SPRAWOZDANIA ARCHEOLOGICZNE 71, 2019
PL ISSN 0081-3834
DOI: 10.23858/SA71.2019.001

ARTICLES

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UNIQUE POTTERY KILN CONSTRUCTION? THE INTERPRETATION OF MASSIVE CLAY OBJECTS FROM THE TROSTIANCHYK SITE OF THE TRYPILLIA CULTURE

ABSTRACT

Rud V., Zaitseva O., Hofmann R., Rauba-Bukowska A., Kosakivskyi V. 2019. Unique pottery kiln construction? The interpretation of massive clay objects from the Trostianchyk site of the Trypillia culture. *Sprawozdania Archeologiczne* 71, 11-39.

The article considers the characteristics of truncated-pyramidal and discal type clay objects that were found in pit 1 at the Trostianchyk site (Vinnytsia oblast, Ukraine) of BII Trypillia stage. The context, location and chronology of these artifacts are characterized. On the basis of ethnographic evidence, the interpretation of the clay objects as movable constructive elements of a pottery kiln is given. We assume that such kilns are the archaic link in the evolution of ceramic firing devices. They preceded the multi-channel kilns that have been known in Cucuteni-Trypillia Cultural Complex since the end of V millennium BC.

Keywords: Cucuteni-Trypillia Cultural Complex, Ukraine, Trypillia BII, massive clay objects, pottery kiln
Received: 18.09.2019; Revised: 29.09.2019; Accepted: 11.10.2019

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1. INTRODUCTION

Ten years ago, a new period of studying Cucuteni-Trypillia Cultural Complex (CTCC) began. It started in 2009 with field research using modern geophysical equipment on the Prut-Dnister region (Okiul Alb, Koban etc.) and Southern Buh left bank settlements (Nebelivka) (Rassmann *et al.* 2016; Hale 2010; Chapman *et al.* 2014a). Due to successful cooperation between Ukraine, Moldova, Romania, Great Britain, Germany and Poland, geophysical plans of a large amount of CTCC settlements were acquired, and previously unknown objects were discovered that change our knowledge about different aspects of the lives of CTCC people (Chapman *et al.* 2014b; Rassmann *et al.* 2014; Dębiec *et al.* 2014; Müller and Videiko 2016; Hofmann *et al.* 2016; Rud *et al.* 2016; Ţerna *et al.* 2016). One of the real breakthroughs was the discovery of previously unknown multi-channel kilns originally examined as the result of a geophysical survey at the Talianky settlement in 2013 (Kruts *et al.* 2015; Korvin-Piotrovskiy *et al.* 2016; Ţerna *et al.* 2017). Further investigations have shown the existence of such kilns on the CTCC territory from the Prut River to the left bank of the Southern Buh (Videiko 2019).

In 2015, test excavations of the BII Trypillia stage were performed at the Trostianchyk settlement by the East Podillia Archaeological Expedition (EPAE) of the Institute of Archaeology (IA) of NAS of Ukraine. Three objects were examined completely and one partially. Pit 1 of trench 1 contained massive clay objects, which have no direct analogies at sites of the CTCC. They were interpreted as the remains of archaic kilns. Preliminary publication of the artifacts' context has already been made (Rud 2016). Due to cooperation between EPAE IA NASU (V. Rud) and the Graduate School "Human Development in Landscapes" of Kiel University (R. Ohlrau), geophysical survey was performed in 2016 (Rud *et al.* 2016). The Sensys MAGNETO® MX V3 system with eight inductional gradiometers FGM650/3 was used. A series of radiocarbon dates were examined from objects investigated in 2015. Magnetic examination and radiocarbon dating were provided in the frame of the CRC 1266 "Scales of Transformations" and the sub-project D1 "Population agglomerations at Tripolye-Cucuteni mega-sites".

2. SITE, MATERIALS AND METHODS

2.1. Site

2.1.1. Geographical and cultural position

The Trostianchyk settlement (48°31'44.2"N 29°20'50.8"E) is located to the west of Trostianchyk village in Trostianets Raion, Vinnytsia Oblast, Ukraine. It occupies the cape of the plateau, created by the bend of the Nedotica riverbed (Fig. 1-2), 3.2 km to the west

of the point where it falls into Southern Buh River. The cape is located on the left coast of the river and has a triangular form, stretched in a north-south axis. The highest northern part of the settlement is 25 m above the water level, while the lowest southern portion is 16 m above. Most of the territory is located on the flat, slightly steep surface. The height difference from the north to the south is 9 m, from the west to the east in the main part of the settlement it is no more than 4 m, but on the hills, where settlement layer is located, the decrease is more rapid.

From the west, northwest and northeast, the settlement is surrounded by a shallow valley. From the south and southeast, there are steep slopes, which go down to the valley and riverbed. As of today their incline in different parts is 30-50°. In the southeastern part of the cape there is a narrow section of the slope that is 3-25°.

Fig. 1. Magnetic plan of the Trostianchyk site superimposed on a Google satellite image. UTM coordinate system (zone 35N) and WGS 84 ellipsoid. Geophysical survey after R. Ohlrau, modified by R. Hofmann

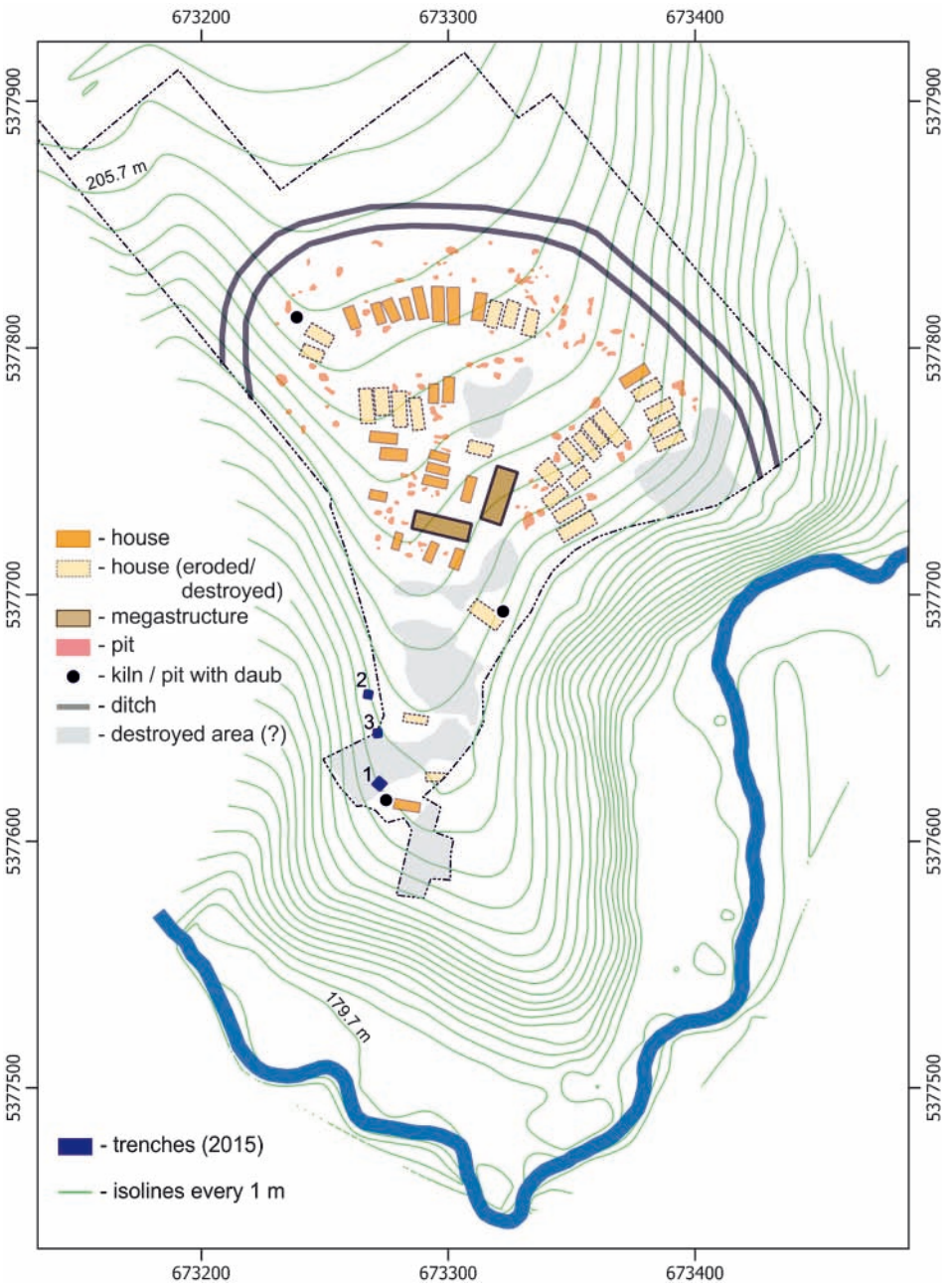

Fig. 2. Digital elevation model of the Trostianchyk site combined with interpreted magnetic features. UTM coordinate system (zone 35N) and WGS 84 ellipsoid. Elevation model after O. Manigda, magnetic features interpretation after R. Ohlrau, modified by V. Rud

2.1.2. Site structure

Magnetic survey was conducted on an area of 4.2 ha (Fig. 1). The anomalies of potential archaeological objects are located in a square of 3.0 ha. Considering the unsurveyed area on the edge of the cape, the size of the site must expand for 0.24 ha to 3.24 ha.

The magnetic anomalies (Fig. 2) of the Trostianchyk settlement were divided into the following categories:

- 24 rectangular anomalies of ruins of burnt clay houses;
- 26 rectangular anomalies of houses that were a) destroyed by slight fire, b) have another type of construction or c) eroded;
- 2 rectangular anomalies of unique buildings – a so-called "megastructure" (cf. Hofmann *et al.* 2019);
- 104 anomalies of pits of different shapes;
- 3 round anomalies with high magnetization, which might represent a) kilns or b) pits filled with daub;
- 2 linear anomalies of ditches, which partly outline the settlement territory.

At the northern, northwestern and northeastern parts of the Trostianchyk archaeomagnetic plan, we notice two parallel linear anomalies of presumable ditches, arranged semicircularly, which enclose the site area. The width of the anomalies amounts to 1.5-2.0 m, and the length of each is approximately 317 m. The distance between them varies at different spots from 5.8 to 7.3 m.

Four different arrangements of houses and pits are observed: 1. a long, curved row running parallel to the ditches; 2. several short rows of dwellings; 3. stand-alone houses; 4. groups of pits that are distant from the buildings.

Type 1, described above, is represented at the site by the outer semicircular row, 180 m long. It runs parallel to the ditches, outlining the site. The buildings are set with their ends to the ditches, and there is a gap in the north-eastern part of the row. The gap is 40 m long and is occupied by the anomalies of pit objects. Aside from that, numerous pits are located between the gable ends of the buildings and the inner ditch. Rarely, pits are located between the buildings or at their gable ends, pointed toward the center of the settlement.

