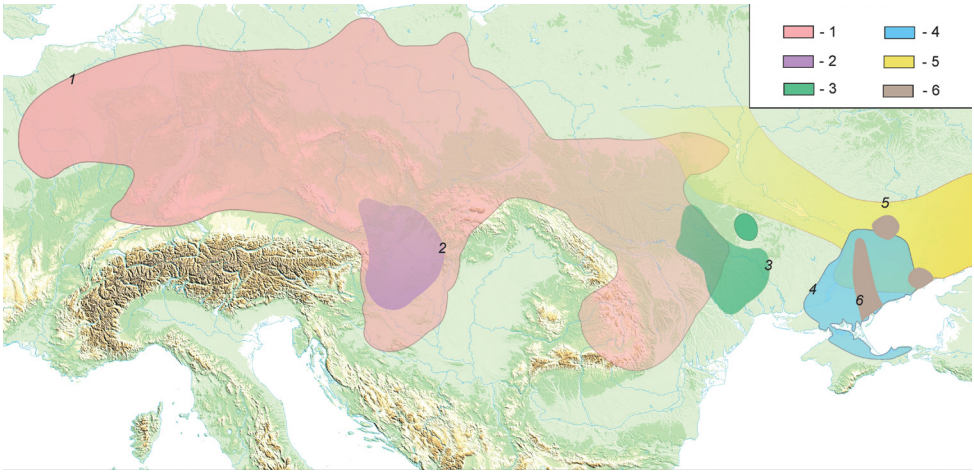

Figure 20 Map of archaeological cultures. After Telegin 1985, 1987; Kotova 2015; Kiosak et al. 2023, fig. 8 with modifications. 1: Younger LBK; 2: Formative LBK; 3: 'Buh-Dniester'; 4: Azov-Dnieper; 5: Dnieper-Donetsk, 6: Surskyi. Drawn by the Author

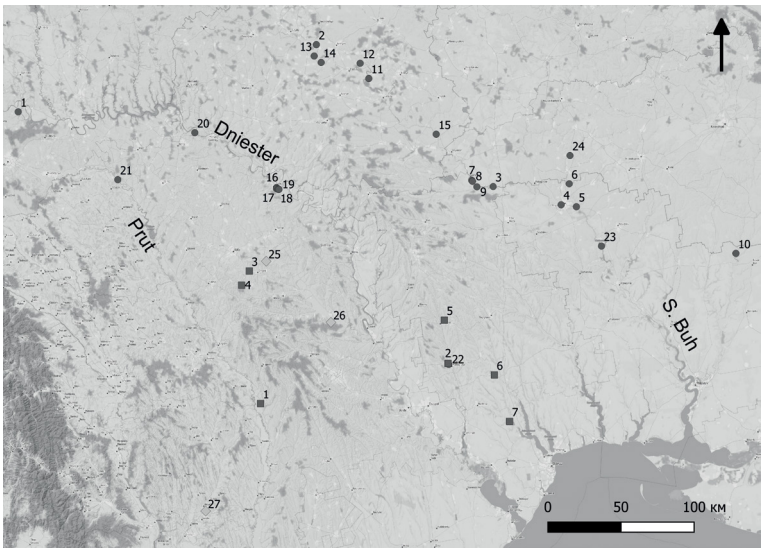

Figure 21 Para-Neolithic sites and settlements of the Criș culture. 'Buh-Dniester' para-Neolithic (circles). 1: Perebykivtsi; 2: Kanava; 3: Melnychna Krucha; 4; Pervomaisk; 5: Hrushivka; 6: Mykolyna Broiaka; 7: Zavallia; 8: Zhakchyk; 9: Savran; 10: Novorozanivka; 11: Sokiltsi 2, 6; 12: Samchyntsi; 13: Nova Mykolaivka; 14: Pechera; 15: Dzhulynka; 16-19: Tsykynivka, Soroca sites; 20: Tătăreuka Noua 15; 21: Pereryta; 22: Hirzheve; 23: Gard cluster (Gard, Gard 3-4, Puhach 1 and 2); 24: Dobrianka 1-3. Criș Culture (diamonds), 25: Sacarovca 1; 26: Seliste; 27: Trestiana. Sites with ceramics and microlithic tools: (squares), 1: Sarateni; 2: Hirzheve; 3: Biliceni Vechi 12; 4: Chischereni 5; 5: Zakharivka 1; 6: Katarzhyno 1; 7: Karpove. Topo: Stamen Terrain. Mapping by the Author

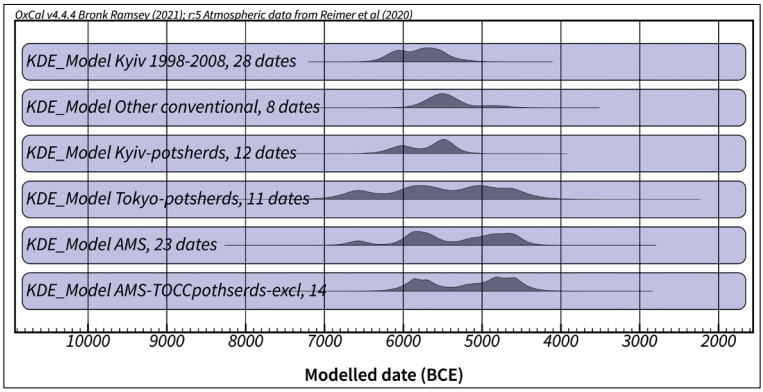

Figure 22 Buh-Dniester sites. Comparison of conventional Kyiv (1998-2008), other conventional, AMS dates, Dates on TOCC of potsherds from Kyiv, dates on TOCC of potsherds from Tokyo. **ST 2-1. Model 2-1.** Done In OxCal by the Author

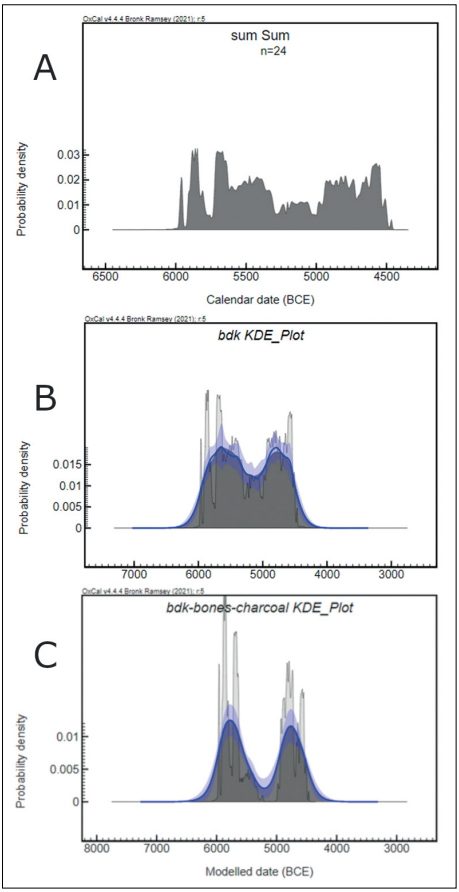

Figure 23
Sum (A) and Kernel Density estimates calculated for a set of relevant (24 dates) dates of Buh-Dniester para-Neolithic. **ST 2-1.** Dates with mark Incl.
Done in OxCal by the Author

