

Modelling the Subsistence Economy of the Settlement Rykan-3 in the Don Forest-Steppe

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Abstract: This article presents a reconstruction of a subsistence strategy at the Middle Bronze Age settlement Rykan-3. The settlement is located in the centre of the Don forest-steppe and dates to 26th–24th century BC; it was mostly excavated in 2009–2014. Rykan-3 is of particular interest because, unlike many other Bronze Age settlements in the South of Eastern Europe, it yielded only a single cultural layer, which was deposited during the existence of the settlement of the Middle Don Catacomb culture. Mainly for this reason, Evgenii Gak chose to conduct a systematic excavation, and to combine it with zooarchaeological, archaeobotanical, and pedological investigations. Additionally, radiocarbon dating was provided. Various proxy data were obtained during the excavation from various laboratories. Pottery fragments and animal bones formed the bulk of the finds. The assessment of the animal bones, the archaeobotanical and pedological information, and the interpretation of particular settlement features make it possible to create a model of a temporary settlement inhabited mainly in winter. Its inhabitants were mainly engaged in animal husbandry with special attention to cattle. The archaeobotanical survey could not reveal any evidence of agriculture during the period of occupation in the Middle Bronze Age. Radiocarbon dating proved that the isolated plant macro remains were clearly recent intrusions. Interdisciplinary research of the settlement Rykan-3 and the inclusion of various information from accompanying scientific investigations have made it possible, for the first time, to reconstruct a seasonal cattle breeding settlement, inhabited in winter, of the Catacomb Cultural Community in Eastern Europe.

Keywords: Middle Bronze Age, Middle Don Catacomb Culture, forest-Steppe, economy, cattle breeding, seasonality, subsistence basis

Introduction

The Catacomb Cultural Community is an archaeological culture dating to the 3rd millennium BC in the Eastern European steppe and forest-steppe between the Volga and the Dniester. In this large area of dissemination, various regional groups have been described by several archaeologists.¹ The regional group of the Middle Don Catacomb Culture is limited to the forest-steppe. In contrast to other regional groups, which are known

mainly from burials in grave mounds, 300 settlements of the Middle Don Catacomb Culture, in addition to graves, have been identified. Although these settlements became the focus of independent research,² many questions remain open due to the ephemeral character of the sites and absent stratigraphies. A site favourable for settling was usually occupied at different periods, but excavation has not revealed distinguishable layers. As a result, materials from various archaeological cultures have been mixed in a single cultural

¹ For early comprehensive studies see Popova 1955; Bratchenko 1976.

² Pryakhin 1982.

layer³ Nevertheless, the settlements are the main source for studying economic activities during the Middle Don Catacomb Culture.⁴ Current research has established that the subsistence economy was based on animal husbandry with a predominance of cattle. Questions about the type of pastoralism – mobile, semi-mobile, sedentary – remain an issue of ongoing debate not only among Russian, but also among western European archaeologists.⁵ The existence and role of other economic activities have been discussed controversially.⁶

In this light, the Rykan-3 settlement is of particular interest. It was excavated almost completely, and complementary research was provided using zooarchaeology, archaeobotany, radiocarbon dating, and pedology. Such systematic and, to a certain degree, multidisciplinary investigations of Bronze Age settlements are still rare in Eastern European archaeology.

In contrast to many other settlements in this region, a single cultural layer has revealed that Rykan-3 was inhabited only during the Catacomb Culture. This was the main reason why Rykan-3 was chosen for excavation. Already from the very beginning, pedological, zooarchaeological, and archaeobotanical investigations were planned, and samples were taken accordingly. The archaeological results, combined with the findings from the corresponding scientific disciplines, allow us to develop a model of the lifestyle and subsistence economy of the pastoralists of the Catacomb Cultural Community within the forest-steppe in general, which will be presented in this article. First, a brief overview of the excavation and its results will be given, before we turn to the description and assessment of different proxy data used for the reconstruction of the pattern of seasonality.

Excavation of the Settlement Rykan-3

Description of the Settlement Features

Rykan-3 is located in the centre of the Middle Don forest-steppe (Fig. 1) on the first low terrace of the

³Gak 2013, Table 1.

⁴Pryakhin 1982, 145-153; Ivashov 2002, 48-50; Sanzharov 2004, 78-88; Antipina 2011a.

⁵Pryakhin 1982, 145-148; Ivashov 2002; Sanzharov 2010; Kaiser 2019.

⁶Pryakhin 1982, 149-153; Korobkova et al. 2005–2009.

right bank of the Usman river (the left tributary of the Voronezh river). The settlement stretches from west to east for about 200 meters; the finds are spread over an area of 10 thousand m². Erosion gullies transversely divide the settlement area into three parts. The central area is the largest and was settled intensively. Its southern edge was destroyed by the river, which also damaged the eastern part to a greater extent. The western part lies on a sandy terrace and is separated from the Usman river by a narrow floodplain (Fig. 2).

The settlement was excavated first in 1979 by Yuri Matveev, then in 2009–2014 by Evgenii Gak. In total, 1,492 m² were uncovered. Rykan-3 can be considered as a reference point for subsequent settlement studies of the Middle Don Catacomb Culture because of its outstanding preservation and the modern state of research. The central and largest part of Rykan-3 was excavated completely, and the most informative areas in the west and east were thoroughly investigated archaeologically. After the settlement was abandoned, it was never settled again, no building activities took place, and it was never ploughed – a rather unique situation in this region.

In the central part, the layer with the archaeological materials (dark grey loam up to 0.4 m thick) was covered only by a humus layer (Fig. 3). Most of the finds were concentrated in the lower half of the layer. The eastern part exhibited a similar layer (0.65 m thick), which contained only few finds in its upper half. In the west, the layer was composed of a heterogeneous dark sandy loam with a height of up to 0.6 m. The archaeological materials are distributed here at all levels with varying frequency, but their quantity increases in the lower part.

The excavation, together with pedological analyses, allowed us to reconstruct the settlement structure and to understand both its layout in relation to the paleorelief and the function of particular dwellings within the entire infrastructure.⁷ Three dwellings of different sizes were erected on the ancient surface in the central part. Postholes allow us to reconstruct the more-or-less rectangular layout of the dwellings (Fig. 2; 4). The walls between the posts were probably made of wattle and daub.

⁷Gak 2013; Gak / Borisov 2011; Gak / Davydov 2014; Gak et al. 2014.

