

Radiocarbon chronology of Neolithic in the Lower Don and North-eastern Azov Sea

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ABSTRACT – *So far, four different cultural-chronological groups of sites have been identified in the North-eastern Azov Sea and Lower Don River areas, including sites of the Rakushechny Yar culture, Matveev Kurgan culture, Donets culture, and sites of the Caspian-Ciscaucasian region. An analysis of all known dates, as well as the contexts and stratigraphies of the sites, allowed us to form a new perspective of the chronology of southern Russia, to revise the chronology of this region, and change the concept of unreliability of dates for this area.*

KEY WORDS – *Neolithic; chronology; earliest pottery; Lower Don; North-Eastern Azov Sea*

Radiokarbonska kronologija neolitika na območju spodnjega toka reke Don in v severovzhodnem delu Azovskega morja

IZVLEČEK – *Na območjih severovzhodnega dela Azovskega morja in spodnjega toka reke Don so bile do danes prepoznane štiri različne kulturno-kronološke skupine najdišč, ki vključujejo najdišča kulture Rakushechny Yar, kulture Matveev Kurgan, kulture Donets in druga najdišča v kaspjsko – cis-kavkaški regiji. Z analizo vseh znanih radiokarbonskih datumov, njihovih kontekstov in stratigrafij na najdiščih, smo lahko oblikovali nove poglede na kronologijo južne Rusije, revidirali staro kronologijo in spremenili odnos do datumov, ki so veljali za nezanesljive.*

KLJUČNE BESEDE – *neolitik; kronologija; najzgodnejša lončenina; spodnji tok reke Don; severovzhodni del Azovskega morja*

Introduction

The Neolithic period of the North-eastern and Eastern Azov Sea areas has been investigated for more than 50 years, and over 100 radiocarbon dates are available (Tab. 1). Four different cultural-chronological groups of sites are now distinguished here. They include sites of the Rakushechny Yar culture

(the Lower Don River), Matveev Kurgan culture (Mius River), sites of Donets culture (Low Siversky Donets River) and of the Caspian-Ciscaucasian cultural group (Tsybrij 2008; Belanovskaya 1995; Krizhevskaya 1991; for the areas of these cultures' distribution, see Gorelik et al. 2016). Each of these cultures is repre-

sented by several sites (see *Tsybrij 2008*). In the majority of cases, the Neolithic period in this region is marked by the appearance of pottery, an intensification of sedentism, the appearance of ‘wattle and daub’ architecture (at some sites), specific anthropomorphic and zoomorphic plastics, and new features in the stone industry. The previous determination of domesticated animals at the Matveev kurgan I site dated to the end of the 7th millennium BC were re-examined (*Krizhevskaya 1991; Gorelik et al. 2016. 149*); evidence of domesticated animals at the Rakushechny Yar site are under discussion (*Tsybrij et al. 2017*).

This article will give an overview of chronological frameworks of these cultures, with a particular focus on Rakushechny Yar (Fig. 1). An analysis of all the known dates, as well as a context and stratigraphy, allowed a new view and revision of the chronology of south-western Russia, as well as changes of the concept of unreliability of dates for this region (*cf. Motuzaitė Matuzeviciute et al. 2015.657–658*) based on the Rakushechny Yar case study.

Rakushechny Yar: in search of old excavations and new studies

Rakushechny Yar culture was distinguished by Tatjana D. Belanovskaya on the basis of materials from the Rakushechny Yar site, which yielded a very particular set of finds related to a complex subsistence system (*Belanovskaya 1983; 1995*). Only few sites are attributed to this culture: an early phase (7th–6th millennium BC), including Rakushechny Yar (layers 23–11) and Razdorskoe I (layer 1). The later Neolithic phases (5th millennium BC) include Rakushechny Yar (layer 5) and Samsonovskoe (layer 6) (*Tsybrij 2008.51–52*).

Rakushechny Yar is located in the Rostovsky region, on the island of Porechny near the village of Razdorskaya. Porechny is of non-homogeneous geomorphological structure (*Velichko et al. 2011*). The north-western part is located in a high flood-plain area, and the south-western part on a low flood-plain. These two flood plains

can be clearly seen from the opposite bank of the Don River. It might be suggested that the outer part of the right river bank where the site was located became separated when a new riverbed was forming, and thus the island appeared (*Velichko et al. 2011*). Much of the site has been destroyed and is still being destroyed. This can be clearly seen by comparing images of the island on 19th century maps and photos of the 1960s, and modern investigations.

The site was discovered in 1956 by Leonid T. Agarkov, a teacher at Razdorskaya village. It was excavated in 1959–1966, 1968, 1971, 1976–1977, and 1979 by Leningrad University expeditions headed by Belanovskaya; the various excavations were made that acquired different names (Fig. 2)¹. Collections obtained during excavations by Belanovskaya in the 1960s–1970s (*Belanovskaya 1995*) and later (*Aleksandrovsky et al. 2009; Tsybrij et al. 2014*) helped creating a typology of these materials (*Mazurkevich, Dolbunova 2015*), and an analysis of the site’s stratigraphy and chronology. In 2008–2013 and 2016–2017, new excavations were conducted (*Tsybrij et al. 2014*), and the stratigraphy that was revealed appeared to be very similar to that described by Belanovskaya of excavations I–III and a trench made by Dmitry Y. Telegin in 1975, which was located, according to archive data, between trenches IV–V made by Belanovskaya (Figs. 2–4).

The geological deposits on the site are up to 6m deep and the cultural layers up to 5m. According to Bela-



Fig. 1. Site distribution in the Lower Don and North-eastern Azov Sea area (only sites indicated in Table 1 are presented here).

¹ Usually only the materials from excavation I are presented in the publications.

novskaya, the cultural layers can be traced to a distance of 240m to the south-east. The borders of the site inside the island are not clearly defined. The layers are not distributed uniformly and their number varies in different parts of the island. Only the upper layers (1–5) are deposited uniformly, whereas the layers below are isolated and vary in depth and area and are often separated by sterile layers of sand. This is what complicates the correlation of layers of excavations in different parts of the island. From the very outset, Belanovskaya noted that only the layers of excavations I–III can be correlated based on stratigraphic observation. This is why each part that was excavated has its own numbering system, which can be correlated only on the basis of ^{14}C dates from precise layers (see Fig. 3). Future excavations and the connection of all of the excavated areas will allow us to correlate stratigraphic units of different parts.

The surface excavated in the 1960s–1970s amounted to 1000m² (Belanovskaya 1995.9–12). The main trench (trench I) was in the northern part of the island (Fig. 2). Six horizons were distinguished here based on a very precise lithology, included cultural layers, often separated by sterile interlayers. The upper cultural layers of the Eneolithic and Later Neolithic period (layers 4 and 5) include thick layers filled by *Viviparus dilluvianus* shells, which were cemented together and protected the underlying lay-

ers from being destroyed (Belanovskaya 1995). The low horizon (correlated with horizon VI of Telegin; Fig. 3a) included several thin lithological layers (2–25cm) (Fig. 3f). Cultural layers 23–12 were separated by sterile sand interlayers, and layers 12–10 by sandy clay 5–10cm thick. No remains of structures were found in layers 23–18, besides shell piles with a great amount of fish and animal bones, charcoal and artefacts inside and nearby. Post pits, fire-places on clay platform-floors, shell piles, daub fragments from the walls/roofs of dwellings were found in layers above. The particularities of microstratigraphy and the spatial distribution of finds allows us to suppose that the inhabitants of this ancient settlement had to leave this place periodically (at least the part excavated), probably due to seasonal flooding of the paleoriver, but then they returned (Belanovskaya 1995.13). A particular material culture was revealed in the Neolithic layers, with flat-bottom pottery, predominantly undecorated, flint borers, slate chisels, and numerous bone points and antler hoes (Figs. 5–8).