The next approach to site planning (type 2 above) is the arrangement of buildings in small straight rows, which include 3-6 buildings. One such row (with five buildings) in the eastern part of the settlement runs radial to the outer semicircle. It surrounds the unbuilt territory ("plaza"; Ohlrau 2019) opposite to megastructure No 2. Two more short rows of three and six houses, to the west and east from megastructure No 2, are parallel to outer semicircle. Two rows, each having three buildings, run parallel to the megastructures. The pits near these rows are both located near the ends of the buildings and their sides.

The third strategy of building on the settlement territory is the arrangement of stand-alone houses, which are not parts of rows. Such houses are located near the megastructures and to the south of them. For instance, the location of the objects on the narrow,

southern part of the cape is interesting. There are only four buildings, which are very distant from each other. Near two of these buildings, anomalies were found, which probably are kilns or pits filled with daub. The geophysics research also shows a large number of anomalies that are difficult to interpret on this square of 0.5 ha. This space is marked as "damaged" (Fig. 2). At first glance, these, as well as two others in the central and eastern parts of the site, look like areas of moved (damaged, destroyed or excavated) cultural layers, especially when compared to geomagnetic plans of other settlements. As an example, on the plans of Maidanetske (Rassmann *et al.* 2014, fig. 22a), Talianky (Rassmann *et al.* 2014, fig. 9A; 12) and Petreni (Rassmann *et al.* 2016, fig. 9) the locations of excavated objects are clearly seen. In this case, it is important to say that at Trostianchyk, the excavations were conducted on an area of no less than 300 m² at the end of the 1980s (Tsvek 2006, 47). However, the exact coordinates of the excavations are unknown to us.

From the other point of view, sectors of the Trostianchyk site, which we marked as "damaged", resemble territories with large numbers of pits of different shapes and sizes. This theory is confirmed by the excavations of 2015, conducted in the southwestern outskirts of the settlement (Fig. 2) (Rud 2016). Three pits were excavated (trenches 1, 2, 3; Fig. 2), the contents of which showed no signs of damage or destruction. However, this may only apply to those objects that were excavated. The preservation of other anomalies\ objects on "damaged" territories is unknown.

The last direction in the strategy of territory development of the settlement (type 4 above) is the placement of pit groups at a distance from the buildings. Therefore, any attempt to connect a group of pits with a particular building would fail. We find such groups on the western outskirts of the settlement, to the north of megastructure No 2, between houses of the outer semicircle, and between it and inner ditch.

The square of the building anomalies is 23.1-100.2 m². Two much larger buildings are considered as "megastructures" representing some kind of integrative architecture or assembly houses (cf. Hofmann *et al.* 2019). They are located in the central part of the settlement. The first of them, No 1 (south, 175.5 m²), is oriented along an east-northeast – west-southwest axis. Since it consists of a series of small amorphous anomalies, it might alternatively represent the remains of several normal dwellings arranged in a short row. Megastructure No 2 is located to the northeast and perpendicular to the first such structure. It is created by a clear anomaly on its entire square of 194.9 m². Part of the settlement (approximately 55 x 20 m) to the northeast of the building's end is free from magnetic anomalies.

Three round anomalies, which we initially interpreted as kilns or pits filled with daub are located on the settlement. The first of them is located in the northwestern part of the settlement. The second is situated southeast of the central part of the site. The third is in the southern part of the site. The first and third anomalies are located at the ends of the buildings, 2.0-2.5 m away from them. The second one is close to the long north side.

Aside from the mentioned anomalies, several other objects exist that are similar in shape and size but with much lower magnetization. The presence of both kilns and pits

filled with daub makes it difficult to interpret round anomalies with high magnetization. Two similar objects were excavated in Maidanetske in 2013 (Müller and Videiko 2016, 79-86, fig. 6, 12; Müller *et al.* 2017). Pit 2 (trench 2; Fig. 2), which was completely filled with daub, was also excavated in Trostianchyk in 2015 (Rud 2016).

2.2. Materials

Only a small number of settlements of the Trypillia BII stage are known in the area of the south forest-steppe zone in the Southern Buh and Dnister interfluve, and even less of them have been excavated so far (Rud 2018, fig. 2). Most of them are known from field-walking surveys (Rud 2018, 26-37). In Trostianchyk, excavations were conducted at the end of the 1980s (Tsvek 2006, 47). However, the results of this work were never fully published, and as of 2015, we did not know the storage location of the excavated artifacts. Therefore, to obtain material for clarifying the relative chronology of the region in the BII Trypillia stage, the site was newly examined. The survey showed that in the last decade of the Soviet era, the Trostyanchyk settlement was planted with an orchard, which was uprooted several years ago. As a result of this activity, the cultural layer of the settlement is damaged; therefore, the urgency of the excavations has increased, becoming rather rescue excavations.

Pit 1 was unearthed in trench 1 (4 × 4 m), which is located in the southwestern outskirts of the settlement (Fig. 2), where the flat plateau joins the slope of an adjacent valley. The inclination of the surface at the location of the feature is 5-10°. According to the geomagnetic plan, pit 1 is situated at the edge of the area and marked as “damaged”. Three metres to the southeast of it, a rounded anomaly is located, which most likely represents a kiln or a pit filled with daub (Fig. 2).

2.3. Methods

Various arguments are decisive for the interpretation of the clay objects under examination as elements of pottery kilns. Basic criteria for the assessment of the objects in question are their shape, size, and macroscopically visible technical properties. Additionally, for two of the objects, microscopic examinations were performed by means of thin section microscopy. Sample 13 originated from the internal part of a truncated-pyramidal type object and sample 14 is a piece of a discal-type object. Furthermore, the firing temperature was estimated based on thermally induced changes in the clay matrix of the samples.

Seven pottery fragments from other objects of the Trostianchyk site (excavated in 2017) were also examined for comparison. Thin sections were used to examine the samples under a transmitted light polarising microscope. Petrographic descriptions were made, and the contents of such components as minerals and aggregates (>0.05 mm), with their mineral composition, grain sizes, and roundness parameters, were determined.

Table 1. Trostianchyk pit 1 ^{14}C dates after Müller *et al.* in prep.

Sample name	Laboratory no.	14C age (BP)	Deviation	N (%)	C (%)	col (%)	Level	Grid	Trench no.	Material	Taxon	Description	Calibration (68,2 %)	Calibration (95,4 %)
Trostianchyk 1	Poz-87488	5145	35	1,5	4,1	0,5	5 (-0,82 m)	B	1	bone	*Bos taurus*	Pit 1 filling	3991BC (55.8%) 3942BC; 3856BC (5.7%) 3844BC; 3836BC (6.7%) 3821BC	4041BC (7.7%) 4013BC; 4003BC (62.8%) 3927BC; 3877BC (24.9%) 3805BC
Trostianchyk 2	Poz-87489	5120	35	1,0	3,3	1,8	3 (-0,4-0,6 m)	A	1	bone	*Bos taurus*	Pit 1 filling	3972BC (32.5%) 3937BC; 3862BC (35.7%) 3812BC	3986BC (47.5%) 3895BC; 3881BC (47.9%) 3800BC
Trostianchyk 3	Poz-87490	5170	35	2,5	7,3	5,7	7 (-1,2-1,25 m)	A	1	bone	*Bos taurus* or *Equus ferus* (?)	Pit 1 filling	4037BC (14.6%) 4021BC; 3995BC (53.6%) 3957BC	4046BC (91.6%) 3941BC; 3856BC (3.8%) 3819BC

In addition to the consideration of the physical properties of the objects themselves, the context of the find and the composition of the assemblage within the pit were included into the investigation as independent criteria. This makes it possible to assess the depositional conditions and circumstances.

Ethnographic analogies provide information about the potential usage of the clay truncated-pyramidal objects from Trostianchyk.

The local identity of the settlement was determined on the basis of a comparison of the found pottery with the published collections of pottery from other settlements. Before that, a formal typology of vessels was made. It was based on the experience of predecessors (Ryzhov 1999; Ovchynnykov 2014, 71-96, 143-145). At the top of our classification are technological groups. We divided pottery into sub-groups on the basis of the surface decoration of the vessels. Further statistical calculations were made, taking into account the shape and ornamentation of each fragment that was reconstructed (Ryzhov 1999, 29).

From pit 1 in Trostianchyk, three bone samples from different layers were successfully radiometrically dated in the Poznań Radiocarbon Laboratory (Table 1) (Müller *et al.* in prep.). Calibration and Bayesian modelling of these dates was performed using the software OxCal v. 4.3.2 (Bronk Ramsey 2009; Reimer *et al.* 2013).

3. RESULTS

3.1. Pit 1 stratigraphy and features

Geological stratigraphy within the trench 1 (Fig. 3: 2) is as follows: down to a depth of 0.34/0.42, a layer of black and grey Chornozem is located, which covers grey and yellow loam. The loam lasts down to a depth of 1.1/1.41 m. Below, yellow loess is found.

The borders of pit 1 (Fig. 3: 1) were found at a depth of 0.3 m in the eastern part of the trench. Borders of the filling were completely visible at a depth of 0.5 m. The maximum depth of the pit from the modern surface is 1.49 m. From the Trypillia surface, the pit presumably was 1.04-1.16 m deep. It has an oval form, with dimensions of 3.70 × 2.85 m, and it is stretched along a northeast – northwest axis (Fig. 3: 1). Its section has a funnel shape (Fig. 3: 2).

The stratigraphy (Fig. 3: 2) within the pit is as follows: layer 1,0-0.34/0.42 m – Chornozem with small pieces of burnt clay and ceramics; layer 2A, 0.34/0.42-0.63/0.74 m – dark, compact pit filling with grey shades, which includes massive clay objects, ceramic fragments, stones, animal bones, *Unio* shells, tools, fragments of burnt clay. Layer 2B, 0.63/0.74-0.97/1.16 m – dark, with grey shades, and containing more massive clay objects compared to layer 2A. Layer 3, 0.97/1.16-1.12/1.49 m – black, with a small amount of ash and clay crumbs.

