

Nina L. Morgunova and Mikhail A. Turetskij

ARCHAEOLOGICAL AND NATURAL SCIENTIFIC STUDIES OF PIT-GRAVE CULTURE BARROWS IN THE VOLGA-URAL INTERFLUVE

The aim of the paper is to provide the research results concerning the Pit-Grave culture sites of the south Ural region, which is a part of the Volga-Ural interfluve. The Pit-Grave culture developed mostly out of the Khvalynsk Eneolithic culture at the turn of the 5th–4th millennium cal BC. People of the Sredny Stog and forest-steppe Eneolithic cultures from the Middle Volga region also influenced the Pit-Grave culture. The paper considers the radiocarbon data (more than 120 dates), specifies the periodization of the Pit-Grave culture of the Volga-Ural interfluve, singles out the three stages of its development. The chronology of the culture is determined 3900–2300 cal BC. The authors provide new information about the Pit-Grave economy. Paleopedology, palynology, anthropology, metallography, ceramic technical, and technological analyses were used together with archaeological methods to make a more detailed description of the culture.

Nina L. Morgunova, Orenburg State Pedagogical University, 19 Sovetskay St., 460014 Orenburg, Russia; nina-morgunova@yandex.ru
Mikhail A. Turetskij, Volga Region Branch of Institute of the Russian History of the RAS, 3a Studencheskij St., 443001 Samara, Russia; maturet@mail.ru

Introduction

The Pit-Grave culture spread on huge territory of Eastern Europe steppe – from Kazakhstan and south Ural to the Dniestr region. The eastern Pit-Grave artefacts were found in the Volga-Ural interfluve and in the south Ural region on the territory of the Astrakhan, Volgograd, Saratov, Samara, and Orenburg oblasts, Russia. The environmental conditions of the steppe existed on the most part of the territory and forest steppe – in the north (Fig. 1).

Today, natural conditions are determined by the continental climate, which corresponds to hot summers with low precipitation and severe winters with a lot of snow. The flora of watersheds is typical for the Volga sheep fescue-feather grass steppe (the type of steppe where sheep fescue and feather grass flourish). Various kinds of meadow grass, bushes, and streamside forests grow in river valleys and gulches. The paleoclimatic conditions of the Pit-Grave culture are

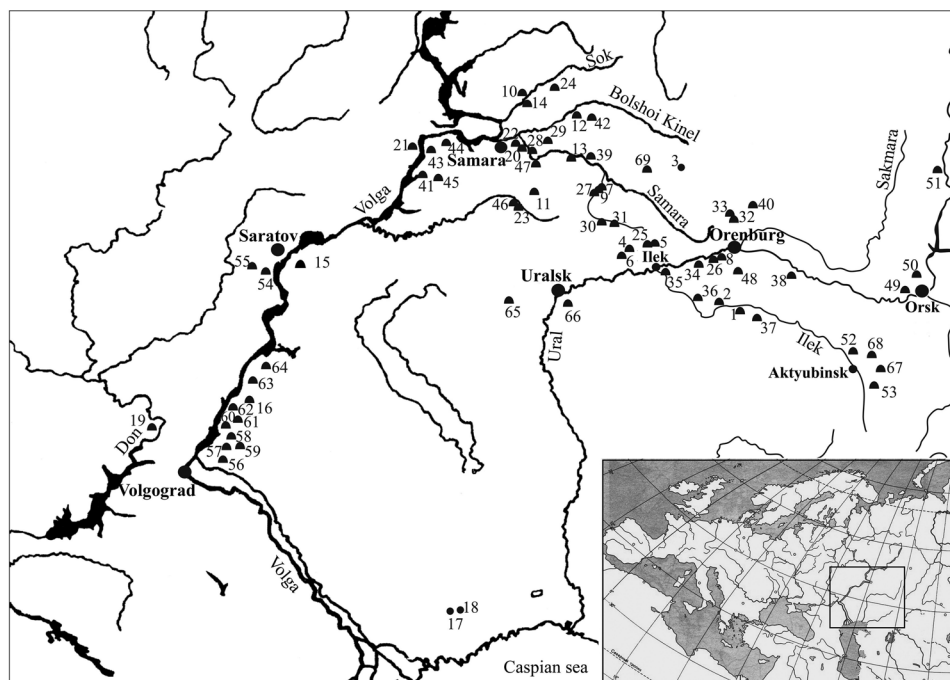


Fig. 1. Monuments of the Pit-Grave culture of the Volga-Ural region. 1 Tamar-Utkul VII, VIII, 2 Izobilnoye I, II, 3 Turganik settlement, 4 Shumaevo OK, I, II, 5 Mustaevo V, 6 Boldyrevo I, IV and Trudovoe II, 7 Skvortsovka, 8 Nizhnaya Pavlovka V, 9 Petrovka, 10 Lopatino I, II, 11 Orlovka I, 12 Poludni II, 13 Gvardejtsy II, 14 Grachevka II (the Samara region), 15 Shumejka, 16 Skatovka, 17 Kyzyl-Khak I settlement, 18 Kyzyl-Khak II settlement, 19 Repin Khutor settlement, 20 Nur I, 21 Uvarovka II, 22 Podlesnoye I, 23 Zhuravlikha I, 24 Kalinovka I (the Samara region), 25 Gerasimovka II and Khutor Baryshnikov, 26 Pyatiletka, 27 Kurmanaevka III, 28 Krasnosamarskij I-IV, 29 Kutuluk I, 30 Efimovka IV, 31 Sverdlovo I, 32 Uranbash, 33 Pershin, 34 Krasnokholm II, Kardailovo I-II, 35 Ilesky, 36 Linevka, 37 Uvak, 38 Buranchi I, 39 Koltubanka, 40 I Novotroitskij (the Oktyabrskij district), 41 Ekaterinovka, 42 Bereznyaki, 43 Kashpir II-III, 44 Prepolovenka I, 45 Vladimirovka, 46 Tambovka II, 47 Utevka I, Pokrovka II, 48 Donguz II, 49 I Novotroitskij (the Gayskij district), 50 Ishkinovka I-II, 51 Malo-Kizilskij II, 52 Tanabergen II, 53 Zhaman-Kargala I, 54 Panitskoe 6B, 55 Gold Kurgan, 56 Verkhne-Pogromnoe, 57 Kalinovka, 58 Stepan Razin khutor, 59 Bykovo I-II, 60 Politotdelskoe, 61 Berezhnovka I-II, 62 Ilovatka, 63 Rovnoe, 64 Staraya Poltavka, 65 Svetloe Ozero, 66 Ilekshar I, 67 Shandar, 68 Kurajli I, 69 Grachevka (the Orenburg region).

different to the modern climate. Eneolithic and Pit-Grave culture existed in the favourable natural conditions practically all the time. The precipitation was 50 mm higher compared to the humidity today. The environmental conditions and temperature drops were milder than we had in past decades (Spiridonova & Aleshinskaya 1999; Khokhlova et al. 2006; 2010; Khokhlova 2012). Many scientists think that the climate change and the emergence of aridity period coincided with the start of the Late (Poltavka) stage of the Pit-Grave culture and the Catacomb culture spread to the west of Volga (Demkin et al. 2006; Shishlina 2007; Khokhlova et al. 2010; Khokhlova 2012).

V. V. Golmsten, P. S. Rykov, I. V. Sinitsyn, K. F. Smirnov, N. Ya. Merpert, V. P. Shilov, N. K. Kachalova, I. B. Vasilyev and other archaeologists studied the Pit-Grave sites in the Volga-Ural interfluvium in the 20th century. During the Smirnov expedition the first Pit-Grave culture barrows (kurgans) were discovered at the end of the 1950s and beginning of the 1960s. Smirnov (1965) compared the Ural materials with the Lower Volga graves and found that there are skeletons in right lateral crouched position. After considering unique metal finds (a knife and a hammer) archaeologists came to the conclusion that during the Pit-Grave period an independent metallurgy center appeared on the base of the Kargala copper deposit (80–90 km to the north of Orenburg) in the south Ural region (Chernykh 1966, 68 f.).

Later, at the end of the 20th century, the research by E. N. Chernykh proved the above-mentioned statement. This added the original character of the Ural group of the Pit-Grave culture and historical area (Chernykh 2002, 7 ff.).

At the beginning of the 1970s N. Ya. Merpert published the monograph, in which he summarized all the data concerning the Pit-Grave culture (Merpert 1974). The scholar singled out three local groups of sites within the Volga-Ural Pit-Grave cultural and historical area: the Ural, the Lower Volga, and the Middle Volga.

Since 1977 the Pit-Grave research has been carried out under the guidance of N. L. Morgunova in the Orenburg oblast. She discovered diverse Pit-Grave complexes. In the second part of the 1980s the Pit-Grave culture research became well targeted and systematic. It resulted in considerable growth in the number of analysed Pit-Grave barrows (Morgunova & Kravtsov 1994). The first periodization of the Ural Pit-Grave culture was put forward. Scholars raised some questions concerning the economy and the structure of the Early Bronze Age society (Morgunova 1991). We formed the hypothesis of singling out the Middle Volga–Ural local type of the Pit-Grave culture (Turetskij 1999). Results of various kurgan studies in the area together with a lot of finds – various metal artefacts – substantially changed the popular opinion that the Ural Pit-Grave culture had peripheral character.