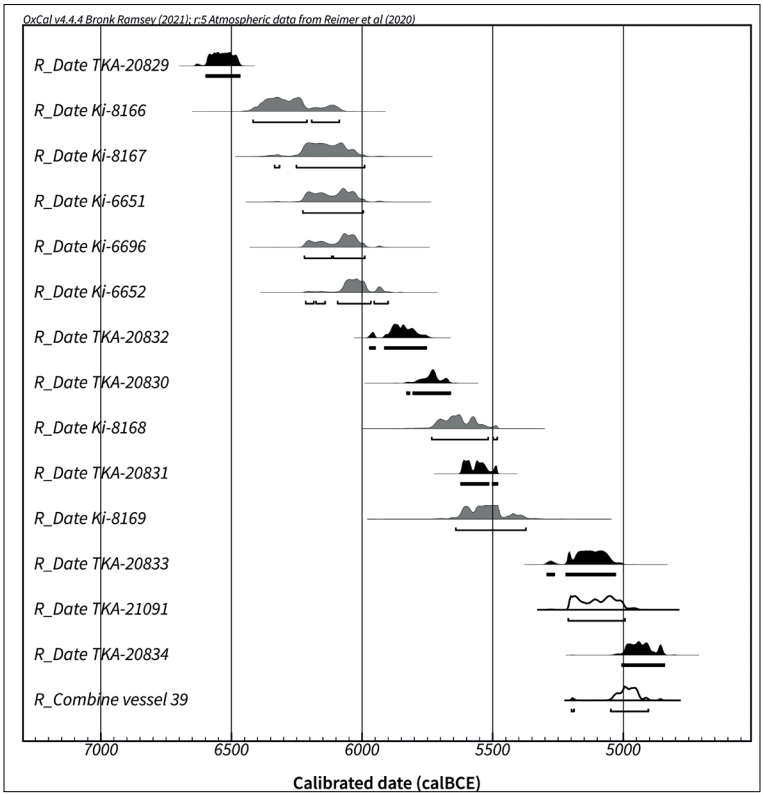

Figure 24 The radiocarbon dates for the site of Bazkiv Ostriv. Black: dates on TOCC of potsherds; grey: dates on animal bones; empty: a date of organic residue stuck to the potsherd. R_Combine vessel 39 – combination of dates TKA-21091 and TKA-20834, which failed X-Test fails at 5% – vessel 39 X2-Test: df=1 T=5.984(5% 3.8). After Haskevych et al. 2019. **ST 2-1**. Done in OxCal by the Author

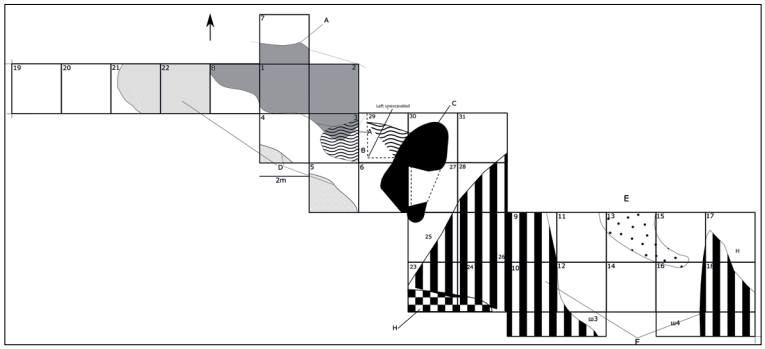

Figure 25 Plan of Melnychna Krucha. SU2: A. decortification zone (SU2b); C. shell scatter (SU2c); D. zone of disturbed sediments by the river bank (SU2a); I. dispersed cultural layer (SU2d), SU3; B. the charcoal-rich scatter; E. chipped stone scatter, SU4 – F-H. Drawing by the Author

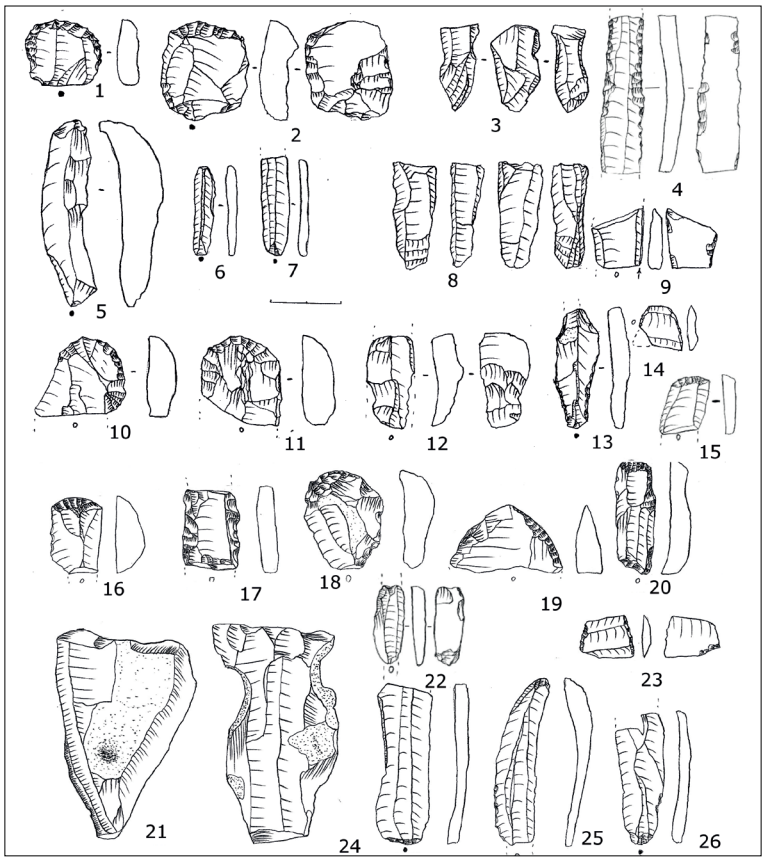

Figure 26 Melnychna Krucha. Lithic tools of SU2. After Kiosak 2019

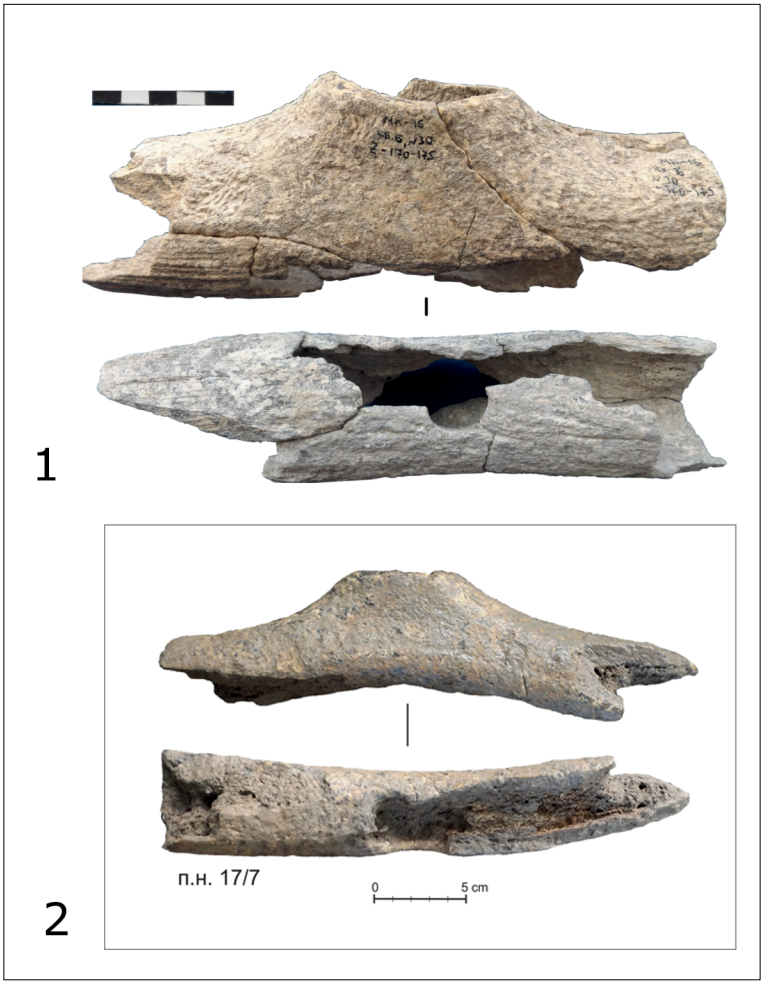

Figure 27 Melnychna Krucha SU2. T-shaped axes. The upper axe is directly dated to 5834-5727 calBCE (2σ), the lower axe is directly dated to 5736-5651 calBCE. Photo by the Author