After the pit was dug, it was filled with ash and clay crumbs. These materials form the lowest layer (3). Later, massive truncated-pyramidal and discal-type clay objects were

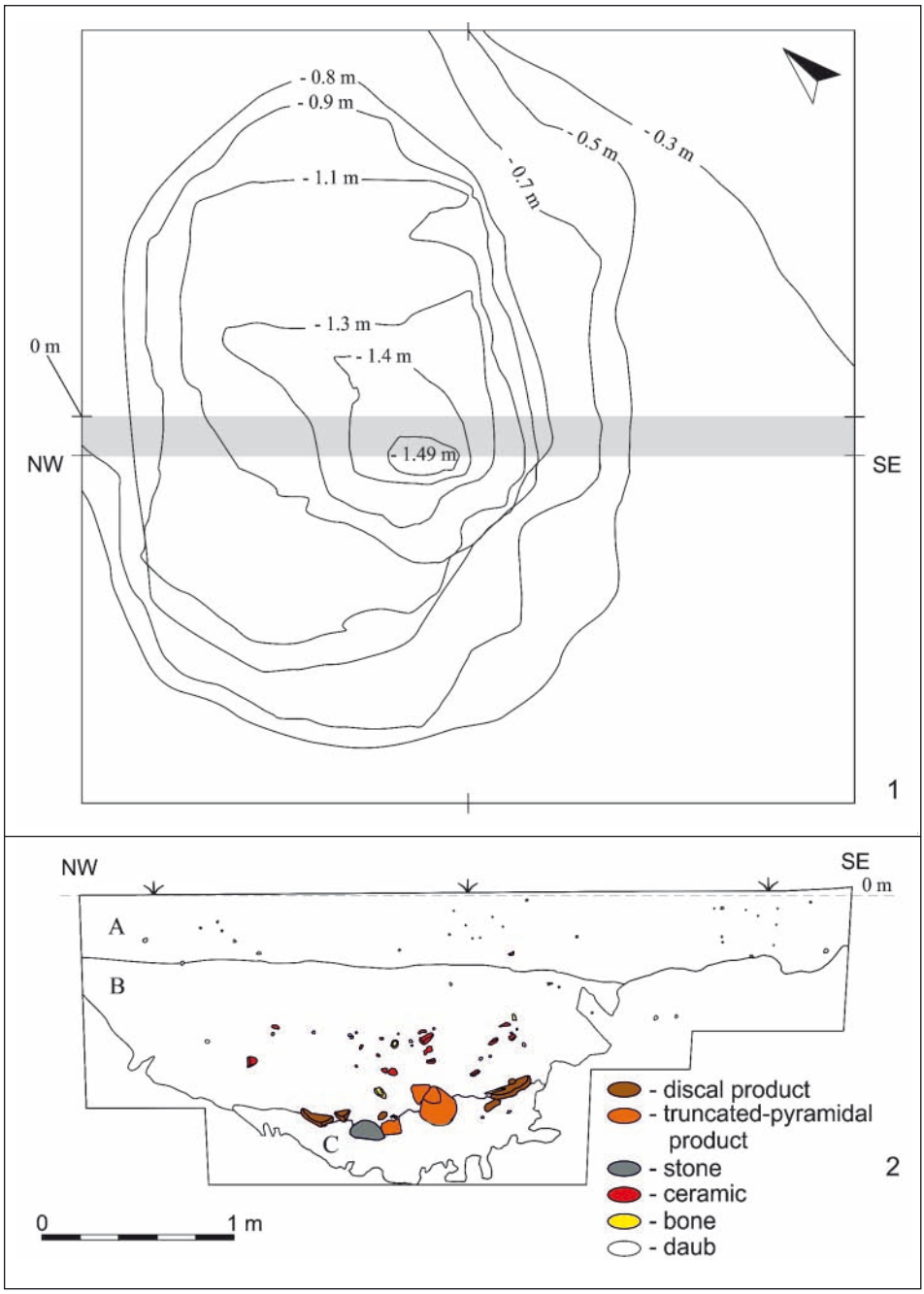

Fig. 3. Plan (1) and section (2) of pit 1 from Trostianchyk. In the section: A – layer 1; B – layers 2A and 2B; C – layer 3. Drawn by V. Rud

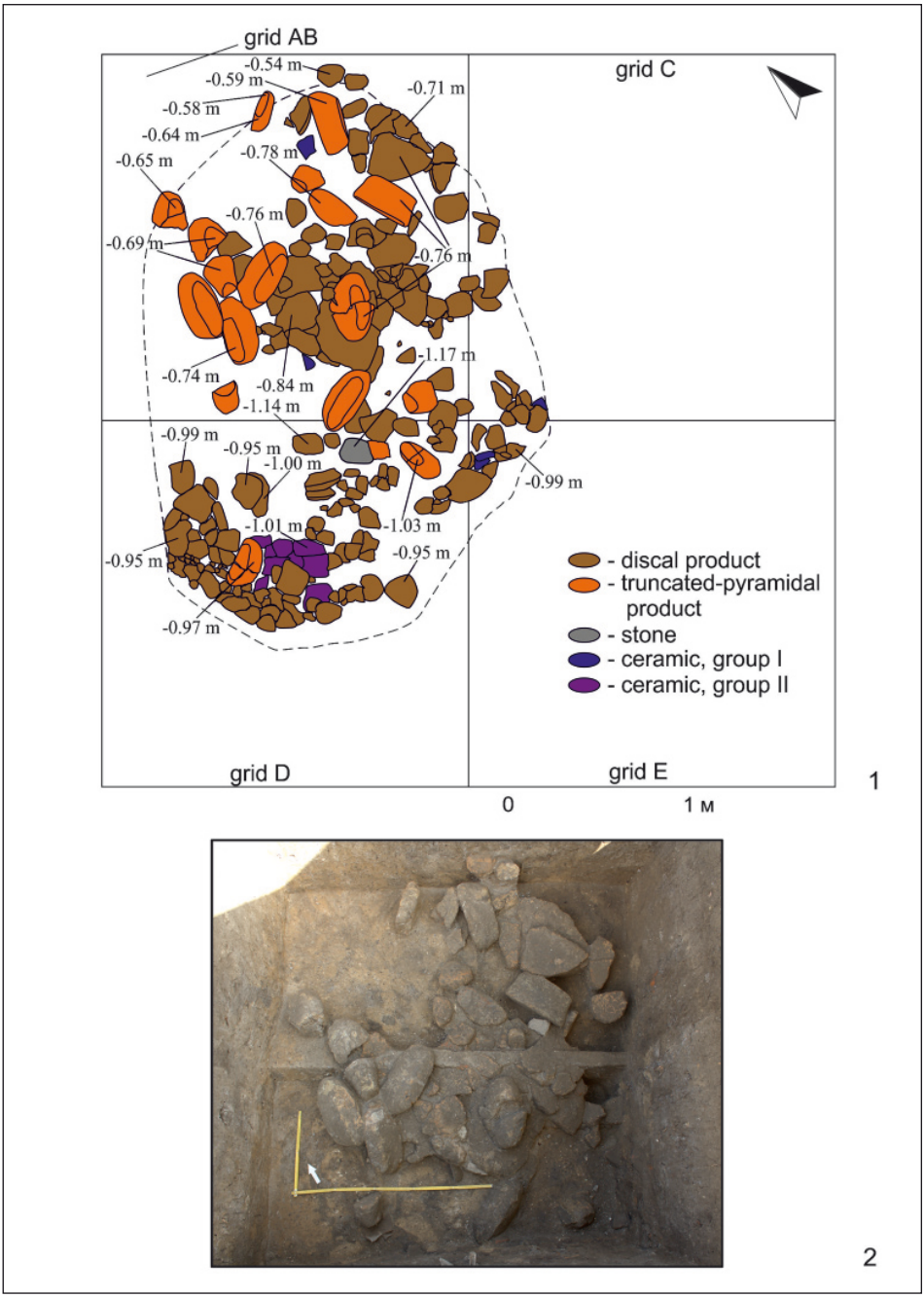

Fig. 4. Plan (1) of the fill of pit 1 at the level of massive clay objects and photo (2) of the arrangement of clay objects in square AB of pit 1 from Trostianchyk. Drawn by V. Rud

dumped, as well as a burnt piece of granite stone (layer 2B). Most of them are located at a depth of 0.7-1.15 m. On the slope walls of the pit, such objects can be found up to 0.54-0.69 m. Discal-type objects were dumped first, as truncated-pyramidal objects are above them. The concentration of the objects around the pit varies (Fig. 4). Large numbers of strongly fragmented clay disks can be seen in the western, central and eastern parts of the pit. Truncated-pyramidal objects are seen in the central and northwestern parts of the pit. In some spots, clay fragment layers are 0.3 m thick. In the western part of the pit, a fragment of a large "kitchen" pot was dumped, along with massive clay objects, found among fragments of discal-type objects. Above the massive clay objects, the pit is filled (layer 2A) with a strongly fragmented inventory, most likely domestic garbage.

3.2. Pit chronology

3.2.1. Relative chronology

The complex of pottery from pit 1 is divided into two technological groups. Group I includes so-called "table" ceramics (Fig. 5; 6) – different vessels (120 items), most of which are made of strongly silted clay and fired under oxidising conditions. Based on the surface decoration, we divide the first group into three sub-groups: the first one has painted ornaments, the second – deepened ornaments and the third includes undecorated vessels with slipwared surfaces.

The pottery of group I is made of both iron-rich, reddish clay types and whitish, kaolinite ones. Most of the pottery is covered with pinkish white slipware. Some fragments are with orange engobe, which is typical for objects made of kaolinite clay.

The ornaments of the first sub-group (Fig. 5: 1, 3-12, 15-19; 6: 1-18) are painted a monochromatic dark brown (black). Only some fragments show bichromatic ornaments: the dark brown is primary and white is secondary.

We can conclude that petrographically examined vessels of sub-groups I.1 (4 items) and I.2 (1 item) were fired in oxidising conditions, in temperatures of up to ca. 800-850°C.

The pottery of sub-group I.1 is represented by eight morphological forms as well as miniature vessels (2.50%) (Fig. 5: 15). Truncated-conic bowls (12.5%) (Fig. 5: 5, 7) are decorated with comet-like (1 item) and figure-eight (11 items) schemes. Semi-spherical bowls (22.5%) (Fig. 5: 1, 3, 4, 6) also are decorated with comet-like (1 item) and figure-eight (22 items) schemes, and also with concentric circles (1 item). Small goblets (22.5%) (Fig. 5: 8-12) are painted with face-like motifs (11 items) and festoons (1 item). Big goblets (8.33%) (Fig. 5: 16-19) are painted with metopes (1 item) and face-like schemes (2 items). Craters (8.34%) (Fig. 6: 1-5) are ornamented with meander schemes (7 items), and there are also lids (1,67 %) (Fig. 6: 12), amphoras (1.67%) (Fig. 6: 14), thin-throated biconic vessels (4.17%) (Fig. 6: 6-8) and binocular-like vessels (0.83%) (Fig. 6: 17-18).