However, by the end of the 20th century it had become quite clear that the Pit-Grave sites were essential for applying new methods so that archaeologists could exploit new sources to find solutions for different complicated problems – first of all the issues concerning the origin, the periodization and the chronology of the culture.

In 1999, the Orenburg State Pedagogical University launched the comprehensive research of barrow burial grounds near the villages of Shumaevo, Mustaevo, and Skvortsovka. Researchers used archaeological, paleopedological methods, micro-biomorphic, palynological, anthropological analyses, and radiocarbon dating; they studied the production technology of metal and pottery (Morgunova et al. 2003; 2005; 2010a; Morgunova & Khokhlova 2006; 2013; Morgunova 2014).

In the Ural region, we discovered 162 Pit-Grave burials in 152 kurgans (according to the data of 2014). Burial grounds (52 studied in total) were situated on fluvial terraces of the Samara, the Irtek, the Kindelya, the Ural, the Ilek and

other rivers. In spite of the long-term search only one large settlement of the Pit-Grave culture (located on the Turganik River) has been discovered in the Ural region. A number of the burials (the Uranbash and Pershin barrow cemetery) were found on the area of the Kargala copper deposit.

Thus, the burials constitute the main source for studying the Pit-Grave culture of the Bronze Age population in the steppes of Eastern Europe.

Funeral ceremony

The skeleton position provided the basis for the classification of inhumations. Three main ceremonial groups (CG) were singled out: I CG – supine position of bodies with knees bent to the right; II CG – skeletons in the right lateral crouched position; III CG – the extraordinary burials (bodies in prone or sitting positions, with separate skull, or cenotaphs). A big group (54 complexes) include ransacked burials, and it is impossible to identify the position of skeletons there.

26 burials from 18 barrow cemeteries were referred to I CG. Simple pits in rectangular shape (150–270 cm length, 80–180 cm width) comprised the majority of burials. The pits were 0.7–2.0 m deep. There was enough space for a dead body, which was usually placed at the centre of pit (Fig. 2: 1). Bottoms of pits were always covered with mat. Biomorphologic analysis showed that the mat was made of fresh stems and leaves of reed. People mostly used hydrophilous plants. Scientists found “pillows” of different herbs under skulls (Golyeva 2005; 2006). Bodies, walls, and stairs of pits were also covered with reed mat.

I CG grave goods were scanty. There was pottery in 4 burials (Fig. 2: 3–5). Wheels were discovered in 2 burials, though they served as symbols as it was impossible to use the items for transportation as they were too massive. Both wheels consisted of 3 parts and were cut out of huge wood pieces. It was significant that in both cases the wheels were placed under heads of dead persons. Other finds included bone tubes, pebble, flint flakes, animal bones, and shells. Archaeologists did not find any grave goods in most burials. Therefore, such finds as copper knife, awl, and stone mould for casting of axes are of particular interest (Fig. 2: 6). Axes cast in similar moulds were discovered in several burials of II CG (Fig. 3: 3). One bone pin-amulet was also found (Fig. 2: 2).

Population represented in the I CG burials in the Ural region was not as numerous during the Pit-Grave period as II CG. Apparently, the first group was in a subordinate situation. According to anthropologist A. A. Khokhlov, the representatives of I and II ceremonial groups belonged to different anthropological types, I CG – to the Northern European, II CG – to the Southern European type (Khokhlov 2006, 102). The majority of the buried from I and II CG were male. Child and female burials were rare. One more group was singled out – graves of priestesses who seemed to perform rituals before death.

A substantial number of burials (72) are referred to II CG. They are grouped into two types: 1 type – simple pits (40 items) (Fig. 3: 1, 4); 2 – pits with steps along its perimeter (32 burials) (Fig. 4: 1).

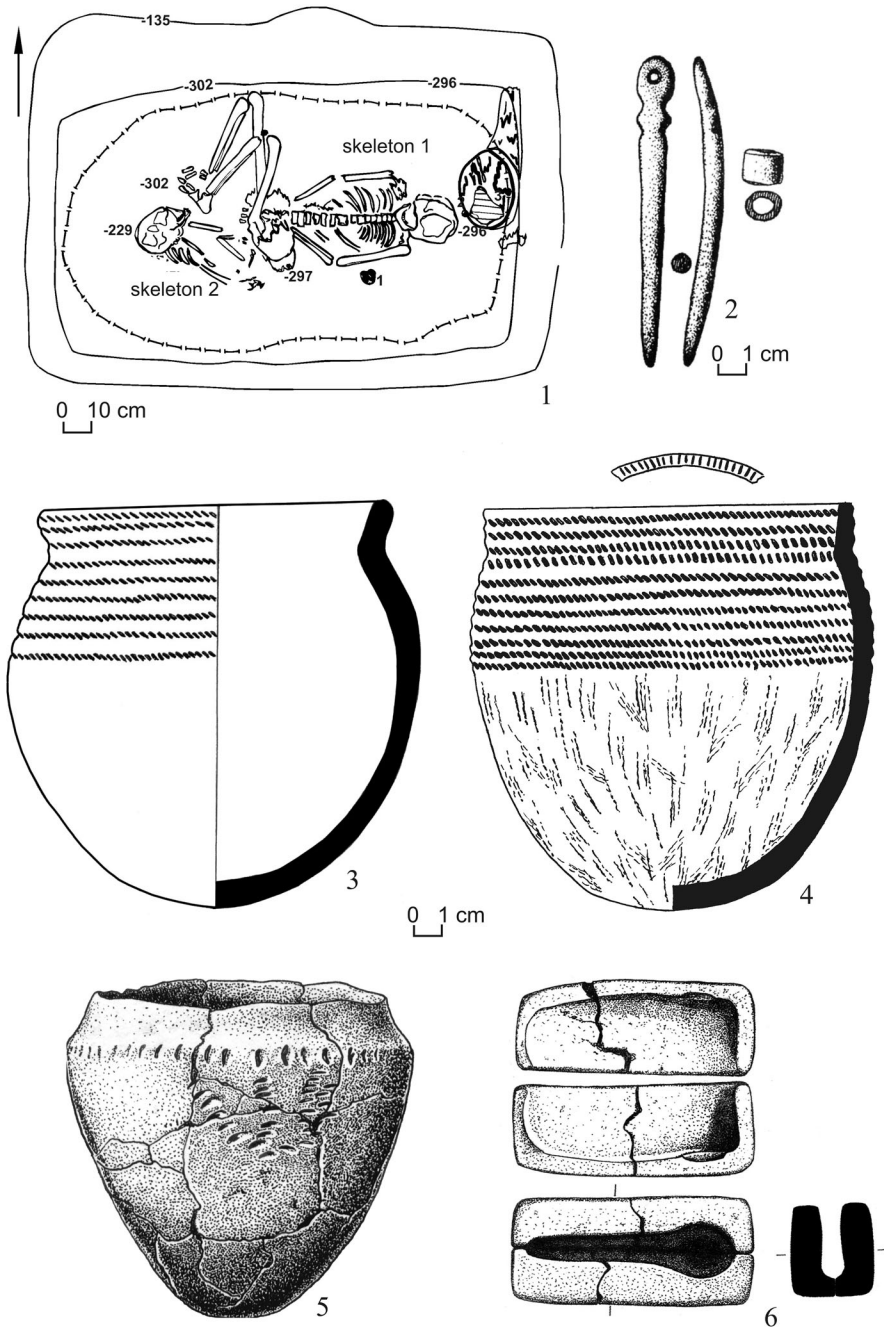


Fig. 2. Materials of burials of the I ceremonial group of Pit-Grave culture of the Volga-Ural region. 1 Shumaevo II, k.6, b.6, 2 Kurmanaevka III, k.1, b.1, 3 Petrovka, k.1, b.2, 4 Skvortsovka, k.5, b.4, 5 Khutor Baryshnikov, k.4, b.1, 6 Pershin, k.1, b.4.