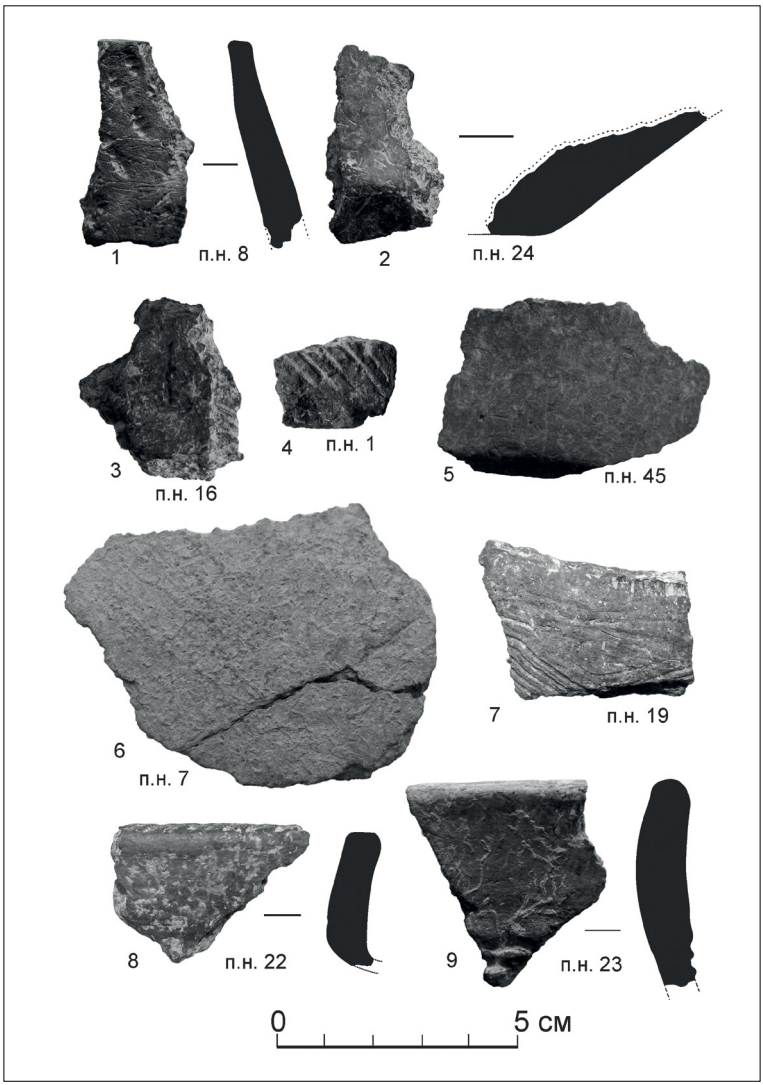

Figure 28 Melnychna Krucha. SU2 and R4. Potsherds. Photo by the Author

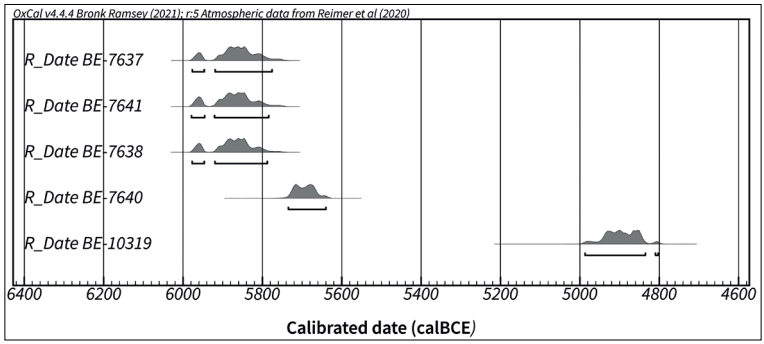

Figure 29 Melnychna Krucha, SU2 – four upper dates and R4 – lower date. Done in OxCal by the Author

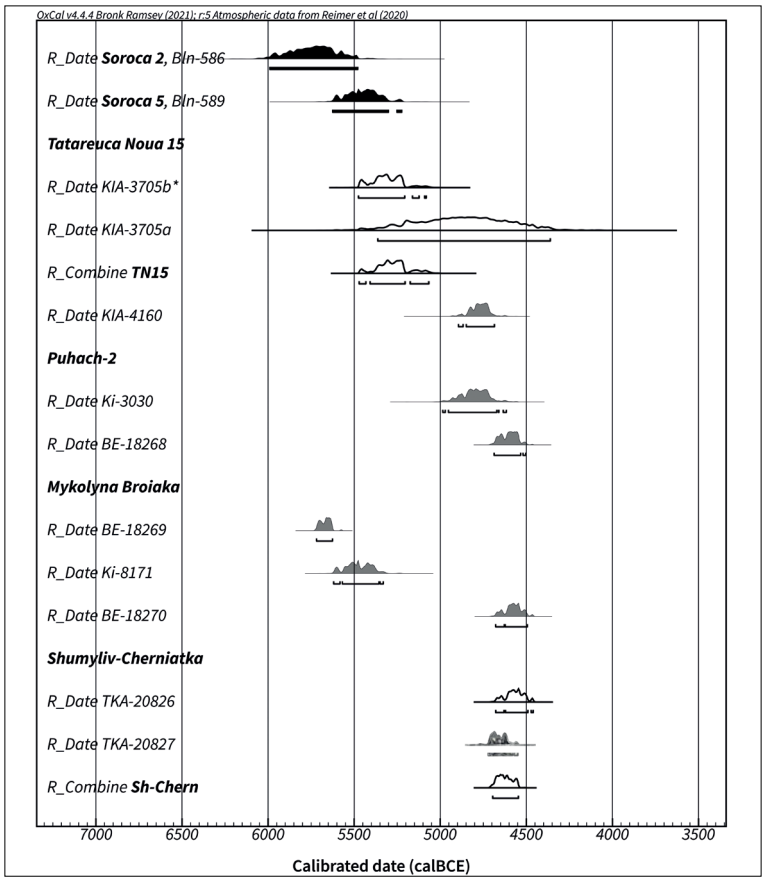

Figure 30 Relevant dates for Buh-Dniester para-Neolithic. Black: charcoal; empty: organic residues; grey: animal bone and antler; dirty: TOCC of a potsherd. R-Combine TN15 – a combination of dates KIA-3705a and b. R-Combine Sh-Chern – a combination of dates TKA-20826-27. Done in OxCal by the Author

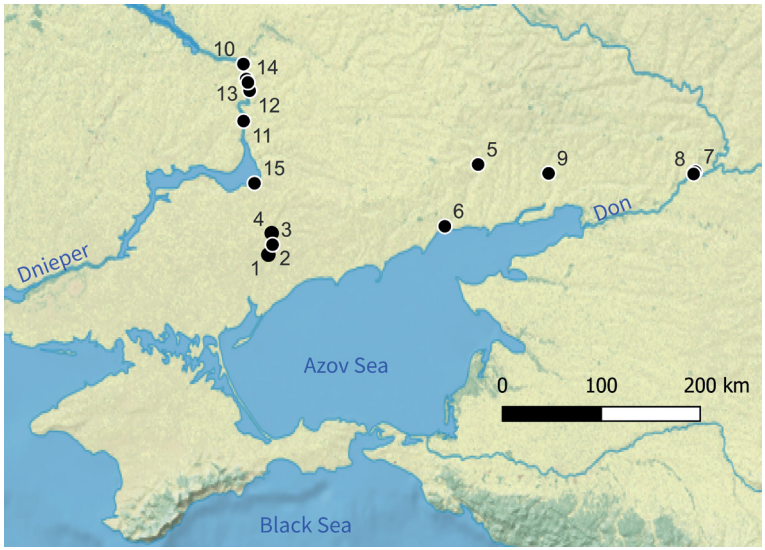

Figure 31 Map of the sites of Surskyi and Azov-Dnieper culture. 1: Semenivka 1; 2-3: Kamyana Mohyla 1 and 3; 4: Chapaevka; 5: Rozdolne; 6: Mariupol; 7-8: Rakushechnyi Yar, Razdorskaia; 10: Ihren 8; 11: Vovchok; 12-14: Shulaiv, Surskyi, Strilcha Skelia; 15: Lysa Hora. Topo: Natural Earth. Mapping by the Author