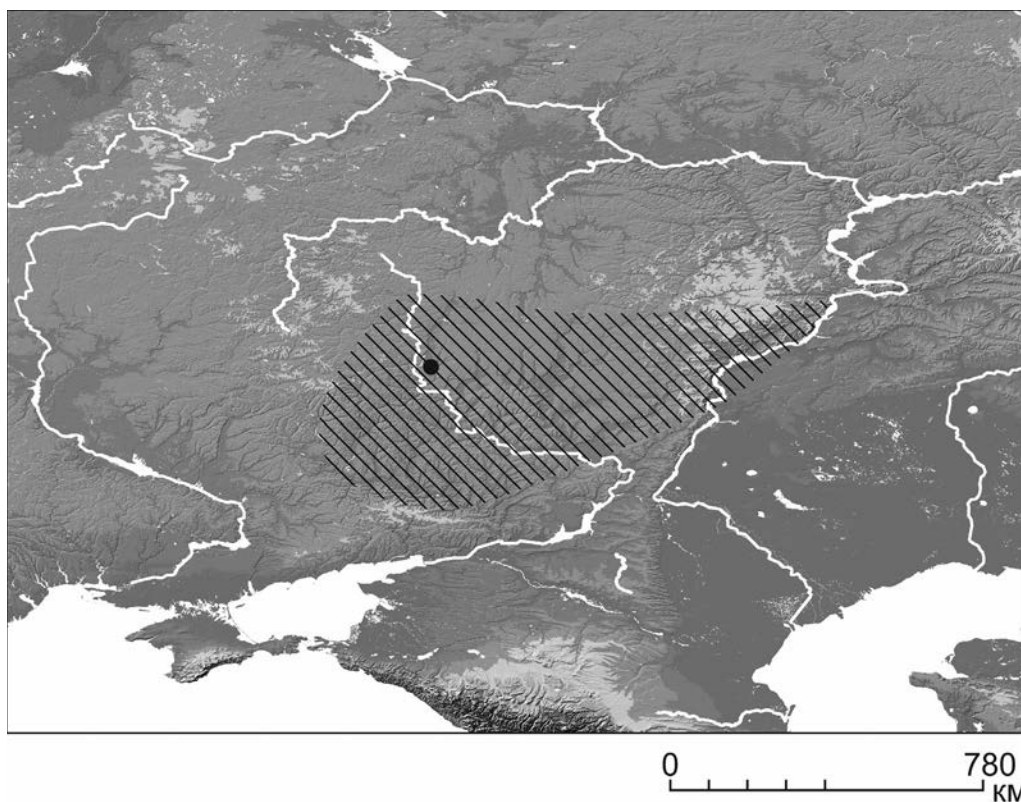


Fig 1. The distribution area of Middle Don Catacomb culture and location of Rykan-3

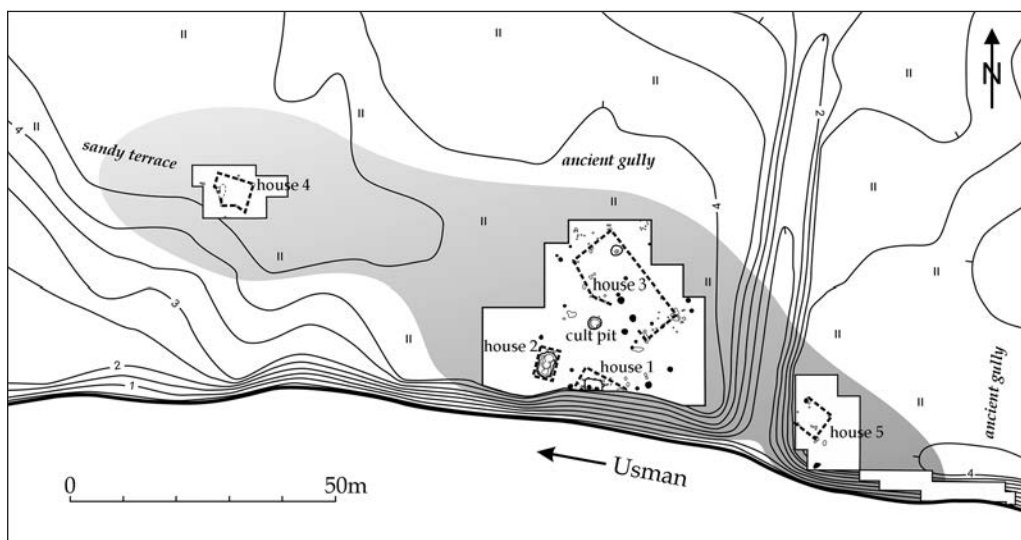


Fig. 2. Plan of the settlement Rykan-3 after excavation with main features

Only the northern part of dwelling 1 was preserved. In the ground, a 3,2 x 2,1 m large area was deepened. Two small fire pits were found at the bottom. Unlike in the other two dwellings, the floor in dwelling 1 was only slightly deepened by about 45 cm, and is therefore not considered as a storage pit. Due to the fragmentary preservation,

the total sizes of the dwelling and the deepened structure are not clear.

Inside dwellings 2 and 3, a pit of different form and size was dug out. In dwelling 2, a 4.8 x 4.2 m pit occupied practically the entire area of the house and had a maximal depth of 1.35 m below the modern surface (Fig. 4).