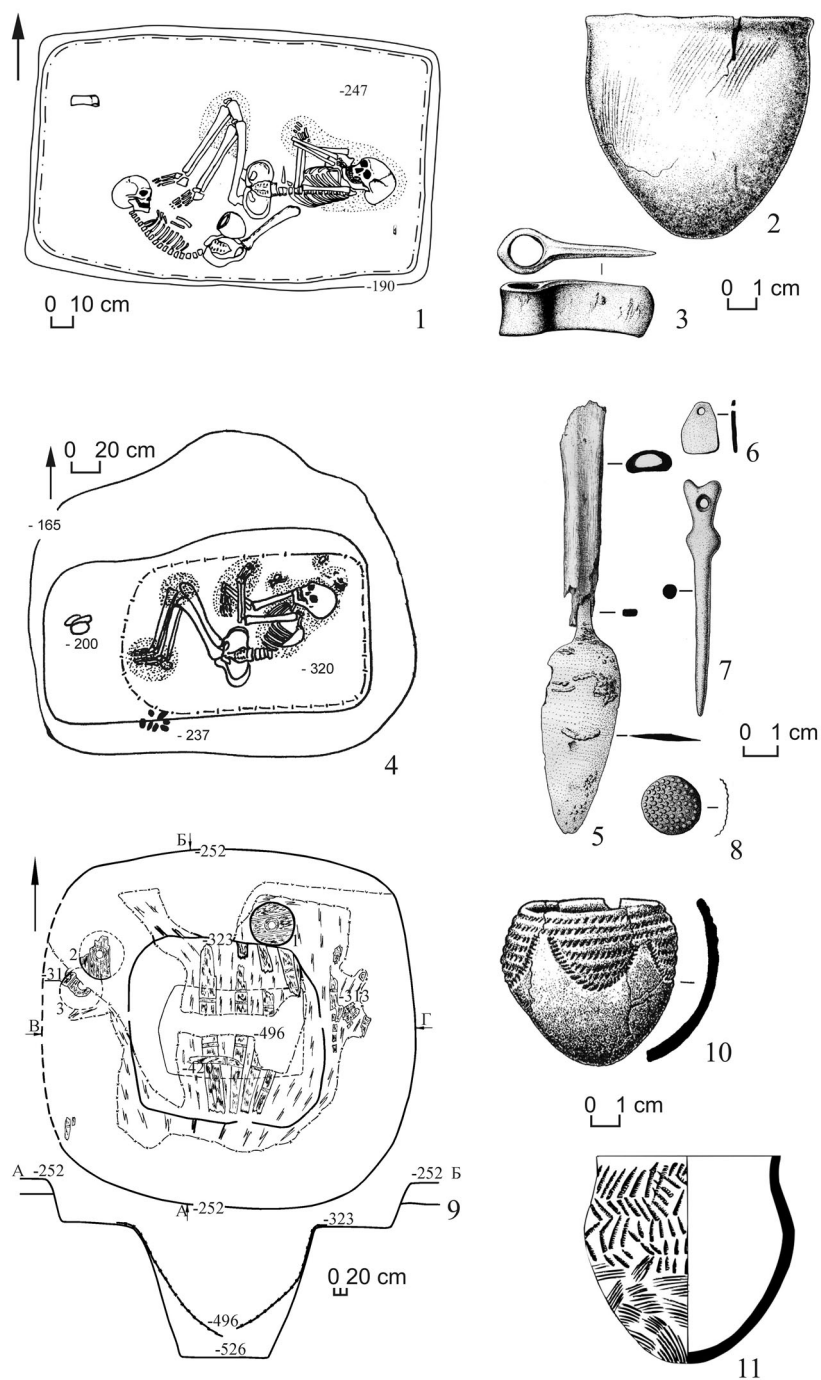


Fig. 3. Materials of burials of the II ceremonial group of Pit-Grave culture of the Volga-Ural region. 1–3 Tamar-Utkul VIII, k.4, b.1, 4–8 Tamar-Utkul VII, k.1, b.1, 9 Shumaevo SK, b.2, 10 Khutor Baryshnikov, k.3, b.6, 11 Tamar-Utkul VIII, k.5, b1.

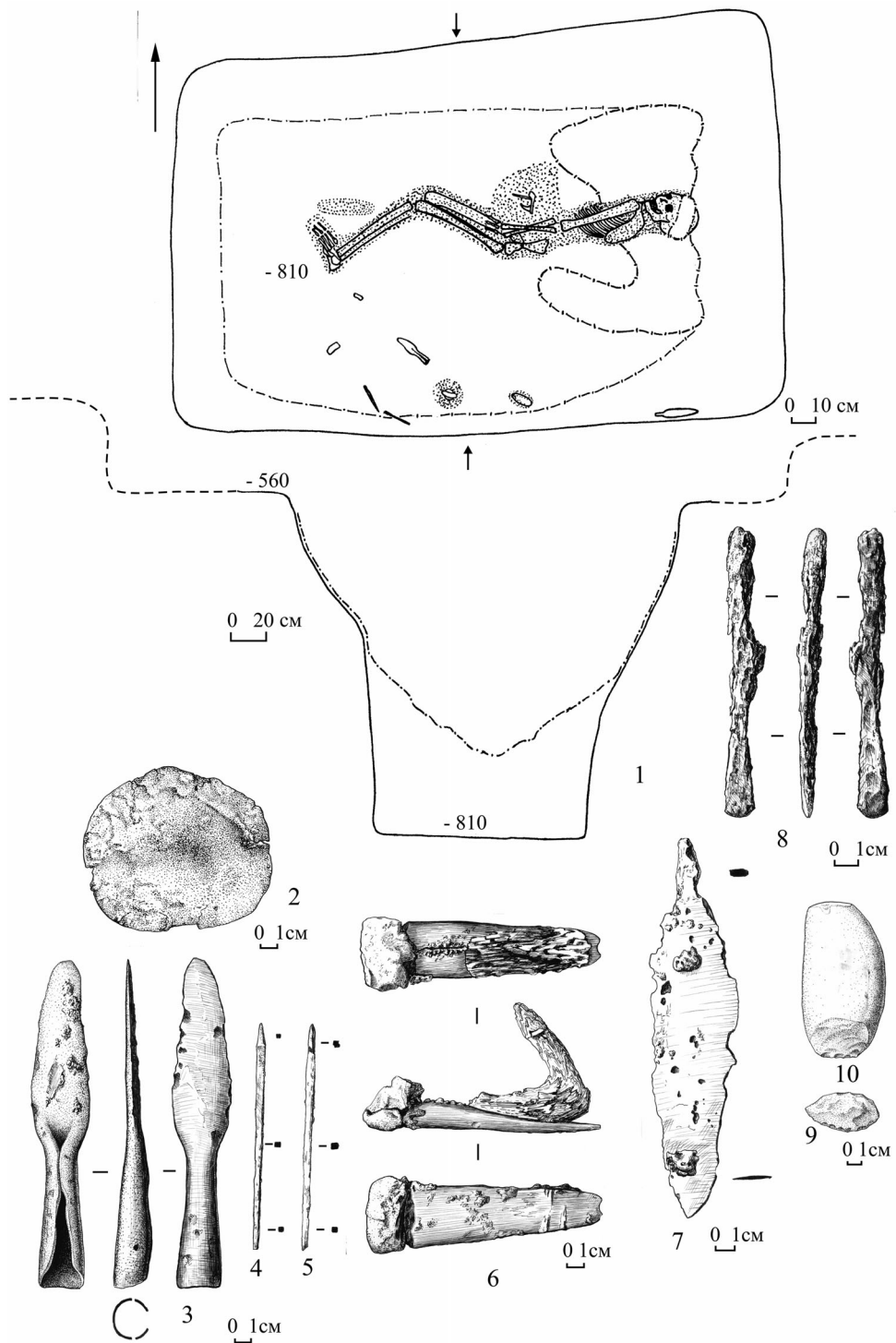


Fig. 4. Burial ground Boldyrevo I: kurgan 1, burial 1. Plan of burial, copper and iron tools.

The dead were buried under a barrow mound made of ground taken from ring ditches. Large embankments (30 m in diameter and more than 1.5 or 2.0 m high) comprised 55% of barrows within the group. All kurgans were single graves. Pits were different in size and design. Their depth reached 2.0–3.5 m.

Pit steps were covered with a mat of herbs, reed, sometimes of bark. People put mat on walls and at the bottom of burials as well. Archaeologists discovered big unique burials with wheels and cart parts placed on steps (Fig. 3: 9). An outstanding barrow was found in Boldyrevo I (No. 1 d = 60 m, h = 6 m), where in addition to numerous copper items 6 artefacts made of meteor iron were collected (Fig. 4: 2, 6, 8).

We singled out a group of a pair and collective burials, which differed much both in the way the dead were buried and in grave goods. We also collected evidence that accompanying groups of people (children and adults) were buried alive intentionally (Fig. 3: 1).

The number of burials with grave goods was much bigger for II CG and comprised about 60%. Pottery was placed in 18 burials. Complexes with copper items were singled out including prestigious articles such as an axe tooth, knives-daggers, a hammer, axes, gouges, a spear-head, an adze with trunnions and an adze-hammer (Figs 3: 3, 5; 4: 3, 6).

Thus, burials of II CG with the right lateral position of bodies and heads to the east or north-east are typical for the steppe Ural. Pits were either simple or more complicated with steps along the perimeter. The right lateral skeleton position tradition was found both in early and late complexes. At the same time with II CG bodies were buried in I CG in a crouched supine position, legs turned to the right or to the left (very rare).

12 unusual burials included graves with skeletons placed in prone or sitting positions, with separate skulls, or cenotaphs (Fig. 5: 2, 7). Apparently, it was connected with a particular ritual practice.

With the help of the above-mentioned features, scholars could distinguish the Ural Pit-Grave sites from the Middle Volga and Lower Volga barrows. Considering this N. Y. Merpert singled out 3 groups of sites within the Volga–Ural variant of the Pit-Grave culture and historical area (Merpert 1974). However, the Early Bronze Age population of the Volga–Ural region seemed to be one cultural, economic, and political whole.