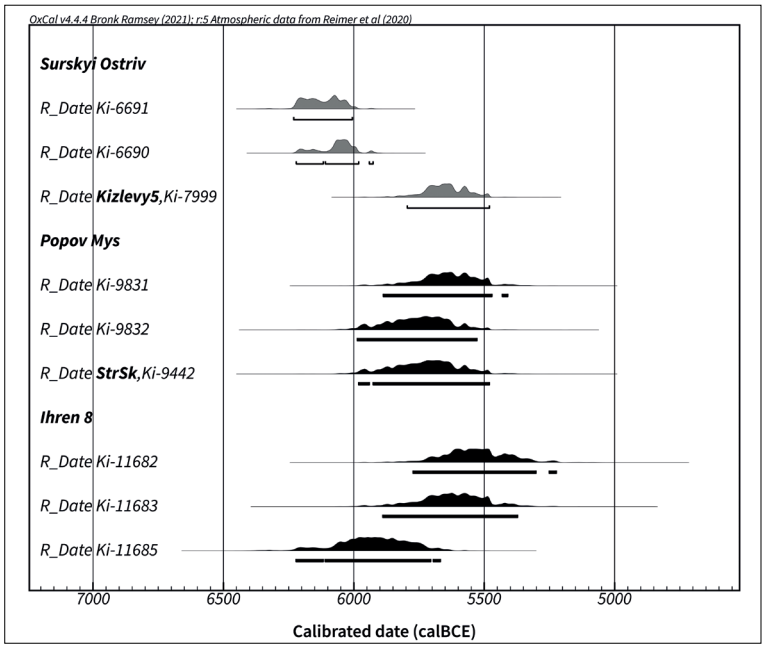

Figure 32 Legacy dates for the sites with Surskyi-style pottery. Grey: dates on bones; black: dates on potsherds. **ST 2-2**. Done in OxCal by the Author

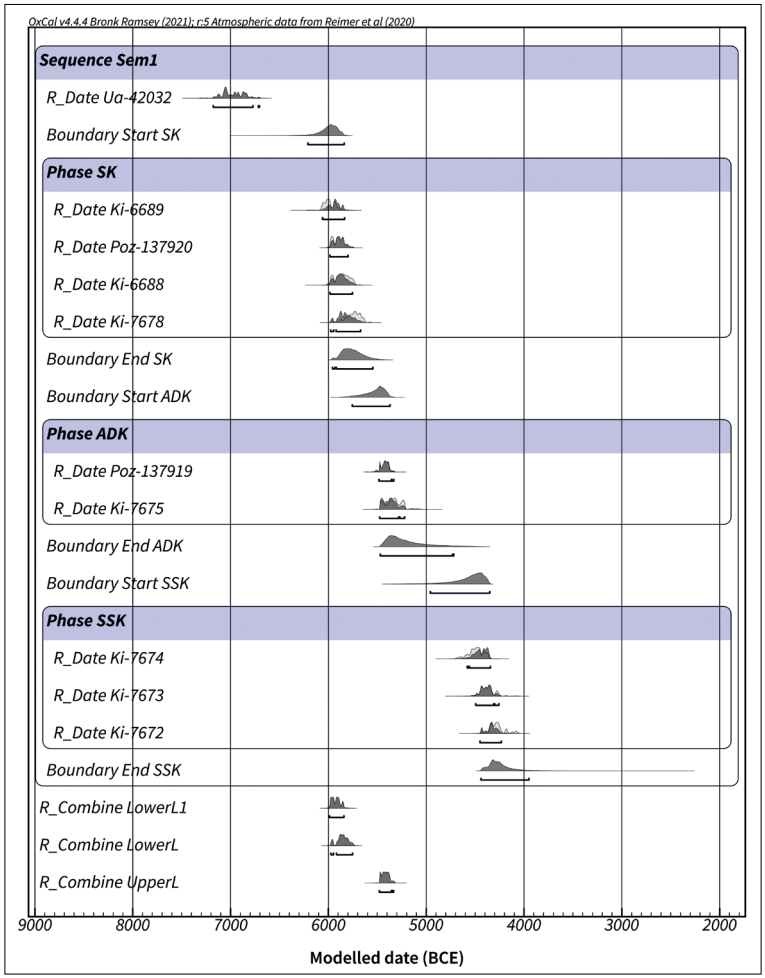

Figure 33 Semenivka 1. Modeled radiocarbon dates in sequence and combinations of dates. Sem1 – Semenivka 1, SK – Surskyi, ADK – Azov Dnieper, SSK – Eneolithic stratigraphic units respectively. LowerL1 – combination of dates Ki-6689, Poz-137920 and Ki-6688. LowerL – combination of dates Poz-137920, Ki-6778 and Ki-6688. UpperL – combination of Poz-137919 and Ki-7675.
Model 2-2. **ST 2-3**. Done in OxCal by the Author

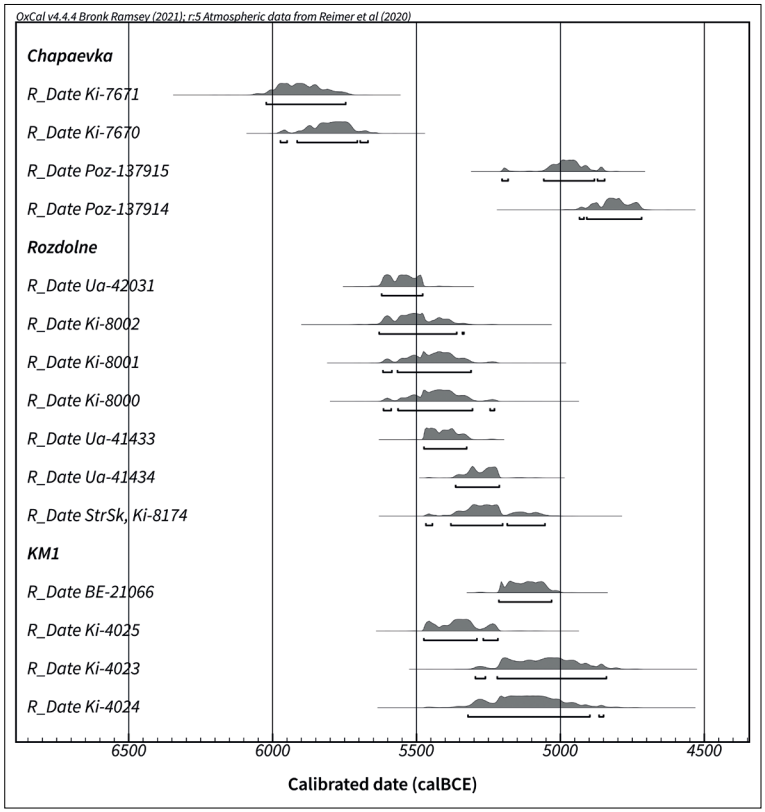

Figure 34 Radiocarbon dates for Azov-Dnieper sites. StrSk – Strilcha Skelia, KM1 – Kamyana Mohyla 1. All dates are from animal bones. **ST 2-4**. Done in OxCal by the Author

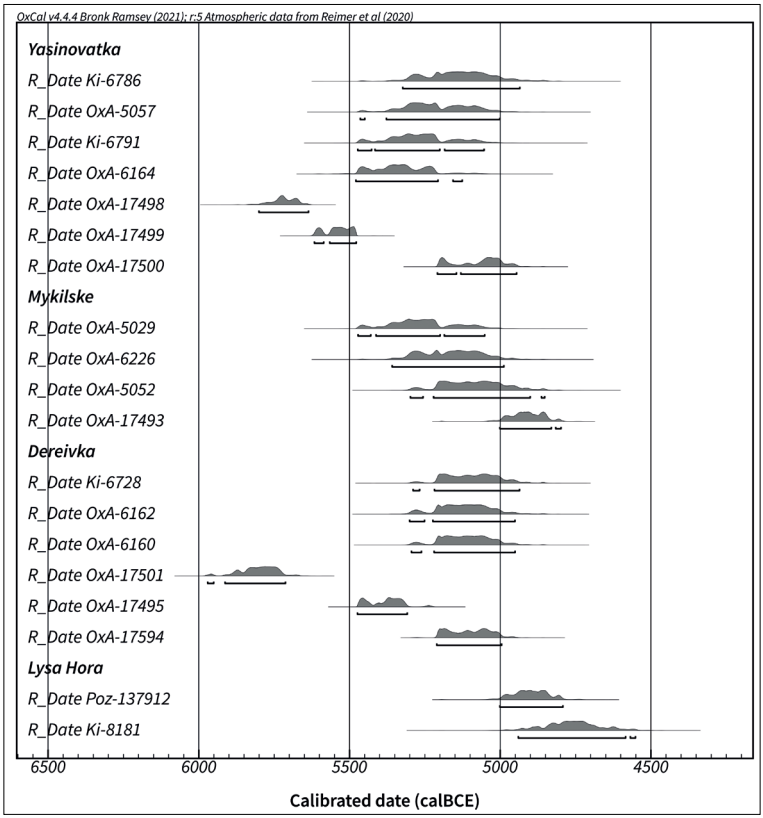

Figure 35 Radiocarbon dates of Azov-Dnieper cemeteries. All dates are from human bones. Done in OxCal by the Author