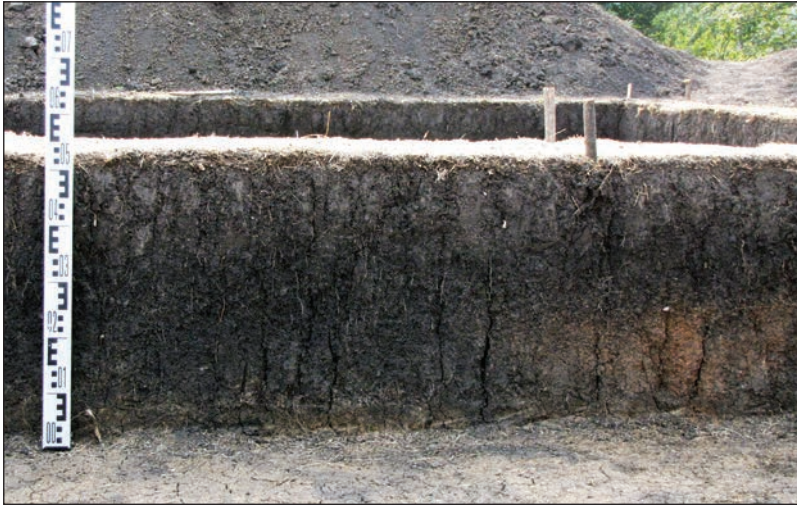


Fig. 3. Photo of the layers at the central part of Rykan-3

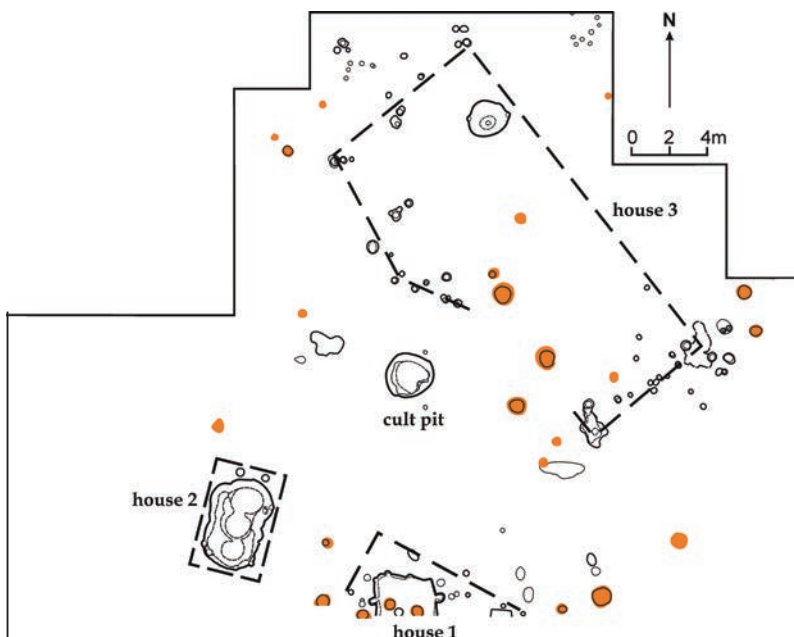


Fig. 4. Central part of settlement Rykan-3. Reconstructed dwelling contours according to postholes

The contours of dwelling 3 were easily observed due to a large number of postholes. The rectangular building was 20 m long and 7 to 10 m wide (Fig. 4). In its northwestern part, a round 2.25 x 1.9 m large pit, with a maximum depth of 1,0 m below the modern surface, was discovered. Both pits in dwellings 2 and 3 are interpreted as being used for storing food. Further small pits, some of them containing traces of fire in the form of charcoal, burnt soil, etc., were found inside and outside the houses. Dwellings 1–3 formed a kind of circle, which surrounded an inner space. In its

centre, a pit of 2.5 m in diameter and a maximum depth of 1.4 m below the modern surface was excavated. In its lower part, it was filled with an ash-grey sediment containing calcinated bones, ashes, and charcoal, covered by a thick dark grey sediment (Fig. 5). This pit is tentatively interpreted as a sacrificial place, since no discarded items were found here. The construction, content, and location indicate that the pit might have been used for ritual fire, serving as a sacred place on the settlement.

In the western part, only one dwelling was documented on the basis of several post-holes and a dugout area with a maximum depth of 0.4 m and a length of 8.5–9 m from N-S and 6.5–8.5 m from W-E. In the eastern part, another dwelling was identified only on the basis of postholes. This dwelling measured 6 m from NW-SE and more than 8 m from NE-SW. Finds were concentrated inside the dwelling, where a small fire place was also found. Neither of these two dwellings contained a pit or a partially deepened floor, in contrast to the constructions in the central part of the site.

Materials Found at Rykan-3

Pottery sherds were the most abundant material found: 3767 ceramic fragments in the central, 605 specimens in the eastern, and 294 fragments in the western part. It was possible to reconstruct the contours of 179 vessels, all showing typical features of Middle Don Catacomb Culture pottery (Fig. 6). The pottery found in all parts of the settlement is so similar that the settlement was almost certainly settled and enlarged by a single social group, probably based on kinship.



Fig. 5. Cult pit with pyrogenic soil in the central part of settlement Rykan-3

In addition to ceramic fragments, a large number of artefacts made from other materials were found (Fig. 7). A copper awl was the only item made of metal. Among stone artefacts, the fragment of a polished axe is of importance as it shows facets characteristic of an axe that are part of the famous Borodino hoard⁸ (Fig. 7, 12).

It is mostly the pottery, in addition to some other artefacts, which point to the first half of the later phase of the Middle Don Catacomb Culture. Four samples of cattle bones and one charcoal sample were radiocarbon-dated and show comparable results. The calibrated time spans are relatively large – from 2850 to 2300 cal BC – due to high standard deviation of two results and many wiggles of the calibration curve.⁹ Relying on data sets from other Middle Don Catacomb Culture sites, the first half of its later phase dates to the 26th–24th centuries BC.¹⁰

As this paper is devoted to the economic activities of the settlement's inhabitants, we conclude here the brief overview of the archaeological evidence and will continue with the

information obtained by zooarchaeological, archaeobotanical, and pedological investigations. The economic activities of the inhabitants were analysed using archaeological and natural-science methods. To reconstruct the main features of the subsistence economy, a comprehensive analysis of animal-bone remains was carried out; systematic flotation of the cultural layer during excavation was undertaken to obtain charred plant remains, and the archaeobotanical materials (fruits and seeds) were dated directly by radiocarbon analysis.

Zooarchaeological Evidence

The collection of animal bones was studied according to the methodological scheme of the Laboratory of Natural Science Methods of the Institute of Archaeology of the Russian Academy of Sciences. In addition to anatomical and taxonomic identification, the taphonomic preservation, the degree of the bone fragmentation, and the presence of artificial traces were assessed. Age, gender, and size characteristics, as well as pathologies, were recorded. All these data were used to extrapolate the economic structure.¹¹

⁸ Shishlina 2019, Fig. 11.

⁹ Gak 2019, 150-159: GrA-45167: 3955 ± 35 bp; GrA-45169: 4120 ± 35 bp; Poz-52381: 4190 ± 35 bp; IGAN-4556: 3950 ± 100 bp; IGAN-4557: 3970 ± 70 bp.

¹⁰ Gak 2013.

¹¹ Antipina 2004; 2008; 2016.