Cultural layers 6–23 were attributed to the Neolithic (Belanovskaya 1995). Telegin identified six lithological horizons here, attributing horizons 4–6 to Early Neolithic layers (Telegin 1981) (Fig. 3a). This is a very important point, because the numbering of layers, indicated by Telegin, does not correspond to the now widely used layer numbering system pro-

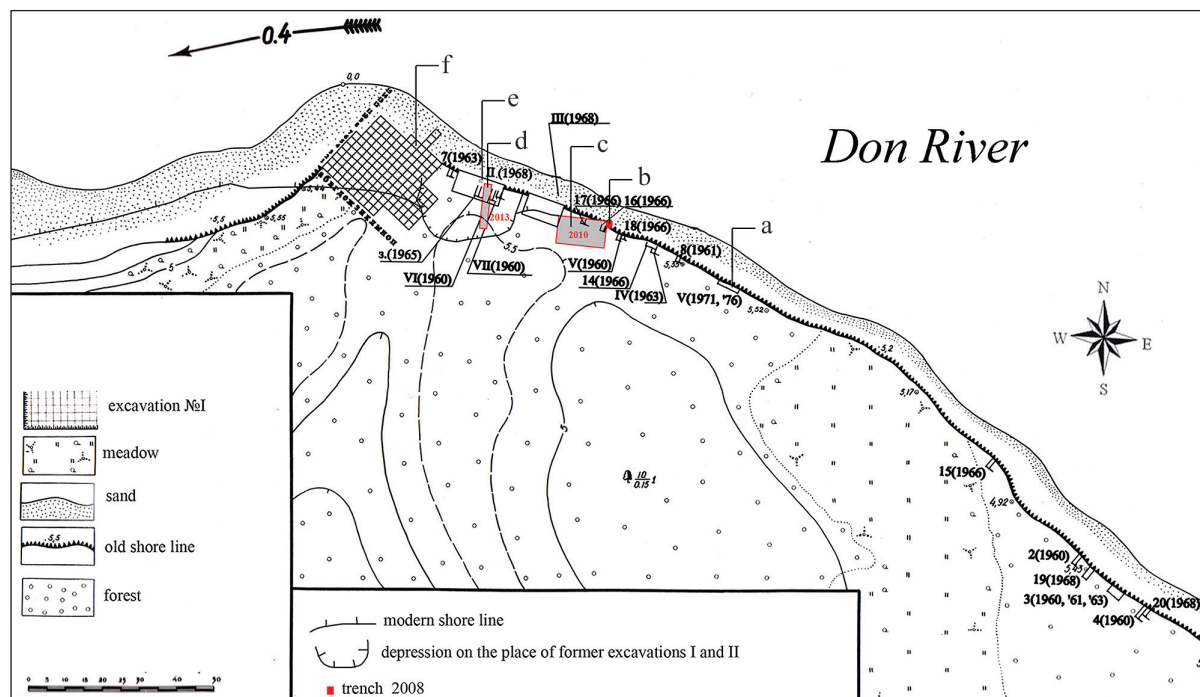


Fig. 2. Rakushechny Yar site. Plan of excavations in the 1960–1970s, and new excavations in 2008–2016 (for a–f see Fig. 3).

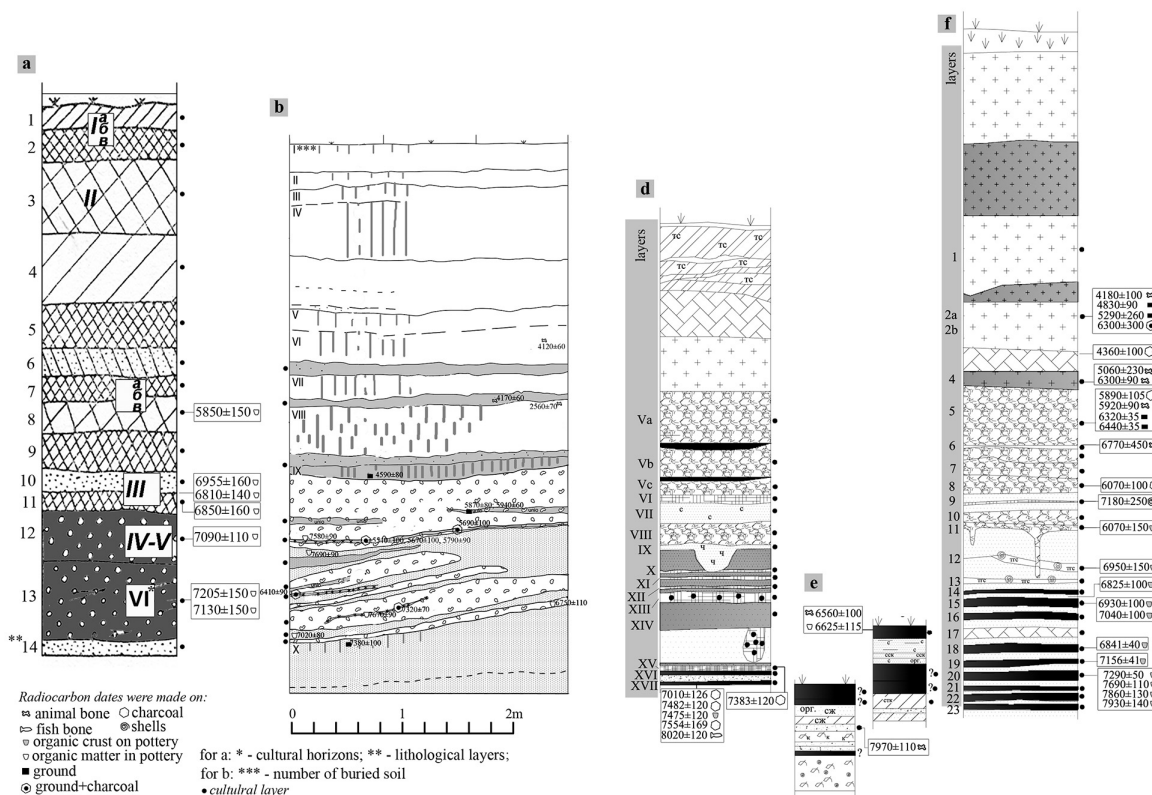


Fig. 3. Rakushechny Yar. *a* stratigraphy of Telegin's excavation (from Telegin 1981); *b* stratigraphy of excavation of 2008 (modified from Aleksandrovky et al. 2009); *d* stratigraphy of trench 2013; *e* sondages #1, #2 and new excavations of 2016–2017; *f* excavation I by Belanovskaya in 1966 (modified from Belanovskaya 1995; the lower layers 16–23 were drawn according to description). See the description of the lithological layers in the text.

posed by Belanovskaya, so dates made on materials with the firmer index system cannot be correlated with other dates without a special analysis of materials and discussion (cf. Kotova 2002; Manko 2006 etc.).

In order to refine the stratigraphy of the site and its chronology, which remained a subject of discussion, a stratigraphic trench was made in 2013, and further excavations carried out during 2016–2017, which allowed us to precisely place the previous excavations by Belanovskaya, to correlate the stratigraphy of different parts of the settlement and obtain new materials for radiocarbon dating.

Chronology of the Rakushechny Yar site

The chronology of the settlement can be reconstructed based on radiocarbon dates made on different materials – charcoal, bone, soil and organic crust – from trench I of the 1960s (Belanovskaya et al. 2003; Belanovskaya, Timofeev 2003), from the trench dug in 2008 (that might be located near excavation 16 made by Belanovskaya) and enlarged in 2010, and from the trench dug in 2013 at the location of the II

by Belanovskaya (Tsybrij et al. 2014) (Fig. 3). The stratigraphy of different excavations was correlated in order to refine the chronology of the site, new samples were selected, and artefacts, including dated samples, were spatially analysed.

Most of the radiocarbon dates of the organic materials from excavation I correlate rather well with each other (Tab. 1; Fig. 9). They show the dynamics of occupation of the site. The dates of materials from layer 20 might reflect different periods of occupation of the site. Only the dates of shells, and some dates of mixed samples of charcoal and soil could have been influenced by some postdepositional processes, and these do not reflect the real date of the layers' formation. Comparing the dates of fish bones and other materials from one layer, it is evident that the dates of the former appear to be older (Tab. 1.29). However, it must be noted that there is not enough data and materials to discuss the possibility and extent of the reservoir effect on this site.