Periodization and chronology of the Pit-Grave culture

In Orenburg oblast during the last 15 years archaeologists worked with the Pit-Grave culture periodization using radiocarbon dating and other natural scientific methods. Implementing these techniques, scientists studied a number of Pit-Grave sites – the Shumaevo II single kurgan, the Shumaevo I and II kurgan burial grounds, Mustaev V, Skvortsovka – 19 barrows in total. Grave goods were found

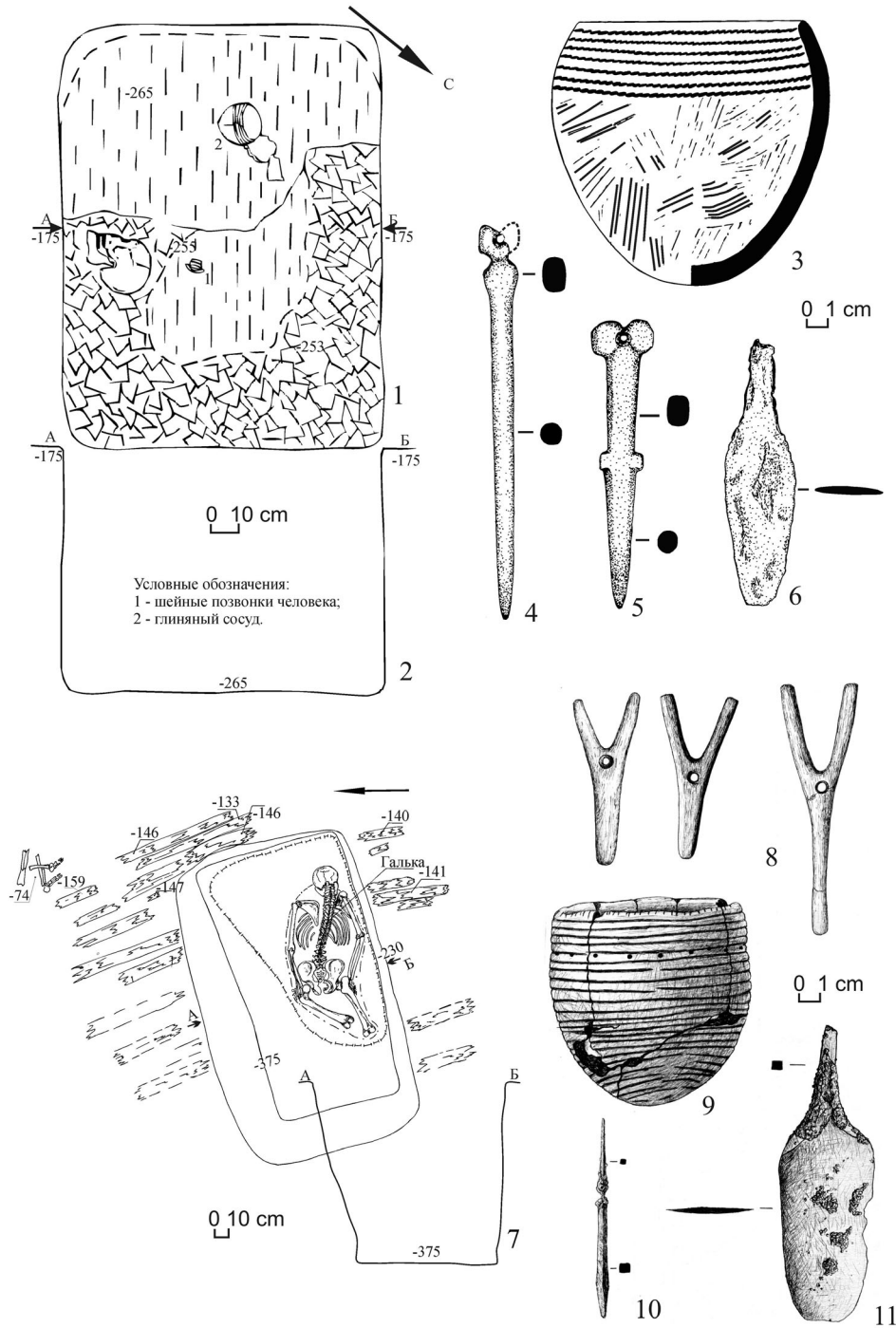


Fig. 5. Extraordinary burials of Pit-Grave culture of the Volga-Ural region. 1-3 Mustaevo V, k.8, b.2, 4-6 Mustaevo V, k.9, b.2, 7 Mustaevo V, k.1, b.1, 8-11 Gerasimovka II, k.4, b.2.

only in 5 burials. They included pottery, metal, and bone pins, which could be compared with materials of other Pit-Grave sites of the Ural and Volga regions studied before. Most burials did not contain any grave goods, in this case the paleopedological research by O. S. Khokhlova and A. A. Golyeva became very important (Morgunova et al. 2003; 2010a; Golyeva 2006; Khokhlova et al. 2006; 2010; Khokhlova 2012). Considering the structure and the composition of burial soils, scientists found out the sequence of barrows. The kurgans within one burial ground were divided into groups that was later proved by ^{14}C dating. Besides carbonate ^{14}C age was determined, which helped to sequence the barrows.

We used different materials for radiocarbon dating in different dating laboratories.¹ So ^{14}C dating combined with paleopedological and archaeological data allowed us to specify and to prove the three stage periodization of the Volga–Ural Pit-Grave culture: I – the Early (Repin) stage, II – the Developed stage with 2 horizons (A and B), and III – the Late (Poltavka) stage.

The Early (Repin) stage

A number of steppe Eneolithic features remained at the Repin stage. The cultural continuity between the Pit-Grave, Khvalynsk, and Sredny Stog Eneolithic cultures was proved by the following features: skeletons in crouched supine position with bent legs to the left or to the right, heads at the eastern sector of burials, ochre coverage with high or low density, multiple burials, egg-shaped ceramics with neck and crushed shell impurity. Technical and technological analysis of pottery was another evidence demonstrating the pottery continuity between the Khvalynsk and Repin traditions (Vasilyeva 2002; Salugina 2005). Big soil burial grounds were substituted by individual burials under the barrow. The spread of local production copper articles was a distinctive feature of the Pit-Grave culture. This was the phenomenon, which archaeologists consider to be the beginning of the Early Bronze Age in steppe of Eastern Europe.

The sites of the period were represented by barrow burials and short-term seasonal settlements.

Ceramics sherds from the northern Caspian (Kyzyl-Khak I and II), the Turganik settlement (the middle horizon) of the southern Ural, and Repin Khutor settlement on the Don River were taken for radiocarbon dating (Morgunova et al. 2010b; Morgunova & Khokhlova 2013; Morgunova 2014). The chronology of all four settlements is close – the dates were between 5230 ± 90 and 4540 ± 80 BP

¹ Institute of Geography of the Russian Academy of Sciences, Moscow (O. A. Chichagova, E. P. Zazovskaya), Institute of History of Material Culture of the Russian Academy of Sciences, Saint Petersburg (G. I. Zajtseva), Radiocarbon Laboratory of National Academy of Sciences of Ukraine, Kiev (N. N. Kovalyukh, V. V. Skripkin), The Russian State Pedagogical University of A. I. Herzen, Saint Petersburg (M. A. Kulkova), Radiocarbon Laboratory, Poznan, Poland (Tomasz Goslar) and Isotope Archaeology Center for Isotope Research, Groningen, Netherlands (J. van der Plicht).

or 4200–3100 BC in calibrated time scale (Ki-15598; Ki-14543). After the dates were corrected and analysed, the interval was cut to 3900–3300 BC.

A number of scholars do not rely on ceramic dates (Chernykh & Orlovskaya 2011). They may be right but according to our data in some cases ^{14}C ceramic dates match with dates received after analysing other materials. For instance, on the Turganik settlement pottery ^{14}C dates (4710 ± 80 BP, Ki-15597) were confirmed by animal bone ^{14}C dates obtained by M. A. Kulkova in 2015.

1. Horizon 7–8 (SPb-1490): 4887 ± 90 BP (3786–3631 cal BC). 2. Horizon 10 (SPb-1493): 4900 ± 80 BP (3786–3635 cal BC). 3. Horizon 10 (SPb-1494): 4716 ± 95 BP (3632–3561 cal BC). 4. Horizon 11 (SPb-1498): 4800 ± 70 BP (3656–3517 cal BC). 5. Horizon 12 (SPb-1503): 5180 ± 80 BP (4221–3931 cal BC).²

Burials from Skatovka, Petrovka, Orlovka I, Skvortsovka, and Lopatino I were referred to the Repin horizon due to the presence of pottery, which was similar typologically to the settlement ceramics and metal artefacts (Figs 2: 3, 4; 5, 8–11). Both ceramics and human bones were dated. In general, they were similar to the ^{14}C settlement dates (Morgunova & Khokhlova 2013; Morgunova 2014).

