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Pottery and Hillforts: Some Aspects of Pottery Production During the Late Bronze Age in the Territory of Latvia

Keramika un pilskalni: trauku izgatavošanas tehnoloģiskie aspekti vēlajā bronzas laikmetā Latvijas teritorijā

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The paper is dedicated to the technological aspects of pottery production in the Late Bronze Age in the territory of Latvia. For the purposes of the current research, nine pottery assemblages were analysed. As hillforts appeared in the Late Bronze Age, they represented the dominant aspects of pottery production in this period, therefore this type of settlement was chosen for the analysis. Two types of analytical techniques were used for this research: visual (macroscopic) and ceramic petrography (microscopic). For the petrographic analysis, 78 thin sections were made from all the analysed hillfort ceramic collections. In this paper, the structure of clay, as well as temper, vessel shape, size and wall thickness were analysed and grouped.

Keywords: Late Bronze Age, Ceramics, Pottery production, clay matrix, tempering traditions.

Pētījums veltīts keramikas trauku izgatavošanas tehnoloģiskajiem aspektiem, kuri konstatējami vēlā bronzas laikmeta pilskalnu materiālā. Kopumā analizētas deviņu pilskalnu keramikas kolekcijas, kas pārklāj visu Latvijas teritoriju. Pētījumā izmantotas divu veidu analīzes – vizuālā un keramikas petrogrāfija. Pēdējai kopumā sagatavoti 78 keramikas plānslīpējumi. Rakstā analizēti šādi keramikas trauku tehnoloģiskie aspekti: māla veidmasa, liesinātāji, trauku izmērs, izgatavošanas tehnika, forma un sienu biezums.

Atslēgvārdi: vēlais bronzas laikmets, keramika, māla trauku izgatavošana, veidmasa, liesinātāju tradīcijas.

Introduction

Pottery and its production during the Late Bronze Age in the territory of Latvia is an interesting topic, which has enjoyed a quite extensive attention among the researchers. Overall, there have been

studies about pottery of this period in the context of its visual appearance and connections with ethnicity, as well as its distribution in the region. For example, a detailed study of striated pottery in the context of ethnogenesis of the Balts was presented by the archaeologist Jānis Graudonis.[1] The most detailed pottery study of this period, which includes clay matrix and tempering analysis using binocular microscope, has been implemented by archaeologist Andrejs Vasks.[2] Although these studies yield important information about pottery and its connection to the traditions and cultural aspects of prehistoric societies, they do not include detailed clay matrix and tempering analysis, nor view its interaction with visual appearance of ceramic, using laboratory analysis, in this case – ceramic petrography. It should be noted that since these studies new data have been collected on the basis of excavations of Late Bronze Age settlements (for example, Krievu kalns, Padure, Rušenica hillforts, etc.).

In this study, the author has chosen to analyse ceramic assemblages of Late Bronze Age hillforts (Fig. 1.). There is a number of reasons for selecting this type of settlement for analysis: 1) in the territory of Latvia, hillforts appear as a dominant type of settlement in the Late Bronze Age, thereby they represent the main aspects of craftsmanship during this period, including pottery production; 2) few field settlements have been discovered in the territory of Latvia, therefore the material to work with is scarce; 3) Additionally, in the opinion of the author, it is important to analyse one type of settlement to define the main tendencies in the pottery production in the region. For this paper, ceramic assemblages of nine hillforts were chosen: Western part of Latvia: Krievu kalns (7133 sherds), Paplaka (858 sherds) and Padure (~ 7800 sherds) hillforts; Lower part of Daugava river:

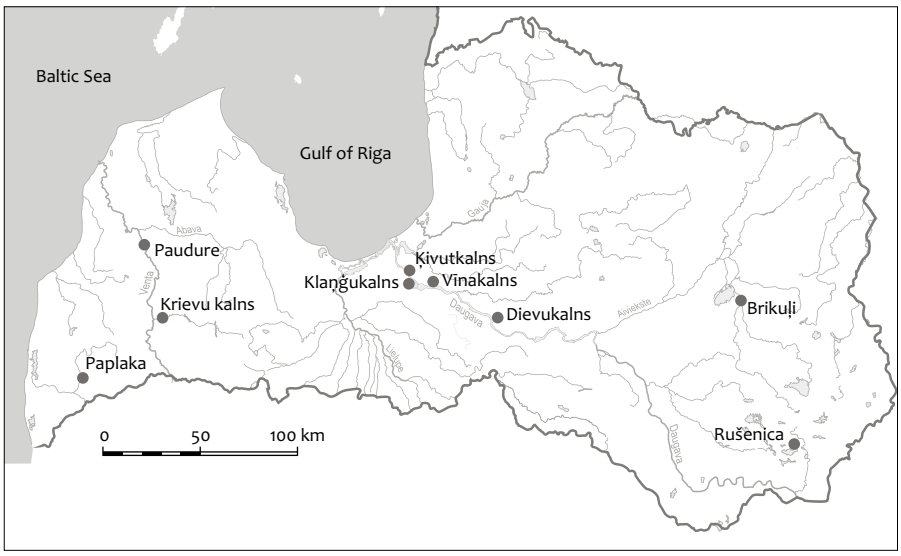

Fig. 1. **Location of the analysed settlements.**

1. att. **Analizēto pieminekļu lokācija kartē.**

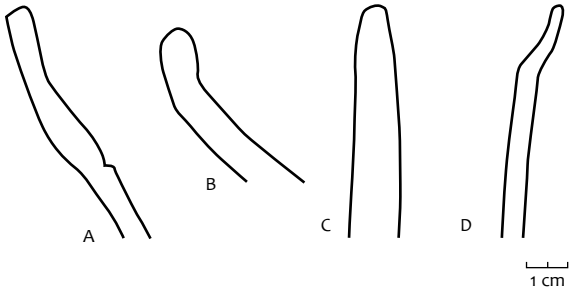

Fig. 2. **Common shapes of pottery. A** – CS (Klaņģukalns A9960); **B** – S (Padure A13673:115); **C** – IC (Vīnakalns I field – 1st layer); **D** – IK (Brikuļi A12468:196).

2. att. **Sastopamās trauku profila formas. A** – CS (Klaņģukalns A9960); **B** – S (Padure A13673:115); **C** – IC (Vīnakalna I laukums – 1. kārta); **D** – IK (Brikuļi A12468:196).

Dievukalns (3499 sherds), Klaņģukalns (3707 sherds), Ķivutkalns (~ 38 000), Vīnakalns (3057) hillforts; Eastern part of Latvia: Brikuļi (33 107 sherds), Rušenica (2198 sherds) hillforts. The author must note that Ķivutkalns and Brikuļi collections, due to their massive amount, have not been fully analysed in this study. Although these collections have not been fully analysed by the author, the collected information still presents the main tendencies of the pottery production in these settlements.

The aim of this paper is to study the technological aspects of pottery production.*

Although surface treatment and firing of pottery are substantial variables, these questions will not be discussed in the study. The pottery surface treatment and its geographical distribution[3] is a well-studied topic, whereas the study of firing process requires complex analysis which, for now, is not available to the author. Two techniques of analysis were used for the purposes of this study: visual (macroscopic) and ceramic petrography (microscopic). For visual analysis, simple measurements of wall thickness, rim diametral size and largest temper grain were made. The profile forms of pots were grouped using the Rimute Rimantiene vessel profile shape classification (with modifications of A. Vasks (IK)[4] and Valdis Bērziņš (IC)[5]) – IC (barrel-shaped); CS, S (curved); IK (biconical – medium curved axis in the shoulder part of the vessel) (Fig. 2.).[6]

For petrographic analysis, 78 ceramic thin sections were made. Pottery samples were chosen to make up a representative selection of the surface treatment variation: as striated pottery overall is the dominant type in the Late Bronze Age (in Dievukalns, striated pottery makes up 72% of the collection, Klaņgukalns – 50.3%, Ķivutkalns – 90%, Krievu kalns – 74.6%, Padure – 52.1%, Paplaka – 73% and Vīnakalns – 74%, whereas in Brikuļi and Rušenica it is not dominant, forming 26.6% and 32% of collection), 38 thin sections of this group were made, smoothed – 18 Ts, textile impressed – 13 Ts and coarse-slipped – 9 Ts.

* This paper is based on author's master's thesis "Traditions of pottery craft in Late Bronze and Earliest Iron Age in the territory of Latvia" (defended on 12.06.2017, University of Latvia Faculty of History and Philosophy).

As the IC vessel shape is the dominant, most of the samples are from vessels with this type of profile form. The wall thickness of samples varied from 0.5 cm to 1.8 cm. The structure of clay matrix, as well as the main tendencies of tempering and their interaction with visual features of the vessels were studied using this analytical technique.