Another set of dates was obtained from materials from the lower layers of the trench dug at excavation II in 2013, from the trench of 2008, and pottery

from excavations by Telegin in 1975 (*Telegin 1981*), which allowed us to establish the radiocarbon chronology of different parts of the site. Charcoal from a shell pile (layer XVII, trench of 2013) was dated to 7554±169 BP (Ua-48460) ($\delta^{13}C$ -22.6) and 7010±126 BP (Ua-48461) ($\delta^{13}C$ -23.0) (6590–6230 and 6000–5760 cal BC). It is clear in Figure 3 that a direct correlation of lithological layers in the lower part of the sediments of this site is impossible due to the different number and features of lithological and cultural layers. A direct correlation of layers based on their height values is also impossible, as the layers lie in an oblique position, at different heights in different places (Fig. 4). The radiocarbon date of an elk bone of 7970±110 BP (SPb-729) (7179–6596 cal BC) (Fig. 3e) allows its synchronisation with layers 21–23 (excavation No. I of Belanovskaya). Radiocarbon dates and stratigraphic

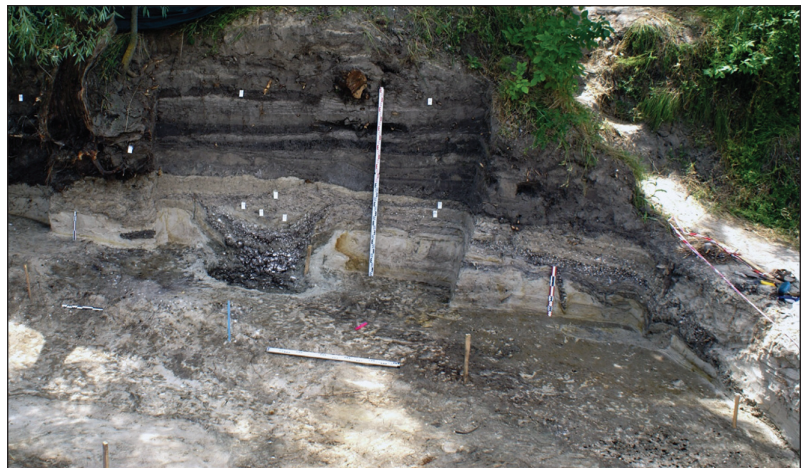


Fig. 4. Rakushechny Yar. Stratigraphy of the excavation at the site of trenches II–III by T. D. Belanovskaya (excavation ‘e’. 2016).

observations on the area of excavations I–III allowed us to date the earliest stages of occupation to 7186–6472 cal BC.

Another group of dates of various materials (bones, pottery, soil with charcoal and soil) from the trench of 2008 presents a completely different picture (Fig.



Fig. 5. Rakushechny Yar. Vessel forms in layers 23–14 (after Mazurkevich, Dolbunova 2015).

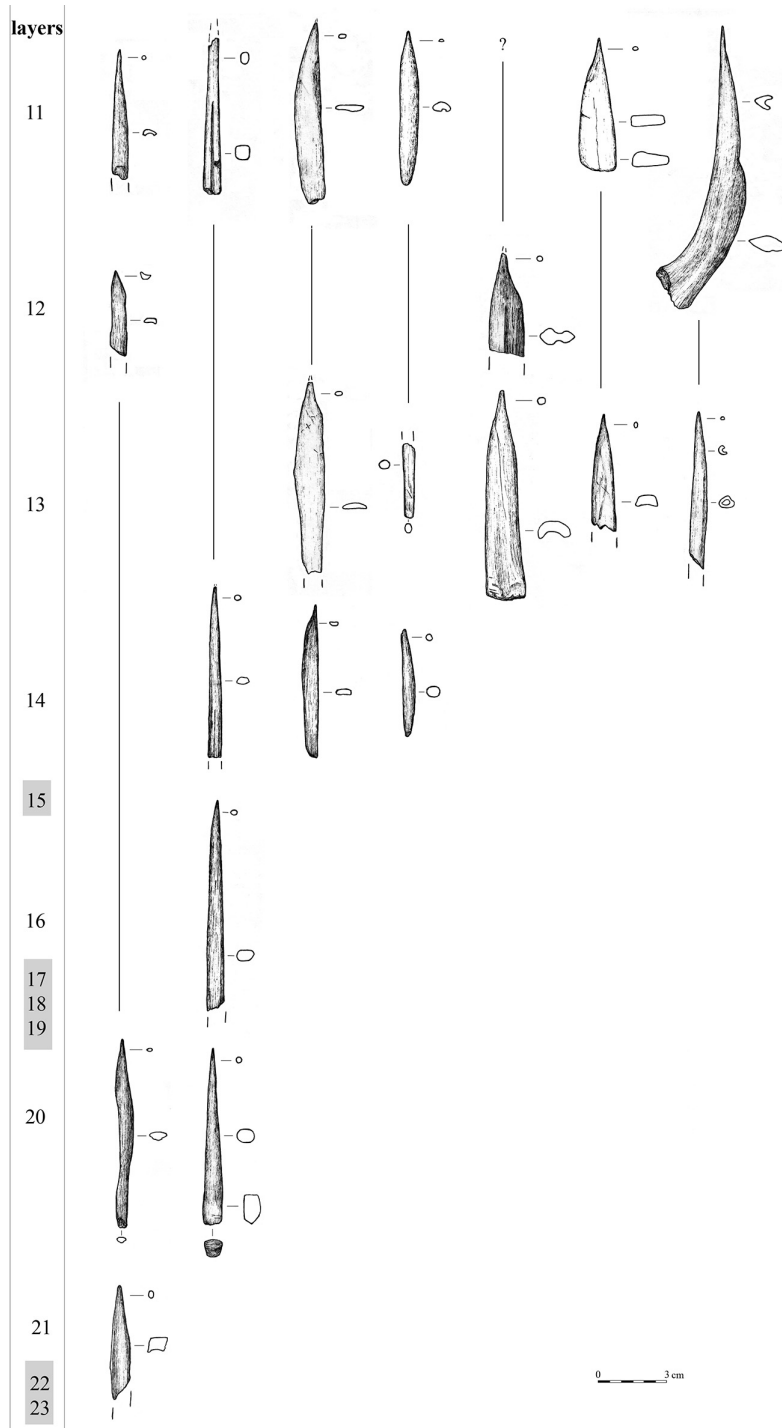


Fig. 6. Rakushechny Yar. Bone points in layers 23–11.

3b). The trench is located to the south-east of the excavation I–III (Fig. 2). The dates of the soil and soil with charcoal are in chronological correspondence. In most cases, the dates of pottery and bones from dated charcoal interlayers are older, and slightly younger in only few cases. This needs to be discussed further and can be explained only after new excavations on this part. This is why we will base our chronological reconstructions for this part on the

dates of soils and charcoal from cultural layers. The buried soil No. X from the trench of 2008, lying on the bottom of cultural layers, was dated to 7380 ± 100 BP (KI-15181) (6431–6061 cal BC), *i.e.* this part was inhabited approx. 600 years later than the low layers from the place where excavations I–III by Belanovskaya were made. According to Alexander L. Aleksandrovsky, the process of soil formation started here later, as it was located lower than excavation I and occurred over a period of 100–200 years. Only when the area of excavation I was inhabited did the soil start to form here. We might synchronise the beginning of occupation and the formation of a cultural layer, which occurred between the period of layers 20 and 19 (excavation I – Fig. 3f) and during the period of layer XVI (location of excavations II–III – Fig. 3d). Further short periods of occupation, marked by thin sandy layers with *Unio* shells under the buried soil (IX – Fig. 3b) can be synchronised with layers 11–9 (excavation I – Fig. 3f).

The last group of dates were made on materials from the trench of Telegin dug in 1975 (Fig. 3a), located in the same place as excavation V by Belanovskaya, far to the south-east of the main area of excavation (trenches I–II). The stratigraphy of this trench is similar to that of the trench dug in 2008 (Fig. 3b). The dates were made on organic matter in pottery, and they show that this place might have been first inhabited

at approximately the same time as the low layer of the trench dug in 2008. The typology of the dated vessels also supports this assumption.

Various layers traced in different parts of the island (Figs. 2; 3.a–f) can be correlated precisely on the basis of radiocarbon dates, as artefacts attributed to the Early Neolithic comprise a rather homogenous complex that preserved a range of features that seem

to survive through centuries. Nevertheless, more dating of different materials and the connection of different excavation areas are needed in order to refine the chronology of this part of the site, and the correlation of the various layers.

