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TECHNICAL AND TECHNOLOGICAL ANALYSIS OF CERAMICS FROM THE FYODOROVKA CULTURE SITES OF THE BRONZE AGE IN CENTRAL KAZAKHSTAN¹

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The article presents a study of the ceramics production technology of the Fyodorovka archaeological culture (Bronze Age, Central Kazakhstan). The relevance of the work is due to the insufficient study of this cultural formation in the Kazakhstan region, which is associated with a limited number of archaeological studies and uneven distribution across the territory. The aim of the study is to reconstruct local production traditions and analyze the technological features of the Fyodorovka ceramics production. For this purpose, materials from 17 sites in Central Kazakhstan were studied; vessels from the Lisakovsky 1 burial ground (Northern Kazakhstan) were used for comparison. The study was conducted according to the methodology of A. A. Bobrinsky. The following were analyzed: raw materials and pottery pastes; techniques for constructing the “seed-bodies” and hollow bodies of vessels; surface treatment methods; technologies for imparting strength and eliminating moisture permeability (a firing). A comparison of Central Kazakhstan ceramics with Fyodorovka materials from the Lisakovsky 1 burial ground revealed similar technological traditions (raw material selection, pottery paste recipes, and construction methods), with some regional differences (the use of gruss in Central Kazakhstan and chamotte in Northern Kazakhstan). It was confirmed that the wall only “seed-bodies” can serve as an indicator of the ceramics' affiliation with the Fyodorovka culture, while vessels with the bottom to wall «seed-bodies» are associated with the Alakul culture. The data obtained provide a basis for further comparative research and can be used in the study of other regions and cultures of the Bronze Age.

Keywords: archaeology, Kazakhstan, the Bronze Age, Andronovo cultural-historical community, Fyodorovka culture, burial grounds, settlements, ceramic, technical and technological analysis, comparative analysis.

ТЕХНИКО-ТЕХНОЛОГИЧЕСКИЙ АНАЛИЗ КЕРАМИКИ ПАМЯТНИКОВ ФЕДОРОВСКОЙ КУЛЬТУРЫ ЭПОХИ БРОНЗЫ ЦЕНТРАЛЬНОГО КАЗАХСТАНА²

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В статье представлено исследование технологии изготовления керамики федоровской археологической культуры (эпоха бронзы, Центральный Казахстан). Актуальность работы обусловлена недостаточной изученностью данной культурной формации в казахстанском регионе, что связано с ограниченным числом археологических исследований и неравномерностью их распределения по территории. Цель исследования – реконструкция локальных производственных традиций и анализ технологических особенностей изготовления федоровской керамики. Для этого изучены материалы 17 памятников Центрального Казахстана; для сравнения привлечены сосуды из могильника Лисаковский-1 (Северный Казахстан). Исследование проводилось по методике А. А. Бобринского. Анализировались: исходное сырье и формовочные массы; приемы конструирования начинов и полового тела сосудов; способы обработки поверхности; технологии придания прочности и устранения влагопроницаемости (обжиг). Сравнение центрально-казахстанской керамики с федоровскими материалами могильника Лисаковский-1 показало близость технологических традиций (выбор сырья, рецептов формовочных масс, способов конструирования), при некоторых региональных особенностях (использование дресвы в Центральном Казахстане, шамота – в Северном Казахстане). Подтверждено, что емкостные начини

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2 Работа выполнена при финансовой поддержке Комитета науки Министерства науки и высшего образования Республики Казахстан, тема исследования – «Исследование гидротехнических сооружений эпохи бронзы Центрального Казахстана: локализация, картографирование, конструктивные особенности, функциональное назначение» (IRN AP26100535).

могут служить индикатором принадлежности керамики к федоровской культуре, тогда как сосуды с донно-емкостными начинками связаны с алакульской культурой. Полученные данные создают основу для дальнейших сравнительных исследований и могут быть использованы при изучении других регионов и культур эпохи бронзы.

Ключевые слова: археология, Казахстан, бронзовый век, андроновская культурно-историческая общность, федоровская культура, могильники, поселения, керамика, технико-технологический анализ, сравнительный анализ.