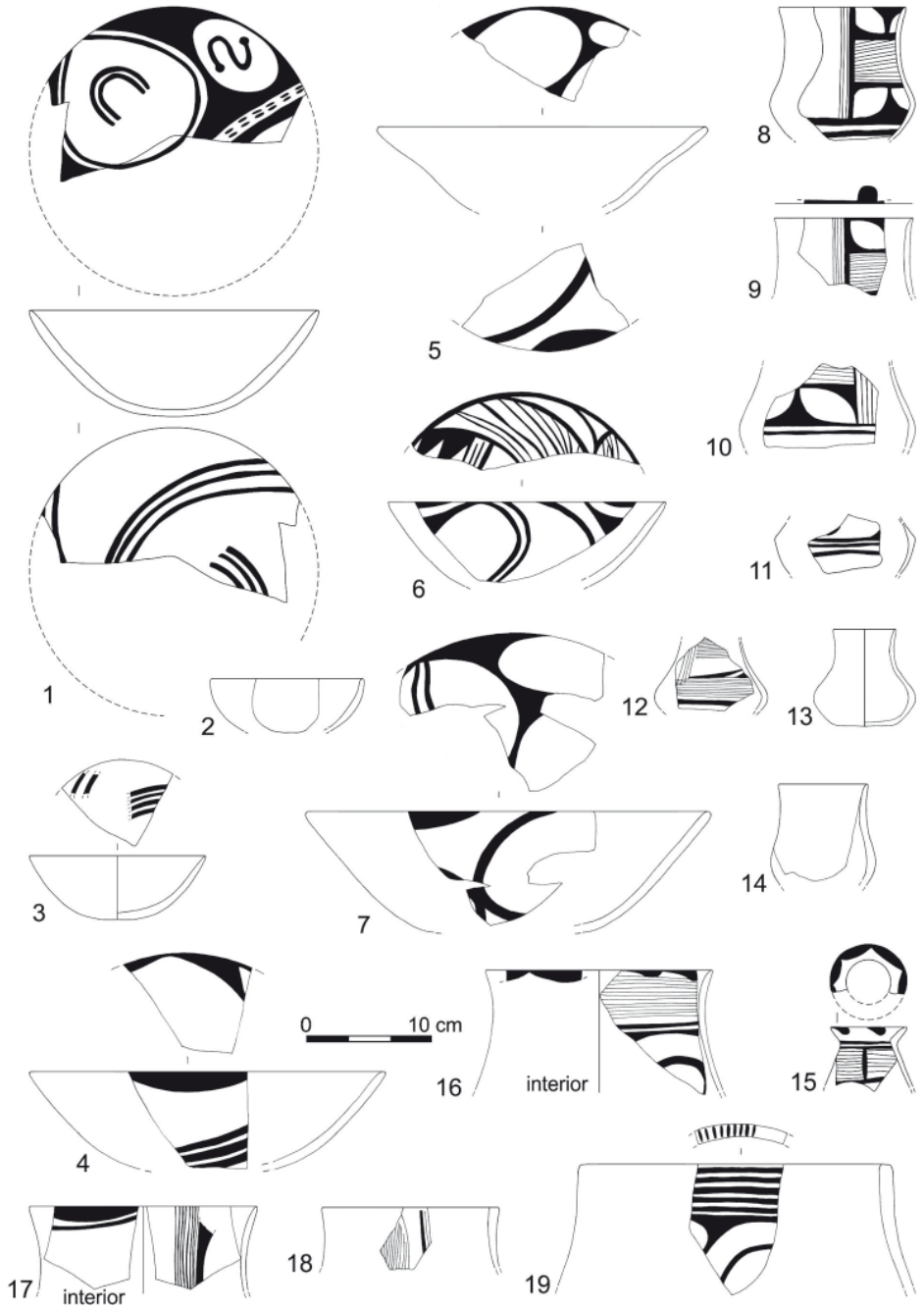

Fig. 5. Pottery of subgroups I.1 (1, 3-12, 15-19) and I.3 (2, 13, 14) from the Trostianchyk site (excavations 2015). Drawn by V. Rud and V. Kosakivskyi

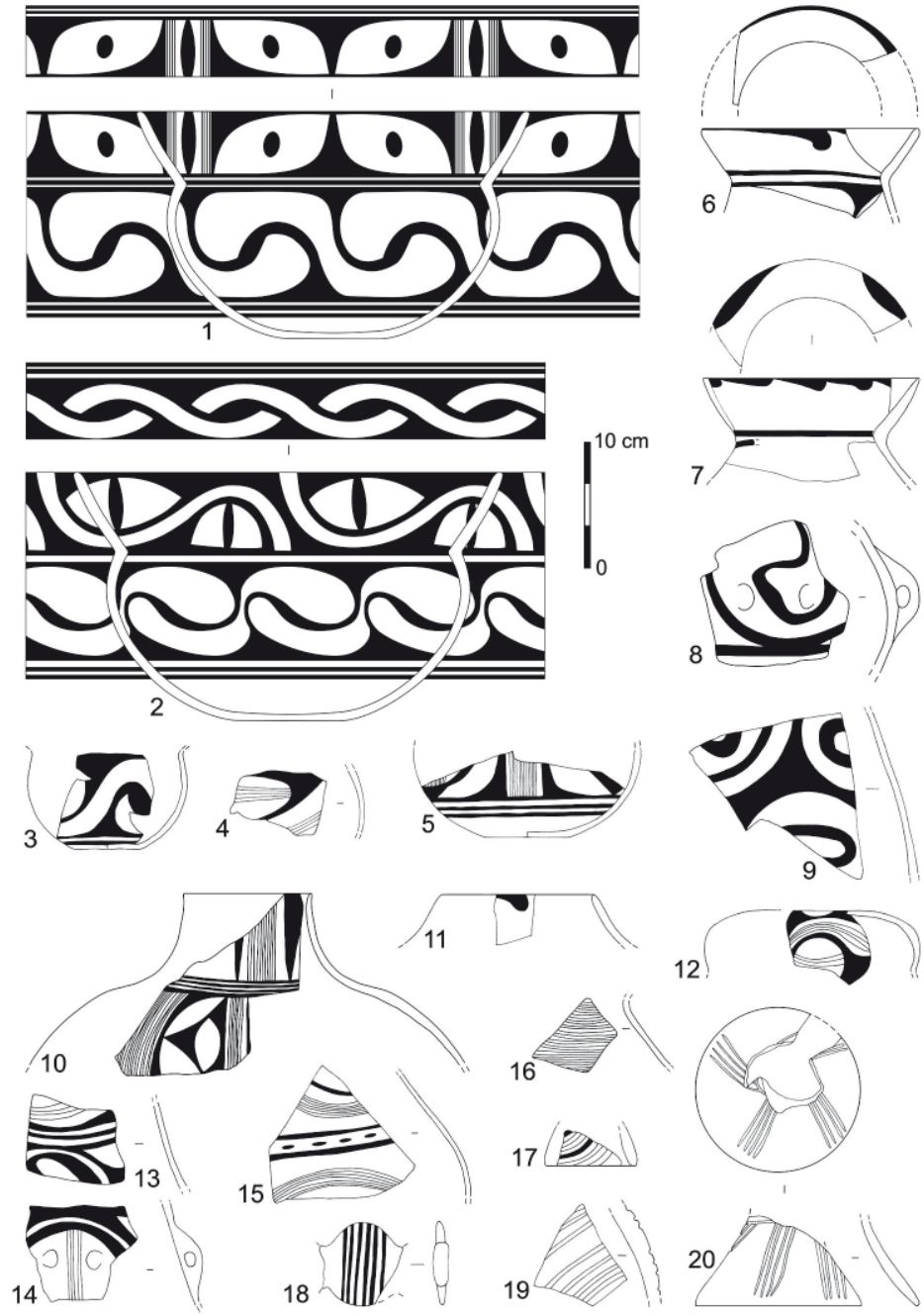

Fig. 6. Pottery of subgroups I.1 (1-18) and I.2 (19, 20) from the Trostianchyk site (excavations 2015). Drawn by V. Rud and V. Kosakivskyi

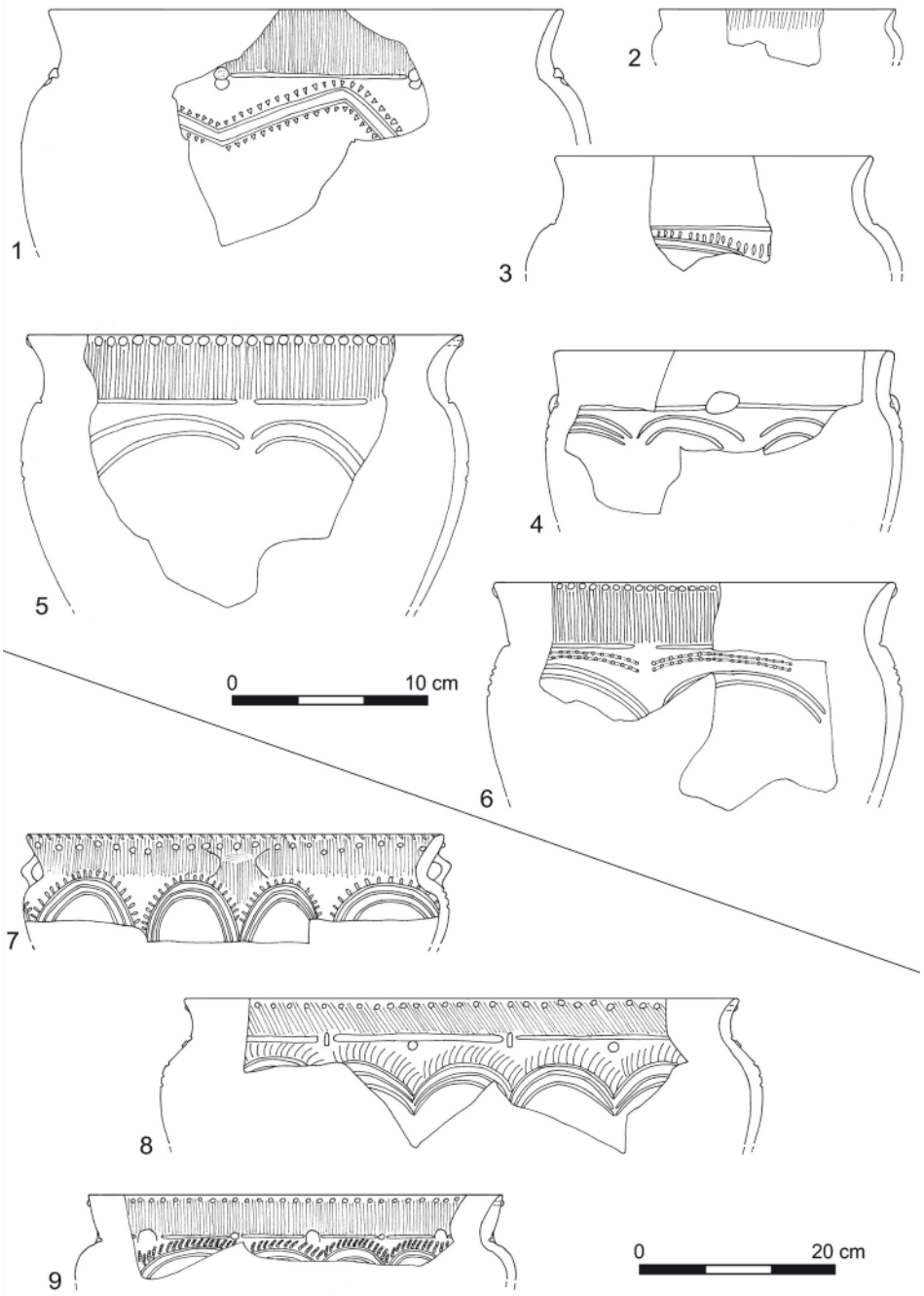

Fig. 7. Pottery of group II from the Trostianchyk site (excavations 2015).
Drawn by V. Rud and V. Kosakivskyi

The sub-group I.2 is represented only by pear-like vessels (0.83%) (Fig. 6: 19). The pottery of sub-group I.3 has three forms: truncated-conic (8.33%) and semi-spherical (4.17%) bowls (Fig. 5: 2), small goblets (0.83%) (Fig. 5: 13-14) and craters (0.83%). The Trostianchyk site also has pear-like vessels (Fig. 6: 10-11) of sub-group I.1, as well as lids and binocular-like vessels (Fig. 6: 20) of sub-group I.2.

The pottery of technological group II includes so-called "kitchen" ceramics (30 items) (Fig. 7), which consist of vessels made of clay with a large admixture of powdered shells and sometimes rock pieces. Vessels of group II (2 items were examined) were fired under reducing conditions in the fairly low firing temperature of ca. 800°C.