The differences in radiocarbon dates, number and character of cultural layers support suggestion of Belanovskaya's that the cultural layers revealed on the shore line and in different trenches cannot be correlated directly, and such 'diversity' shows that this part of the modern island was inhabited repeatedly during different periods. Taking into account that different parts of the site were excavated, their correlation is problematic, as their length and thickness varies, especially in lower layers. This is a departure point for discussing the validity of the dates derived

from material from different layers of the site (*Motuzaitė Matuzeviciute et al. 2015.662*; for example, dates presented in *Motuzaitė Matuzeviciute 2012. Tab. 1* for Rakushechny Yar are attributed to layers of different areas of the site and cannot be presented together). The main problem is that the dates were obtained from material from different excavated areas located in different parts of the island that cannot be correlated with each other, and not that some processes have influenced the dates. Moreover, it is important to consider the particularities of the layers' formation and seasonal occupation of this site over a long period. For example, given their thickness, layers 5 and 4 could have been accumulated during a long period.

The dates also point to another important problem: the time of accumulation of cultural layers and deposition of materials. The lower cultural layers of excavations I-III are filled with piles of *Unio* shells, fish scales and bones, animal bones and artefacts covered by thin and sterile sandy interlayers. The cultural layers could have been buried under thin sandy layers either after a single seasonal event or accumulated over longer periods. Different parts of the shore zone might have been inhabited, which can be archaeologically traced in radiocarbon dates. It is important to note that objects are recorded mostly *in situ* in the cultural layers (Fig. 8); the distribution of finds indicates only a slight disturbance of the cultural layers.

Razdorskaya II is located on the right bank of the Don River, six kilometres downstream from Rakushechny Yar (*Tsybrij 2008*). It is a multilayered site, with predominantly *Viviparus* shell accumulation, and is rich in fish bones, charcoal, artefacts, and faunal remains. Fishing activity occupied an important place in the economy of Razdorskaya II, as it did at Rakushechny Yar. This is evident from the particu-

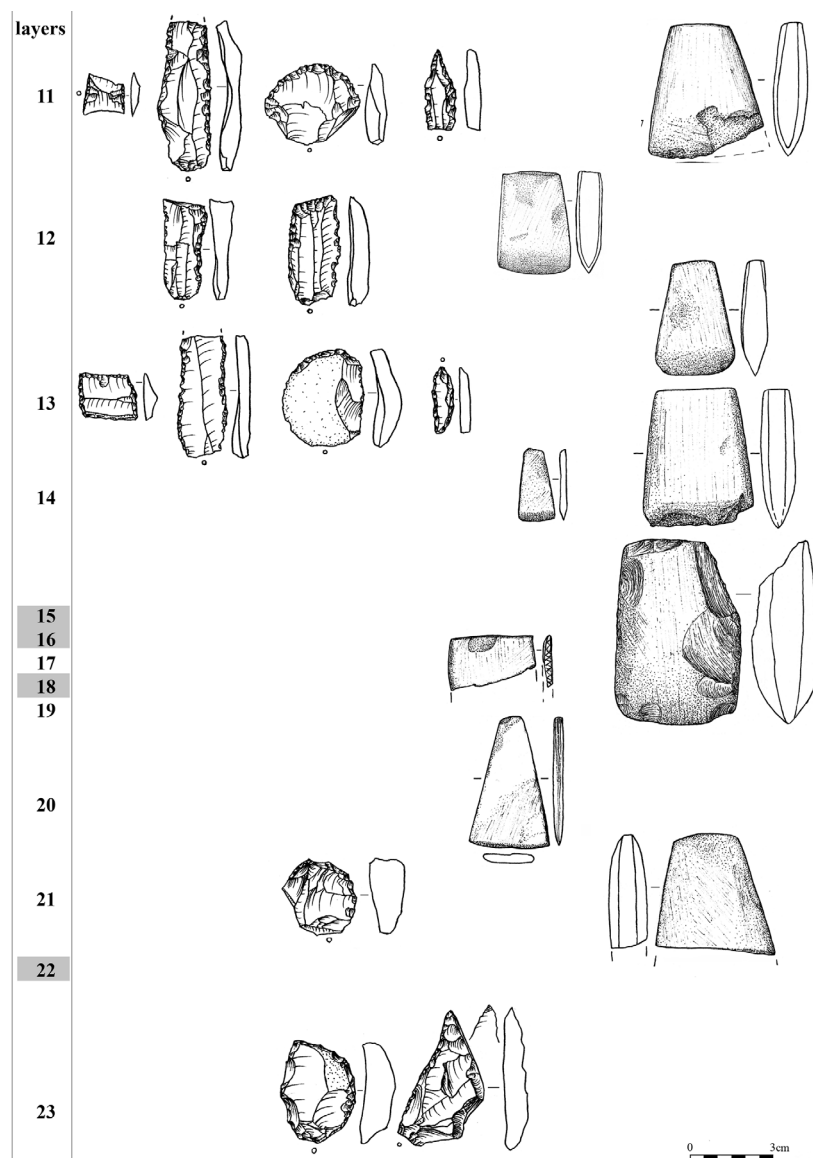


Fig. 7. Rakushechny Yar. Flint and slate tools in layers 23–11 (from Lozovsky 2014; drawings done by V. M. Lozovsky and E. Dolbunova).

larities of the cultural layer (Fig. 10), with stratified shell piles and an inventory which includes a large number of sinkers, axes and bone spears. No pottery was found here, although small ceramic figurines were found. Due to the particular material culture of this site, it was attributed to a specific cultural type. Radiocarbon dates were made on materials from the middle and low cultural layers (*Aleksandrovsky et al. 2009*) (Fig. 10). The early stages of this site are attributed to the earliest aceramic Neolithic phase at the end of the 8th – beginning of the 7th millennium BC. That this site continued to be occupied is evidenced by ¹⁴C dates within the range of the 7th and the beginning of the 6th millennium BC (Tab. 1), which suggest it was contemporaneous with Rakushechny Yar.

Matveev Kurgan culture, Donets culture and sites of the Caspian-Ciscaucasian cultural group

Matveev Kurgan culture was named after Matveev Kurgan I and II sites, located in North-Eastern Azov Sea area, which were excavated in the 1970–1980s by Lija Y. Krizhevskaya (*Krizhevskaya 1991*). Some similarities can be traced with the Lower Don River Neolithic sites. It can be attributed to the very beginning of Neolithic era and dated to the middle – second half of the 7th millennium BC, although more ¹⁴C dates would be needed to refine the chronological position of this culture. Later stages were not found here.

Donets culture was discovered in 1952 by Aleksandr Y. Brusov and was later re-analyzed and re-interpreted in the 1960s to 1990s (*Brusov 1952; Telegin 1968; Danilenko 1969; Gorelik 1984; 1997*). One of the typical features of this culture is the survival of archaic traits in the stone industry for a long period and a small amount of pottery. Complexes attributed to the early phases of Donets culture can be synchronised with Matveev Kurgan culture and dated to the end of the 7th millennium BC. Later phases can be dated to the second half of the 6th and the first half of the 5th millennium BC, and synchronised with layer 5 at Rakushechny Yar site (the chronology is based on typological correlation of materials).

The Caspian-Ciscaucasian cultural group includes material from Kremennaya II and III, Rassypnaya VI and Lagutinskaya, as well as finds from the basins of the steppe rivers of the Rostov oblast' (*Tsybryi 2008.60*). The stone items are similar to material from the Northern Cascaucasian, North-Western and Northern Caspian area. The pottery is not abundant. Kremennaya II and Rassypnaya VI are attributed to early stages of the Neolithic period, and Kremennaya III to a later stage.



Fig. 8. Rakushechny Yar. Low part of a flat bottom-vessel standing on the Unio shell layer No. XVI (excavation 'd' 2013).

Kremennaya II is located in the Gnilaya River basin, near the village of Zolotovskiy (Milutinsky district, Rostovskaya oblast'). The stone industry of the site is characterised by a blade and microlith inventory, including different types of geometrical microliths with secondary treatment: segments, parallelograms, trapezes and backed trapezes. The pottery is not abundant. More than 50 dug-out hearths were found in the base of cultural layer – 15 of which were dated (Fig. 11) – which reveal different stages of occupation of this site during the Neolithic from the 6th to the 5th millennium BC.

Kremennaya III is located near Kremennaya II, at a low hypsometric level. The pottery is not abundant, the flint tools are larger and are similar to tools at Kremennaya II. New tools appeared: polished flint heavy duty tools and arrowheads. A fragment of a copper plate was found in a cultural layer (*Tsybryi 2008*). Four radiocarbon dates were made on animal bones, also revealing different periods of occupation at this site: the end of the 7th to the first half of the 6th millennium BC, and during the 5th millennium BC.