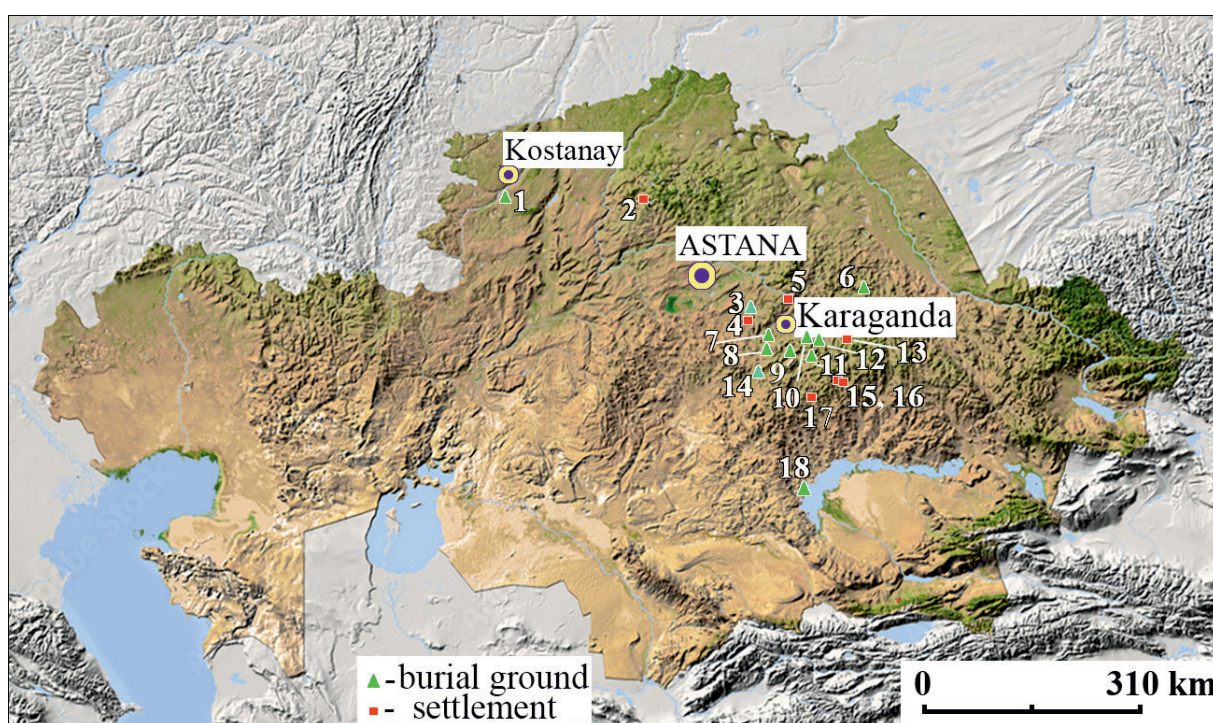


Fig. 1. The location of the sites analysed in this paper: 1 – b.g. Lisakovsky-1; 2 – settl. Shagalaly-2; 3 – b.g. Ikpen-1; 4 – settl. – Ikpen-2; 5 – settl. Kreshchenovka; 6 – b.g. Ayappergen; 7 – b.g. Sherubay-1; 8 – b.g. Dar'insky; 9 – b.g. Taldinsky-1; 10 – b.g. Korzhar; 11 – b.g. Bada; 12 – b.g. Besoba; 13 – Bakybulak; 14 – b.g. Akbaybishe, 15, 16 – Karatal-1, 2; 17 – settl. Atasu-1; 18 – b.g. Tasaral (b.g. – burial ground; settl. – settlement)

Рис. 1. Местонахождение памятников, проанализированных в работе: 1 – мог. Лисаковский-1; 2 – пос. Шагала-2; 3 – мог. Икпень-1; 4 – пос. – Икпень-2; 5 – пос. Крещеновка; 6 – мог. Аяпперген; 7 – мог. Шерубай-1; 8 – мог. Дарьинский; 9 – мог. Талдинский-1; 10 – мог. Коржар; 11 – мог. Бада; 12 – мог. Бесоба; 13 – пос. Бакубулак; 14 – мог. Акбайбише; 15, 16 – пос. Каратал-1, 2; 17 – пос. Атасу-1; 18 – мог. Тасарал

Central Kazakhstan, with its rich historical heritage, is a unique territory for the study of ancient cultures. One of the least studied cultural formations in the region is the Fyodorovka archaeological culture, which was part of the Andronovo cultural-historical community of the Bronze Age in Kazakhstan, the Southern Urals, and Western Siberia.

The dearth of scientific data on the Fyodorovka culture in Kazakhstan is due to several factors. A key issue is the insufficient number of archaeological studies conducted on settlement and burial complexes. Another limiting factor is the uneven distribution of research, leading to significant gaps in the study of specific

Kazakhstan territories. Thanks to research by the Saryarka Archaeological Institute at the Buketov Karaganda National Research University, Central Kazakhstan has been studied more extensively than other regions.

Archaeological analysis of Fyodorovka sites reveals a remarkable pattern: despite significant territorial fragmentation, there is a marked unification of ceramic assemblages. This trend is reflected in the high degree of similarity in the morphological and stylistic characteristics of pottery.

The pottery traditions of the Fyodorovka culture are actively studied by archaeologists in Western Siberia (Gutkov et al., 2014; Ilyushina,

2009; 2014a; 2014b; 2015; 2017; 2019; Savko, 2021 a-c; 2023 a, b; Savko et al., 2023; Stepanova, Savko, 2022). However, in Kazakhstan, research aimed at reconstructing local production traditions and analyzing the technological features of Fyodorovka ceramics is still in its infancy. This necessitates the accumulation and systematization of material for a comprehensive study of the technological aspects of Fyodorovka ceramic production.

This article presents the results of a study of Fyodorovka ceramic technology in Central Kazakhstan based on materials from 17 sites (10 burial grounds and 7 settlements – Fig. 1). Vessels from the Fyodorovka section of the Lisakovsky-1 cemetery (Kostanay Region, Northern Kazakhstan) were used for comparison. The study followed A.A. Bobrinsky's methodology (1978, 1999) using an MBS-10 binocular microscope.

Ceramics from burial grounds (Central Kazakhstan). A total of 64 vessels from 10 burial grounds were analyzed (Fig. 2; Fig. 3). Raw materials and pottery pastes were studied for all samples, construction techniques were analyzed for 38 samples. For 60 vessel fragments, only techniques related to the hollow body were studied, as the bases were missing. Surface treatment was analyzed for 50 vessels.

Raw materials. Three types of raw materials were used in the production of ceramics: 1) low-ferrous clays – 7.9%, 2) medium-ferrous clays – 81.2%, 3) highly-ferrous clays – 10.9%.

Based on fine natural sand content, low-ferrous clays are classified as low-sanded, while highly-ferrous clays are classified as medium-sanded. Medium-ferrous clays are subdivided into low-sanded (32.7%), medium-sanded (61.5%), and highly sanded (5.8%). Overall, preference was given to medium-ferrous, medium-sanded clays (used in 50% of all vessels).

Pottery pastes. The following types of artificial additives to clay were used: organic – herbivore manure or extracts; organo-mineral – bone (1.6%); mineral – broken stone temper (81.3%), sand (15.6%), chamotte (9.3%), and talc (1.6%). Six pottery paste recipes were noted, with variations:

- 1) clay + Sand
 - a) + manure – 12.5%,
 - b) + organic matter – 1.6%,
- 2) clay + Broken stone temper
 - a) + manure – 46.8%,

- b) + organic matter – 28.0%,
- 3) clay + Sand + Chamotte + manure – 1.6%,
- 4) clay + Broken stone temper + Chamotte + manure – 6.3%,
- 5) clay + Talc + Chamotte + manure – 1.6%,
- 6) clay + Broken stone temper + Bone + manure – 1.6%.

The predominant recipe was "clay + broken stone temper + manure/organic matter," accounting for 74.8% of samples. Notably, the Ikpen-1 burial ground lacked broken stone temper, utilizing sand and chamotte instead.

Broken stone temper was primarily used (60.4%) of medium size, in concentrations of 1:3 (15.6%), 1:4 (46.9%), and 1:5 (37.5%). Fine broken stone temper (11.3%), in concentrations of 1:3 and 1:4, and coarse broken stone temper (28.3%), in concentrations of 1:3 (6.7%), 1:4 (53.3%), and 1:5 (40.0%) was also used. Overall, the 1:4 concentration was predominant (49.1% of all samples).