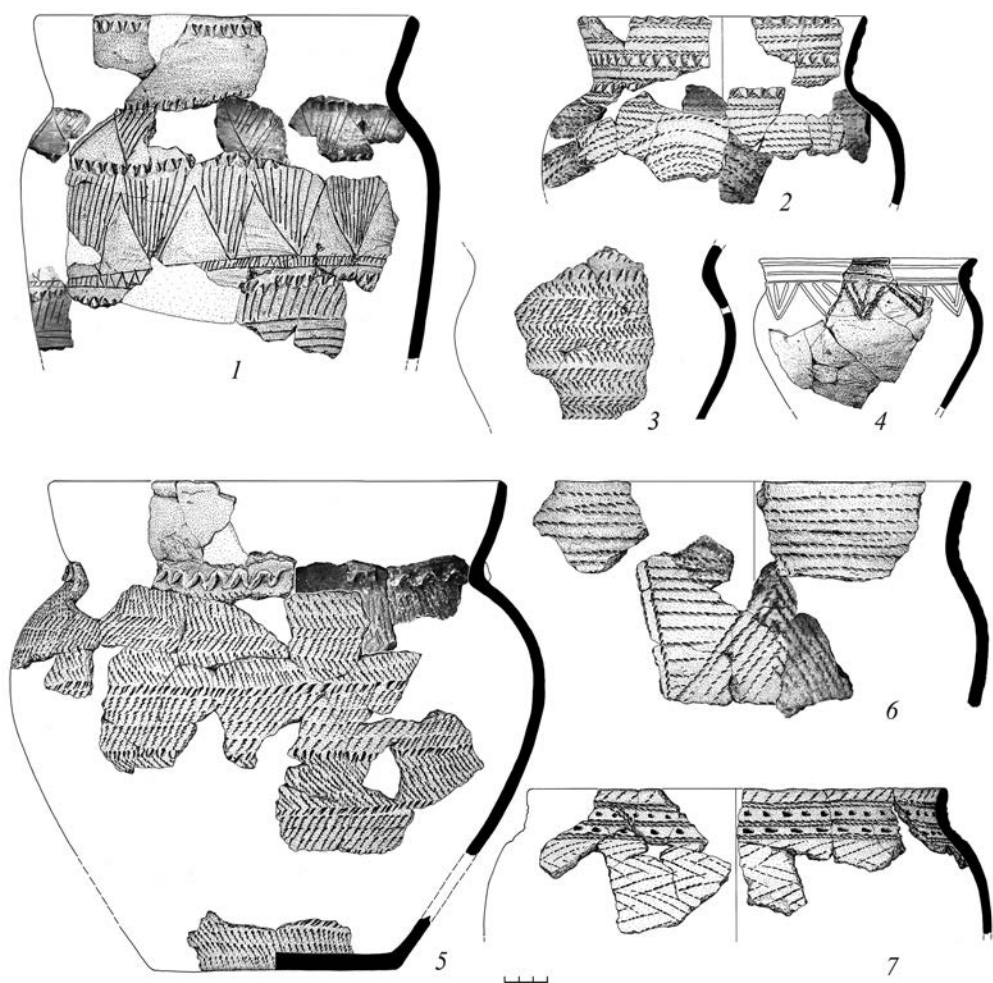


Fig. 6. Pottery from the settlement Rykan-3

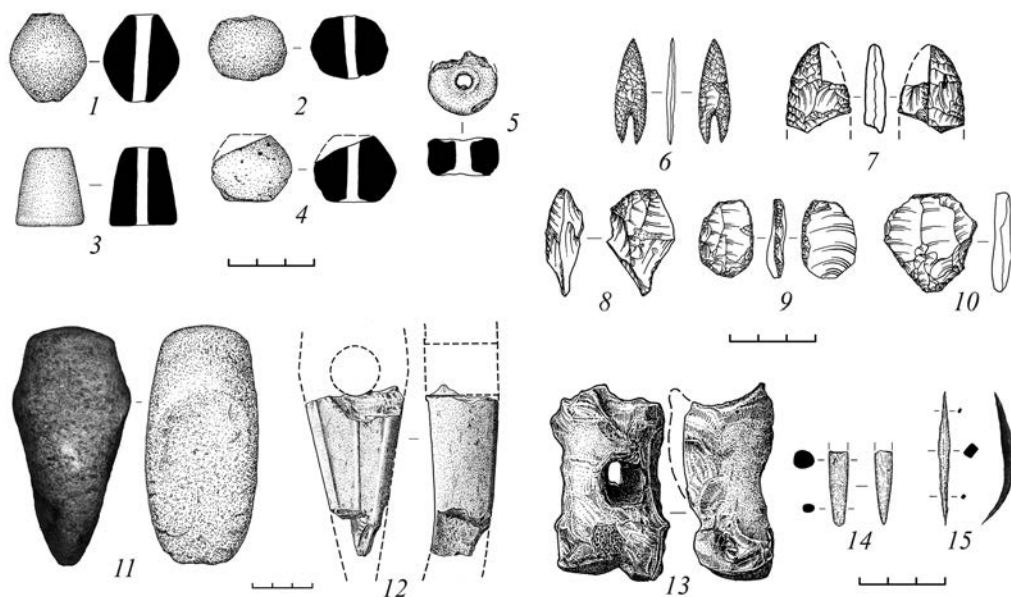


Fig. 7. Artifacts from different materials excavated in the settlement Rykan-3. 1-5 spindle whorls made of burnt clay; 6-10 different flint tools; 11 semi-product of a stone axe; 12 fragment of a stone axe with facettes; 13 bone object; 14-15 copper tools

The natural preservation of most of the bone collection was poor and, only in some cases, satisfactory (2–3 points). This reflects the unfavourable taphonomic conditions for organic remains associated with the high humidity of the strata and the activity of soil biota. Various taphonomic factors affected the degree of fragmentation. However, the smallest fragments from the layer of the central part – close to the fire pit near dwelling 2, inside dwelling 3, and above the pit with burnt soil – showed the best preservation. The osteological collection contains about 6,898 bone fragments. 46% were determined up to the species level.

The osteological material of Rykan-3 includes, as in other settlements of the Middle Don Catacomb Culture,¹² five domestic species: cattle (*Bos taurus*), horses (*Equus caballus*), sheep/goats (*Ovis aries* / *Capra hircus*), pigs (*Sus scrofa* forma domestica), and dogs (*Canis familiaris*). Nine hunted species were documented: wild boar (*Sus scrofa* f. ferus), elk (*Alces alces*), roe deer (*Capreolus capreolus*), bear (*Ursus arctos*), wolf (*Canis lupus*), fox (*Vulpes vulpes*), badger (*Meles meles*), marten (*Martes* sp.), and beaver (*Castor fiber*). They can still be found in the modern fauna of the Middle Don forest-steppe (Table 1; Fig. 8).

Table 1 Zooarchaeological results of settlement Rykan-3. Number and percentages of identified animal bones (excavations 2009-2014)

Horizons of cultural layer and features	Animal bones										TOTAL NISP
	domestic					wild		pig or wild boar.	NISP		
	cattle	horse	sheep/goat	pig	dog	sum				sum	
						NISP	%	NISP	%		
Central part											
horizon 1	61	17	8			86	96,6	3	3,4	-	89
horizon 2	556	98	43	1	1	699	93,6	48	6,4	-	747
horizon 3	713	117	116	1	-	947	93,1	70	6,9	3	1020
horizon 4	129	31	18	-	-	178	96,7	6	3,3	-	184
dwelling 1	16	5	2	-	-	23	100,0	-	-	-	23
dwelling 2	76	4	13	-	-	93	100,0	-	-	-	93
dwelling 3	20	4	5	-	-	29	100,0	-	-	-	29
central basin	45	12	18	-	-	75	98,7	1	1,3	-	76
further features	69	21	34	-	-	124	100,0	-	-	-	124
total	1685	309	257	2	1	2254	94,6	128	5,4	3	2385
Western part											
horizons 1-3	34	14	1	-	-	49	100,0	-	-	-	49
horizon 4	45	8	3	-	-	56	98,2	1	1,8	-	57
horizons 5-6	32	3	1	-	-	36	100,0	-	-	-	36
total	111	25	5	-	-	141	99,3	1	0,7	-	142
Eastern part											
horizons 1-2	5	1	-	-	-	6	100,0	-	-	-	6
horizon 3	41	21	4	-	1	67	94,4	4	5,6	-	71
horizon 4	107	81	1	-	-	189	95,0	10	5,0	4	203
horizon 4 (concentration)	178	133	-	-	-	311	99,7	1	0,3	-	312
horizons 5-6	31	11	-	-	-	42	85,7	7	14,3	-	49
total	362	247	5	-	1	615	96,6	22	3,4	4	641
TOTAL	2158	581	267	2	2	3010	95,2	151	4,8	7	3168
%	71,7	19,3	8,9	0,07	0,07	100,0					

¹² Zhuravlev 2001; Antipina 2011a.