Clay variations

The structure of the clay is the dominant aspect, which determines the use of the material for pottery production. Ethnoarchaeological studies reveal that potters knew exactly what kind of clay is needed in order to make a qualitative vessel either as a result of knowledge transfer from ancestors or from their own experience.[7]

In the territory of Latvia, only secondary clay[8] is present.[9] In this region, the deposits of clay minerals occurs in Quaternary, Jurassic, Triassic and Devonian periods. As clay beds of the Devonian period are not located as deep in the Earth's surface as the rest of them in this region,[10] it would be consistent to assume that the clay of this period was used to make vessels. In the petrographic analysis, eight possible variations of clay were distinguished, using criteria of the coarseness of natural inclusions and their sorting in the clay (Fig. 3.):

1) Clay with fine inclusions, well sorted. This type is rich in silt and fine sand, rarely has sand inclusions. This is the most common clay type, 41% of samples belongs to this group;
2) Clay with fine, medium sorted inclusions. This type is rich in silt, fine sand is common, while sand is rare. 10% of the samples belongs to this group. It is not present in four collections – Brikuļi, Klaņģukalns, Vīnakalns and Paplaka;
3) Clay with fine inclusions, poorly sorted. This clay type is rich in silt and fine sand, sand is rare. 11% of the samples belong to this group. This type of clay is not present in three collections – Dievukalns, Ķivutkalns and Rušenica;
4) Clay with medium coarse, well sorted inclusions. This type is one of the rarest among all. Only 3% of the samples belong to this group. It is notable that only two collections contain this type of clay – Ķivutkalns (KIV7 – rich in fine sand and sand, whereas silt is rare) and Krievu kalns (SKRU1 – rich in silt and fine sand, sand is rare);
5) Clay with medium coarse, medium sorted inclusions. 4% of the samples belong to this group. Three collections contain this type of clay – Brikuļi (BR9), Dievukalns (DK10) and Rušenica (RU3). Samples of Brikuļi and Rušenica rarely contain silt, they are rich in fine sand and sand, whereas in Dievukalns sample silt and fine sand are common, they are also rich in sand inclusions;
6) Clay with medium coarse, unsorted inclusions. This type of clay is rich in fine sand and sand, while silt is rare. This group is the second most common among all. 15% of the samples belong to this group. This type is not present in two collections – Dievukalns and Rušenica;
7) Clay with coarse, medium sorted inclusions. This type of clay is rich in sand, fine sand is common, but silt is rare. 4% of the samples belong to this group. This type is identified only in Dievukalns collection (DK3, DK7, DK9);
8) Clay with coarse, unsorted inclusions. This type of clay is rich in sand, fine sand is common, silt is rare. 12% of the samples belong to this group. It is not present in Brikuļi, Krievu kalns, Padure and Paplaka collections.