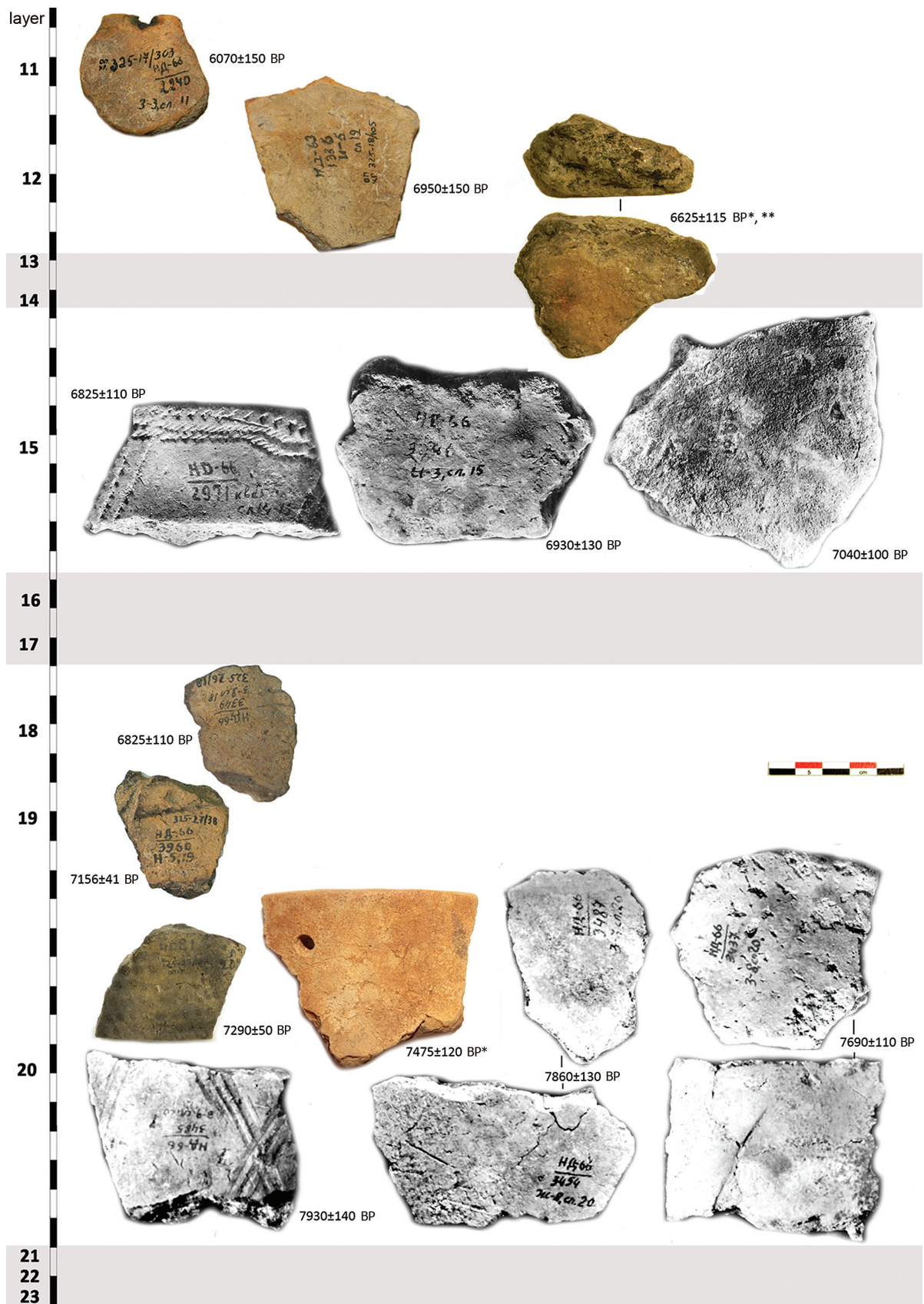


Fig. 9. Fragments of ¹⁴C dated pottery (material for dating – organic crust) from excavation I, with an indication of the layers where they were found. * fragments from the excavation of 2013; ** pottery fragment was dated.

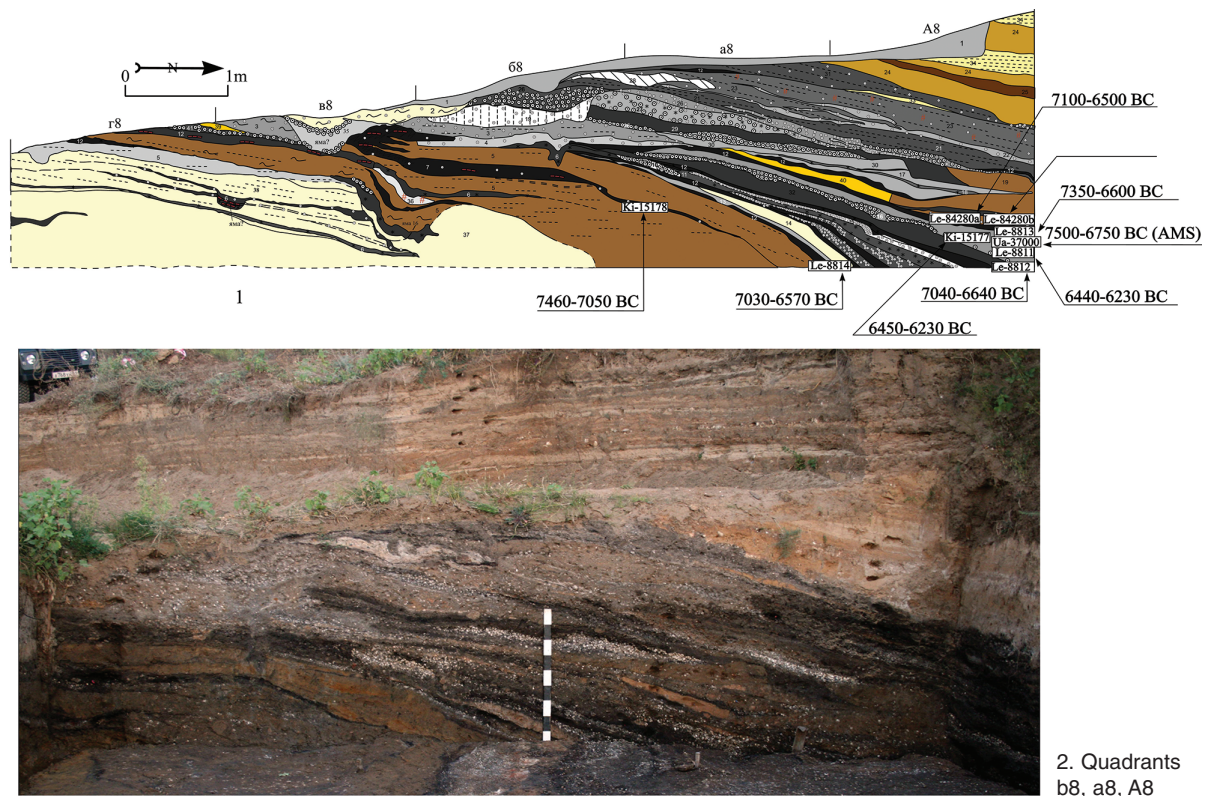


Fig. 10. Razdorskaya II. Stratigraphy profile, with indication of places where samples for dating were taken.

Rassypnaya VI is located in the Rassypnaya valley (Tsybrij 2003). The flint industry is similar to that at Kremennaya II and III and other sites in the Eastern Azov basin (Rassypnaya 1, Zhukovskaya 2, etc.). Microlithic tools predominate, including segments, parallelograms and trapezes, including backed trapezes. The pottery is not abundant; it was decorated by comb stamp and traced lines organised in simple compositions. Dates were made on five animal bones and one bone from burial 1, found at the bottom of cultural layer of the site (Fig. 12). Given the typology, we can suppose that most material can be dated to the last quarter of the 6th to the first quarter of the 5th millennium BC. Although this site was probably also visited/inhabited during the 7th and second half of the 5th millennium BC.

Conclusion

The Lower Don River and North-eastern Azov Sea encompass several archaeological cultures, including Rakushechny Yar, Matveev Kurgan, Donets and the Caspian-Ciscaucasian cultural group. The chronological timeframes of these cultures are contemporaneous, which indicates the mosaic cultural character of this area during the period between the 7th and 5th millennium BC. The small number of radiocarbon dates for such a long period prevents us from refin-

ing the chronology of the different cultural groups and definite ceramic types within this area.