Thus, considering the radiocarbon dating the chronology of the Early stage of the Pit-Grave culture in the Volga–Ural region was determined 4000–3300 BC. If we compare it with other existing opinions concerning the culture we will see our data shows the period to be 500 years older (Chernykh & Orlovskaya 2004; Kuznetsov 2011; 2013). It was proved by the artefacts that the Repin type and the Early Maykop culture were synchronous. The chronology of the Early Maykop culture was determined on the basis of numerous ^{14}C dates in the period of 4000–3500 BC (Korenevskij 2004; Korenevskij & Rezepkin 2008).

Taking into account the data of paleopedology and radiocarbon dating the **Developed stage** was divided into 2 chronological phases – A and B.

We referred to a number of barrows with ^{14}C dates between 4440 ± 140 BP (JIE-8579) and 4245 ± 35 BP (Poz-47868) as “*Developed stage A*” (Fig. 5: 1–6). Paleopedological data proved the early age of the kurgans. The soils under the A stage kurgans differed substantially from soils under the B stage kurgans. It indicated a certain period of time between their construction (Morgunova & Khokhlova 2013; Morgunova 2014).

^{14}C dates of the Middle Volga barrows allowed to confirm the age (3300–2900 cal BC) of Developed stage A (Kuznetsov 2007; Turetskij 2007). For these kurgans, ^{14}C dates showed a smaller interval – the calibrated period of 3365–2800 BC.

We discovered sites, which kept all burial tradition features of the previous stage. They were referred to as “*Developed stage B*” (Figs 2: 1; 3; 4; 5: 7). Important differences of the B phase included: the size of barrows was various; burial features were diverse; there were burials with human sacrifice, numerous metal artefacts and other grave goods. It indicated changes in the quality of life and a higher degree of social inequality.

² The dates are published for the first time.

According to radiocarbon dating, Developed stage B chronology was determined in the period from 3000–2900 to 2600–2500 cal BC. Complexes with rare artefacts were dated, which allowed to find out the time of their spread. For example, the burial Pershin, 1/4 with an axe mould (Fig. 2: 6) was dated (^{14}C) to 4200 ± 60 BP (Chernykh et al. 2000). Professor Y. van der Plicht received similar dates of human bones (Morgunova & van der Plicht 2013) for burials with axes cast in the same mould as the tools from Tamar-Utkul VII and VIII (Fig. 3: 3). A date of ceramics from these burials was the same (Fig. 3: 2).

The burials with wagon parts from the Shumaevo II single kurgan, the Shumaevo II kurgan burial ground (Fig. 2: 1), and elite burial of the Boldyrevo I 1/1 kurgan (Fig. 4) with numerous articles of copper and meteor iron dated to the same chronological interval. The classic stage of the Pit-Grave culture in other steppe areas of Eastern Europe was usually determined to 3000–2600 cal BC. The end date is proved by ^{14}C dates of the Early Catacomb burials (Nikolova 1999; Ivanova 2006; Shishlina 2007; Nikolova & Kaiser 2009).

The Late (Poltavka) stage

The Catacomb culture spread on the territory between the Don and the Dnepr rivers and merged with the Pit-Grave culture. However, the Pit-Grave tradition remained practically the same, slightly influenced by the Catacomb culture in the Volga–Ural interfluvium. For instance, its impact resulted in the spread of flat-bottomed pottery (Fig. 6: 2, 5).

According to the paleopedological and archaeological data, a number of burials from Shumaevo II and Skvortsovka were referred to the later Pit-Grave stage. Paleopedology showed they were constructed under conditions of increasing aridization, which made them different from Developed stage B kurgans. We obtained ^{14}C dates for all barrows. Three ^{14}C dates were received for simultaneous burials 1 and 4 of the Skvortsovka, barrow 5. Different materials were analysed (pottery, human bone and wood), but the dates were close to each other – 3940 ± 70 (Ki-16489), 3810 ± 25 (JIE-7685), 3810 ± 40 BP (JIE-8415). The dates of burial 3 of the same barrow and of burials of barrow 6 of the same burial ground were also close to the above-mentioned values. The reference of this burial group to the Pit-Grave Catacomb period was proved by the presence of flat-bottomed pottery and a bent copper knife (Fig. 6: 2, 5).

Similar ^{14}C values were obtained for burials of barrow 3 of the Izobilnoye I burial ground, where clay wheels were found, and for a set of burials with flat-bottomed ceramics in the Samara Transvolga region (Kuznetsov 2007; Turetskij 2007).

Thus, the late stage of the Pit-Grave culture was dated to the calibrated period of 2600–2300 BC on the territory of the Volga–Ural interfluvium. The Catacomb sites dated to the same period in Kalmykia, the Lower Don (Shishlina 2007), and the Dnepr regions (Nikolova 1999; Pustovalov 2003; Kaiser 2011).

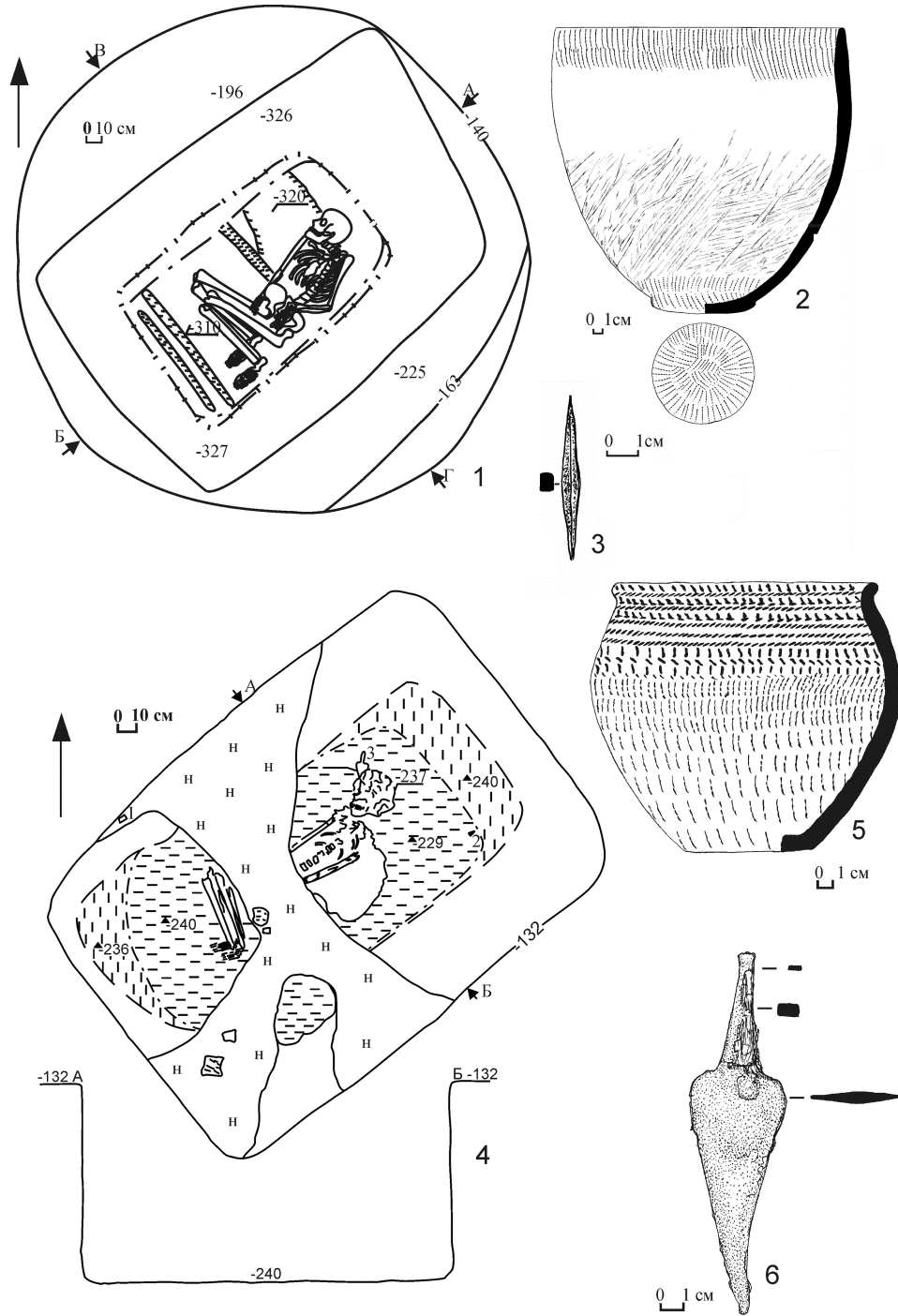


Fig. 6. Cemetery Skvortsovka. 1 k.6, b.3, 2 k.6, b.1, 3 k.7, b.1, 4-6 k.5, b.4.

Branches of economic activity

Cattle breeding

In the first half of the 1970s scholars considered that the beginning of cattle breeding in the south of Eastern Europe was connected with the Pit-Grave culture (Merpert 1974; Shilov 1975). Earlier archaeologists thought that the Pit-Grave tribes were engaged only in the appropriating economy (Kruglov & Podgaetskij 1935, 141).