The use of fine, medium, and coarse sand was noted in 10 vessels (15.7%), in concentrations ranging from 1:2 to 1:5.

Chamotte was found in the pottery paste of six vessels (9.5%) from the Ikpen-1 and Sherubay-1 burial grounds, exclusively in mixed recipes with sand, broken stone temper, and talc. Its size ranged from medium to coarse, with concentrations of 1:4 and 1:5.

A single vessel with crushed bone added (small size, at a concentration of 1:6) was discovered at the Korzhar burial ground.

Recipes with chamotte are almost completely absent from the ceramics of Central Kazakhstan. Only at the Ikpen-1 burial ground were two vessels found using mixed recipes: "clay + Broken stone temper + Chamotte + manure" and clay + Talc (medium size, at a concentration of 1:4) + Chamotte + manure."

Construction of the "seed-body". Only one method was identified: the wall only «seed-body» (Fig. 4), belonging to the composite group, a subgroup of patch building. Based on the manufacturing method, the "seed-bodies" are divided into: type 1 – patchwork-lumpy (86.8% of all vessels), subtype a – single-layer (63.6% of patchwork-lumpy), subtype b – double-layer (36.4%); type 2 – patchwork-spiral (13.2% of all vessels), subtype – single-layer.

Hollow body construction. The identified construction methods belong to the manual class, the composite group, the patchwork subgroup, the

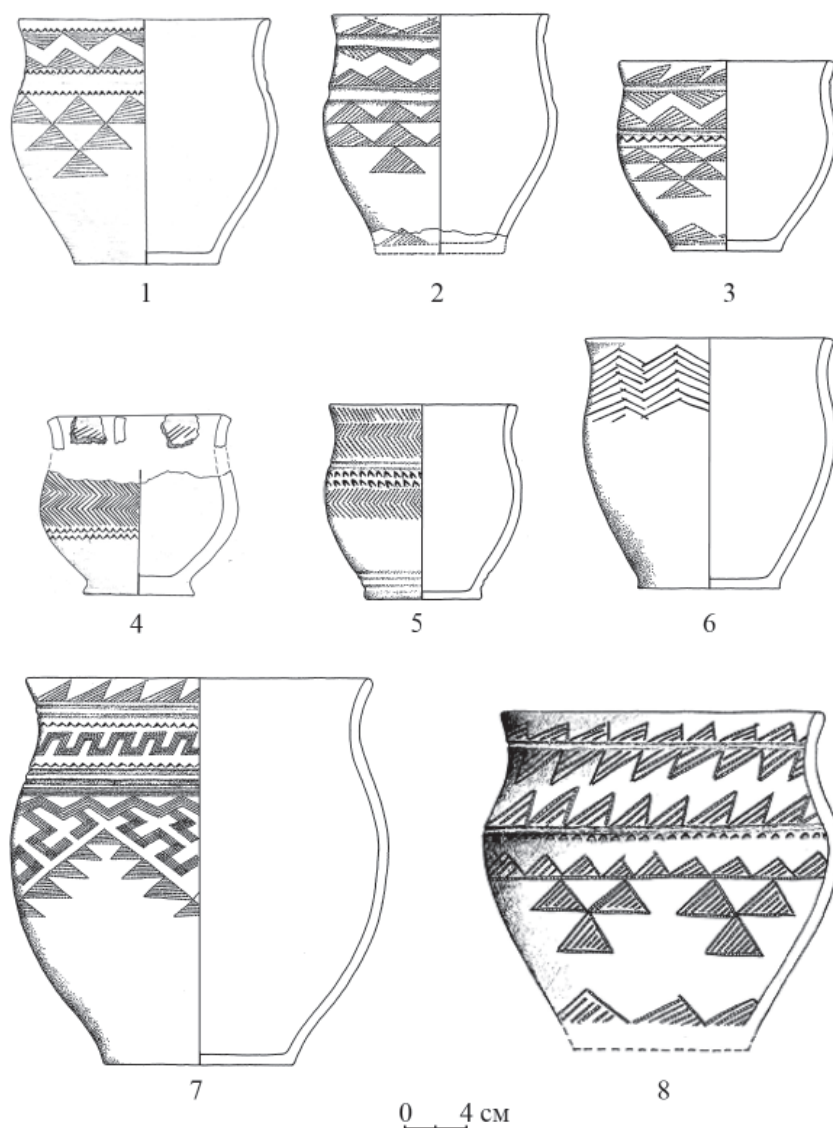


Fig. 2. Ceramics of the Fyodorovka culture from the burial grounds of Central Kazakhstan: 1, 4 – Bada (Varfolomeev, Loman, 2017, Fig. 1); 2, 3, 5-7 – Korzhar (Varfolomeev V.V. et al., 2019, Fig. 4); 8 – Taldinsky-1 (Kukushkin et al., 2020, Fig. 1)

Рис. 2. Керамика могильников федоровской культуры Центрального Казахстана: 1, 4 – мог. Бада (Варфоломеев, Ломан, 2017, рис. 1); 2, 3, 5-7 – мог. Коржар (Варфоломеев В.В. и др., 2019, рис. 4); 8 – мог. Талдинский-1 (Кукушкин и др., 2020, рис. 1)

patchwork-lumpy (90.0%) and patchwork-spiral types, and the single-layer subtype (10.0%). Within the patchwork-lumpy subtypes, the following subtypes are distinguished: a) single-layer (56.7% of all vessels) and b) double-layer (33.3% – Fig. 5).

Technological schemes for vessel construction.

1. The wall only “seed-body” with patchwork-lumpy walls (86.9%): a) in one layer and a bottom made of one layer of patches (42.1% of

all vessels), b) in one layer and a bottom made of two layers of patches (13.2%), c) in two layers and a bottom in one layer (21.1%), d) in two layers both walls and bottom (10.5%);

2. The wall only “seed-body” with walls made of patches along a spiral trajectory (13.1%): a) in one layer and a bottom in one layer (10.5% of all vessels), b) in one layer and a bottom in two layers (2.6%).