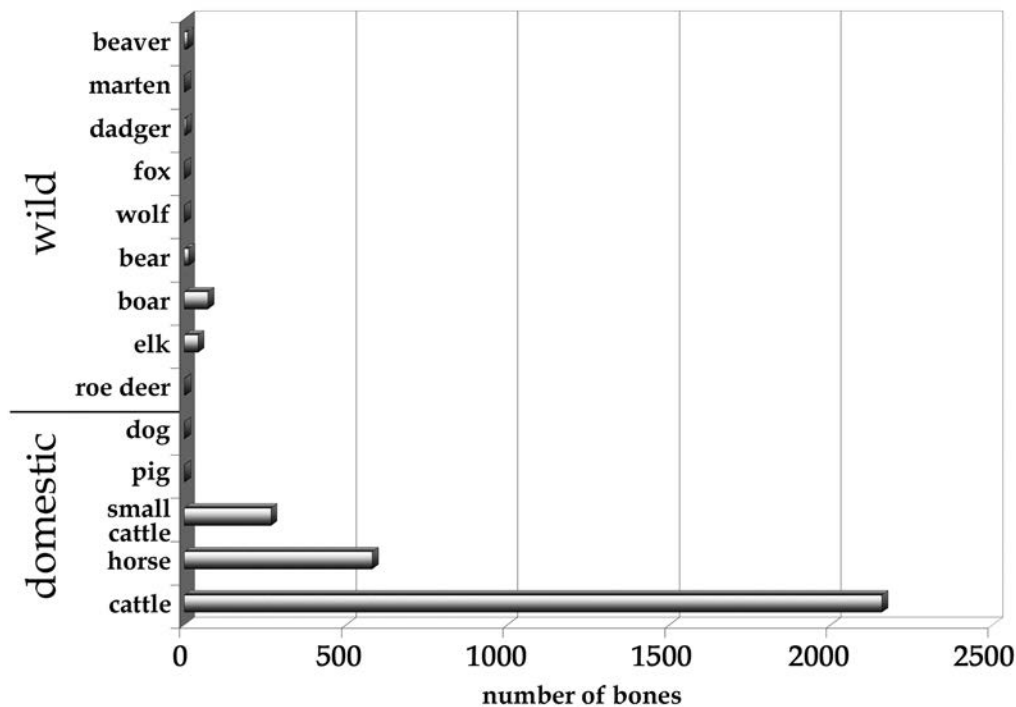


Fig. 8. Zooarchaeological results of settlement Rykan-3. Distribution of osteological remains by species (from excavations 2009-2014)

The presence of domestic ungulates is typical for the Bronze Age in the Eastern European steppe and forest-steppe.¹³ However, wild forms of at least cattle, horse and pig were still present in this period. Therefore, the bones have to be assigned to either wild or domestic animals.

Specific pathologies confirm the domestic status of cattle and horse. On most phalanges and fragments of metapodia taxonomically identified as cattle (*Bos*), both exostoses (osteophytes) and joint degeneration were documented. This combination reflects an increased load on the joints of the limbs of draft animals,¹⁴ which clearly indicates that these remains belong to livestock. Similar pathological manifestations were encountered on the first phalanges and distal parts of the radial bone of the Rykan-3 horses (Fig. 9).

The most intriguing question concerns pig. The collection of bones of this species includes 73 fragments from different parts of the skeleton of a boar. Five bones of young individuals could not be assigned as wild or domestic, but only to *Sus* sp. in general. Only two bones were identified as small domestic pig, both found in



Fig. 9. Exostoses (indicated by arrows) on the first phalanx of domestic horse found in the settlement Rykan-3

¹³ Tsalkin 1958; Zhuravlev 2001; Antipina / Morales 2005.

¹⁴ Bartosiewicz et al. 1997.

the cultural layer. But until their age is verified by radiocarbon dating, it remains an open question whether domestic pigs were kept at Rykan-3.

About 95% of the analysed bones belong to domestic ungulates, with a predominance of cattle – 69% (Table 1). Single scattered dog bones were found in the central and eastern part, as well as in a niche under dwelling 2 as a foundation deposit. Among wild animals, the remains of wild boar (about 50%) prevail, followed by elk (28%), bear (about 9%) and beaver (6%).

The main part of the collection is characteristic for kitchen refuse, among which there are almost all elements of the skeleton of domestic ungulates. This shows that whole carcasses were butchered within the settlement. At the same time, epiphyseal parts dominate over those of diaphyses, which reflects the selection of compact parts of bones for different needs. Bone artefacts show the use of animal bones for different purposes in the settlement.

The variability in the size of adult domesticates in one population depends, first of all, on nutrition and other conditions of animal husbandry. The size of most adult cattle phalanges from Rykan-3 is similar to those from other Eastern European Bronze Age sites. They probably belong to large individuals of up to 130 cm at the withers. On the other hand, bones of smaller individuals, similar to the cattle of the Russian Middle Ages, are also present. Such significant differences in the size of animals exceed the usual sexual dimorphism for one herd of cattle and can be associated either with individuals used for different economic purposes, or with animals that were fed on different nutritional bases.

The Rykan-3 horses can be evaluated only at a qualitative level, since very few complete bones were preserved. Measurements show large and medium-sized animals.

Mostly sheep were identified among the small ruminant remains; only one goat astragalus was present. The sheep seem to have been relatively large in size. The number of 170 cattle teeth allows us to assess the slaughter age (Fig. 10). No “summer” calves up to 3 months old were found, and only very few individuals from 3 to 8 months (about 2%), which were probably slaughtered during autumn and winter. Cattle from 8 months to 1.5 years are represented with 11%, but the bulk of the meat was obtained from adult animals of 1.5 to 6 years (76%). Only 3% were older than 9 years.

The age structure of horses is based on a smaller data set (60 teeth). However, it is possible to say that horses were slaughtered when they were adult, showing a wide range from 3 to 20 years.

Only 39 teeth were preserved among the remains of small cattle, which indicates only their general age range. They belong to individuals from 1–4 months to 6–8 years. (Fig. 11). In a concentration of small bones from the fire pit near dwelling 2, the hock joint of a newborn lamb or goat was found. If this find indicates late winter/early spring (March) as the time of the animal’s death, then young dairy animals of 3–4 months were slaughtered in the summer. It is difficult to guess where and how it occurred, since there are only three teeth from this age group.