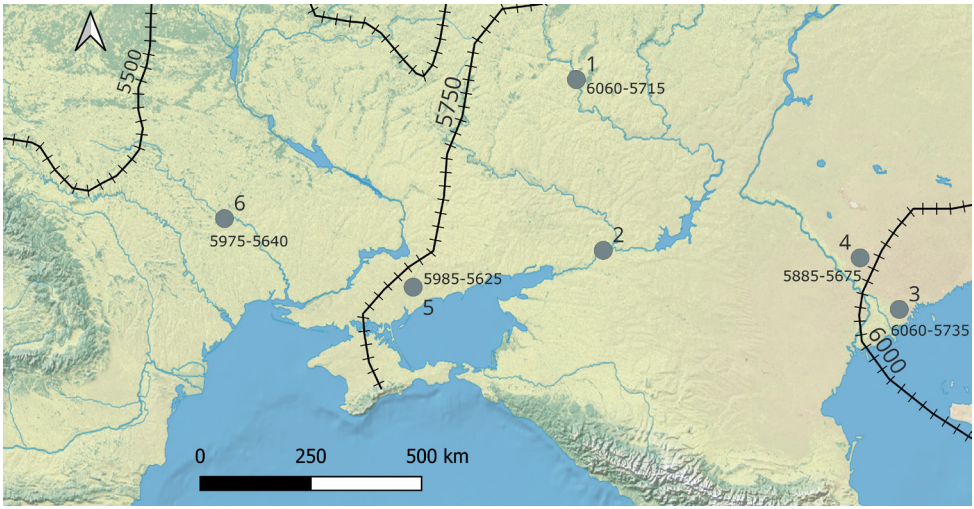

Figure 36 Map of the sites with early ceramic ware in the Ponto-Caspian region. 1: Cherkasskaya 5; 2: Rakushechnyi Yar; 3: Baibek; 4: Kairshak 3; 5: Semenivka 1; 6: Melnychna Krucha. The barred lines – isochrones of ceramic diffusion as modelled by Dolbunova et al. 2023. Topo: Natural Earth. Mapping by the Author

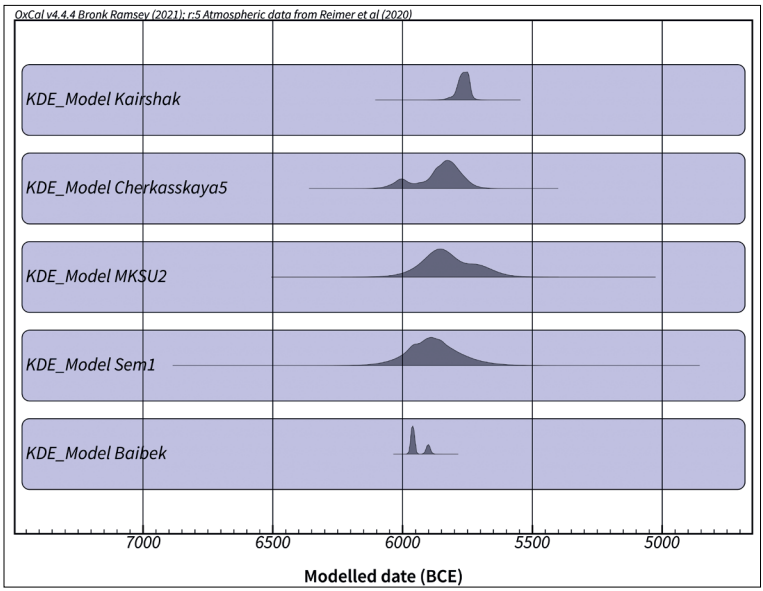

Figure 37 KDE models of the sites in question. MKSU2, Melnychna Krucha SU2, Sem1, Semenivka 1. Done in OxCal by the Author