The Razdorskaya II site located in the Lower Don River basin is supposed to be one of the most ancient sites attributed to the Neolithic era (see discussion of the term 'Neolithic' in Mazurkevich, Dolbunova 2015), having a particular stone industry and complex subsistence strategy, predominantly fishing, but with no pottery. The early stages of this site are attributed to the earliest non-ceramic Neolithic phase, at the end of the 8th and beginning of the 7th millennium BC. This site was inhabited later, during the 7th and beginning of the 6th millennium BC, which suggest its contemporaneity with Rakushechny Yar. New research of the latter site allowed us to revise its stratigraphy, archaeological context and chronology. The differences in radiocarbon dates, number and character of cultural layers which were revealed support Belanovskaya's suggestion that the cultural layers located on the shore line and different trenches cannot be correlated directly. Such 'diversity' shows that this part of the modern island was inhabited repeatedly during different periods.

The Rakushechny Yar culture existed, probably, for approx. 1500 years, during the 7th and 6th millennium BC. It must be noted that the material culture

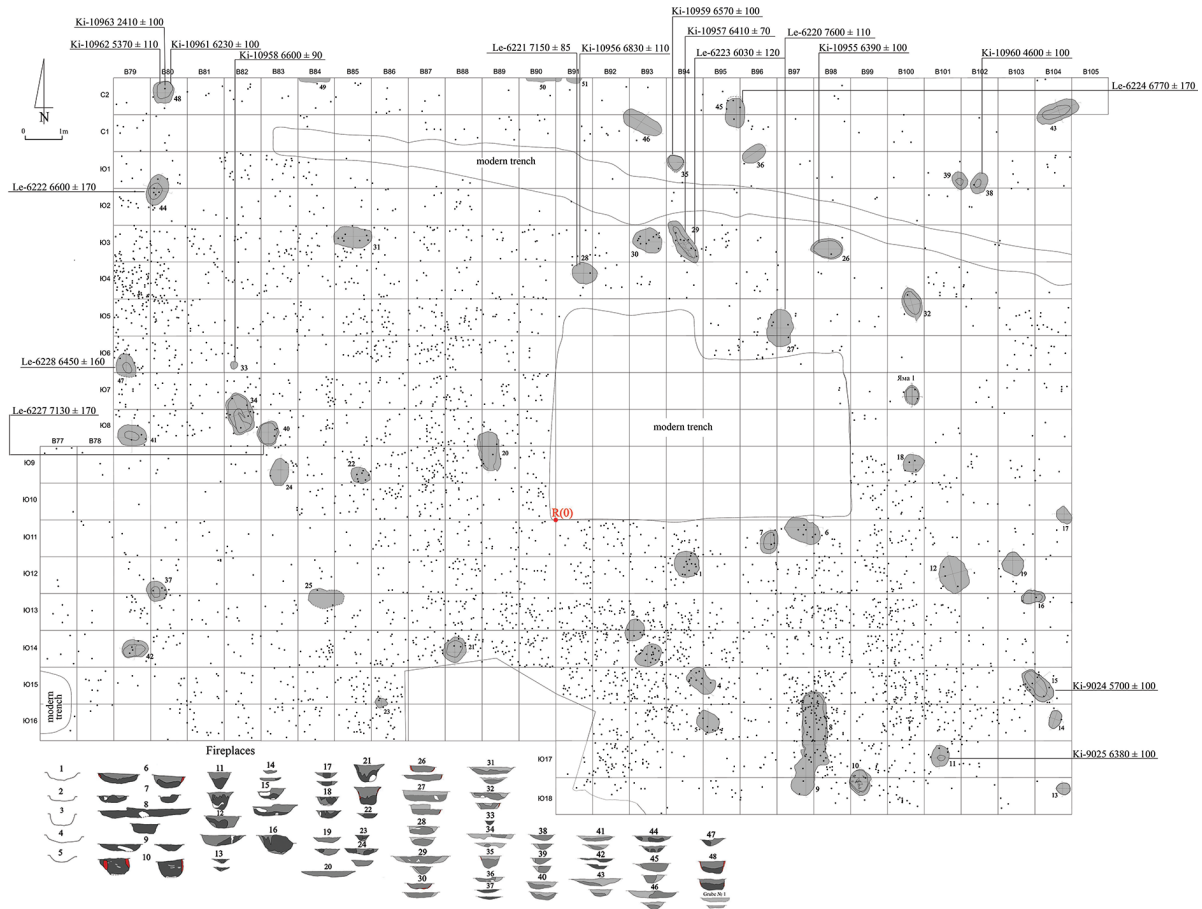


Fig. 11. Kremennaya II. Plan of the excavation 2, with the objects dated.

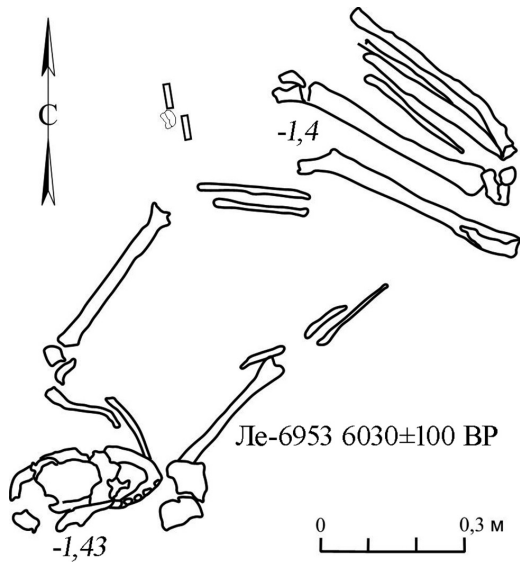


Fig. 12. Rassypnaya VI. Excavation 2, burial 1.

was very conservative and retained a number of specific traits through centuries. New dates and the analysis of radiocarbon dates, taking into the account stratigraphy of excavations and spatial analysis of finds, point to the first half of the 7th millennium BC as the period when Rakushechny Yar appeared, with one of the earliest ceramic in Eastern Europe. The excavated area was a seasonal site with a particular set of finds, including different animal and fish bones, hearths, 'wattle and daub' architecture, and an anthropomorphic figurine made on horse pastern. Previous discussions about the estimated dates made for this site arose not because of the validity of dates, but their presentation as they were analysed out of context. Our analysis of archived materials and new excavations allowed us to refine the chronology of this site and change the idea of unreliability of radiocarbon dates for this site.

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Tab. 1. Radiocarbon dates of the Neolithic in the Lower Don River and North-eastern Azov Sea.

No.	¹⁴ C (BP)	cal BC	lab-index	dated material	¹³ C	site	information about dated material	Archaeolo. culture	references
1	5290±260	4715–3536	Le-5327	Charcoal		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 2*		Timofeev et al. 2004,76
2	4830±90	3797–3372	Le-5387	Charcoal		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 2*		Timofeev et al. 2004,76
3	6300±300	5787–4547	Le-5343	Ground with charcoal		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 2*		Timofeev et al. 2004,76
4	4180±100	3011–2480	Le-5428	Animal bone		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 2*		
5	4360±100	3357–2702	Bln-1177	Charcoal		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 3*		Timofeev et al. 2004,75
6	5060±230	4361–3365	Le-5340	Animal bone		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 4*		Timofeev et al. 2004,76
7	6300±90	5471–5056	Le-5482	Animal bone		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 4*		Timofeev et al. 2004,76
8	6440±35	5479–5342	Le-5582a	Ground		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 5*, square A-2		Timofeev et al. 2004,76
9	6320±35	5366–5220	Le-5582b	Ground		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 5*, square A-2		Timofeev et al. 2004,76
10	5920±90	5016–4553	Le-5479	Animal bone		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 5*		Timofeev et al. 2004
11	5890±105	5019–4501	Ki-955	Charcoal		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 5*		Timofeev et al. 2004,76
12	6770±450	6611–4725	Le-5481	Animal bone		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Under the layer 5*		Timofeev et al. 2004
13	6070±100	5282–4728	Bln-704	Charcoal		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 8*		Timofeev et al. 2004,75
14	7180±250	6563–5622	Le-5344	Shells		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 9*		Timofeev et al. 2004,76
15	6070±150	5344–4616	SPb-751	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 11*	Rakushechno-yarskaya culture	
16	6950±150	6201–5562	SPb-752	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 12*	Rakushechno-yarskaya culture	
17	6825±100	5974–5558	Ki-6479	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 14-15*	Rakushechno-yarskaya culture	Timofeev et al. 2004,76
18	7040±100	6085–5720	Ki-6480	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 15*	Rakushechno-yarskaya culture	Timofeev et al. 2004,76
19	6930±100	5999–5647	Ki-6478	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 15*	Rakushechno-yarskaya culture	Timofeev et al. 2004,76
20	6625±115	5739–5358	SPb-747	Pottery fragment		Rakushechny Yar, nearby the excavation II (2012, test-pit 2)	Layer XV**	Rakushechno-yarskaya culture	
21	6560±100	5657–5326	SPb-731	Animal bone		Rakushechny Yar, nearby the excavation II (2012, test-pit 2)	Layer XV**	Rakushechno-yarskaya culture	