In general, the data on the age structure of domestic ungulates suggest that mainly adult cattle and horses that had reached almost optimal weight were slaughtered. The calculation of the relative volumes of meat consumption of these two species showed the absolute predominance of beef in the daily diet. Similar meat diets are recorded in many other Bronze Age settlements.¹⁵

The proportion of fragments per species reveals the importance of the different

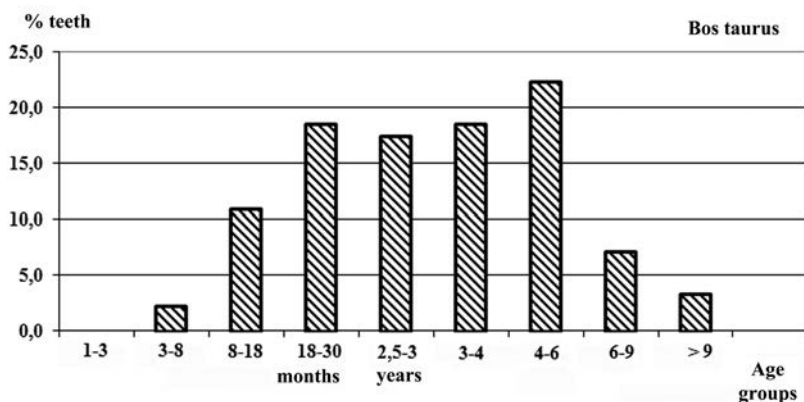


Fig. 10. Zooarchaeological results of settlement Rykan-3. Age structure of cattle (n=170 teeth)

¹⁵ Antipina 2011; 2008.

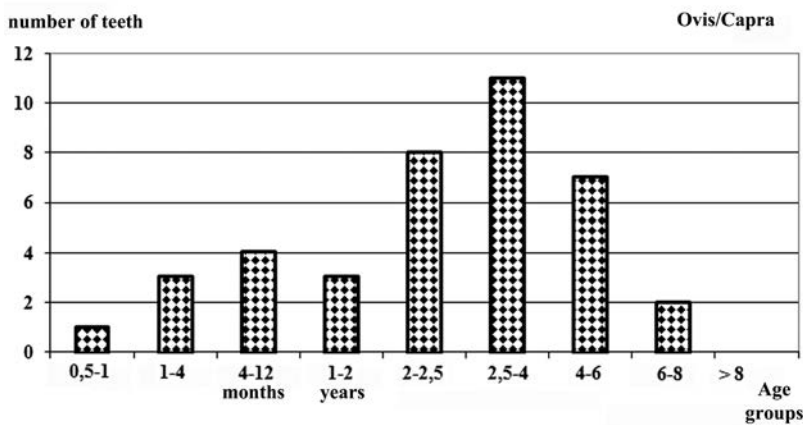


Fig. 11. Zooarchaeological results of settlement Rykan-3. Age structure of sheep/goat (n=39 teeth)

animals in the subsistence economy.¹⁶ The results clearly show the dominance of cattle in the herds of Rykan-3, with horses second in terms of numbers, sheep third, and goats and perhaps pigs represented in single numbers only. Similar observations are recorded in other Bronze Age settlements.¹⁷

Our zooarchaeological study shows the predominance and proportions of domestic species, and perhaps their products, in the economy, which provided the settlers with meat and other animal products. Nevertheless, the data is not sufficient to construct a model of cattle breeding; in order to do so, a combination of zooarchaeological, archaeological, landscape-ecological, and archaeobotanical data is required.

Archaeobotanical Remains and Their Absolute Dating

Rykan-3 is the only settlement of the Catacomb Cultural Community where archaeobotanical remains were systematically obtained. 63 sieving samples and two carbonized fruit remains found during excavations were studied. 633 litres of soil from the cultural layer were investigated using the common manual sieving technique.¹⁸

Carbonized plant macro-remains (53 specimens) were found in 19 samples. Samples were taken from various features, including hearths, fire pits, postholes, the pit of dwelling 3, and from the cultural layer at various depths.

Cultivated plants are represented by three grains of millet *Panicum miliaceum*. All of them are poorly preserved but they are the first finds of cultivated cereals in any settlement of the Catacomb Cultural Community. Until recently, the only evidence of cultivated cereals from this period was a bag with spicas of two hulled wheat species from a catacomb grave excavated in a burial mound near the village of Bolotnoye, Crimea.¹⁹ Of special interest among the finds of Rykan 3

are the forest fruits found for the first time in a Bronze Age settlement in Russia: raspberry seed (*Rubus idaeus*); four fragments of hazelnut shells (*Corylus avellana*); a fragment of the upper part of a plum stone very similar to the blackthorn (cf. *Prunus spinose*), as well as a fragment of a nut (seed without pericarp), probably an acorn (cf. *Quercus* sp). Another hazelnut and two fragments of one cotyledon of acorn were already recognised during the excavation.

Most of the macro-remains belong to seeds of weeds and wild grasses (40 specimens). 12 taxa were identified on different levels from family to species. Best represented are the following plants: seven specimens of the family Rubiaceae (bedstraw and woodruff, *Galium* sp., *Asperula* sp.); five specimens of sedge (*Cyperaceae*); four of maple-leaved goosefoot (*Chenopodium hybridum*); three seeds of buckwheat (*Polygonaceae*); and vetch (*Vicia* sp.).

The origin of millet and its distribution across Eurasia has been discussed intensively recently.²⁰ As cultivated cereals are very rare in Bronze Age settlements,²¹ we decided to date seven macro-remains by radiocarbon analysis: three millet grains, two hazelnut shells, one acorn fragment, and one raspberry seed. These macro-remains were found at various depths and in different parts of the settlement, including in the northern area close to land that was used for agriculture until recently. Sample №1, a millet grain, was

¹⁶ Antipina 2008.

¹⁷ Antipina 2004; 2011a; 2011b.

¹⁸ Lebedeva 2008; 2016.

¹⁹ Korpusova / Lyashko 1990.

²⁰ Hunt et al. 2008; Motuzaitė-Matuzevičiūtė et al. 2013; Miller et al. 2016.

²¹ Lebedeva 2005; 2008.