This group of vessels either has relief ornaments (sub-group 1) or has non-ornamented surfaces (sub-group 2). The pottery of the group has two forms: pots (96.67%) (Fig. 7) and miniature vessels (3.33%). The settlement also has semi-spherical bowls of group II.

On the basis of the typological characteristics of the ceramic materials, we consider that the settlement belongs to the second phase of development of the Rakovets group – type Mereshovka-Chetetsuie III (by S. Ryzhov; Ryzhov 1993, 91, 92; 2003, 31-32) of the Trypillia BII stage. Such ceramic complexes are known to have a significant number of settlements in the Dnister, Prut and Southern Buh areas, among them Mereshovka-Chetetsuie III (Sorokin 1983), Brynzeni VIII (Ţerna and Heghea 2017, 306-308, figs. 8, 9), Bryhydivka (Ryzhov 1993, 89-90), Berezova – Bereh I (Korvin-Piotrovskiy and Husiev 2000, 37-39), Studenytsia – Lanok (Ryzhov 2003a), Moshanets (Tkachuk and Shevchuk 2007), Busha (Kosakivskyi and Rud 2010, 181-183, 185-188), and Voloshkove 1 and 3 (Chernovol *et al.* 2012, 35-36, figs. 1-10).

3.2.2. Absolute chronology

Three successive stages of the pit filling were dated, although the lowest infilling layer was excluded from this due to a lack of datable sample material. Sample Poz-87490 was associated with the massive clay objects in the middle-lower part of the pit at the border between layers 3 and 2B. The sample Poz-87488 is related to an event of pottery infilling in layer 2A. The sample Poz-87489 dates the upper part of layer 2A.

The modelling of these dates resulted in a very robust model with the high overall probability of 153.2. According to this model, the backfilling of the pit took place over a relatively short period between 4017–3959 and 3974–3900 BCE (68.2%), or between 4172–3947 and 3983–3721 BCE (95.4%). The highest dating probability falls in the narrow range of only 20 years between 3970 and 3950 BCE (Fig. 8).

Summarizing the results obtained from trench 1, the backfilling of pit 1 from Trostianchyk took place, with the 'highest' dating probability, during the first half of the 40th century BCE. Considering a more reliable dating range of 68.2% probability, a longer, 200-year use of the site from the middle of the 41st until the end of the 40th century is possible. The 2 sigma dating range falls between about 4170 and 3730 BCE.

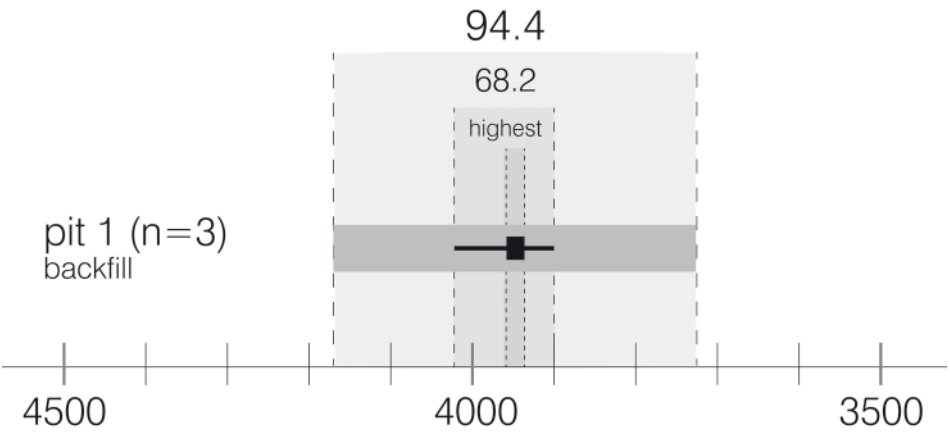

Fig. 8. Probability distributions of radiocarbon dates from pit 1 of the Trostianchyk site according to Bayesian modelling in OxCal. Drawn by R. Hofmann

Other dated contexts from Trostianchyk show, in the case of pit 2 and trench 4, similar narrow dating results falling in the first half of the 40th century (Müller *et al.* in prep.). In contrast, the highest dating probability of pit 3 and trench 6 might indicate a significantly longer dating range of the settlement between the last decades of the 41st century and about 3800 BCE. However, in the case of the latter two contexts, the quality of the models might be influenced by the fact that in each case only two 14C dates are available.

3.3. Finds

3.3.1. Massive clay objects

3.3.1.1. Truncated-pyramidal type

Truncated-pyramidal type objects found in pit 1 (Fig. 9; 10; 11: 1-7) resemble a trapezoid in cross section, and are semi-oval on the base. Outside, they are slightly flat. The base is not flat. It was formed on a non-flat surface (ground or clay base), previously covered by cereal chaff, according to a number of imprints. Most of the objects were made of one piece of clay. Three of them (No 1, 2 and 5) were formed in two stages: first, the base was modeled, and then the upper part was added. Artifact No 16 was formed in at least three stages, according to layers of clay which separate in joints.

Microscopic observation shows that the truncated-pyramidal type object and the discal-type object were produced of loess-like raw material with deliberate sand admixtures. The sand admixtures reached proportions of ca. 5-10%, with grains of ca. 0.1-0.3 mm.

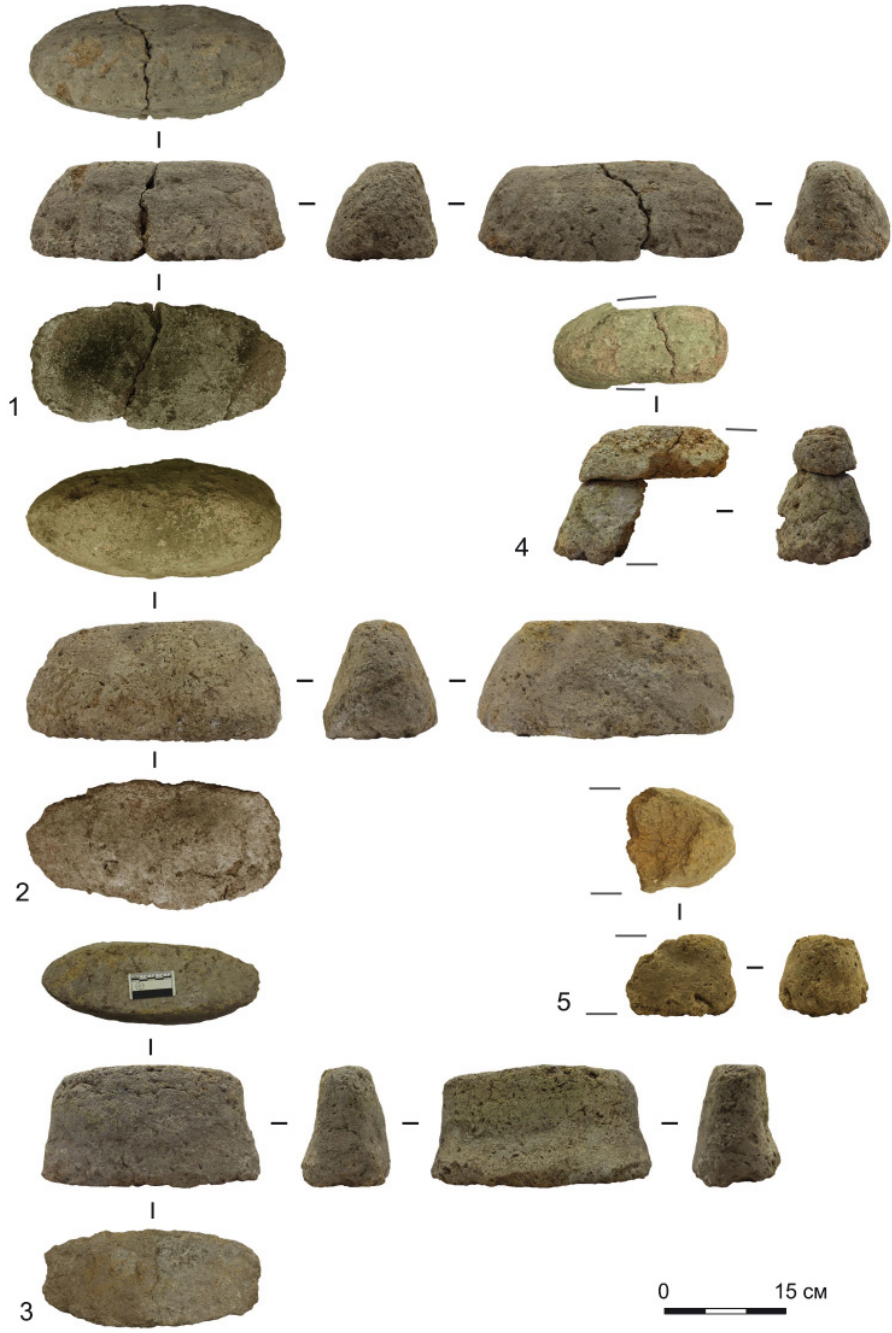

Fig. 9. Massive truncated-pyramidal clay objects, pit 1, Trostianchyk.
Photo by V. Rud, modified by V. Rud and Ye. Sliesariev