Shaping. The ceramics were made in a mould-capacity, sewn together, judging by the

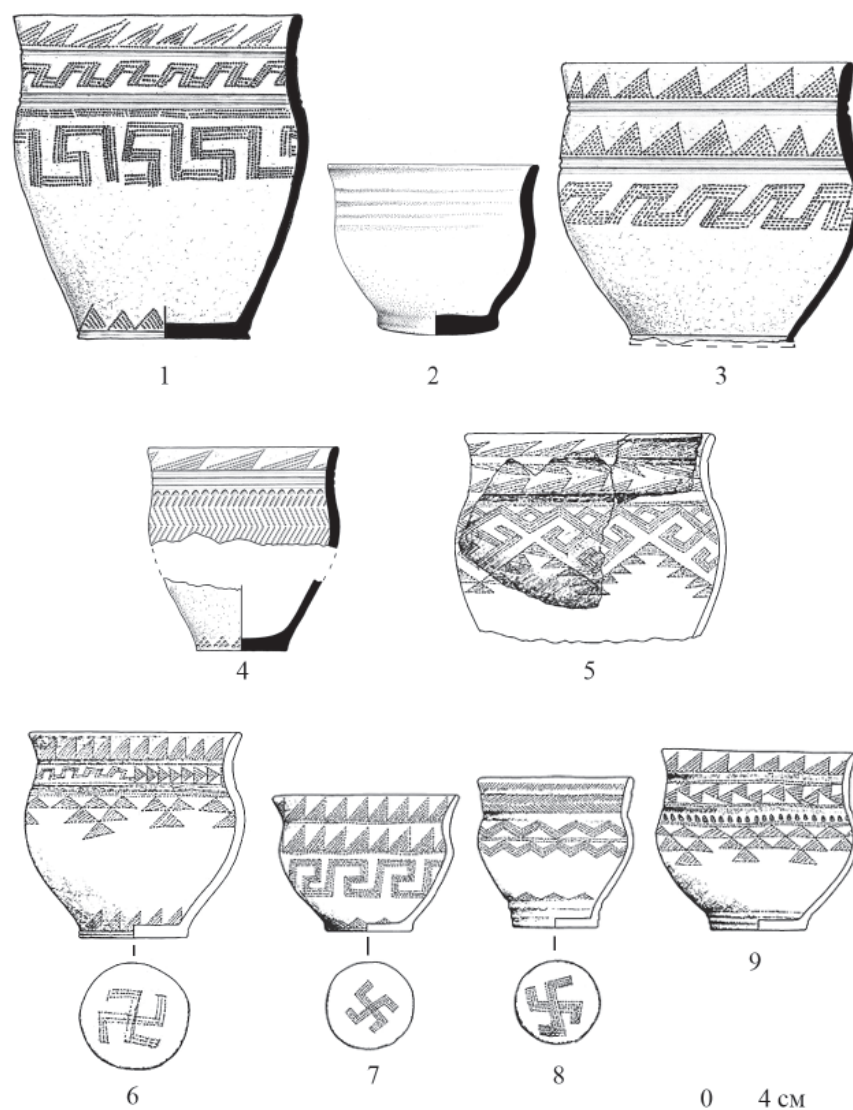


Fig. 3. Ceramics of the Fyodorovka culture from the burial grounds of Central Kazakhstan: 1-4 – Dar'insky (Loman, Kukushkin, 2012, Fig. 12, Fig. 13); 5, 6 – Besoba (Kukushkin, Dmitriev, 2017, Fig. 8); 7-9 – Sherubay-1 (Kukushkin, Dmitriev, 2018, Fig. 3)

Рис. 3. Керамика могильников федоровской культуры Центрального Казахстана: 1-4 – мог. Дарьинский (Ломан, Кукушкин, 2012, рис. 12, рис. 13); 5, 6 – мог. Бесоба (Кукушкин, Дмитриев, 2017, рис. 8); 7-9 – мог. Шерубай-1 (Кукушкин, Дмитриев, 2018, рис. 3)

imprints preserved on the outer surfaces of the vessels, from leather or fabric. Finger squeezing and hammering were used for shaping. On some vessels, rims were formed using an applied coil.

Surface treatment. Fifty vessels were identified using methods related to two trends in the development of surface treatment skills:

Without coating treatment (90.0% of all vessels used to determine surface treatment):

Class I. Smoothing (36.0% of all vessels).

Group 1. Simple (20.0%): type 1 – with fingers (4.0% of all vessels), type 2 – with a leather flap (10.0%), type 3 – with fabric (2.0% of all vessels), type 4 – with sheepskin (4.0%).

Group 2. Furrowed (16.0%): type 1 – with grass (12.0%), type 2 – with chip (4.0%).

Class II. Burnishing (54.0%). Group 1. Simple. Subgroup 1 – on a dried base.

Coating treatment (10.0%): five vessels were coated with clay plaster (slip), with two having

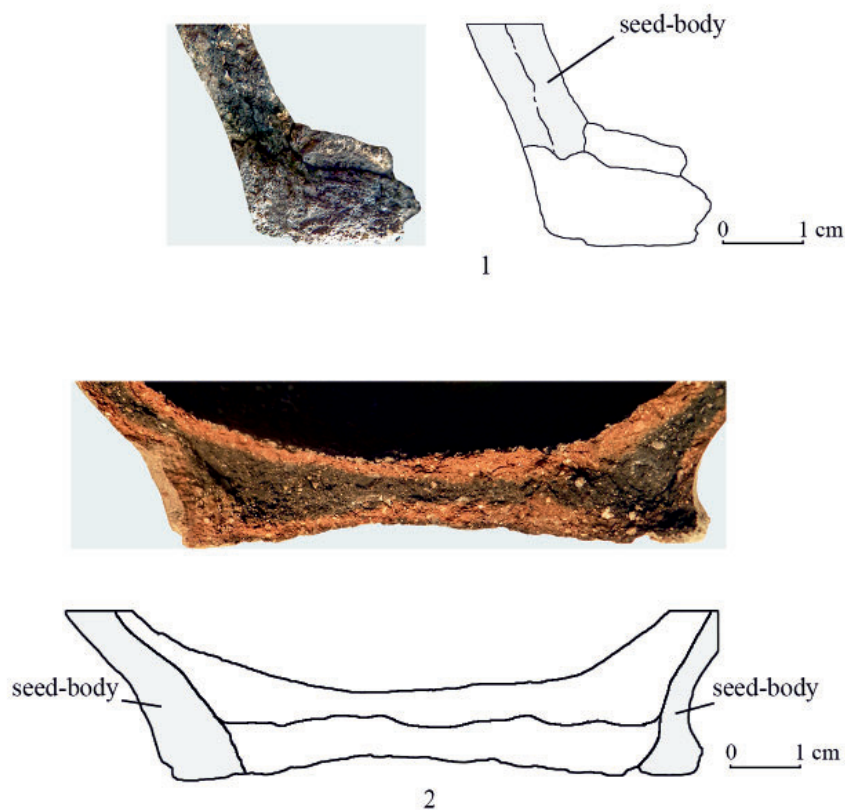


Fig. 4. Burial ground Korzhar: 1, 2 – the wall only “seed-bodies”