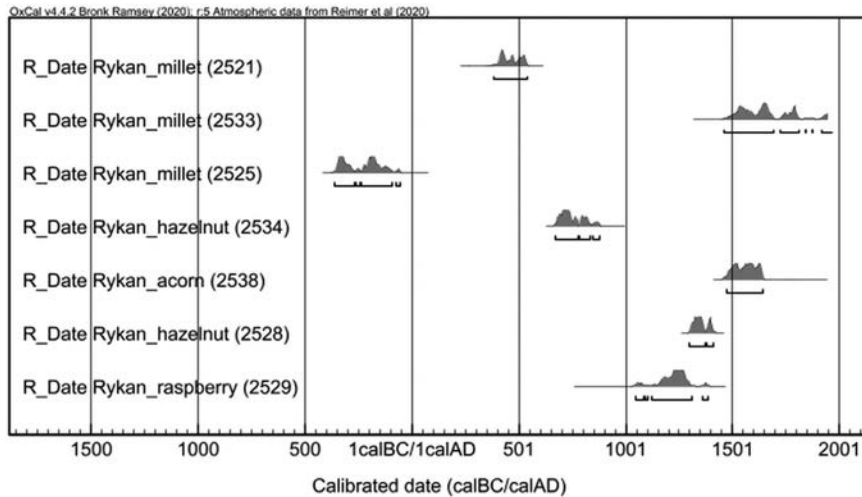


Fig. 12. Calibrated radiocarbon dates of archaeobotanical finds found in the settlement Rykan-3. The samples are listed from top to bottom according to their internal sample number (see Table 2)

found in the fire pit in the central part. Sample №3, another millet grain, and sample №7, a raspberry seed, were both excavated in postholes in the western part. All other remains selected for dating were taken from the cultural layer.

The samples were analysed at the AMS radiocarbon laboratory in Poznań. The ^{14}C dates showed completely different time intervals that do not overlap after calibration (Fig. 12; Table 2). None of the dates is synchronous with the absolute dating of the settlement. The oldest date was provided by sample №3 (*Panicum miliaceum* 2525): 360–109 cal BC (σ 95.4%). All other samples show dates within the last two millennia. The calibration of the radiocarbon age of sample №2 (*Panicum miliaceum* 2533) showed a large time span of ca 500 years due to the relatively large standard deviation (\pm 60 years) and the wiggles of the calibration curve.

All calibrated time intervals suggest that the sampled grains, seeds, and fruits are later intrusions after the settlement had already been abandoned for a long time. This is disappointing but nevertheless an important finding, as it shows that all cereal remains from settlements like this should be radiocarbon-dated. The significant differences in dates clearly indicate that people came to the site at different times during one and a half millennia and this caused the intrusion of plants into Rykan-3, with the help of rodents and insects. These radiocarbon dates end the discussion over farming as an economic activity in the

settlement. Apparently, arable agriculture was not relevant for the subsistence of the Catacomb Cultural Community. For the above-mentioned find of a sack with grain in a grave in the Crimea, the possibility that the crop was exchanged has been discussed. Thus, the grain remains do not necessarily represent a direct indication of arable agriculture.²² Similarly, single imprints of cultivated cereals, which have been detected on pots in catacomb graves of the Lower Dniester region, do not indicate that farming played a significant role during the Middle Bronze Age in the grass- and forest-steppe.²³

This is not the first time that absolute dating of archaeobotanical remains does not match the archaeological context in which they were found. A number of publications clearly show that, independent of the carefulness of sampling, younger intrusions cannot be excluded.²⁴ Therefore, charred macrobotanical remains should always be dated by ^{14}C because they clearly indicate that the absence of cultivated crops in Catacomb Culture settlements is not due to bad preservation. Another good reason for using absolute dating might be that the cultural layer in such settlements is often relatively thin or may contain material from different periods.

²² Lebedeva 2005.

²³ Kuzminova 1990.

²⁴ Motuzaitė-Matuzevičiūtė et al. 2013; Pelling et al. 2015.

Table 2 Results of the radiocarbon dating of archaeobotanical finds (for calibrated date see Fig.12)

Internal sample №	Material (Archive number)	Lab number	¹⁴ C age BP	cal BC (σ 95.4%)	Remarks
01	<i>Panicum miliaceum</i> (2521)	Poz-61887	1630 ± 30 BP	346AD (49.4%) 371AD 377AD (64.6%) 475AD 485AD (24.9%) 536AD	0.4mgC
02	<i>Panicum miliaceum</i> (2533)	Poz-61888	260 ± 60 BP	1461AD (70.3%) 1691AD 1729AD (18.9%) 1811AD 1924AD (6.2%) ...	0.16mgC
03	<i>Panicum miliaceum</i> (2525)	Poz-61889	2165 ± 35 BP	360BC (95.4%) 109BC	0.8mgC
04	<i>Corylus avellana</i> (2534)	Poz-61890	1255 ± 30 BP	672AD (57.7%) 779AD 790AD (15.1%) 868AD	-
05	<i>Quercus</i> sp. (2538)	Poz-61891	335 ± 30 BP	1475AD (95.4%) 1641AD	-
06	<i>Corylus avellana</i> (2528)	Poz-61893	595 ± 30 BP	1298AD (69.7%) 1371AD 1379AD (25.7%) 1410AD	-
07	<i>Rubus idaeus</i> (2529)	Poz-65951	790 ± 70 BP	1043AD (8.6%) 1104AD 1118AD (85.2%) 1302AD 1367AD (1.5%) 1382AD	0.15mgC

Archaeological and Pedological Data

At this point, some information gained from excavation and various complementarily conducted pedological research will be added to complete the basis upon which we are going to tentatively reconstruct the subsistence economy and how people during the 3rd millennium BC adapted to their natural environment. The settlement is located on the first floodplain terrace of the Usman river, 3–4 m above the summer water level, on the level of high floodplains. Phytolith samples taken from the cultural layer revealed biomorphs of both typical dry-steppe species and boreal forest vegetation characteristic of the vegetation in the forest-steppe. The biomorphic spectrum of ancient and modern background soil were crosschecked with phytolith-analyses and showed comparable results, indicating that here the environment today is similar to the Bronze Age.

The lower part of the cultural layer of the settlement was not disturbed by natural and later anthropogenic processes and only 20 cm thin. According to the pedological results obtained from analysed samples, this layer contained only few biogenic and technogenic microelements, but a mixed sediment. The presence of phosphates slightly distinguishes this layer from the upper and lower sediment layers.²⁵

Dwellings 2 and 3 in the centre and the dwelling in the western part were dug into this layer.²⁶ The dwellings were relatively massive: the markedly indented sediment under the roof posts indicates significant pressure. The fact that some of the houses were dug into the ground, and also had storage pits below them, also points to solid constructions. In contrast to the cult pit with burnt material, other features and objects are randomly scattered over the central part of the settlement. Many fire pits and places were located outside the dwellings, although still very close to them.

The pottery was intensively fragmented; sherds of up to 2 cm² in size account for 58 to 72% in different parts of the settlement. The same holds true for bones: almost two-thirds are smaller than 8 cm². Apparently, kitchen refuse was lying on the surface over a long period, undergoing constant weathering and destruction. Concentrations of fragments from one or more vessels represent a specific feature in Eastern European settlements (so called ‘razval sosudy’ or crushed vessels). All pots in such concentrations are incomplete, mostly consisting of large parts of the wall or bottom. Probably, they were still in use before they were destroyed.

Objects of other economic activities beyond subsistence are present: clay spindle whorls (textile production); flint flakes together with

²⁵ Gak / Borisov 2011, 122.