Supplementary Tables

ST 2-1 Radiocarbon dates for 'Buh-Dniester' sites

Site name	Provenance	Lab. no.	Date BP	SD	Phase	Material	Calibration date range BC (1 sigma)	Calibration date range BC (2 sigmas)	Reference	Mark of relevance
The "old" chronology										
Soroca-2-l.1	Cultural layer	Bln-586	6825	150	Pechera	Charcoal	5885-5620	I	Markevich 1974	Incl
Gard	Lower layer	Ki-14790	6630	90	Pechera	Pottery	5630-5490	5721-5385	Tovkailo 2014	Excl
Gard	Lower layer	Ki-14789	6480	80	Pechera	Pottery	5520-5360	5612-5310	Tovkailo 2014	Excl
Gard	Upper layer	Ki-14791	6710	80	Savran	Pottery	5710–5560	5734-5489	Tovkailo 2014	Excl
Gard	Upper layer	Ki-14792	6520	80	Savran	Pottery	5560-5370	5618-5338	Tovkailo 2014	Excl
Gard	Upper layer	Ki-14793	6400	90	Savran	Pottery	5480–5310	5546-5210	Tovkailo 2014	Excl
Soroca-5	Cultural layer	Bln-589	6495	100	Savran	Charcoal	5545-5360	5631-5234	Markevich 1974	Incl
Tătărăuca Nouă-1	Cultural layer	KIA-3705b*	6340	70	Savran	Food crust	5460-5220	5478-5081	Wechler 2001	Incl
Tătărăuca Nouă-1	Cultural layer	KIA-3705a	5960	230	Savran	Food crust	5210–4580	5366-4362	Wechler 2001	Incl
Tătărăuca Nouă-1	Cultural layer	KIA-4160	5900	40	Savran	Antler				Incl
Puhach-2	Cultural layer	Ki-3030	5920	60	Savran	Charcoal	4877-4717	4961-4618	Tovkailo 2014	Incl
"New" chronology										
Bazkiv Ostriv		Ki-8166	7410	65	Pechera	Bone	6382-6225	6416-6086	Kotova 2003	Excl
Bazkiv Ostriv		Ki-8167	7270	70	Pechera	Bone	6220-6067	6333.5-5989.5	Kotova 2003	Excl
Bazkiv Ostriv		Ki-6651	7235	60	Pechera	Bone	6214-6023.5	6225.5-5994.5	Kotova 2003	Excl
Bazkiv Ostriv		Ki-6696	7215	55	Pechera	Bone	6202-6016	6216-6002	Kotova 2003	Excl
Bazkiv Ostriv		Ki-6652	7160	55	Pechera	Bone	6070-5988	6207-5912	Kotova 2003	Excl
Pechera		Ki-8164	7205	70	Pechera	Bone	6204-6006	6227-5930	Kotova 2003	Excl
Bazkiv Ostriv	Sq. U4	Ki-8168	6720	70	Savran	Bone	5705-5565	5736-5514	Kotova 2003	Incl
Bazkiv Ostriv	Sq. Tsch14, depth 60 cm	Ki-8169	6580	80	Savran	Bone	5615-5480	5644-5374	Kotova 2003	Incl
Savran	dwelling 2	Ki-6653	6920	50	Savran	Bone	5845-5735	5969-5716	Kotova 2003	Excl
Savran		Ki-6654	6985	60	Savran	Bone	5975-5800	5986-5744	Kotova 2003	Excl
Puhach-2	Trench 2, depth 2,5-2,6 m	Ki-6656	6895	50	Savran	Animal bone	5835-5725	5890-5674	Telegin et al. 2000	Excl
Puhach-2	XIX-51	Ki-6657	6810	60	Savran	Animal bone	5735-5645	5836-5622	Telegin et al. 2000	Excl
Puhach-2		Ki-6649	6780	60	Savran	Animal bone	5720-5635	5788-5564	Telegin et al. 2000	Excl
Puhach-2		Ki-6648	6740	65	Savran	Animal bone	5715-5620	5741-5534	Telegin et al. 2000	Excl
Puhach-2	Trench 1, depth 2,8-2,9 m	Ki-6679	6560	50	Savran	Animal bone	5555-5480	5621-5390	Telegin et al. 2000	Excl
Puhach-2	Trench 1, depth 2,4-2,5 m	Ki-6678	6520	60	Savran	Animal bone	5550-5385	5615-5363	Telegin et al. 2000	Excl
Gard-3	Sq. 5	Ki-6655	6930	55	Savran	Animal bone	5875-5740	5976-5716	Telegin et al. 2000	Excl
Gard-3		Ki-6650	6865	50	Savran	Animal bone	5810-5675	5875-5650	Telegin et al. 2000	Excl
Gard-3	trench 8	Ki-6687	6640	50	Savran	Animal bone	5620-5535	5636-5486	Telegin et al. 2000	Excl
Mykolyna Broyaka	Sq. 1, depth 120 cm	Ki-8171	6520	70	Savran	Animal bone	5555-5380	5618-5356	Kotova 2003	Incl
Dobrianka-1	Cultural layer	Ki-9833*	6530	140	Kyiv-	Pottery	5616-5370	5714-5224	Man'ko 2006	Excl
Dobrianka-1	Cultural layer	Ki-9834	6360	150	Kyiv-	Pottery	5490–5080	5616-4991	Man'ko 2006	Excl
Tashlyk2	cultural layer	Ki-10789	6160	60		Animal bone	5206.5-5038.5	5296.5-4939.5	Man'ko 2006	
Hirzheve	Cultural layer	Ki-11241	7280	170	Samchynts	Pottery carbon	6365.5-5990.5	6461-5804	Man'ko 2006	
Hirzheve	Cultural layer	Ki-11743	7200	220	Samchynts	Pottery carbon	6349.5-5841.5	6464.5-5664.5	Man'ko 2006	
Dobrianka-3	Cultural layer	Ki-11108	7260	170		Pottery carbon	6359.5-5982.5	6442-5797	Man'ko 2006	
Dobrianka-3	Cultural layer	Ki-11106	7070	150		Pottery carbon	6068.5-5782	6230-5665.5	Man'ko 2006	
Dobrianka-3	Cultural layer	Ki-11107	7050	160		Pottery carbon	6058.5-5760.5	6229-5637.5	Man'ko 2006	
New AMS dates										
Melnychna Krucha	*SU2*	*BE-7637*	*6980*	*24*	*Unknown*	*Bone*	*5980-5900*	*5990-5880*	*Kiosak et al. 2021*	Incl
Melnychna Krucha	*SU2*	*BE-7641*	*6986*	*24*	*Unknown*	*Bone*	*5872-5778*	*5888-5748*	*Kiosak et al. 2021*	Incl
Melnychna Krucha	*SU2*	*BE-7638*	*6985*	*22*	*Unknown*	*Antler*	*5773-5724*	*5835-5714*	*Kiosak et al. 2021*	Incl
Melnychna Krucha	*SU2*	*BE-7640*	*6812*	*24*	*Unknown*	*Bone*	*5762-5716*	*5806-5675*	*Kiosak et al. 2021*	Incl
Melnychna Krucha	*SU-R4*	*BE-10319*	*6008*	*21*	*Unknown*	*Bone*	*4880-4795*	*4930-4780*	*Kiosak et al. 2021*	Incl
Hlyns'kel	vessel 16, Complex 1	TKA-20828	7795	30	Pechera	Organic	6645-6600	6685-6530	Haskevych et al.	Excl
Hlyns'kel	vessel 7	TKA-21090	7080	30	Criș import	Organic	6002-5918	6014-5898	Haskevych et al.	Excl
Bazkiv Ostriv	vessel 23	TKA-20829	7710	25	Pechera	Organic	6586-6503	6597-6477	Haskevych et al.	Excl
Bazkiv Ostriv	vessel 1	TKA-20830	6855	30	Samchynts	Organic	5769-5707	5807-5666	Haskevych et al.	Excl
Bazkiv Ostriv	vessel 22	TKA-20831	6625	25	Skybentsi	Organic	5613-5534	5621-5514	Haskevych et al.	Incl
Bazkiv Ostriv	vessel 21	TKA-20832	6970	25	Skybentsi	Organic	5891-5810	5972-5769	Haskevych et al.	Incl
Bazkiv Ostriv	vessel 2	TKA-20833	6190	35	Samchynts	Organic	5212-5069	5288-5030	Haskevych et al.	Incl
Bazkiv Ostriv	vessel 39	TKA-20834	6040	25	Samchynts	Organic	4987-4907	5003-4847, mistakenly reported as 5211-	Haskevych et al.	Incl
Bazkiv Ostriv	vessel 39	TKA-21091	6145	35	Samchynts	Charred	5205-5027	5211-5000, mistakenly reported as 5003-	Haskevych et al.	Incl
Shumyliv-Chemiatka		TKA-20826	5725	30	Savran	Charred	4608-4515	4683-4491	Haskevych et al.	Incl
Shumyliv-Chemiatka		TKA-20827	5805	25	Savran	Organic	4709-4615	4723-4558	Haskevych et al.	Incl
Puhach-2	cultural layer	BE-18268	5750	26	Savran	animal bone	4656-4543	4686-4503	Kiosak et al. subm	Incl
Mykolyna Broiaka	*House 1, 280 cm deep*	*BE-18269*	*6762*	*27*	Savran?	*Animal*	*5708-5631*	*5719-5625*	Kiosak et al. subm	Incl
Mykolyna Broiaka	cultural layer	BE-18270	5731	26	Savran	animal bone	4647-4505	4678-4493	Kiosak et al. subm	Incl
Zakharivka-1	Cultural layer	Poz-21999	5935	35	?	Animal bone	4876-4726	4927-4716	Kiosak 2019	

ST 2-2 Radiocarbon dates for sites with Surskyi style pottery

Site Name	e	Lab. Number	Date BP	SD	Material	CalBCE (1 sigma)	CalBCE (2 sigmas)	Reference	Remark
Surskyi Ostriv	lower layer	Ki-6691	7245	60	animal bone	6216.5-6029	6229.5-6005	Kotova 2003	
Surskyi Ostriv	lower layer	Ki-6690	7195	55	animal bone	6085-5987	6219.5-5925	Kotova 2003	
Kizlevy V		Ki-7999	6740	90	Bone tool	5726-5560.5	5794-5479	Kotova 2015	
Popov Mys		Ki-9831	6720	120	TOCC potsherd	5725-5529	5885.5-5409	Kotova 2015	
Popov Mys		Ki-9832	6840	130	TOCC potsherd	5878-5624.5	5985.5-5527.5	Kotova 2015	
Strilcha Skelia		Ki-9442	6810	140	TOCC potsherd	5875-5564.5	5980.5-5479.5	Kotova 2015	
Ihren 8	PD8, D	Ki-11682	6600	140	TOCC potsherd	5655.5-5385	5771.5-5223	Man'ko 2005	N. Kotova doubts Surksyi outlook of this potsherd
Ihren 8	PD8, E	Ki-11683	6700	140	TOCC potsherd	5721.5-5480.5	5887.5-5371.5	Man'ko 2005	N. Kotova doubts Surksyi outlook of this potsherd
Ihren 8	PD8, D2	Ki-11685	7050	140	TOCC potsherd	6055.5-5783.5	6220-5667.5	Man'ko 2005	N. Kotova doubts Surksyi outlook of this potsherd