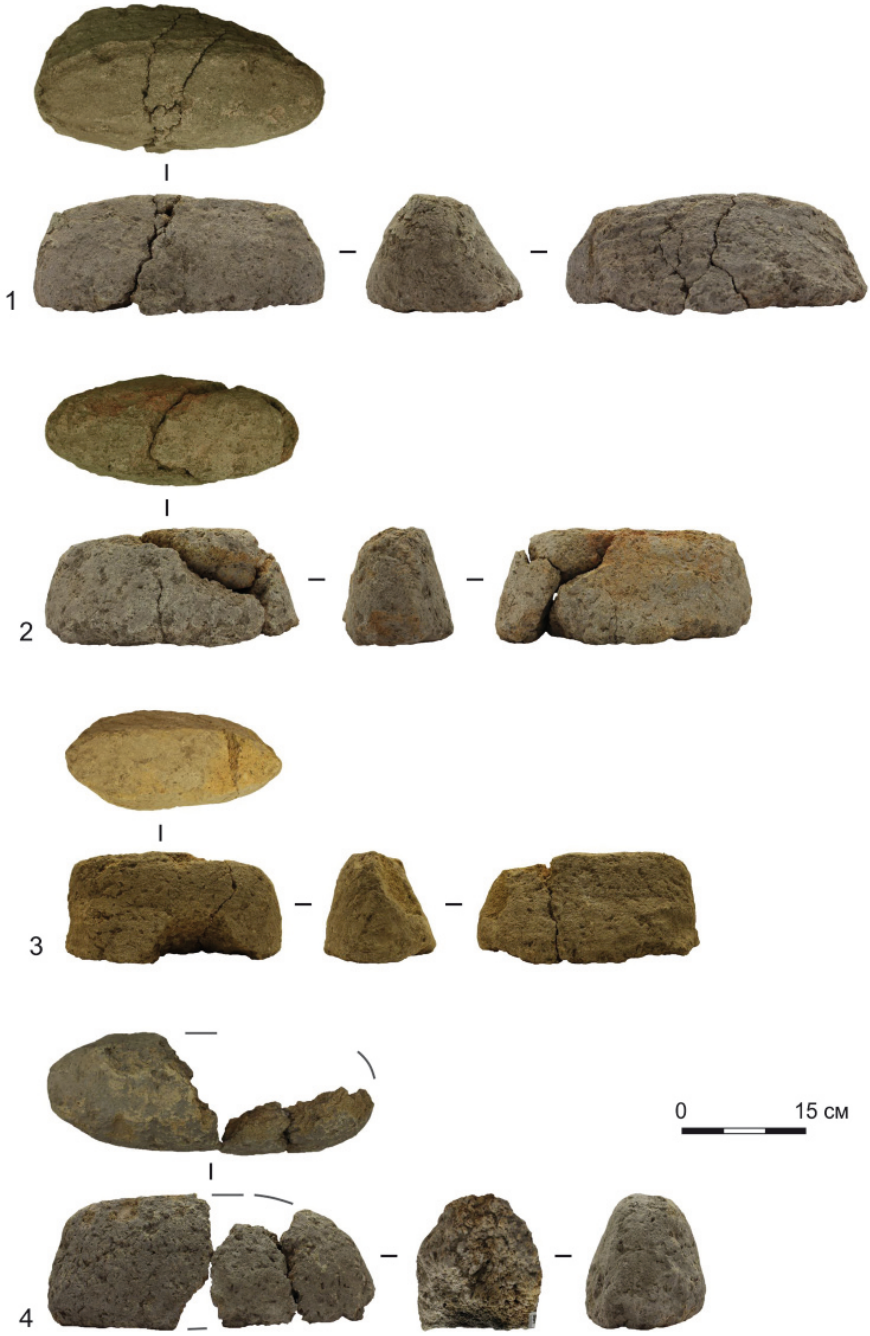

Fig. 10. Massive truncated-pyramidal clay objects, pit 1, Trostianchyk.
Photo by V. Rud, modified by V. Rud and Ye. Sliesariev

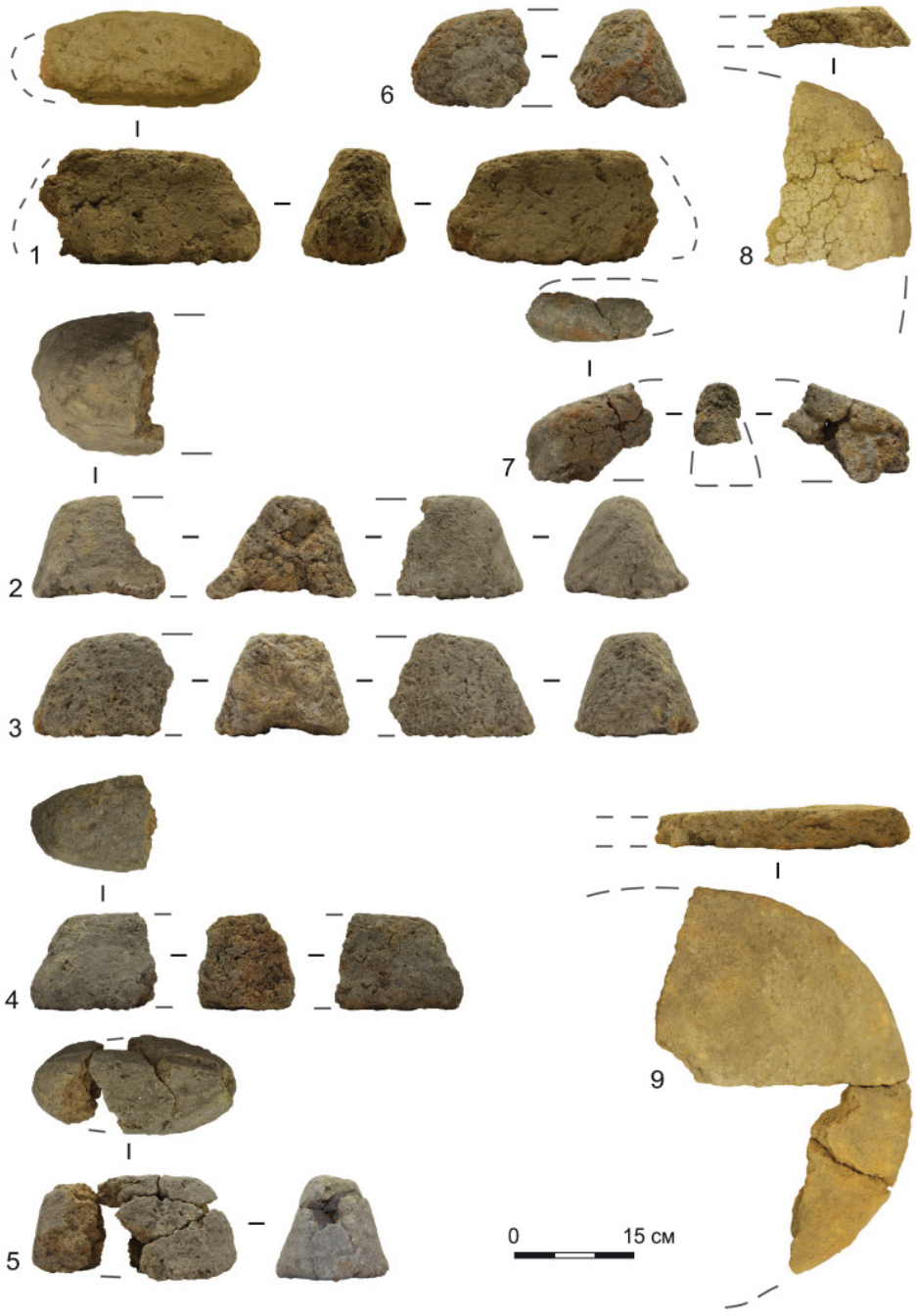

Fig. 11. Massive truncated-pyramidal clay objects (1-7) and discal-type objects (8-9), pit 1, Trostianchyk. Photo by V. Rud, modified by V. Rud and Ye. Sliesariev

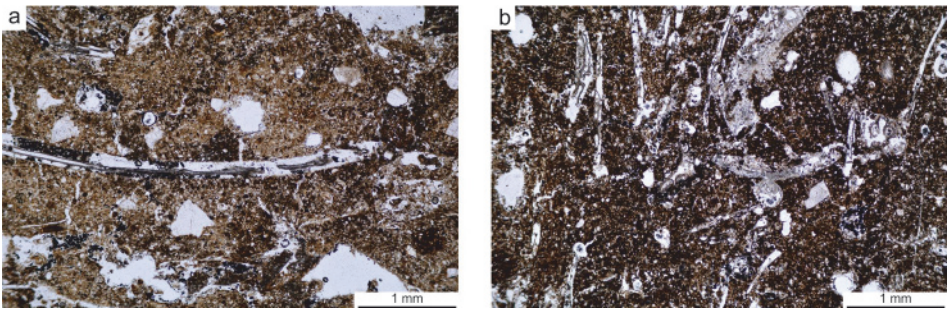

Fig. 12. Microphotographs of thin sections of daub samples; a – sample 13 (truncated-pyramidal object), porous, loess-like raw material with remains of organic material (plant), a few grains of quartz are visible, PPL; b – sample 14 (discal-type object), porous, loess-like raw material with remains of organic material (plant), a few grains of quartz are visible, PPL. Photo by A. Rauba-Bukowska

Samples contain coarse, poorly rounded crystalline grains, and a higher content of carbonate components, eg. micrite clasts (Fig. 12). Some concentrations of probably secondary calcite were also visible along the plant tissues and in holes remaining after such tissues had been destroyed. The clay mass of the raw material was isotropic (in the initial phase of vitrification), which suggested a firing temperature of ca. 850°C.

S. A. Gorbanenko examined the surfaces of the objects and their broken edges, and discovered pellicles of plant origin and their imprints as well as imprints of straws up to 5.0-7.0 cm long. All pellicle imprints belong to *Hordeum vulgare*. We have the admixtures of the results of plant processing to the clay mass of the objects (Rud 2016, 74).

The top and the sides of the objects have been fired to a dark-green color. The inner side of the objects is burnt to a dark-orange color. The bases (lower part) of most of the objects have the same color. The black color of the clay (a sign of burning without air access) is seen in the center of the side facing down. This dark layer is usually no more than 1.0 cm thick.

At the end of one of the artifacts, a human arm print was left. It appeared before the firing. Therefore, the object could have been formed and then moved to the place of its usage. Or, during the final stage of manufacture, the master decided to move it. Judging by the fact that prints were left on one side only, the object was moved vertically, using one arm.

The size, the level of preservation and the mass of truncated-pyramidal type massive clay objects are presented in Table 2. Only two of the objects were found whole (No 2 and No 3), and two more (No 5 and No 12) were restored completely. Their weight is 6.9-7.5 kg. Artifacts No 4, 9 and 14 are preserved at 80-90%, the rest – less than 70%. The high fragmentation of the objects is probably caused by mechanical damage from dumping them into the pit. The poorly preserved objects have fallen to pieces, and their fragments are impossible to find among amorphous parts of burnt clay.

Table 2. Dimensions, the level of preservation and the mass of truncated-pyramidal type clay products

No	Level of preservation	Size				Mass (kg)	Figure
		Length (cm)	Wideness (cm)		Highness (cm)		
			of foundation	of top			
1	fragment (~25%)	-	14.0	7.8	18.7	2.8	9:4
2	whole	34.5	15.5	9.0	18.5	7.5	9:3
3	whole	36.7	18.3	8.7	15.8	6.9	9:2
4	fragment (~90%)	34.0	16.0	8.8	14.5	5.1	10:2
5	whole (restored)	38.6	20.5	7.5	14.8	7.2	10:1
6	fragment (~35%)	-	13.0	6.8	14.0	2.6	11:4
7	fragment (~20%)	-	14.5	-	-	1.9	9:5
8	fragment (~40%)	-	17.5	7.5	13.4	3.0	11:3
9	fragment (~90%)	36.0	19.5	8.5	14.5	7.1	10:3
10	fragment (~40%)	-	21.3	6.0	15.5	3.3	11:2
11	fragment (~70%)	-	15.0	7.0	15.5	4.6	10:4
12	whole (restored)	38.7	19.3	6.8	13.2	7.0	9:1
13	fragment (~65%)	32.0	18.0	7.5	14.0	4.2	11:5
14	fragment (~80%)	-	16.3	8.0	16.0	5.5	11:1
15	fragment (~20%)	-	-	-	14.3	1.9	11:6
16	fragment (~15%)	-	-	-	-	1.3	11:7

3.3.1.1. Discal type

Discal type objects (Fig. 11: 8-9) from pit 1 have formed edges, have a round or oval form, and some fragments have a diameter of 0.45-0.53 m and are 3.5-5.0 cm thick. They are made of a similar, plant-tempered clay mass as the truncated-pyramidal type objects, and were produced with the same technology. The color of the objects varies from orange to dark green. In some objects the colors are equal, while in the others one color surpasses another, which indicates firing with different temperatures.

3.3.2. Other artefacts

The majority of artifacts come from layer 2A, which covers the massive clay objects. It largely consists of separate fragments (1043 items from the pit) of “table” and “kitchen” vessels. The number of fragmented animal bones is fewer. According to the preliminary conclusion of Ye. Yanish and M. Kublii, the species composition, strongly fragmented bones and presence of traces of external influence on the bones provide evidence that the osteological material from pit 1 belongs to kitchen remains.