²⁶ Gak et al. 2014, 26-27.

broken flint tools (flint processing); unfinished axes of hard rock (stone processing); smoothers and spatulae made of pot sherds, bone tools for decoration (pottery production); stone adzes with a grooved blade (woodworking); a curved awl made of arsenic bronze, flint piercing tools and scrapers (processing of skin and leather); half-products and finished bone objects with traces of cutting, polishing, and decoration (processing of bone and horn). The vertebrae of pike *Esox lucius* L in the 'cellar' of house 2 attests to fishing as an additional branch of subsistence.

Discussion of Results

The results of the different analyses provide the basis for reconstructing the economic structure of the inhabitants of Rykan-3. Archaeobotanical and radiocarbon data became a 'reference point': despite good preservation conditions for charred botanical macro-remains, no remains of cultivated cereals date to the same time period as the settlement, thus suggesting the absence of agriculture. Nor are there remains of gathered plants, although wild species could have been found easily in the settlement's environment. It becomes obvious that cattle breeding played a predominant role in subsistence. The organization of the settlement was subordinated to its structure and needs.

For the herds of Rykan-3, an absolute predominance of cattle with complementary portions of sheep/goat was reconstructed. When arable agriculture is absent in a subsistence economy based on animal husbandry, pastoralism is often organized in mobile or semi-mobile forms.²⁷ The significant differences in the size of cattle can be explained in two ways: 1) different types of cattle serving different economic purposes, or 2) the animals were kept on feed with different nutritional values, which confirms a mobile pastoral regime.

At first glance, the zooarchaeological results seem to indicate activities during all seasons. Calves were slaughtered during fall and winter; the bones of a new-born lamb point to early spring. But winter in the central European part of Russia continues until April. Although four teeth

of young dairy cattle may suggest habitation in the summer period, these single finds could be explained in different ways, including that they represent later intrusions.

Other data seem to be more significant in determining the season of habitation as winter:

1) The cultural layer does not show intensive anthropogenic impact. This layer is characterized by highly fragmented kitchen refuse that has laid on a hard, probably frozen surface for a while;

2) The dwellings were built close to each other and form a circular structure, probably as a protection against the cold climate;

3) The dwellings were relatively solid, which means that all activities, such as heating, cooking, and storing food, could take place indoors;

4) Open fireplaces, probably used for heating, were situated close to dwellings, which is only possible when the area was covered by snow; otherwise the risk of accidentally burning the houses would be too great.

5) Indicators for economic activities unambiguously connected with summer are missing. Processing of skin, leather, flint, hard stone, and textiles could take place independently of the season. In winter, fewer people were engaged in caring for young animals, grazing adult animals, and processing their intravital products (milk and blood). The scarce evidence of fishing could indicate frozen rivers. The few remains of hunted animals, the complete absence of bird bones, and, most importantly, gathered plants, together suggest habitation of Rykan-3 only in winter;²⁸

6) A pit in the centre of the settlement suggested that the rituals performed here were connected with fire. Such rituals might be more important in the cold season;

7) According to similar modern vegetational conditions in comparison to the 3rd millennium BC, pastures were available in the surroundings of the settlement even in winter.

Although each indication on its own may not form proof for the season of habitation, in combination they make a strong case for winter habitation

²⁷ Cribb 1991.

²⁸ Gak / Borisov 2017, 27-28.

Conclusion

For the first time, a model of the subsistence economy of the Catacomb Cultural Community was developed based on the results of systematic excavation of a settlement in the Middle Don region. Rykan-3 is of great importance because it consists of a single layer of a particular time span, e.g. 26th–24th centuries BC. Thus, it could be ruled out that materials from different phases of occupation were mixed in the cultural layer, which was only 20 cm thin. The overall ephemeral character of the site points to its seasonal character, although it was repeatedly inhabited over several generations.

Beyond ceramic sherds, fragmented animal bones were abundant. Thorough zooarchaeological analysis showed the dominance of cattle breeding, which had been established as a leading form of animal husbandry in the Eastern European grass- and forest-steppe since the beginning of Yamnaya Cultural Community.²⁹ So far, the proportion of arable agriculture in the Bronze Age in this region is still debated. Therefore, systematic sieving of the sediment containing artefacts was carried out, and it revealed a small number of charred macrobotanical remains. But direct radiocarbon dating of seven specimens indicated their considerably younger age: all of them represent later intrusions.

In the discussion, we have argued, based on various indications, that Rykan-3 can be considered as a winter camp of a small group of mobile pastoralists who adapted to the continental climate and environmental conditions in the Middle Don area. We are completely aware that our model still needs to be further developed and improved. But such improvements can be expected when more settlements of the 3rd millennium BC have been discovered and investigated, particularly with an extended research strategy. As for Rykan-3, animal teeth are currently being sampled sequentially and analysed using oxygen and strontium isotopes. Residue analyses of ceramic fragments might provide insight into the diet of the inhabitants, which promises great potential. Our aim was to use our research to present a model for reconstructing economic and lifestyle patterns and thus to show the perspectives

for research on Bronze Age settlements in the West-Eurasian grass- and forest-steppe.

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Rezime

Rekonstrukcija privredne strategije naselj Rykan-3 u Donskoj šumo-stepi

U članku je prikazana rekonstrukcija privredne strategije u naselju Rykan-3 iz srednjeg bronzanog doba. Naselje se nalazi u centralnom dijelu donske šumo-stepe i datira iz vremena od 26. do 24. vijeka pr.n.e. Sistematska iskopavanja su obavljena u periodu 2009.–2014. godine. Naselje Rykan-3 je posebno zanimljivo jer, za razliku od mnogih drugih nalazišta iz bronzanog doba na jugu istočne Europe, ima kompaktan kulturni sloj koji je nataložen u vrijeme Katakombne kulture.

Iz tog razloga ga je Evgenij Gak izabrao za sistematsko istraživanje u kombinaciji sa arheozoološkim, arheobotaničkim i paleosolnim studijama, kao i uz uključivanje radiokarbonskog datiranja. Glavni nalazi su fragmenti glinenih posuda i životinjske kosti koji su proučavani i analizirani u različitim laboratorijima. Sveobuhvatna procjena arheološke i osteološke zbirke, rezultati flotacije kulturnog sloja, istraživanja paleosola i drugi podaci, omogućili su izradu modela sezonskog naselja naseljenog uglavnom zimi. Glavno zanimanje njegovih stanovnika bilo je stočarstvo s dominacijom krupne rogate stoke.

Arheobotanička istraživanja nisu dala nikakve tragove zemljoradnje, a radiokarbonsko datiranje makrostatika nađenih biljaka pokazalo je da se tu radi o recentnim intruzijama. U cjelini gledano može se reći da je interdisciplinarno istraživanje naselja Rykan-3 po prvi put dalo mogućnost za rekonstrukciju jednog

²⁹ Kaiser 2019, 150-157.

zimskog sezonskog kampa stočara katakombne kulturne zajednice istočne Evrope.

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