A collection of osteological data and its analysis in the second half of the 20th century allowed N. Y. Merpert to prove that the economy of the Pit-Grave population of Eastern European steppe was not limited to hunting and gathering (Bibikova 1960; Lagodov'ska et al. 1962; Tsalkin 1970; Shilov 1975) and describe its features (Merpert 1974). The scientist showed that nomadic pastoralism was the predominant activity for the culture. Later, after Neolithic and Eneolithic sites were discovered in the Volga and Ural regions, the beginning of food-producing economy was referred to an earlier period in this territory (Vasil'ev 1981; Matyushin 1982; Morgunova 1995). Information concerning the beginning of cattle breeding in Neolithic and Eneolithic allowed to explain why the nomadic pastoralism was so highly developed in the Pit-Grave culture.

Materials from a number of settlements including such big ones as Mikhajlovka II, Repin Khutor, Turganikskoye, and others served as evidence that animal breeding was the dominant activity at the Early Repin stage of the Pit-Grave culture (Sinitsyn 1957; Lagodov'ska et al. 1962; Korobkova & Shaposhnikova 2005). Bones of domestic animals (sheep, cattle, horse, and dog) constituted the majority of all osteological remains (more than 80%) in the above-mentioned settlements. The herd composition was typical for nomadic pastoralism (Shnirel'man 1980; Masanov 1995).

But constant migration could not exist without any transport. Wagon parts and even unbroken wagons were discovered in burial complexes in the territory from the Ural to the Dnestr regions (Gej 2000; Shishlina 2007; Nikolova & Kaiser 2009). As mentioned above, wagon parts were found in Pit-Grave burials in the Ural region (Morgunova & Turetskij 2003) – in the burials of elderly people (Fig. 3: 9).

We would like to highlight a very important feature as a symbolic use of wagon parts in burials. A wagon seemed to be not only a means of transport for nomads, but also a home in everyday life; that is why they put only wheels or wagon parts in burials. Wheels were placed in the corners of burials, so that it would be the last home on wheels for the dead. The burial design with wheel remains allowed to find out how covered wagons (which were necessary for long travels) spread. Another interesting fact is that the Pit-Grave population made wheels for burials of poplar; this type of wood is not durable (Golyeva 2006). Probably these wheels were produced for burials, one set for one occasion.

Wheel transport was closely connected with carpentry development. A number of burials with specific tools served as evidence that professional carpenters appeared in the culture. Archaeologists discovered middle-aged men's burials accompanied with sets of tools for working with wood (axe, adze, big knife, gouge, pin, chisel) in some barrows of Orenburg oblast. All the finds were discovered in unusual kurgans, which seemed to be prepared for people of high social position considering the labor input for its construction and the burial features (Fig. 4).

People took advantage of all opportunities while developing cattle breeding – meat, milk products, leather, and wool. For example, the biomorphic analysis of sites in the Ural region and Kalmykia proved that wool and leather were widely used for production of underlay, pillows, and clothes (Morgunova et al. 2003; 2010a; Golyeva 2006). In three cases a good quality mat with a simple weave was discovered, which indicates the Pit-Grave culture weaving skills. There are some facts (not numerous though) – the presence of spindle whorls and bone curved awls which showed that weaving existed in previous Eneolithic cultures. What is more, after carrying out the technical and technological analysis of the Khvalynsk culture pottery researchers found out the ceramics was ornamented with imprints of textile goods (Orfinskaya et al. 1999; Shishlina 1999; Vasilyeva 2002).

A very important research about the weaving of Bronze Age steppe people in Kalmykia was conducted under the guidance of N. I. Shishlina. She obtained irrefutable evidence that weaving spread among tribes of the Pit-Grave and Catacomb cultures (Orfinskaya et al. 1999). Technological analysis of cloth fragments, imprints and mat allowed even to reconstruct the weaving looms. Archaeologists proved that people used both braiding and weaving textile production. The authors suppose that the simplest weaving devices (horizontal and vertical frames) appeared in Neolithic in steppe and people started to use the loom in the Pit-Grave culture.

The results of traceology by G. F. Korobkova also seemed to be very important. She analysed finds from the Mikhajlovka settlement (Korobkova & Shaposhnikova 2005). The research showed consistent evolution of cattle breeding in the Dniepr region starting from the Late Eneolithic to Pit-Grave Catacomb period. Multifunctional tools indicated special workshops (Mikhajlovka II–III settlements), which served as evidence of a high level of leather production. A substantial part of tools was used to make woolen yarn. People exploited simplest looms to weave cloth, which was proved by such finds as ceramic spindle whorls and weights (to keep the threads taut) (Korobkova & Shaposhnikova 2005, 249 ff.).

Thus, we have enough evidence demonstrating a developed, multicomponent cattle breeding of the Pit-Grave culture not only in the Ural region but also in all territory of the culture. Each type of the culture naturally has its own features, which appear due to natural conditions, cultural traditions, or cultural interaction. The Ural region was included into the system of the Volga–Ural type of the Pit-Grave culture and historical area. The Pit-Grave tribes probably spent spring,

summer and autumn in the Transvolga (the Samara River basin) and Ural regions. In winter they moved to the south, to the steppe of the northern Caspian region. Summer period seemed to be connected with another important activity of the Pit-Grave culture – metallurgy.

Metallurgy and metal-working

Archaeologists have discovered about 150 copper objects in total in the Volga–Ural region in the burials of the Pit-Grave culture, 70 of them – in the Ural region. Metallographic analysis was performed only for the Ural tools (Degtyareva 2003; 2010). Three metallurgical groups were singled out. *The first group* items (comprised about 80%) were made of pure copper with a low concentration of impurities. It included both numerous objects (such as knives and pins) and some unique tools (double butt hammer (Fig. 7: 2), bushing spear (Fig. 4: 3), adze-hammer (Fig. 7: 3), knives-daggers (Fig. 7: 6, 7), bimetallic adze-plane (Fig. 4: 6), adze (Fig. 7: 5), gouges (Fig. 7: 8, 9) and axes (Fig. 7: 4). The chemical composition of metal was similar to its corresponding centre in Kargala copper deposit (Chernykh 1966; 2002). It is important that the group included a knife and jewelry from burials of the early stage of the Pit-Grave culture burial ground – Gerasimovka II (Fig. 5: 11). *The second group* was also pretty numerous and included items of pure copper with increased concentration of lead (Pb), bismuth (Bi), and antimony (Sb). Besides knives and pins the group consisted of rare tools – an axe tooth (Fig. 7: 1), a pickaxe with no close plug (Fig. 7: 12) and an adze with trunnions. Similar composition of metal was discovered in some objects of the Cucuteni-Tripolye culture (Chernykh 1966; Ryndina 1998). Researchers thought that the origin of the metal was connected with the Balkan mining-metallurgical centre. *The third group* consists of only 3 items and its composition included arsenic impurity. The knife found in burial 10/3 of Boldyrevo I could be considered as an import from Caucasus as the concentration of As comprised more than 4.5%.

The Ural metallurgists cast sockets in open two- or three-side moulds with plug-in cores. They used well-heated clay and stone moulds. Big metal objects were made first with casting, then with hot forging, the reduction rate was about 50–60%. A big gouge with not close plug was made in preparation with forging. After performing all casting and forging operations metallurgists had high-quality tools, and faults were very rare. Blades of about 60% of tools were also forged cold. The strain hardening was frequently used in order to strengthen the metal. Metallurgists resorted to welding very rarely. It was discovered only in bimetal objects of copper and meteor iron.

We found the unified production technology for the first and second groups of tools. The ancient blacksmiths mainly used the Kargala copper. These two facts indicate a high level of local metallurgy, which was highly competitive with other contemporary metallurgical centres. It is confirmed by many finds – numerous objects in unique shapes, that had a slight resemblance only to tools from the Caucasus and western areas of the Black Sea region.



Fig. 7. Copper tools from the burials of the Pit-Grave culture of the Volga-Ural region. 1 Nizhnepavlovka V, k.1, b.2, 2 Uvak, k.12, b.4, 3, 10 Khutor Baryshnikov, k.6, b.3, 4-5, 8 Tamar-Utkul VII, k.8, b.4, 6 Boldyrevo I, k.2, b.1, 7 Uvak, k.12, b.4, 9 Paytiletka, k.5, b.2, 11 Zhaman-Kargala I, k.1, b.7, 12 Mustaev V, k.8.

Thus, the metallurgy of the Ural Pit-Grave culture had been based on local raw material of Kargala copper sandstone since the Repin period. It used to be the main source of metal till the end of the culture. Furthermore, there is evidence that the tools of the Ural metallurgical centre spread to the Middle and Lower Volga regions already at the early stage.