Рис. 4. Могильник Коржар: 1, 2 – емкостные начинны

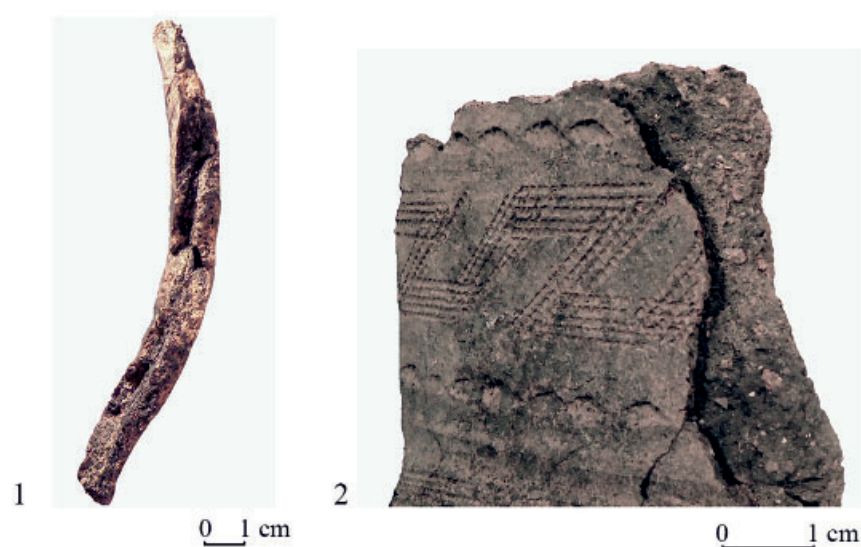


Fig. 5. Patchwork-lumpy double-layer hollow body: 1 – burial ground Sherubay-1; 2 – burial ground Korzhar

Рис. 5. Лоскутно-комковатое полое тело в два слоя: 1 – могильник Шерубай-1; 2 – могильник Коржар

the inner surface coated and three having the outer surface (Fig. 6).

Note the combinations of methods from different directions: two vessels from the Besoba burial ground had their outer surface coated with clay plaster, then burnished in one of them, and smoothed with a leather flap in the other. Five vessels from the Dar'insky burial ground had their outer surface burnished, and the inner surface smoothed with a leather flap (three vessels) or grass (two vessels). One of the vessels from the Sherubay-1 burial site had its outer surface coated with plaster, then smoothed with grass, and its inner surface smoothed with grass.

Imparting strength to vessels and eliminating moisture permeability.

Firing in a reducing environment – 43.9%, including: short-term low-temperature firing – 92.0%, rapid rise in low final temperatures and rapid cessation of their effect – 8.0%,

Firing in an oxidizing environment, partial exposure to annealing temperatures – 56.1%, including: rapid rise in temperature and short holding at the final temperature – 78.0%, cooling in the firing device with a rapid drop in final temperatures – 22.0%.

Ceramics from the Lisakovsky-1 burial ground (Northern Kazakhstan). A total of 39 vessels were studied. The raw materials and pottery pastes were analysed for all samples, and the construction techniques of the “seed-bodies” were analysed for 23. For fragments of 26 vessels, only those related to the construction of a hollow body could be studied, as the bases were missing. Surface treatment was analysed for 29 vessels.

Raw materials. The use of three types of raw materials was revealed: 1) medium-ferrous clays – 84.6%, 2) highly ferrous-rich clays – 12.8%, 3) a mixture of non-ferrous and medium-ferrous clays – 2.6%.

Medium-ferrous clays are predominantly (57.6%) slightly sanded, while highly-ferrous clays are all moderately sanded. A clear preference for medium-ferrous clays is evident in both regions, with a difference in the degree of sand content.

Pottery pastes. The following artificial clay additives were used in the production of Lisakovsky-1 burial ground ceramics: organic – herbivorous animal manure or its extract; organo-mineral – freshwater mollusc shells (5.1%); mineral – chamotte (74.4%) and sand (38.5%).



Fig. 6. Coating treatment of the outer surface (burial ground Sherubay-1)

Рис. 6. Обмазка внешней поверхности (могильник Шерубай-1)

The ceramics were made using four pottery paste recipes:

- 1) clay + Sand
 - a) + manure – 12.8%,
 - b) + organic matter – 12.8%,
- 2) clay + Chamotte
 - a) + manure – 43.7%,
 - b) + organic matter – 12.8%,
- 3) clay + Sand + Chamotte + manure – 12.8%,
- 4) clay + Chamotte + Shell + manure – 5.1%.

The main recipe was “clay + Chamotte + manure/organic matter” (56.5%). Chamotte was also noted in mixed recipes with sand and crushed shell.

Chamotte of medium size (51.7%) was used in concentrations of 1:3 (13.3%), 1:4 (26.7%), and 1:5 (60.0%), and coarse (48.3%), in concentrations of 1:3 (21.4%) and 1:5 (78.6%).

Chamotte had a medium ferrous content in 62.1% of cases, high ferrous content in 24.1%, and low ferrous content in 13.8%.

Fine sand (20.0%) was used in a 1:2 concentration, medium sand (73.3%) in concentrations

from 1:2 to 1:5, with 1:3 being the predominant concentration, and coarse sand (6.7%) in a 1:4 concentration.

Construction of the "seed-body". The "seed-bodies" of the Fyodorovka vessels from the Lisakovsky-1 burial ground were constructed exclusively using the wall only «seed-body» programme, patchwork-lumpy type with subtypes: a) single-layer (52.2%) and b) double-layer (47.8%).