ST 2-3 Radiocarbon dates for the site of Semenivka 1

Site name	Provenance	Lab. no.	Date BP	SD	Phase	Material	CalBCE (1 sigma)	CalBCE (2 sigmas)	Reference
Sem1		Ua-42032	8058	55	Mesolithic layer	auroch bone	-7129.5 till-6829	-7175.5 till-6703	Kiosak et al. 2023
Sem1		Ki-7679	7285	70	Surskyi layer	animal bone	-6220.5 till-6074	-6357.5 till-6010.5	Kiosak et al. 2023
Sem1		Ki-6689	7125	60	Surskyi layer	animal bone	-6059 till-5921	-6083 till-5842.5	Kiosak et al. 2023
Sem1	**Exc. tr. 2, sq. 1, depth 120-140 cm**	Poz-137920	**7010**	40	Surskyi layer	II ph Bos sp.	-5976.5 till-5840.5	-5986 till-5786	Kiosak et al. 2023
Sem1		Ki-6688	6980	65	Surskyi layer	animal bone	-5972 till-5789.5	-5984 till-5731.5	Kiosak et al. 2023
Sem1		Ki-7678	6850	70	Surskyi layer	animal bone	-5799.5 till-5659.5	-5885.5 till-5624.5	Kiosak et al. 2023
Sem1	**Exc. tr. 2, sq. 1, depth 90-100 cm**	Poz-137919	**6480**	40	Azov-Dnieper layer	tooth of small canid	-5476.5 till-5380	-5523 till-5334.5	Kiosak et al. 2023
Sem1	**Exc. tr 2/ sq. 3, z -110-120 cm**	Ki-7675	6360	70	Azov-Dnieper layer	animal bone	-5467 till-5219	-5475 till-5209.5	Kiosak et al. 2023
Sem1	**Exc. tr 2/ sq. 6, z -100-120 cm**	**Ki**-7674	5655	60	Seredny Stog layer	animal bone	-4545.5 till-4368.5	-4656 till-4352.5	Kiosak et al. 2023
Sem1	**Exc. tr 2/ sq. 4, z -90-115 cm**	**Ki**-7673	5525	70	Seredny Stog layer	animal bone	-4447 till-4328.5	-4534.5 till-4241.5	Kiosak et al. 2023
Sem1	**Exc. tr 2/ sq. 1, z -90-100 cm**	**Ki**-7672	5440	60	Seredny Stog layer	animal bone	-4349.5 till-4240	-4441 till-4056	Kiosak et al. 2023

ST 2-4 Radiocarbon dates for Azov-Dnieper culture residential sites

Site name	Provenance	Aspect/Phase	Lab. no.	Date BP	SD	Material	CalBC (1 sigma)	CalBC (2 sigmas)	Reference
Chapaevka	Sq. 3, -64 cm	ADK/I	Ki-7671	7030	70	Animal bone	5985-5840	6021-5745	Kotova 2015
Chapaevka	Sq. 6, -62 cm	ADK/I	Ki-7670	6910	60	Animal bone	5875-5726	5972-5668	Kotova 2015
Chapaevka	sq. 27 / z -136 cm		Poz-137915	6070	35	animal bone	5033-4911	5202-4845	Kiosak et al. 2023
Chapaevka	sq. 29 / z = -128 cm		Poz-137914	5940	40	incisor of Equus sp.	4887-4728	4933-4717	Kiosak et al. 2023
Rozdolne	2010, tr. 1, -280 cm		Ua-42031	6609	49	Mandible of cattle	5615-5481	5620-5478	Kotova et al. 2017
Rozdolne	1991, tr. 2, sq. 1, -120-140 cm		Ki-8002	6550	80	Animal bone	5615-5407	5629-5335	Kotova et al. 2017
Rozdolne	1991, tr. 2, sq. 1, -120-140 cm		Ki-8001	6490	80	Animal bone	5527-5365	5616-5310	Kotova et al. 2017
Rozdolne	1991, tr. 2, sq. 1, -120-140 cm		Ki-8000	6475	80	Animal bone	5516-5335	5614-5228	Kotova et al. 2017
Rozdolne	2000, tr. 5, sq.6Б, -174		Ua-41433	6428	37	Mandible of cattle	5471-5368	5473-5325	Kotova et al. 2017
Rozdolne	2000, tr. 5, sq.6Б, -174		Ua-41434	6310	38	Mandible of cattle	5318-5216	5363-5211	Kotova et al. 2017
Strilcha Skelia	Sq. 8, cut 9	ADK/II	Ki-8174	6290	65	Bone tool	5359-5208	5466-5053	Kotova 2015

ST 2-5 Radiocarbon dates for cemeteries attributed to Azov Dnieper culture

Site name	Provenance	Lab. no.	Date BP	SD	Cultural aspect	Material	Calibration date range BC (1 sigma)	Calibration date range BC (2 sigmas)	Reference
Yasinovatka	burial 34	ADK/II	Ki-6786	6195	80	Human bone	5290-5039	5323-4934	Kotova 2015
	burial 36	ADK/II	OxA-5057	6260	80	Human bone	5314-5071	5463-5000	Kotova 2015
	burial 45	ADK/II	Ki-6791	6305	80	Human bone	5460-5130	5472-5053	Kotova 2015
	burial 45	ADK/II	OxA-6164	6360	75	Human bone	5468-5219	5478-5125	Lillie 1998
	burial 65		OxA-17498	6840	37	Fish tooth	5744-5666	5800-5635	Lillie et al. 2009
	burial 54		OxA-17499	6593	35	Human fibula	5606-5481	5616-5477	Lillie et al. 2009
	burial 54		OxA-17500	6121	34	Deer tooth pendant	5204-4990	5208-4945	Lillie et al. 2009
Mykilske	burial 125	ADK/II	OxA-5029	6300	80	Human bone	5372-5126	5471-5051	Lillie 1998
	burial 94	ADK/II	OxA-6226	6220	75	Human bone	5299-5054	5356-4987	Lillie 1998
	burial 137	ADK/II	OxA-5052	6145	70	Human bone	5207-5000	5297-4852	Lillie 1998
	unknown		OxA-17493	6020	34	Animal tooth	4950-4844	5000-4798	Lillie et al. 2009
Dereivka	burial 11	ADK/II	Ki-6728	6145	55	Human bone	5206-5003	5288-4935	Kotova 2015
	burial 33	ADK/II	OxA-6162	6175	60	Human bone	5210-5045	5300-4950	Lillie 1998
	burial 49	ADK/II	OxA-6160	6165	55	Human bone	5207-5045	5294-4950	Lillie 1998
	burial 29		OxA-17501	6915	50	Fish tooth	5839-5732	5970-5712	Lillie et al. 2009
	burial 29		OxA-17495	6398	35	Human bone	5467-5320	5473-5308	Lillie et al. 2009
	burial 29		OxA-17594	6147	35	Deer bone	5206-5010	5210-4995	Lillie et al. 2009
Lysa Hora	burial 17, above pit 3		Poz-137912	6010	40	Human bone	4950-4838	5000-4791	Kiosak et al. 2023
	pit 4		Ki-8181	5890	70	Human bone	4877-4680	4939-4551	Kiosak et al. 2023