Conclusion

Comprehensive research of the Ural Pit-Grave sites thus provided a lot of new data concerning the chronology of the culture stages, allowed to describe the cultural continuity from the Khvalynsk-Berezhnovka stage till its decline in the Catacomb period. Radiocarbon dating confirmed the three-stage periodization of the Volga–Ural Pit-Grave culture; it included the Early, Developed and Late stages. Thus, the Pit-Grave culture existed in the period from the beginning of the 4th millennium BC till the beginning of the last quarter of the 3rd millennium BC. The data of paleopedological, paleoanthropological, technical and technological analyses of ceramics and metallography not only made a more detailed and precise description of every stage, but also provided evidence that the Pit-Grave culture was an ethnic multicomponent culture in the Volga–Ural region and it had relations with numerous contemporary cultures on the territory of Europe and Asia. Recent finds, e.g. wheel transport remains, proved the statement that cattle breeding was the predominant activity for the Pit-Grave tribes in the mentioned area. The analysis of the copper tools indicated that the culture population developed independent mining-metallurgical centre, used local copper deposits, and introduced technological innovations of metal working.

Acknowledgements

The authors are grateful to the Russian Humanitarian Scientific Fund for support with grant No. 14-01-00127 and the Russian Ministry of Education for help with the State Assignment No. 33.1471.2014K.

We are also grateful to the scholars, who assisted the comprehensive research of the materials found in the sites. Paleopedological analysis was performed by O. S. Khokhlova (Institute of Physical, Chemical, and Biological Problems of Soil Science, the Russian Academy of Sciences, Pushchino, Russia), microbiomorph and palynological analyses – A. A. Golyeva (Institute of Geography of the Russian Academy of Sciences, Moscow, Russia), anthropological analysis – A. A. Khokhlov (Samara State Academy of Social Sciences and Humanities, Samara, Russia), metallographic analysis – A. D. Degtyareva (Institute of Problems of Development North of the Russian Academy of Sciences, Tyumen, Russia), technical and technological analysis of ceramics – N. P. Salugina (Samara State Institute of Culture, Samara, Russia). The publication costs of this article were covered by the Estonian Academy of Sciences.

References

- Bibikova, V. I.** 1960. On the history of the domestication of the horse in the south-east Europe. – *Археология*, XXII, 55–67.
- Chernykh, E. N.** 1966. = **Черных Е. Н.** История древнейшей металлургии Восточной Европы. Наука, Москва.
- Chernykh, E. N.** 2002. Kargaly – ancient mining and metallurgical complex. – Древнейшие этапы горного дела и металлургии в Северной Евразии: Каргалинский комплекс. Ed. E. N. Chernykh. Институт археологии РАН, Москва, 7–10.
- Chernykh, E. N. & Orlovskaya, L. B.** 2004. Radiocarbon chronology of ancient Pit-Grave community and origin of Kurgan cultures. – *Российская археология*, 2, 39–47.
- Chernykh, E. N. & Orlovskaya, L. B.** 2011. Ceramics and radiocarbon dating within a Pit-Grave archaeological community: Interpretation problems. – Аналитические исследования лаборатории естественнонаучных методов. Ed. L. A. Belyaev. Институт археологии РАН, Москва, 2, 64–78.
- Chernykh, E. N., Kuzminykh, S. V., Lebedeva, E. Yu. & Lunkov, V. Yu.** 2000. Investigation of the kurgan cemetery near Pershin village. – Археологические памятники Оренбуржья. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, IV, 63–84.
- Degtyareva, A. D.** 2003. Metal products of Pit-Grave culture of southern Cis-Ural area. – **Моргунова Н. Л. и др.** Шумаевские курганы. Издательство Оренбургского государственного педагогического университета, Оренбург, 359–377.
- Degtyareva, A. D.** 2010. = **Дегтярева А. Д.** История металлопроизводства Южного Зауралья в эпоху бронзы. Наука, Новосибирск.
- Demkin, V. A., Solovyeva, U. I., Demkina, T. S. & Borisov, A. V.** 2006. Palaeoecology of the East European steppe during eras of an Eneolithic and Bronze. – Проблемы изучения ямной культурно-исторической области. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, 37–41.
- Gej, A. N.** 2000. = **Гей А. Н.** Новотиторская культура. Старый сад, Москва.
- Golyeva, A. A.** 2005. Organic raw materials in funeral monuments of Mustayevo barrows. – Археологические памятники Оренбуржья. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, VII, 70–85.
- Golyeva, A. A.** 2006. Features of use of organic material in Pit-Grave burials of the south of the Orenburg region. – Проблемы изучения ямной культурно-исторической области. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, 28–30.
- Ivanova, S. V.** 2006. The Pit-Grave cultural-historical community: Problems of formation in the light of radiocarbon dating. – *Российская археология*, 2, 113–120.
- Kaiser, E.** 2011. Problems of absolute dating of Catacomb culture of northern Black Sea coast. (Краткие сообщения Института археологии.) Institute of Archaeology RAN, Moscow, 225, 15–27.
- Khokhlov, A. A.** 2006. Main problems of a paleoanthropology of Pit-Grave culture. – Проблемы изучения ямной культурно-исторической области. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, 100–104.
- Khokhlova, O. S.** 2012. Soil evolution and paleoclimatic reconstruction derived from the study of the short and long-term pedochronosequences of the Skvortsovsky burial ground on the south of the Cis-Ural steppe region, Russia. – *Steppe Ecosystems: Dynamics, Land Use and Conservation*. Ed. D. M. Germano. Nova Science Publishers, New York, 81–100.
- Khokhlova, O. S., Khokhlov, A. A. & Morgunova, N. L.** 2006. Paleopedological study of the Pit-Grave culture kurgans on the southern Pre-Ural steppe of Russia. – *Archaeology of Burial Mounds*. Ed. L. Smejda. Plzeň, 78–82.
- Khokhlova, O. S., Khokhlov, A. A., Morgunova, N. L. & Yustus, A. A.** 2010. Short chronosequences of paleosols from the Skvortsovka kurgans in the Buzuluk River Valley of Orenburg Oblast. – *Eurasian Soil Science*, 9, 965–976.

- Korenevskij, S. N.** 2004. = **Кореневский С. Н.** Древнейшие земледельцы и скотоводы Предкавказья. Майкопско-новосвободненская общность. Проблемы внутренней типологии. Наука, Москва.
- Korenevskij, S. N. & Rezapkin, A. D.** 2008. Radiocarbon chronology of monuments of a circle of a Maikop barrow and Novosvobodnaya tombs. – Проблемы истории, филологии, культуры. Ed. M. G. Abramzon. Москва, Магнитогорск, Новосибирск, XXII, 109–127.
- Korobkova, G. F. & Shaposhnikova, O. G.** 2005. = **Коробкова Г. Ф. & Шапошникова О. Г.** Поселение Михайловка – эталонный памятник древнейшей культуры. Институт истории материальной культуры РАН, Санкт-Петербург.
- Kruglov, A. P. & Podgaetskij, G. V.** 1935. = **Круглов А. П. & Подгаецкий Г. В.** Родовое общество степей Восточной Европы. Москва, Ленинград.
- Kuznetsov, P. F.** 2007. Time for new cultural practices in the Bronze Age of the Volga-Ural region. – Радиоуглерод в археологических и палеоэкологических исследованиях. Eds G. I. Zaitseva & M. A. Kulkova. Teza Press, Санкт-Петербург, 216–224.
- Kuznetsov, P. F.** 2011. Pit-Grave barrows of a burial ground of Grachevka II in the Samara Volga region. – Археологические памятники Оренбуржья. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, IX, 75–92.
- Kuznetsov, P. F.** 2013. Dating of a monument at Repin Khutor and chronology of cultural and related materials of an era of Early Bronze of a steppe zone of Eastern Europe. – Российская археология, 1, 13–21.
- Lagodov'ska, O. F., Shaposhnikova, O. G. & Makarevich, M. L.** 1962. = **Лагодовська О. Ф., Шапошникова О. Г. & Макаревич М. Л.** Михайлівське поселення. Наукова думка, Київ.
- Masanov, N. E.** 1995. = **Масанов Н. Е.** Кочевая цивилизация казахов. Основы жизнедеятельности кочевнического общества. Социнвест, Алматы, Горизонт, Москва.
- Matyushin, G. N.** 1982. = **Матюшин Г. Н.** Энеолит Южного Урала. Наука, Москва.
- Merpert, N. Ya.** 1974. = **Мерперт Н. Я.** Древнейшие скотоводы Волжско-Уральского междуречья. Наука, Москва.
- Morgunova, N. L.** 1991. To a question of Poltavka culture. – Советская археология, 4, 123–131.
- Morgunova, N. L.** 1995. = **Моргунова Н. Л.** Неолит и энеолит юга лесостепи волго-уральского междуречья. Издательство Южный Урал, Оренбург.
- Morgunova, N. L.** 2014. = **Моргунова Н. Л.** Приуральская группа памятников в системе волжско-уральского варианта ямной культуры исторической области. Издательство Оренбургского государственного педагогического университета, Оренбург.
- Morgunova, N. L. & Khokhlova, O. S.** 2006. Kurgans and nomads: New investigations of mound burials in the southern Ural. – Antiquity, 80, 303–317.
- Morgunova, N. L. & Khokhlova, O. S.** 2013. Chronology and periodization of the Pit-Grave culture in the area between the Volga and Ural Rivers based on radiocarbon dating and paleopedological research. – Radiocarbon, 55: 2–3, 1286–1296.
- Morgunova, N. L. & Kravtsov, A. Yu.** 1994. = **Моргунова Н. Л. & Кравцов А. Ю.** Древняя культура на Илеке. Наука, Екатеринбург.
- Morgunova, N. L. & Turetskij, M. A.** 2003. Pit-Grave monuments at the village of Shumayevo: New data on wheel transport at the population of the western Orenburg Oblast during an era of Early Metal. (Вопросы археологии Поволжья.) Издательство Самарского научного центра РАН, Самара, 3, 144–159.
- Morgunova, N. L. & van der Plicht, J.** 2013. Results of radiocarbon dating of Tamar-Utkul barrows in the Orenburg region. – Известия Самарского научного центра РАН, Самара, 15: 5, 261–268.
- Morgunova, N. L., Gol'eva, A. A., Kraeva, L. A., Meshcheryakov, D. V., Turetskij, M. A., Khalyarin, M. V. & Khokhlova, O. S.** 2003. = **Моргунова Н. Л., Гольева А. А., Краева Л. А., Мещеряков Д. В., Турецкий М. А., Халяпин М. В. & Хохлова О. С.** Шумаевские курганы. Издательство Оренбургского государственного педагогического университета, Оренбург.
- Morgunova, N. L., Kraeva, L. A. & Matyushko, I. V.** 2005. Kurgan cemetery Mustaevo V. – Археологические памятники Оренбуржья. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, VII, 5–49.