Construction of the hollow body. The hollow body construction methods of the Lisakovsky-1 vessels belong to the handcrafted class, the composite group, the patchwork subgroup, the patchwork-lumpy type, and the subtypes: a) single-layer (57.7%) and b) double-layer (42.3%).

Technological schemes for vessel construction.

One TS was identified for 23 vessels with the following variants:

1. The wall only «seed-body» with patchwork-lumpy walls (100.0%): a) single layer and a bottom made of a single layer of patches (4.3%), b) single layer and a bottom made of two layers of patches (47.8%), c) two layers and a single-layer bottom (8.7%), d) two layers of both walls and bottom (39.2%).

Some bottoms were attached to the "seed-body" from the inside using clay coil.

Shaping. Some vessels were made using a mould-base. Finger squeezing and knocking were used for shaping.

Surface treatment. Without coating treatment (89.7% of all vessels for which surface treatment was determined).

Group 1. Simple (13.8%): type 1 – with fingers (1 specimen), type 2 – with a leather flap (1 specimen), type 3 – with fabric (1 specimen), type 4 – with a wooden scraper (1 specimen).

Group 2. Furrowed (10.3% of all vessels): type 1 – with grass (2 specimens), type 2 – with a chip (1 specimen).

Class II. Burnishing (65.5%).

Group 1. Simple. Subgroup 1 – on a dried base.

Coating treatment (37.9%): clay coating covered the outer surface of 45.5% of vessels, the inner surface of 27.2%, and both surfaces of 27.2%. A combination of methods was also used: six vessels had their outer surfaces coated and then polished, while two of them also had a coated inner surface. Two vessels had a polished outer surface and a coated inner surface.

Imparting strength to vessels and eliminating moisture permeability.

Firing in a reducing environment accounted for 64.1% of the total, including: short-term low-temperature firing (84.0%), rapid rise in low final temperatures and rapid cessation of their effect (8.0%), and prolonged exposure to low temperatures (8.0%).

Firing in an oxidizing environment, partial exposure to annealing temperatures with a rapid temperature rise and short hold at the final temperature (35.9%).

Let us separately consider a specific category of the Fyodorovka "set" – the so-called "dishes", which are usually found in burial grounds located to the north of Central Kazakhstan, although they are also occasionally found in settlements (Kargat-6 in the Baraba forest-steppe (Molodin, 1985, p. 102), Ushkatty and Tasty-Butak (Gryaznov, 1966, p. 13), Lisakovskoye (Usmanova, 2005, p. 91)), including those in Central Kazakhstan (Ust-Kenetai (Evdokimov, 1982, Fig. 4: 3). "Dishes" are quite rare – no more than 50 specimens have been found (Popkova, 2018). These items have the appearance of small rectangular or oval trays with low walls and rounded corners, which can be equipped with molded or applied flat protrusions.

Four "dishes" from the Lisakovsky-1 burial ground were studied.

Raw materials. Medium-ferrous clay with medium sand content (1 specimen) and weakly sanded clay (1 specimen), a mixture of medium-ferrous clay with high sand content in a wet state and low-ferrous clay in a dry state (1 specimen), as well as silty clay (1 specimen) were used. All samples contain detrital brown ironstone, fine and medium quartz sand, and two contain a natural admixture of mica.

A technical and technological analysis revealed that, in terms of the characteristics of the raw materials and the pottery pastes recipes, the "dishes" are no different from the main ceramic collection of the Lisakovsky-1 burial ground. It is worth noting that the same concentrate of two types of clay, as in one of the "dishes," was used at the burial ground to make some Alakul vessels.

Pottery pastes. One recipe was recorded: clay + Chamotte + manure. Chamotte was used in fine (1 specimen) and medium (3 specimens) sizes, in concentrations of 1:4 (2 specimens), 1:5 (1 specimen), and 1:6 (1 specimen), and had a low (3

specimens) and medium (1 specimen) degree of iron content.

Construction.

The three “dishes” were made by sculpting and finger pressing on a flat surface using a patchwork-lump method (in two layers), using the bottom to wall «seed-body» program, simultaneously creating the bottom and low walls. Corner projections were molded, with two examples having them at the corners of the top of the piece, and one at the transition from the walls to the bottom. The construction method of the fourth example is interesting: first, also using a patchwork-and-lumpy technique on a flat surface, a tray was created, into the ends of which transverse walls were then embedded. The corner projections were glued on.

Ceramics from the settlements of Central Kazakhstan.

Fragments of 212 vessels from 7 settlements were studied. The raw materials and pottery pastes were analysed for all vessels, the “seed-bodies” construction methods were analysed for 31 vessels, the hollow body construction methods were analysed for 144 vessels, and the surface treatment methods were determined for 119 vessels.

Raw materials. Overall, the settlement materials revealed the use of 5 types of raw materials:

- 1) non-ferrous clay – 0.5%,
- 2) low-ferrous clay – 3.3%,
- 3) medium-ferrous clay – 63.7%,
- 4) highly ferrous clay – 31.6%,
- 5) a mixture of clay and kaolin – 0.9%.

The use of low-ferrous clay is recorded at the settlements of Atasu-1 (medium sandy) and Kreshchenovka (lightly sandy) (one vessel at each), while non-ferrous clay (lightly sandy) was found in only one vessel at the settlement of Ikpen-2.

The primary raw material at the settlements of Atasu-1, Ikpen-2, Karatal-2, and Shagalaly-2 was medium-ferrous clay, while at the settlements of Bakybulak, Karatal-1, and Kreshchenovka, it was highly ferrous clay. A mixture of clay with crushed kaolin was recorded in two vessels at the settlement of Kreshchenovka.

Based on the concentration of natural fine sand, medium-ferrous clays were predominantly used (78.7%) medium-sand. Highly sandy medium-ferrous clays were found in small quantities (5.1%) at the Karatal-2 and Shagalaly-2 settle-

ments, while weakly sandy clays (16.2%) were found at Atasu-1, Ikpen-2, and Shagalaly-2.

Highly ferrous clays were found with medium sand content (64.7%), while highly sandy clays (5.9%) were found at the Karatal-1 settlement. Low sandy highly ferrous clays (29.4%) were used primarily at the Kreshchenovka settlement and were also noted at the Ikpen-2 and Shagalaly-2 settlements (one vessel at each).