Fig. 13. *Unio* shell tools for vessel decoration from pit 1, Trostianchyk
Photo by O. Zaitseva, modified by V. Rud and Ye. Sliesariev

Small pieces of burnt clay were found (maximum size 5.0 × 4.0 × 4.0 cm), both with plant admixture and without. The former are parts of some clay structures with the usage of wood. The latter are obviously parts of the installations with flat surface. Also in the filing of this layer of the pit, we find both complete and fragmented examples of *Unio* shells (33 items). There is also a small amount of zoomorphic figurines (7 items), miniature vessels (2 items), ceramic cones (2 items), flint tools and flakes, and complete and fragmented examples of processed tools for vessel decoration, made of *Unio* shells (Fig. 13). Most likely, the tools of *Unio* that were found were used on the surfaces of the "kitchen" vessels.

4. DICUSSION

4.1. Analogies in CTCC

The authors are unaware of any direct analogies of the truncated-pyramidal objects from pit 1 in CTCC. However, one similar object was found in house complex "2" at Maidanetske in 1988. This object is also made of clay with plant admixture and has the same form. Its height and base diameter is 0.20 m. On top it has two modeled "horns". It is assumed that this object was used as a stand (Shmagliy and Videiko 1988, 8, fig. 24: 1-3). A number of such "horned" objects have been found in the settlements of the Cucuteni culture area (Bodesti, Poduri, etc.) and are called "bucraniums" (Preoteasa 2012).

In recent years, a possible functional usage of discal-type objects was suggested. Discal-type objects found in Nebelivka, Stolniceni and other sites were identified as round clay slabs used as removable channel coverings (Burdo and Videiko 2016, 97-98, fig. 5: 6, 7; Korvin-Piotrovskiy *et al*. 2016, 243-245; Ţerna *et al*. 2017, 310, fig. 7: 3). It is assumed that the clay slabs protected the vessels from fire, and also were racks for these vessels.

4.2. Ethnographic Analogies

Between 1990-1993, a group of archaeologists performed an ethnographic expedition to Tarasara village in western India (Bhagat Kar *et al.* 1993). The purpose of the expedition was to seek out and document local traditions of ceramic production, which could help to reconstruct the techniques of ceramic production of the Harrapan culture.

In Tarasara village, the ceramics are fired in round ovens (Fig. 14) with diameters of approximately 2.70 m and brick walls 0.85 m high. The walls of the oven have eight firing channels 0.33 m high and 0.20 m wide (Bhagat Kar *et al.* 1993, 158-159). Before firing the objects, the bottom of the oven is covered with 25 stands. They are formed on a potter's wheel, and have the form of a hollow cylinder with a diameter of 0.14 m. The stands are placed in three circles, so that none of them blocks the insertion of the fuel inside the oven's chamber. The first circle has 13 racks, the second – eight, and the third (central) – only four. Each cylinder supports one vessel, and the edges of neighboring vessels do not touch each other.

The oven is loaded with closed-form vessels up to a height of 0.30 m above the walls. After that, the oven cell is closed by different vessels called *tavdi* – circular, middle-sized clay objects used for baking bread. The *tavdi* are put upside-down in order to close the oven chamber completely. Small holes are plugged with ceramic fragments, which are always kept near the oven. Fragments of the vessels are put beside the objects while loading the oven in order to keep the required level of heat.

The mobile stands for the vessels are what interest us in the given ethnographic description Indian ovens. We assume that the truncated-pyramidal clay objects from pit 1 in Trostianchyk had the same purpose.

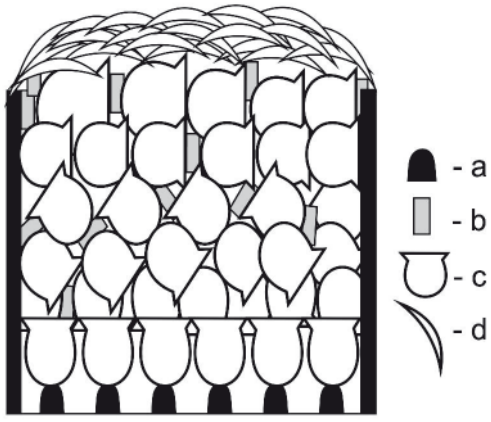

Fig. 14. Schematic representation of an ethnographic pottery kiln, India, early 90s.: a – clay stands; b – sherds; c – vessels; d – tavdi. After Bhagat Kar 1993, fig. 11; modified by O. Zaitseva

During further analysis of the inventory of pit 1, the question about the usage of discal-type objects becomes important.

Considering ethnographic information described above, there can be another version of the usage of such objects in ancient times. They could have been used for the final sealing of the furnace once it was loaded with the vessels. Arranged in several layers, such objects would provide the required amount of heat inside the oven. Also, they could have been used in addition to ceramic fragments for covering the holes. In this case, the walls of the furnace must have been vertical with a movable roof, created by clay disks. This allows for the quick loading and unloading of the chamber, without ruining parts of the construction. It is possible that the oven had no permanent walls, and that stability was provided by clay disks and\or ceramic fragments placed above the objects that were to be fired.

5. CONCLUSIONS

We assume that the massive clay objects from pit 1 of the CTCC Trostianchyk settlement are construction elements of an early pottery kiln. In our view, these truncated-pyramidal clay objects were used as movable stands to separate the goods (vessels) being fired from the fuel. Perhaps a stone that was found in the pit on the same level as the massive clay objects was used as a kind of stand. The discal-type clay objects were most likely placed above the stands. According to present analogies from Nebelivka and Stolniceni, they were used as a grate. According to the size of the discal-type objects, the truncated-pyramidal stands could be placed up to 0.40 m apart, but the scheme of their placement on the surface is not clear. According to the firing temperature of the pottery, a kiln with massive clay products could be used for firing both groups of vessels found in Trostianchyk.

Therefore, we have indirect information about the double chamber kiln with vertical construction found at the Trostianchyk site, which belongs to the Mereshovka-Chetetsuie III type of the Rakovets local group of Trypillia BII. Absolute dates indicate that the massive clay objects were put in the pit before the 40th century BC. Thus, the kiln was used in the last century of the V millennia BC.

Multichannel kilns functioned in the CTCC environment between 4100-3360 BC (Videiko 2019, 858). The oldest one is from Ostroh – Zeman of the Trypillia BII stage (Pozikhovskyi 2016), which, according to M. Videiko, belongs to the early stages of development of the Shypyntsi group (Videiko 2019, 858). Settlements of the Mereshovka-Chetetsuie III type preceded Shypyntsi sites chronologically (Ryzhov 2003b, 142; Ryzhov 2007, 452, 457). Therefore, the kiln with the use of movable structural elements from Trostianchyk is evidence of the existence of an archaic link in the evolution of ceramic firing devices in the environment of ancient farmers in Southeastern Europe.

The analysis of the site structure and topographic specifics indicates that the ceramics were fired on the edge of the settlement, which points to the fact that it was dangerous. The

same picture occurs in smaller settlements that existed later (Zhvanets; Movsha 1971). Although at the big settlements (Nebelivka, Maidanetske, Talianky, Dobrovody, Stolnicheni, Viitivka) (Videiko *et al.* 2015, 150-155; Rassmann *et al.* 2014, fig. 9a, 33a; Korvin-Piotrovskiy *et al.* 2016, fig. 30; Ţerna *et al.* 2016, 45; Rud *et al.* 2018, 14), the kilns are located in different parts of the sites, they are still distant from the buildings. Also, the kiln at Trostianchyk is located in a part of the site that is convenient for using the upward-directed wind at the edge of the slope.

The processes of forming and decorating the ceramic objects at the Trostianchyk site probably took place outside the main part of the settlement – close to pit 1, which is supported by the existence of *Unio* shell tools for vessel decoration at this location (layer 2A). The stratigraphically higher location of such artifacts in respect to the massive clay objects points to their younger age. This means that the pottery they were used for was made after moving the massive clay objects to the pit.

The logical explanation for the dumping of massive clay objects into the kiln is their loss of necessary technical characteristics. However, while some truncated-pyramidal objects were damaged when they were dumped into the pit, several were found unharmed, which means they were still fully functional.

Acknowledgements

Radiocarbon dating was made possible by funding from the German Research Foundation (DFG), project number 2901391021 – SFB 1266. The magnetometry was performed with the assistance of the Graduate School "Human Development in Landscapes" of Kiel University. We are grateful to Dr. Eugeniia Ianish (The I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine) and Mgr. Myhailo Kublii (National University of "Kyiv-Mohyla Academy") for the mass processing of osteological material and for the bone determination for ^{14}C dating, and also to Dr. Serhii Gorbanenko (Institute of Archaeology of the National Academy of Science of Ukraine) for the paleobotanical investigation of massive clay objects. Extraordinary gratitude is due to Stanislav Fedorov for his active participation in fieldwork. The text was translated by the authors and Danylo Klochko.

References

Bhagat Kar S., Koiso M. and Thomas E. 1993. Pottery making traditions at Tarasara, dist. Bhavnagar, Gujarat. *Bulletin of the Deccan College Research Institute* 53, 143-185.

Bronk Ramsey C. 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51 (01), 337-360.

Burdo N. and Videiko M. 2016. Nebelivka: from magnetic prospection to new features of mega-sites. In J. Müller, K. Rassmann and M. Videiko (eds), *Trypillia-Megasites and European Prehistory: 4100-3400 BCE*. London/New York: Routledge, 96-116.

Chapman J., Videiko M., Gaydarska B., Burdo N., Hale D., Villis R., Swann N., Tomas N., Edwards P., Blair A., Hayes A., Nebbia M. and Rud V. 2014a. The planning of the earliest European prototowns: A new geophysical plan of the Trypillia mega-site of Nebelivka, Kirovograd Domain, Ukraine. *Antiquity Gallery* http://antiquity.ac.uk.ezphost.dur.ac.uk/projgall/chapman339/.

Chapman J., Videiko M., Hale D, Gaydarska B., Burdo N., Rassmann K., Mishka C., Mueller J., Korvin-Piotrovskiy A. and Kruts V. 2014b. The second phase of the Trypillia mega-site methodological revolution: A new research agenda. *European Journal of Archaeology* 17 (3), 369-406. https://doi.org/10.1179/1461957114Y.0000000062.

Chernovol D. K., Lysenko S. D., Korvin-Piotrovskiy A. O., Pozikhovskyi O. L. and Marynchenko H. V. 2012. *Roboty Dnistrovskoi kompleksnoi arkheolohichnoi ekspedytsii u 2011 rotsi*. Kyiv: Starodavnii svit.

Dębiec M., Kiosak D., Pelisiak A., Posselt M., Saile T., Tkachuk T. and Ţerna S. 2014. Geomagnetic prospection on Tripillian sites in Central Ukraine. In G. Dumitroaia, C. Preoteasa and C.-D. Nicola (eds), *Cucuteni culture within the European Neo-Eneolithic context. International Colloquium Cucuteni – 130, abstracts*. Piatra-Neamţ: Neamţ County Museum Complex, Cucuteni Culture international Research Centre, 72-73.