- Morgunova, N. L., Gol'eva, A. A., Degtyareva, A. D., Evgen'ev, A. A., Kuptsova, L. V., Salugina, N. P., Khokhlova, O. S. & Khokhlov, A. A.** 2010a. = **Моргунова Н. Л., Гольева А. А., Дегтярева А. Д., Евгеньев А. А., Купцова Л. В., Салугина Н. П., Хохлова О. С. & Хохлов А. А.** Скворцовский курганный могильник. Издательство Оренбургского государственного педагогического университета, Оренбург.
- Morgunova, N. L., Vybornov, A. A., Kovalyukh, N. N. & Skripkin, V. V.** 2010b. Chronological relationship for the Eneolithic cultures of the Volga-Ural region based on radiocarbon dating. – *Российская археология*, 4, 18–27.
- Nikolova, A. V.** 1999. Radiocarbon dates from the graves of the Yamnaya culture at the Ingulets River (the Kirovohrad region). – *The Foundations of Radiocarbon Chronology of Cultures between the Vistula and Dnieper: 3150–1850 BC*. Ed. A. Koško. (Baltic-Pontic Studies, 7.) Poznan, 81–102.
- Nikolova, A. V. & Kaiser, E.** 2009. Die absolute Chronologie der Jamnaja-Kultur im nördlichen Schwarzmeergebiet auf der Grundlage erster dendrochronologischer Daten. – *Eurasia Antiqua*, 15, 209–240.
- Orfinskaya, O. V., Golikov, V. P. & Shishlina, N. I.** 1999. Complex experimental research of textile goods from the Bronze Age Eurasian steppes. – *Текстиль эпохи бронзы евразийских степей*. Ed. N. L. Shishlina. (Труды Государственного исторического музея.) Москва, 109, 58–184.
- Pustovalov, S. Zh.** 2003. The analysis of radiocarbon dates from burials of the Pit-Grave and Catacomb communities published in *Baltic-Pontic Studies*, No. 7, (1999). – *Vita Antiqua*, 5–6, 45–59.
- Ryndina, N. V.** 1998. = **Рындина Н. В.** Древнейшее металлообрабатывающее производство Юго-Восточной Европы. Эditorиал УРСС, Москва.
- Salugina, N. P.** 2005. Ceramic technology of the Repin type burials within the Pit-Grave culture of the Volga-Ural. – *Российская археология*, 3, 85–92.
- Shilov, V. P.** 1975. = **Шилов В. П.** Очерки по истории древних племен Нижнего Поволжья. Наука, Москва.
- Shishlina, N. I.** 1999. The Caspian Sea maritime steppes Bronze Age textile. – *Текстиль эпохи бронзы прикаспийских степей*. Ed. N. L. Shishlina. (Труды Государственного исторического музея.) Москва, 109, 7–53.
- Shishlina, N. I.** 2007. = **Шишлина Н. И.** Северо-Западный Прикаспий в эпоху бронзы (V–III тысячелетия до н.э.). (Труды Государственного исторического музея.) Москва.
- Shnirel'man, V. A.** 1980. = **Шнирельман В. А.** Происхождение скотоводства. Наука, Москва.
- Sinitsyn, I. V.** 1957. Monuments of Lower Volga area and their communication with Pridneprovye. (Краткие сообщения Института археологии.) Киев, 7, 32–35.
- Smirnov, K. F.** 1965. Drevneyamny culture in the Orenburg steppes. – *Новое в советской археологии*. Наука, Москва, 156–159.
- Spiridonova, E. A. & Aleshinskaya, A. S.** 1999. Periodization of the Neolithic-Eneolithic of the European Russia according to the palynological analysis. – *Российская археология*, 1, 23–33.
- Tsalkin, V. I.** 1970. = **Цалкин В. И.** Древнейшие домашние животные Восточной Европы. Наука, Москва.
- Turetskij, M. A.** 1999. Middle Volga and Cis-Ural variant of Pit-Grave culture. – *Археологические памятники Оренбуржья*. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, III, 6–11.
- Turetskij, M. A.** 2007. Problems of cultural genesis in the Early – beginning of Middle Bronze Age in the steppe zone of the Volga-Ural region. – *Археологические памятники Оренбуржья*. Ed. N. L. Morgunova. Издательство Оренбургского государственного педагогического университета, Оренбург, VIII, 116–129.
- Vasil'ev, I. B.** 1981. = **Васильев И. Б.** Энеолит Поволжья. Степь и лесостепь. Издательство Куйбышевского государственного педагогического института, Куйбышев.
- Vasilyeva, I. N.** 2002. About technology of ceramics of the I Hvalynsk Eneolithic burial ground. – *Вопросы археологии Поволжья*. Самара, 2, 15–49.

Nina L. Morgunova ja Mikhail A. Turetskij

**VOLGA JA UURALI JÕGEDEVAHELISE ALA AUKHAUDADE
(JAMNAJA) KULTUURI KÄÄBASTE ARHEOLOOGILISED
NING LOODUSTEADUSLIKUD UURINGUD**

Resümee

Artiklis on käsitletud aukhaudade (Jamnaja) kultuuri ühe piirkonna, Volga ja Uurali jõgedevaheline ala Lõuna-Uuralis, interdistsiplinaarsete uuringute tulemusi.

Esmalt on kirjeldatud aukhaudade kultuuri Uurali-lähedase rühma matmisviisi ja hauapanuseid. Autorid eristavad (vastavalt N. Ya. Merperti klassifikatsioonile) maeti asukoha ja asendi alusel hauas erinevaid rituaalrühmi. Peamiselt asetati surnud kas selili või paremale küljele lihtsatesse aukhaudadesse või keerulisematesse astmelistesse hauasüvenditesse ja kaeti kääbastega.

Aukhaudade kultuur kujunes vaadeldavas regioonis 5. aastatuhande lõpul ja 4. aastatuhande algul eKr Sredni Stogi kultuuri ning Kesk-Volga metsastepi rahvarühmade kaaslusel Hvalõnski eneoliitilise kultuuri põhjal. Enam kui 120 radio-süsinikudateeringut osutavad aukhaudade kultuuri eksisteerimisele ajavahemikul 3900–2300 aastat eKr ja selle arengus võib eristada kolme staadiumi (varane ehk Repini etapp, nn arenenud etapp ning hiline ehk Poltavka etapp).

Lisaks arheoloogiale on läbi viidud ka paleopedoloogilisi, palünoloogilisi, metallograafilisi, keemilisi ja tehnoloogiaalaseid uuringuid. Ka aukhaudade kultuuri inimeste majandusviisi kohta on kogunenud uusi andmeid.

Artiklis on esitatud kontseptsioon, mille kohaselt oli aukhaudade hõimude majandusviisi aluseks mobiilne karjakasvatus. Nomaadlevat karjakasvatust kinnitavad mitmed tõendid, nagu ilmastik, asulakohtade puudumine aukhaudade kultuuri Volga-Uurali variandis, karjade koosseis (peamiselt lambad, harvemini veised ja hobused), transpordivahendite olemasolu (millele osutavad haudadest leitud vankri-rattad) ning villase kanga ja naha kasutamine matmisrituaalides.

Uurali-lähedase aukhaudade kultuuri rühma metallitööndus baseerus kohalikul, Lõuna-Uurali Kargala vaseliivakividest pärit toormel. Sealsest metallitöönduse keskusest jõudsid mõjutused ka Doni piirkonna aukhaudade kultuurirühmadeni ja Alam- ning eriti Kesk-Volga alale. Teine Uurali lähiste metallitöönduse keskuse mõjusuund oli Uurali-ülene ja Toboli piirkond ning Afanasjevo kultuuri ala Altais.