No.	¹⁴ C (BP)	cal BC	lab-index	dated material	¹³ C	site	information about dated material	Archaeolo. culture	references
22	6841±40	5809–5643	Ua-41365	Organic crust	-28,0 ^{**}	Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 18 [*]	Rakushechno-yarskaya culture	
23	7156±41	6092–5923	Ua-41364	Organic crust	-28,0 ^{**}	Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 19 [*]	Rakushechno-yarskaya culture	
24	7383±120	6451–6031	SPb-1177	Charcoal		Rakushechny Yar, nearby the excavation II (stratigraphical section of 2013)	Layer XV [*] (due to stratigraphy of 2013)	Rakushechno-yarskaya culture	
25	7475±120	6566–6075	SPb-1176	Organic crust		Rakushechny Yar, nearby the excavation II (stratigraphical section of 2013)	(Layer XVII [*] (due to stratigraphy of 2013)) layer 19-20 [*]	Rakushechno-yarskaya culture	
26	7554±169	6813–6051	Ua-48460	Charcoal		Rakushechny Yar, nearby the excavation II (stratigraphical section of 2013)	(Layer XVII [*] (due to stratigraphy of 2013)) layer 19-20 [*]	Rakushechno-yarskaya culture	Tsybryi et al. 2014.207
27	7010±126	6200–5643	Ua-48461	Charcoal		Rakushechny Yar, nearby the excavation II (stratigraphical section of 2013)	(Layer XVII [*] (due to stratigraphy of 2013)) layer 19-20 [*]	Rakushechno-yarskaya culture	Tsybryi et al. 2014.207
28	7482±120	6568–6080	SPb-1178	Charcoal		Rakushechny Yar, nearby the excavation II (stratigraphical section of 2013)	(Layer XVII [*] (due to stratigraphy of 2013)) layer 19-20 [*]	Rakushechno-yarskaya culture	
29	8020±120	7315–6640	SPb-1185	Fish bones		Rakushechny Yar, nearby the excavation II (stratigraphical section of 2013)	(Layer XVII [*] (due to stratigraphy of 2013)) layer 19-20 [*]	Rakushechno-yarskaya culture	
30	7290±50	6241–6051	Ua-37097	Organic crust	-28,6	Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 20 [*]	Rakushechno-yarskaya culture	
31	7690±110	6900–6261	Ki-6475	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 20 [*]	Rakushechno-yarskaya culture	Timofeev et al. 2004.76
32	7860±130	7062–6466	Ki-6477	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 20 [*]	Rakushechno-yarskaya culture	Timofeev et al. 2004.76
33	7930±140	7186–6472	Ki-6476	Organic crust		Rakushechny Yar, excavation I (after T. D. Belanovskaya)	Layer 20 [*]	Rakushechno-yarskaya culture	Timofeev et al. 2004.76
34	7970±110	7179–6596	SPb-729	Animal bone		Rakushechny Yar, nearby the excavation II (2012, test-pit 1)	Layer XVII ^{**}	Rakushechno-yarskaya culture	Tsybryi et al. 2014.207
35	4020±90	2872–2301	Le-10473	Animal bone		Rakushechny Yar, excavation of 2010 (near excavation No. 16, 17 of 1966)	Layer 2B [*]		
36	2560±70	835–430	Ki-15184	Animal bone		Rakushechny Yar, excavation of 2010 (near excavation No. 16, 17 of 1966)	Layer 2 [*]		
37	4120±60	2881–2497	Ki-15180	Animal bone		Rakushechny Yar, excavation of 2010 (near excavation No. 16 of 1966)	Layer 2 [*]		
38	4170±60	2894–2581	Ki-15183	Animal bone		Rakushechny Yar, stratigraphical trench of 2008 (near excavation No. 16 of 1966)	Layer 2 [*]		

No.	¹⁴ C (BP)	cal BC	lab-index	dated material	¹³ C	site	information about dated materia	Archaeolo. culture	references
39	4590±80	3628–3030	Ki-15182	Ground		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 3*		
40	5870±80	4940–4542	Ki-15942	Ground		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 14*	Rakushechnoyarskaya culture (?)	
41	7580±90	6599–6245	Ki-15189	Pottery fragment		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 14*	Rakushechnoyarskaya culture (?)	Aleksandrovsky et al. 2009
42	5940±60	4983–4696	Ki-15940	Ground		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 14*	Rakushechnoyarskaya culture (?)	
43	6410±90	5544–5214	Ki-15944	Ground with charcoal		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 15*	Rakushechnoyarskaya culture (?)	
44	5790±90	4876–4450	Ki-15947	Ground with charcoal		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 15*	Rakushechnoyarskaya culture (?)	
45	5690±100	4766–4345	Ki-15941	Ground with charcoal		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 15*	Rakushechnoyarskaya culture	
46	7690±90	6746–6385	Ki-15186	Pottery fragment		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 18*	Rakushechnoyarskaya culture	Aleksandrovsky et al. 2009
47	5540±100	4652–4075	Ki-15946	Ground with charcoal		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 18-19*	Rakushechnoyarskaya culture	
48	5670±100	4726–4336	Ki-15945	Ground with charcoal		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 18-19*	Rakushechnoyarskaya culture	
49	6750±110	5876–5482	Ki-15187	Pottery fragment		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 21-22*	Rakushechnoyarskaya culture	Aleksandrovsky et al. 2009
50	6890±80	5976–5641	Ki-15185	Pottery fragment		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 21-22*	Rakushechnoyarskaya culture	
51	7670±90	6695–6367	Ki-15188	Pottery fragment		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 22*	Rakushechnoyarskaya culture	
52	7020±80	6026–5736	Ki-15190	Pottery fragment		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 23*	Rakushechnoyarskaya culture	Aleksandrovsky et al. 2009
53	7320±70	6367–6052	Ki-15943	Ground with charcoal		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 23*	Rakushechnoyarskaya culture	
54	7380±100	6431–6061	Ki-15181	Ground		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 23*/buried soil X	Rakushechnoyarskaya culture	
55	6450±90	5564–5227	Le-8422	Ground		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 21-22*	Rakushechnoyarskaya culture	

No.	¹⁴ C (BP)	cal BC	lab-index	dated material	¹³ C	site	information about dated materia	Archaeolo. culture	references
56	5900±220	5307–4348	Le-8468	Animal bone		Rakushechny Yar, stratigraphical cut of 2008 (near excavation No. 16 of 1966)	Layer 21-22*	Rakushehnoyarskaya culture	
57	5850±150	5197–4365	Ki-11092	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 8* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
58	6955±160	6206–5563	Ki-11091	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 10-11* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
59	6810±140	5983–5491	Ki-11096	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 10-11* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
60	6850±160	6023–5487	Ki-11095	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 11* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
61	7090±110	6210–5742	Ki-11090	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 12* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
62	7205±150	6395–5789	Ki-11093	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 13* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
63	7130±150	6354–5721	Ki-11094	Pottery fragment		Rakushechny Yar, excavation of D. Y. Telegin of 1975 (supposedly on the place of exc. No. V of T. D. Belanovskaya)	Layer 13* (layers' numbering – according to D. Y. Telegin)	Rakushehnoyarskaya culture (?)	Maniko 2006.16
64	7505±210	7021–5931	GrN-7199	Charcoal		Matveev Kurgan I			Timofeev et al. 2004.76
65	7180±70	6221–5916	Le-1217	Charcoal		Matveev Kurgan I	Fireplace, depth 1.5 m		Ibid
66	5400±200	4685–3795	Le-882	Charcoal		Matveev Kurgan II			Ibid
67	7460±200	6770–5906	IGAN-726	Ground		site Samsonovskoe			Ibid
68	9470±340	10013–7846	IGAN-722			Razdorskoe I			Kremenetsky 1991.117
69	7490±60	6447–6238	Ki-15177	Charcoal		Razdorskaya II		Rakushehnoyarskaya culture (?)	Aleksandrovsky et al. 2009
70	8210±80	7460–7059	Ki-15178	Charcoal		Razdorskaya II	2008, square A5, layer 12, fireplace 2008, square A7-B7, layer 11, fireplace	Rakushehnoyarskaya culture (?)	Ibid