Hale D., Chapman J., Swann N., Videiko M. and Villis R. 2010. Early urbanism in Europe? Geophysical survey at Nebelivka, Ukraine. *Recent Work in Archaeological Geophysics. Geological Society*, 35-36.

Hofmann R., Ţerna S, Ursu C.-E., Brandtstätter L., Tiede H., Mainusch W. and Autenrieth S. 2016. Spatial organisation and population size of small Cucuteni-Tripolye settlements: Results of geomagnetic surveys in Baia and Adâncata, Suceava County, Bucovina, Eastern Romania. *Journal of Neolithic Archaeology* 18, 157-189. https://doi.org/10.12766/jna.2016.4.

Hofmann R., Müller J., Shatilo L., Videiko M., Ohlrau R., Rud V., Burdo N., Dal Corso M., Dreibrodt S. and Kirleis W. 2019. Governing Tripolye: Integrative architecture in Tripolye settlements. PLOS ONE 14(9): e0222243. https://doi.org/10.1371/journal.pone.0222243.

Korvin-Piotrovskiy A., Hofmann R., Rassmann K., Videiko M. and Brandstatter L. 2016. Pottery kilns in Trypillian settlements. Tracing the division of labour and the social organization of Copper Age communities. In J. Müller, K. Rassmann and M. Videiko (eds), *Trypillia-Megasites and European Prehistory: 4100-3400 BCE*. London/New York: Routledge, 221-252.

Korvin-Piotrovskiy O. H. and Husiev S. O. 2000. Bahatosharove trypilske poselennia Berezova, ur. Bereh. *Arkheolohiia* 4, 35-40.

Kosakivskyi V. A. and Rud V. S. 2010. Arkheolohiia Bushi ta okolyts. *Aktualni problemy arkheolohii Ukrainy. Arkheolohiia i davnia istoriia Ukrainy* 4, 180-189.

Kruts V. O., Korvin-Piotrovskiy O.H. Chabaniuk V. V. and Shatilo L.O. 2015. Roboty Trypilskoi ekspedytsii na poselenni Talianky (2013-2014). In Yu. V. Boltrik (ed.), *Arkheolohichni doslidzhennia v Ukraini 2014*. Kyiv: Instytut Arkheolohii NANU, 252-254.

Movsha T. G. 1971. Goncharnyy tsentr tripolskoy kultury na Dnestre. *Sovetskaya arkheologiya* 3, 228-234.

Müller J. and Videiko M. 2016. Maidanetske: New Facts of a Mega-Site. In J. Müller, K. Rassmann and M. Videiko (eds), *Trypillia-Megasites and European Prehistory: 4100-3400 BCE*. London/New York: Routledge, 71-93.

Müller J., Hofmann R. Kirleis W., Dreibrodt S., Ohlrau R., Brandtstätter L, Dal Corso M., Rassmann K., Burdo N. and Videiko M. 2017. *Maidanetske 2013. New excavations at a Trypillia mega-site* (= *Studien zur Archäologie in Ostmitteleuropa* 16). Bonn: Dr. Rudolf Habelt GmbH.

Müller J., Hofmann R. Shatilo M., Ohlrau R. Rud V., Ţerna S., Rassmann K. Videiko M., Burdo N. and Chabaniuk V. Radiocarbon dating confirms contemporaneity of earliest European mega-sites. in prep.

Ovchynnykov E. V. 2014. *Trypilska kultura Kanivskoho Podniprovia*. Kyiv: Vydavets Oleh Filiuk.

Ohlrau R. 2019 [forthcoming]. *Maidanets'ke: Development and Decline of a Trypillia „Mega-site" in Central Ukraine* (= *Scales of Transformation in Prehistoric and Archaic Societies* 7). Leiden: Sidestone Press.

Pozikhovskyi O. 2016. Eneolitychnyi honcharnyi horn v Ostrozi (poperednie povidomlennia). In M. Manko, M, Danyliuk and C. Pozikhovska (eds), *Ostrozkyi naukovyi zbirnyk. Yuvileine vydannia do 100-richchia vidkryttia muzeiu v Ostrozi*. Ostroh: SPD Svynarchuk R. V., 98-105.

Preoteasa C. 2012. Considérations relatives à un certain type d'artéfacts de culte découverts dans des établissements appartenant au complexe culturel Precucuteni – Cucuteni (Considerations regarding a certain type of religious artifacts uncovered in settlements pertaining to the Precucuteni – Cucuteni cultural complex). *Arheologia Moldovei* 35, 75-106.

Rassmann K., Mertl P., Voss H., Bicbaev V., Popa A. and Musteata S. 2016. Copper Age settlements in Moldova: Insights into a complex phenomenon from recent geomagnetic surveys. In J. Müller, K. Rassmann and M. Videiko (eds), *Trypillia-Megasites and European Prehistory: 4100-3400 BCE*. London/New York: Routledge, 55-69.

Rassmann K., Ohlrau R., Hofmann R., Mischka C., Burdo N, Videiko M. and Müller J. 2014. High precision Tripolye settlement plans, demographic estimations and settlement organization. *Journal of Neolithic Archaeology* 16, 96-134. https://doi.org/10.12766/jna.2014.3.

Reimer P. J., Bard E., Bayliss A., Beck J. W., Blackwell P. G., Bronk Ramsey C., Grootes P. M., Guilderson T. P., Haflidason H., Hajdas I., Hatté C., Heaton T. J., Hoffmann D. L., Hogg A. G., Hughen K. A., Kaiser K. F., Kromer B., Manning S. W., Niu M., Reimer R. W., Richards D. A., Scott E. M., Southon J. R., Staff R. A., Turney C. S. M. and van der Plicht J. 2013. IntCal13 and Marine13 Radiocarbon age calibration curves 0-50,000 Years Cal BP. *Radiocarbon* 55(4), 1869-1887.

Rud V. S. 2016. Zahlybleni obiekty z poselennia Trostianchyk. *Arkheolohiia* 3, 65-75.

Rud V., Ohlrau R. and Manigda O. 2016. Heomahnitna ziomka ta heohrafichne modeliuvannia u vyvchenni poselennia Trostianchyk. *Visnyk riativnoi Arkheolohii (Acta Archaeologiae Conservativae)* 2, 55-76.

Rud V., Ohlrau R., Fedorov S. and Zaitseva O. 2018. Doslidzhennia na poselenniakh trypilskoi kultury Trostianchyk ta Viitivka. In Yu. Boltryk (ed.), *Arkheolohichni doslidzhennia v Ukraini 2016*. Kyiv: Instytut Arkheolohii NANU, 11-14.

Rud V. 2018. *Trypilska kultura pivdnia lisostepovoi zony u mezhyrichchi Pivdennoho Buhu ta Dnistra (etapy BII – CI)*. Dysertatsiia k.i.n. IA NANU.

Ryzhov S. M. 1993. Doslidzhennia trypilskykh poselen po r. Liadovii u Serednomu Podnistrovi. *Podilska starovyna* I, 85-96.

Ryzhov S. 1999. Keramika poselen trypilskoi kultury Buho-Dniprovskoho mezhyrichchia yak istorychne dzherelo. Dysertatsiia k.i.n. Instytut Arkheolohii NANU.

Ryzhov S. M. 2003a. Mistse pamiatok rakovetskoho varianta u rozvytku serednoho etapu trypilskoi kultury. In *Halych v doistorii i serednovichchi. Materialy mizhnarodnoi arkheolohichnoi konferentsii*. Halych: Informatsiino-vydavnychyi viddil Natsionalnoho zapovidnyka „Davnii Halych", 29-33.

Ryzhov S. M. 2003b. Trypilski pamiatky petrenskoi lokalnoi hrupy Podillia. In O. H. Korvin-Piotrovskiy, V. O. Kruts and S. M. Ryzhov (eds), *Trypilski poselennia-hihanty. Materialy mizhnarodnoi konferentsii*. Kyiv: Korvin Press, 140-145.

Ryzhov S. M. 2007. Suchasnyi stan vyvchennia kulturno-istorychnoi spilnosti Kukuten-Trypillia. In Yu. Ia. Rassamakin and S. M. Ryzhov (eds), *O. Olzhych. Arkheolohiia*. Kyiv: Vydavnytstvo imeni Oleny Telihy, 437-477.

Shmagliy N. M. and Videiko M. Yu. 1988. *Otchet o rabote Maydanetskogo otryada Tripolskoy ekspeditsii v 1988 g*. Manuscript in Naukovyi arkhiv IA NANU, 1988/4b, 23. Kyiv.

Sorokin V. Ya. 1983. Raskopki mnogosloynogo poseleniya Mereshovka-Chetetsuye v 1980 g. In *Arkheologicheskiye issledovaniya v Moldavii v 1979-1980 gg*. Kishynev: Shtiintsa, 102-111.

Țerna S. and Heghea S. 2017. Middle and Late Copper Age settlements from the Brînzeni microzone on the Prut river: older research in a modern background. *Sprawozdania Archeologiczne* 69, 297-325.

Țerna S., Rassman K., Vasilache M. and Radloff K. 2016. Stolniceni I – new research on a Cucuteni-Tripolye large site. In A. Zanoci, E. Kaiser, M. Kashuba, E. Izbitser and M. Băț (eds), *Man, culture, and society from the Copper Age until the Early Iron Age in Northern Eurasia. Contributions in honour of the 60th anniversary of Eugen Sava* (= *Tyragetia international* I). Chişău: National Museum of History of Moldova, Freie Universität Berlin, 41-52.

Țerna S. V., Rassmann K. and Rud V. S. 2017. Goncharnyy gorn s pozdnetripolskogo poseleniya Stolnicheni I (Edinetskiy rayon. Respublika Moldova) i proizvodstvo keramiki k vostoku ot Karpat v IV tysyacheletii do n. e. *Stratum plus* 2, 301-330.

Tkachuk T. and Shevchuk B. 2007. Trypilske poselennia Moshanets i deiaki problemy etapu VII. *Arkheolohichni doslidzhennia Lvivskoho universytetu* 10, 14-40.

Tsvek O. V. 2006. *Poselennia skhidnotrypilskoi kultury (korotkyi narys)*. Kyiv: Instytut arkheolohii NAN Ukrainy.

Videiko M. Yu. 2019. Honcharni horny trypilskoi kultury: novi horyzonty doslidzhen. In M. Szmyt, P. Chachlikowski, J. Czebreszuk, M. Ignaczak and P. Makarowicz (eds), *VIR BIMARIS, Od kujawskiego matecznika do stepów nadczarnomorskich. Studia z dziejów międzymorza bałtycko-pontyjskiego ofiarowane Profesorowi Aleksandrowi Kośko* (= *Archeologia Bimaris. Dyskusje* 5). Poznań: Uniwersytet im. Adama Mickiewicza, Instytut Archeologii, 847-859.

Videiko M. Yu., Chapman J., Burdo N. B., Gaydarska B., Țerna S. V., Rud V. S. and Kiosak D. V. 2015. Kompleksnyye issledovaniya oboronitelnykh sooruzheniy, proizvodstvennykh kompleksov i ostatkov postroyek na tripolskom poselenii u sela Nebelevka. *Stratum plus* 2, 147-170.