Models

Model 2-1 Buh-Dniester sites. Comparison of conventional Kyiv (1998-2008), other conventional, AMS dates, dates on TOCC of potsherds from Kyiv, dates on TOCC of potsherds from Tokyo

```
Plot()
  {
    KDE_Model("Kyiv 1998-2008, 28 dates")
    {
      R_Date("Ki-8166",7410,65);
      R_Date("Ki-8167",7270,70);
      R_Date("Ki-6651",7235,60);
      R_Date("Ki-6696",7215,55);
      R_Date("Ki-6652",7160,55);
      R_Date("Ki-8164",7205,70);
      R_Date("Ki-8168",6720,70);
      R_Date("Ki-8169",6580,80);
      R_Date("Ki-6653",6920,50);
      R_Date("Ki-6654",6985,60);
      R_Date("Ki-6656",6895,50);
      R_Date("Ki-6657",6810,60);
      R_Date("Ki-6649",6780,60);
      R_Date("Ki-6648",6740,65);
      R_Date("Ki-6679",6560,50);
      R_Date("Ki-6678",6520,60);
      R_Date("Ki-6655",6930,55);
      R_Date("Ki-6650",6865,50);
      R_Date("Ki-6687",6640,50);
      R_Date("Ki-8171",6520,70);
      R_Date("Ki-9833*",6530,140);
      R_Date("Ki-9834",6360,150);
      R_Date("Ki-10789",6160,60);
      R_Date("Ki-11241",7280,170);
      R_Date("Ki-11743",7200,220);
      R_Date("Ki-11108",7260,170);
      R_Date("Ki-11106",7070,150);
      R_Date("Ki-11107",7050,160);
    };
    KDE_Model("Other conventional, 8 dates")
    {
      R_Date("Bln-586",6825,150);
      R_Date("Ki-14790",6630,90);
      R_Date("Ki-14789",6480,80);
      R_Date("Ki-14791",6710,80);
      R_Date("Ki-14792",6520,80);
      R_Date("Ki-14793",6400,90);
      R_Date("Bln-589",6495,100);
      R_Date("Ki-3030",5920,60);
    };
```

```
KDE_Model("Kyiv-potsherds, 12 dates")
{
  R_Date("Ki-14790",6630,90);
  R_Date("Ki-14789",6480,80);
  R_Date("Ki-14791",6710,80);
  R_Date("Ki-14792",6520,80);
  R_Date("Ki-14793",6400,90);
  R_Date("Ki-9833*",6530,140);
  R_Date("Ki-9834",6360,150);
  R_Date("Ki-11241",7280,170);
  R_Date("Ki-11743",7200,220);
  R_Date("Ki-11108",7260,170);
  R_Date("Ki-11106",7070,150);
  R_Date("Ki-11107",7050,160);
};
KDE_Model("Tokyo-potsherds, 11 dates")
{
  R_Date("TKA-20828",7795,30);
  R_Date("TKA-21090",7080,30);
  R_Date("TKA-20829",7710,25);
  R_Date("TKA-20830",6855,30);
  R_Date("TKA-20831",6625,25);
  R_Date("TKA-20832",6970,25);
  R_Date("TKA-20833",6190,35);
  R_Date("TKA-20834",6040,25);
  R_Date("TKA-21091",6145,35);
  R_Date("TKA-20826",5725,30);
  R_Date("TKA-20827",5805,25);
};
KDE_Model("AMS, 23 dates")
{
  R_Date("KIA-3705b*",6340,70);
  R_Date("KIA-3705a",5960,230);
  R_Date("KIA-4160",5900,40);
  R_Date("BE-7637",6980,24);
  R_Date("BE-7641",6986,24);
  R_Date("BE-7638",6985,22);
  R_Date("BE-7640",6812,24);
  R_Date("BE-10319",6008,21);
  R_Date("TKA-20828",7795,30);
  R_Date("TKA-21090",7080,30);
  R_Date("TKA-20829",7710,25);
  R_Date("TKA-20830",6855,30);
  R_Date("TKA-20831",6625,25);
  R_Date("TKA-20832",6970,25);
  R_Date("TKA-20833",6190,35);
  R_Date("TKA-20834",6040,25);
  R_Date("TKA-21091",6145,35);
  R_Date("TKA-20826",5725,30);
  R_Date("TKA-20827",5805,25);
  R_Date("BE-18268",5750,26);
```

```
    R_Date("BE-18269",6762,27);
    R_Date("BE-18270",5731,26);
    R_Date("Poz-21999",5935,35);
  };
  KDE_Model("AMS-TOCCpothserds-excl, 14")
  {
    R_Date("KIA-3705b*",6340,70);
    R_Date("KIA-3705a",5960,230);
    R_Date("KIA-4160",5900,40);
    R_Date("BE-7637",6980,24);
    R_Date("BE-7641",6986,24);
    R_Date("BE-7638",6985,22);
    R_Date("BE-7640",6812,24);
    R_Date("BE-10319",6008,21);
    R_Date("TKA-21091",6145,35);
    R_Date("TKA-20826",5725,30);
    R_Date("BE-18268",5750,26);
    R_Date("BE-18269",6762,27);
    R_Date("BE-18270",5731,26);
    R_Date("Poz-21999",5935,35);
  };
};
```

Model 2-2 Semenivka 1. Sequential phases and some combinations of dates

```
Plot()
  {
    Sequence(Sem1)
    {
      R_Date("Ua-42032", 8058, 55);
      Boundary("Start SK");
      Phase("SK")
      {
        R_Date("Ki-6689", 7125, 60);
        R_Date("Poz-137920", 7010, 40);
        R_Date("Ki-6688", 6980, 65);
        R_Date("Ki-7678", 6850, 70);
      };
      Boundary("End SK");
      Boundary("Start ADK");
      Phase("ADK")
      {
        R_Date("Poz-137919", 6480, 40);
        R_Date("Ki-7675", 6360, 70);
      };
      Boundary("End ADK");
      Boundary("Start SSK");
      Phase("SSK")
      {
        R_Date("Ki-7674", 5655, 60);
        R_Date("Ki-7673", 5525, 70);
        R_Date("Ki-7672", 5440, 60);
      };
      Boundary("End SSK");
    };
    R_Combine("LowerL1")
    {
      R_Date("Ki-6689", 7125, 60);
      R_Date("Poz-137920", 7010, 40);
      R_Date("Ki-6688", 6980, 65);
    };
    R_Combine("LowerL")
    {
      R_Date("Poz-137920", 7010, 40);
      R_Date("Ki-6688", 6980, 65);
      R_Date("Ki-7678", 6850, 70);
    };
    R_Combine("UpperL")
    {
      R_Date("Poz-137919", 6480, 40);
      R_Date("Ki-7675", 6360, 70);
    };
  };
```

Model 2-3 Kernel Density Models for earliest pottery in southern Eastern Europe

```
Plot()
  {
    KDE_Model("Kairshak")
    {
      R_Date("OxA-40228",6908,26);
      R_Date("SUERC-93642",6973,44);
      R_Date("OxA-40229",6890,27);
      R_Date("SUERC- 100998",6934,27);
      R_Date("SUERC- 100999",6885,25);
      R_Date("SUERC- 101001",6872,25);
      R_Date("SUERC- 101000",6901,27);
    };
    KDE_Model("Cherkasskaya5")
    {
      R_Date("OxA-39520",6999,27);
      R_Date("OxA-39521",7130,26);
      R_Date("OxA-39522",6982,26);
      R_Date("SUERC-86147",6987,28);
      R_Date("SUERC-86148",6966,28);
      R_Date("SUERC-86149",6943,28);
      R_Date("SUERC-86150",6950,28);
      R_Date("SUERC-86151",7140,28);
      R_Date("SUERC-86156",6938,28);
      R_Date("SUERC-86157",6908,28);
      R_Date("SUERC-86158",6886,28);
    };
    KDE_Model("MKSU2")
    {
      R_Date("BE-7637",6980,24);
      R_Date("BE-7641",6986,24);
      R_Date("BE-7638",6985,22);
      R_Date("BE-7640",6812,24);
    };
    KDE_Model("Sem1")
    {
      R_Date("Ki-6689", 7125, 60);
      R_Date("Sem1", 7010, 40);
      R_Date("Ki-6688", 6980, 65);
      R_Date("Ki-7678", 6850, 70);
    };
    KDE_Model("Baibek")
    {
      R_Date("DeA-20722",6992,37);
      R_Date("DeA-20723",6976,37);
      R_Date("DeA-20724",7097,41);
      R_Date("DeA-20725",7034,43);
      R_Date("OxA-39162",7010,27);
      R_Date("DeA-20726",7056,38);
      R_Date("DeA-20727",7036,37);
```

```
      R_Date("DeA-20728",6998,39);
      R_Date("DeA-20729",7023,39);
      R_Date("DeA-20957",6952,40);
      R_Date("DeA-20958",7012,34);
      R_Date("DeA-20730",7023,39);
      R_Date("OxA-39163",7060,28);
      R_Date("OxA-39164",7030,28);
      R_Date("OxA-39165",7012,28);
      R_Date("OxA-39166",7035,27);
      R_Date("OxA-39296",7030,27);
      R_Date("OxA-39074",7048,25);
      R_Date("OxA-39332",6989,32);
      R_Date("OxA-39075",7023,24);
      R_Date("OxA-39076",7016,24);
      R_Date("OxA-39077",7024,25);
      R_Date("OxA-39133",6994,29);
      R_Date("OxA-39232",6978,28);
      R_Date("OxA-39134",6994,28);
      R_Date("OxA-39518",7041,27);
      R_Date("OxA-39136",6999,29);
      R_Date("OxA-39137",7020,28);
      R_Date("OxA-39138",7002,29);
      R_Date("OxA-39139",7022,29);
      R_Date("DeA-20731",7037,37);
      R_Date("DeA-20732",7026,76);
    };
};
```