Pottery pastes. The following types of clay additives were used in the composition of the pottery pastes: organic – manure of herbivorous animals or its extract; minerals – broken stone temper (73.6%), chamotte (19.8%), sand (9.0%), talc (0.5%), metallurgical slag (0.5%).

Nine recipes were recorded for the composition of pottery pastes:

- 1) clay + Sand
 - + a) manure – 2.7%
 - + b) organic matter – 5.7%
- 2) clay + Broken stone temper
 - + a) manure – 34.9%
 - + b) organic matter – 35.4%
- 3) clay + Chamotte
 - + a) manure – 6.5%
 - + b) organic matter – 9.4%
- 4) clay + Broken stone temper + Chamotte
 - + a) manure – 2.4%
 - + b) organic matter – 0.5%
- 5) clay + Sand + Chamotte + manure – 0.5%
- 6) clay + Broken stone temper + Metallurgical slag + manure – 0.5%
- 7) clay + Talc + manure – 0.5%
- 8) clay-kaolin mixture + manure – 0.5%,
- 9) a mixture of clay and kaolin + Chamotte + organic matter – 0.5%.

Recipes with sand were noted only at the Ikpen-2 and Kreshchenovka settlements. The most common recipes at all settlements were “clay + Broken stone temper + manure/organic matter” – a total of 70.3%.

A single vessel with talc (medium size, concentration 1:4) was found in the materials from the Shagalaly-2 settlement, and a vessel with metallurgical slag (medium size, concentration 1:5) was found at the Atasu-1 settlement. Ceramic fragments with metallurgical slag were found by researchers at the Taldysay settlement (Kalieva, 2022, p. 125). Unfortunately, it is not entirely clear from the text of the article to what historical period these fragments belong, as the site is multi-layered.

Sand used was primarily coarse (47.4%), followed by fine (21.0%) and medium (31.6%) sand, in concentrations ranging from 1:3 to 1:5.

Broken stone temper was primarily used at the settlements (55.8% of the total) of medium size, in a concentration of 1:5 (55.2%), with the exception of the Bakybulak settlement, where coarse stone was preferred (60.5%). Small amounts of fine stone (8.3%) were found at the Atasul-1, Karatal-1, and Shagalaly-2 settlements. The preferred concentration for coarse stone (35.9%) was 1:5 (57.1%).

Chamotte was most often (66.7%) added to the pottery pastes of medium size, in a concentration of 1:5 (53.6%), as were fine (14.3%) and coarse (19.0%) chamotte. No chamotte vessels were found at the Karatal-1 and Karatal-2 settlements.

Construction of "seed-bodies". Based on the materials from the Fyodorovkaka culture settlements, two construction patterns have been identified: the wall only "seed-body" (80.6%) and the bottom to wall "seed-body" (19.4%). The bottom to wall "seed-bodies" (6 specimens) were found only at the Kreshchenovka settlement.

Based on the general characteristics of the source material, the studied "seed-bodies" belong to the composite group; based on the shape of its portions, they belong to the patchwork subgroup; and based on the construction method, they belong to the patchwork-lumpy type.

Construction of a hollow body. The selected construction methods belong to the manual class, the composite group, the patchwork subgroup, and the following types:

1. Patchwork-lumpy (87.5%), subtypes: a) single-layer (55.6% of all vessels) and b) two-layer (31.9%);

2. Patchwork-spiral (12.5%), subtypes: a) single-layer (10.4% of all vessels) and b) two-layer (2.1%).

Technological schemes for vessel construction. Two TS were identified:

1. The bottom to wall "seed-body", patchwork-lumpy, with a patchwork-lumpy hollow body (19.4%) – a) in one layer (12.8% of all vessels); b) in two layers (6.5%).

2. The wall only "seed-body" with patchwork-lumpy walls (80.6%) – a) in one layer, both walls and bottom (48.4%); b) in one layer, and a bottom of two layers (22.6%); c) in two layers, and a bottom in one layer (6.5%); d) in two layers, both walls and bottom (3.2%).

Apparently, there was also a TS associated with a patchwork-spiral hollow body.

Shaping. Judging by the preserved imprints on the outer surface, the vessels were made in solid mould-capacities on a leather lining. The patchwork bottom was applied from the inside, after which another layer of patches could be applied on the outside. Finger squeezing was used for shaping. On some vessels, a clay coil was applied to decorate the rim.

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Surface treatment. Without coating treatment.

Class I. Smoothing (44.5% of all vessels used to determine surface treatment):

Group 1. Simple (23.5%): type 1 – with fingers (4.2%), type 2 – with fabric (3.4%), type 3 – with a wooden scraper (10.0%), type 4 – with sheepskin (1.7%), type 5 – with a leather flap (4.2%).

Group 2. Furrowed (21.0%): type 1 – with grass (13.4%), type 2 – with a chip (7.6%).

Class II. Burnishing (52.9%).

Group 1. Simple. Subgroup 1 – on a dried base (45.4%), subgroup 2 – on a dry base (7.6%).

Coating treatment – coating the outer surface (2.5% of all vessels).

The surfaces of 16 vessels were treated using a combination of methods: smoothing the outer surface with cloth and grass on the inner (1 vessel); smoothing the outer surface with a leather flap and grass on the inner (2 vessels); smoothing the outer surface with sheepskin and a wooden scraper on the inner (1 vessel); burnishing the outer surface and smoothing with a wooden scraper on the inner (5 vessels); burnishing the outer surface and smoothing the inner surface – with grass (2 vessels), fingers (2 vessels), a chip (2 vessels), and a wooden stick (1 vessel).

Imparting strength to vessels and eliminating moisture permeability.

Firing in a reducing environment – 47.8%, including: short-term low-temperature firing – 87.0%, rapid rise in low final temperatures and rapid cessation of their effect – 2.6%, cooling in the firing device – 1.3%, prolonged exposure to low temperatures – 9.1%.

Firing in an oxidizing environment – 52.2%, including: partial exposure to annealing temperatures, rapid temperature rise and short holding at the final temperature, removal of vessels from the firing device and their rapid cooling in air – 40.5%, partial exposure to annealing temperatures, cooling in the firing device with a rapid drop in final temperatures – 20.2%, full exposure to annealing temperatures – 39.3%.