No.	¹⁴ C (BP)	cal BC	lab-index	dated material	¹³ C	site	information about dated materia	Archaeolo. culture	references
71	7840±80	7029–6503	Ki-15179	Charcoal		Razdorskaya II	2008, layer 11, fireplace	Rakushehnoyarskaya culture (?)	Ibid
72	8145±110	7479–6777	Ua-37000 (AMS)	?		Razdorskaya II	square A5, layer 12, depth -0,82-0,84	Rakushehnoyarskaya culture (?)	Ibid
73	7920±110	7080–6508	Le-84280 a	Hot humic acids		Razdorskaya II	2008, square 7, depth 0,58-0,64	Rakushehnoyarskaya culture (?)	Ibid
74	8130±100	7454–6775	Le-84280 b	Cold humic acids		Razdorskaya II	2008, square 7, depth 0,58-0,64	Rakushehnoyarskaya culture (?)	Ibid
75	7640±120	6767–6232	Le-6873	?		Razdorskaya II	2003, square A1, depth -1,35/ -1,4	Rakushehnoyarskaya culture (?)	Ibid
76	7450±100	6467–6088	Le-6950	?		Razdorskaya II	2003, square A1	Rakushehnoyarskaya culture (?)	Ibid
77	7930±50	7035–6661	Le-6952	?		Razdorskaya II	2003, square A1	Rakushehnoyarskaya culture (?)	Ibid
78	7850±50	7023–6590	Le-8814	Ground		Razdorskaya II	2009, fireplace 2, square a6, depth 110	Rakushehnoyarskaya culture (?)	
79	7850±50	7023–6590	Le-8813	Ground		Razdorskaya II	2009, northern part of the square B4/B5, depth 110	Rakushehnoyarskaya culture (?)	
80	7900±60	7032–6642	Le-8812	Ground		Razdorskaya II	2009, northern part of the square B5, depth 110	Rakushehnoyarskaya culture (?)	
81	7470±60	6439–6232	Le-8811	Ground		Razdorskaya II	2009, northern part of the square A7, depth 99	Rakushehnoyarskaya culture (?)	
82	7100±100	6209–5759	SPb-1467	Charcoal		Razdorskaya II	2003, square B2, depth -140	Rakushehnoyarskaya culture (?)	
83	6390±100	551–5078	Ki-10955	Charcoal		Kremennaya II	Excavation 1, fireplace 26	Caspian-ciscaucasian cultural area	
84	6830±110	5980–5553	Ki-10956	Charcoal		Kremennaya II	Excavation 1, fireplace 28	Caspian-ciscaucasian cultural area	<i>Tsybryi 2011. Tab. 1</i>
85	6410±70	5490–5226	Ki-10957	Charcoal		Kremennaya II	Excavation 1, fireplace 29	Caspian-ciscaucasian cultural area	Ibid
86	6600±90	5701–5374	Ki-10958	Charcoal		Kremennaya II	Excavation 1, fireplace 33	Caspian-ciscaucasian cultural area	Ibid
87	6570±100	5665–5328	Ki-10959	Charcoal		Kremennaya II	Excavation 1, fireplace 35	Caspian-ciscaucasian cultural area	Ibid
88	4600±100	3634–3026	Ki-10960	Charcoal		Kremennaya II	Excavation 1, fireplace 38	Caspian-ciscaucasian cultural area	Ibid
89	6230±100	5466–4939	Ki-10961	Charcoal		Kremennaya II	Excavation 1, fireplace 48	Caspian-ciscaucasian cultural area	Ibid
90	5370±110	4445–3971	Ki-10962	Charcoal		Kremennaya II	Excavation 1, fireplace 48	Caspian-ciscaucasian cultural area	Ibid
91	2410±100	797–235	Ki-10963	Charcoal		Kremennaya II	Excavation 1, fireplace 48	Caspian-ciscaucasian cultural area	Ibid
92	5700±100	4770–4350	Ki-9024	Charcoal		Kremennaya II	Excavation 1, fireplace 48	Caspian-ciscaucasian cultural area	Ibid
93	6380±100	5533–5075	Ki-9025	Charcoal		Kremennaya II	Excavation 1, fireplace 15	Caspian-ciscaucasian cultural area	Ibid
94	7600±110	6650–6233	Le-6220	Charcoal		Kremennaya II	Excavation 1, fireplace 11	Caspian-ciscaucasian cultural area	Ibid
96	7150±85	6221–5848	Le-6221	Charcoal		Kremennaya II	Excavation 1, fireplace 27	Caspian-ciscaucasian cultural area	Ibid
97	6600±170	5871–5219	Le-6222	Charcoal		Kremennaya II	Excavation 1, fireplace 44	Caspian-ciscaucasian cultural area	Ibid
98	6030±120	5294–4685	Le-6223	Charcoal		Kremennaya II	Excavation 1, fireplace 29	Caspian-ciscaucasian cultural area	Ibid

No.	¹⁴ C (BP)	cal BC	lab-index	dated material	¹³ C	site	information about dated materia	Archaeolo. culture	references
99	6770±170	6008–5381	Le-6224	Charcoal		Kremennaya II	Excavation 1, fireplace 45	Caspian-ciscaucasian cultural area	Ibid
100	7130±170	6372–5715	Le-6227	Charcoal		Kremennaya II	Excavation 1, fireplace 40	Caspian-ciscaucasian cultural area	Ibid
101	6450±160	5674–5044	Le-6228	Charcoal		Kremennaya II	Excavation 1, fireplace 47	Caspian-ciscaucasian cultural area	Ibid
102	7060±190	6356–5625	Le-6871	Bone		Kremennaya III	Excavation 1, square c10e43, bottom of the cultural layer	Caspian-ciscaucasian cultural area	Tsybryi 2008,92
103	5540±100	4652–4075	Le-6868	Bone		Kremennaya III	Excavation 1, square c10, bottom of the cultural layer	Caspian-ciscaucasian cultural area	Ibid
104	7440±160	6599–6009	Le-6956	Bone		Kremennaya III	Excavation 1, square c8, bottom of the cultural layer	Caspian-ciscaucasian cultural area	Ibid
105	6582±120	5716–5321	SPb-1250	Bone		Kremennaya III	Excavation 1, No. 214, 593, 60	Caspian-ciscaucasian cultural area	
106	8120±120	7456–6701	Le-6869	Bone		Rassypnaya VI	Excavation 1, square 31, conventional layer 6, No. 1557	Caspian-ciscaucasian cultural area	Tsybryi 2008,92
107	5880±150	5207–4406	Le-6870	Bone		Rassypnaya VI	Excavation 1, horizon 6–8, depth –0,6–0,8m	Caspian-ciscaucasian cultural area	Ibid
108	5160±500	5291–2872	Le-6872	Bone		Rassypnaya VI	Excavation 1, square 55, bones accumulation 1, depth –0,9m	Caspian-ciscaucasian cultural area	Ibid
109	7250±110	6381–5913	Le-6955	Bone		Rassypnaya VI	Excavation 2, sq. 12, find No. 719, depth –1,1m	Caspian-ciscaucasian cultural area	Ibid
110	5420±110	4460–3991	Le-6954	Bone		Rassypnaya VI	Excavation 2, square 13, layer 9, depth –1,05m, No. 738	Caspian-ciscaucasian cultural area	Ibid
111	6030±100	5214–4716	Le-6953	Bone		Rassypnaya VI	Excavation 2, burial 1	Caspian-ciscaucasian cultural area	Ibid

* numbering of layers of each excavation of Rakushechny Yar site is different, they cannot be correlated with each other

** numbers of layers in sondages #1 and #2