Comparison of ceramics from burial grounds and settlements in Central Kazakhstan. At the raw material selection stage, medium-ferrous clays clearly predominated – 59.2% of vessels from settlements and 82.7% from burial grounds. It should be noted that at three settlements (Bakybulak, Karatal-1, and Kreshchenovka), highly ferrous-rich clays were used much more frequently than medium-ferrous clays (from 62.2% to 81.8%).

The main artificial additive in the composition of the pottery pastes was broken stone temper – 73.9% (settlements) and 82.8% (burial grounds). Chamotte was found in burial ceramics only in mixed recipes at two sites: Ikpen-1 (“clay + sand + Chamotte + manure” and “clay + Talc + Chamotte + manure,” one vessel each) and Sherubay-1 (“clay + Broken stone temper + Chamotte + manure,” four vessels).

Medium broken stone temper was used primarily – 55.8% (settlements) and 60.4% (burial grounds). A 1:5 ratio (55.2%) was observed for settlement ceramics, while a 1:4 ratio (46.9%) was observed for burial ceramics.

The primary recipe used for the pottery pastes of both settlement and burial ceramics was “clay + Broken stone temper + manure/organic matter” (70.6% for settlements and 74.8% for burials).

The “seed-bodies” of both settlements and burial grounds of the Fyodorovskaya culture were constructed using the wall only “seed-body” method – 80.6% of settlement ceramics and 100% of burial grounds. Only at one (Kreshchenovka) of the five settlements whose ceramics made it possible to study construction were “seed-bodies” made using the bottom to wall «seed-body» method. The hollow body was constructed from clay patches – types:

1. Patchwork-lumpy (87.5% of settlements, 90.0% of cemeteries), subtypes: a) single-layer (63.5% of settlements, 63.0% of burial grounds); b) double-layer (36.5% of settlements, 37.0% of burial grounds).
2. Patchwork-spiral (15.8% of settlements, 10.0% of cemeteries). The hollow bodies of

vessels from both settlements and burial grounds, crafted from patchwork along a spiral trajectory, were constructed in a single layer. Two-layer patchwork-spiral designs were observed only in the ceramics of the Karatal-2 settlement.

The following general technological schemes apply: the wall only “seed-body” with patchwork-lumpy walls: a) a single layer for both the walls and the bottom; b) a single layer and a two-layer bottom; c) two layers and a single-layer bottom; d) two layers for both the walls and the bottom.

The vessels were made using mould-capacity; the walls were pressed and knocked out during final shaping. The vessel surfaces were processed primarily (45.0% at settlements and 36.0% at burial grounds) by smoothing and burnishing on a dried base (57.5% at settlements and 54.0% at burial grounds). Coating treatment was observed on 3% of vessels from settlements and 10.0% from burial grounds.

The pottery production technology of settlements and burial grounds is unified by the following:

- 1) the use of medium-ferrous, medium-sand clays as the primary raw material;
- 2) the basic recipe for composing pottery pastes is “clay + Broken stone temper + manure/organic matter”;
- 3) the broken stone temper was primarily of medium size;
- 4) the vessel “seed-bodies” were made using the wall only “seed-body” program, a patchwork-and-lump method;
- 5) the surfaces of more than half of the vessels were burnished.

Summarizing the results of the technological analysis of the ceramics from settlements and burial grounds, we come to the conclusion that in terms of production technology, they have much more in common, and the existing differences are insignificant and do not give any reason to think about the preservation of some ancient traditions of production in the dishes from burials.

Comparison of ceramics from burial grounds in Central Kazakhstan and the Lisakovsky-1 burial ground (Northern Kazakhstan).

When selecting raw materials in both regions, medium-ferrous clays were primarily selected: CK – 82.7%, NK – 84.6%. In Central Kazakhstan (the Bada burial ground), the use of low-ferrous clay was noted (3 vessels), while in Northern



Fig. 7. The vessel with the wall only “seed-body” (burial ground Sherubay-1)

Рис. 7. Сосуд с емкостным начинном (могильник Шерубай-1)

Kazakhstan, a mixture of non-ferrous and medium-ferrous clays was used.

When composing pottery pastes, the Fyodorovka potters in these regions had the preferences: CK – “clay + Broken stone temper + manure/organic matter” (74.8%), NK – “clay + Chamotte + manure/organic matter” (56.5%).

We see a similar similarity in traditions regarding size – the choice of the average fraction of the main mineral additive (CK – broken stone temper 60.4%, NK – chamotte 51.7%). It should be noted that coarse chamotte was added primarily at a 1:5 ratio (CK – 100.0%, NK – 78.6%).

The “seed-bodies” of all vessels were universally constructed exclusively according to the wall only “seed-body” program. Similar cultural traditions are also observed in the construction of the hollow body, which was created using patchwork-lump methods (CK – 90.0%, NK – 100.0%), in two subtypes: a) in one layer (CK – 63.0%, NK – 57.7%) and b) in two layers (CK –

37.0%, NK – 42.2%). Vessels with a single-layer, patchwork-spiral hollow body have been found at two burial grounds in Central Kazakhstan; such vessels are absent from the ceramic collection of the Lisakovsky-1 burial ground. Vessels found in both regions were made by Fyodorovka potters using the following general technological scheme: the wall only “seed-body” with patchwork-lumpy walls (CK – 86.8%, NK – 100%), subtypes: a) single-layer walls and a single-layer base (CK – 48.5%, NK – 4.3%), b) single-layer walls and a two-layer base (CK – 15.2%, NK – 47.8%), c) two-layer walls and a single-layer base (CK – 24.2%, NK – 8.7%), d) two-layer walls and a two-layer base (CK – 12.1%, NK – 39.2%).

No differences in surface treatment methods were recorded.

Thus, as an analysis of the construction of Fyodorovka culture vessels has shown, they have exclusively the wall only “seed-body” (Fig. 7). At the same time, within the Alakul culture of

the Andronovo cultural-historical community, the bottom to wall “seed-bodies” are observed mainly in both northern and central Kazakhstan (Loman, 1993, p. 110).

Thus, the wall only “seed-bodies” can serve as an indicator of the ceramics' affiliation with the Fyodorovka culture, while vessels with the bottom to wall “seed-bodies” are associated

with the Alakul culture. This difference in design reflects not only technological but also cultural and historical aspects, such as the different origins of the bearers of these two cultures and the different traditions of ceramic vessel production.

These results provide a basis for further comparative research and can be used in the study of other regions and cultures of the Bronze Age.

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