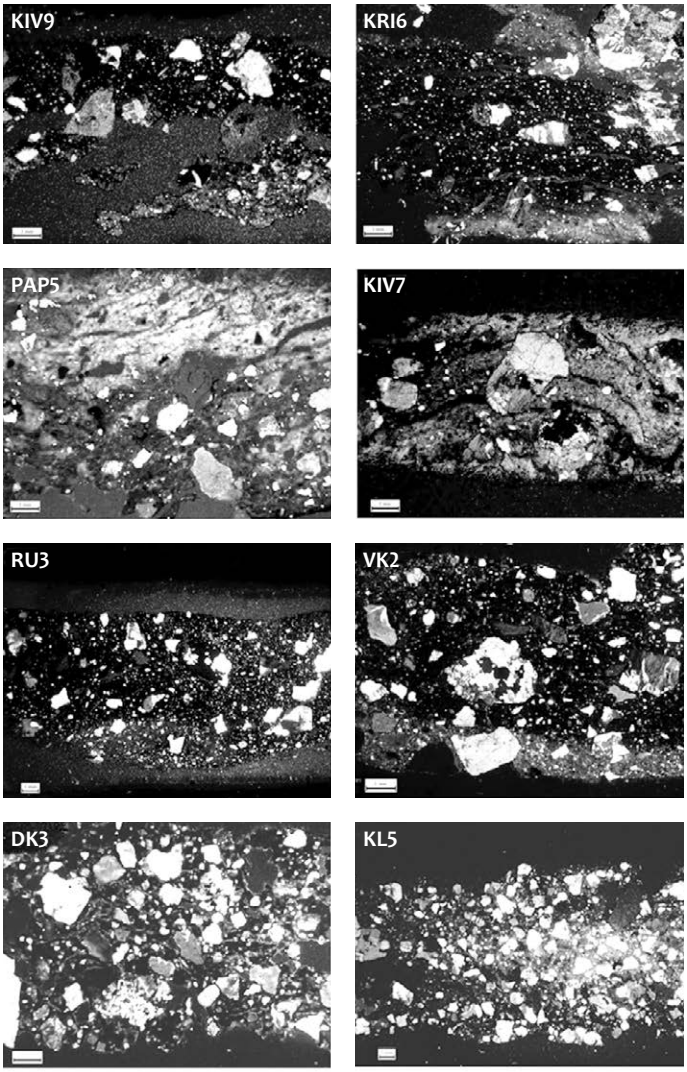

Fig. 3. **Clay groups.** KIV9 – Group 1; KRI6 – Group 2; PAP5 – Group 3; KIV7 – Group 4; RU3 – Group 5; VK2 – Group 6; DK3 – Group 7; KL5 – Group 8 (V. Visocka microscope-photo, crossed polarizers).

3. att. **Konstatētās māla masas grupas.** KIV9 – 1. grupa; KRI6 – 2. grupa; PAP5 – 3. grupa; KIV7 – 4. grupa; RU3 – 5. grupa; VK2 – 6. grupa; DK3 – 7. grupa; KL5 – 8. grupa (V. Visocka mikrofoto, krustoti polarizatori).

Tempering materials

In this study, four main tempering recipes were distinguished: 1: clay + granitic rock; 2: clay + granitic rock + organic (mostly plant material); 3: clay + granitic rock + iron compounds; 4: clay + granitic rock + grog (Fig. 4.). It is important to note that for some of the non-plastics it is still an open question whether they were added as a temper or did they already naturally occur in the clay (lumps of iron compounds and organic matters, as well). This question will be discussed later in the study. It is important to note that tempering traditions and their variations in the analysed hillforts are not correlated with different surface treatments. Non-correlation of surface treatment and temper may show the existence of independent pottery craft traditions. Unfortunately, there is no study about relation of the surface treatment to the vessels' function and social meaning to make further assumptions. Hence, this question will not be discussed in the current study.

Granitic rock tempering: This is the most common tempering material not only in the territory of Latvia, but in the Baltic states and Scandinavia, as well.[11] Granitic rock is common in all eight clay groups. By visual analysis, four tempering qualities of granitic rock can be distinguished: 1) fine (1–2 mm); 2) medium (2–4 mm); 3) coarse (4–6 mm); 4) rough (6–10 mm) (Fig. 5.).

The most common is medium sized granitic rock tempering, 57% of all analysed samples belongs to this group. In 27% of the cases, coarse granitic rock tempering is common in pottery ware. This group is dominant in three collections – Dievukalns (in 41% of samples), Vīnakalns (31%) and

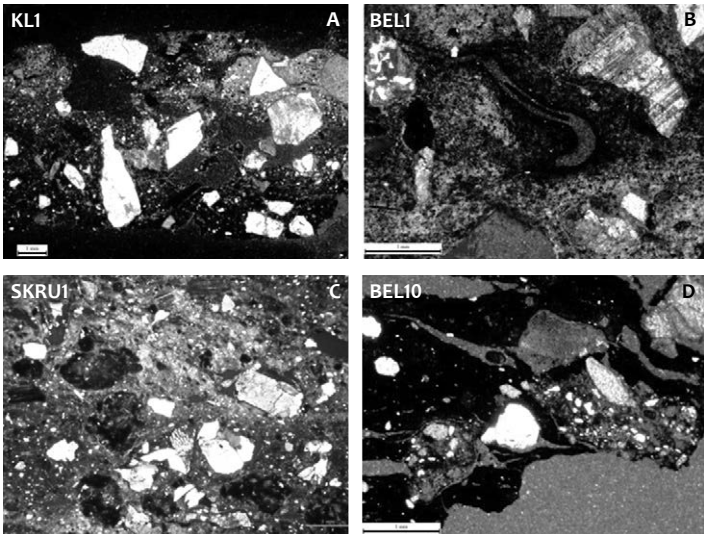

Fig. 4. **Tempering materials.** A – granitic rock; B – organics; C – iron compounds; D – grog (A, B, D – V. Visocka's, C – O. Stilborg's microscope-photo, crossed polarizers).

4. att. **Liesinātāji.** A – granītiskie ieži; B – organika; C – dzelzs savienojumi; D – šamots (A, B, D – V. Visockas, C – Ū. Stilborga mikrofoto, krustoti polarizatori).

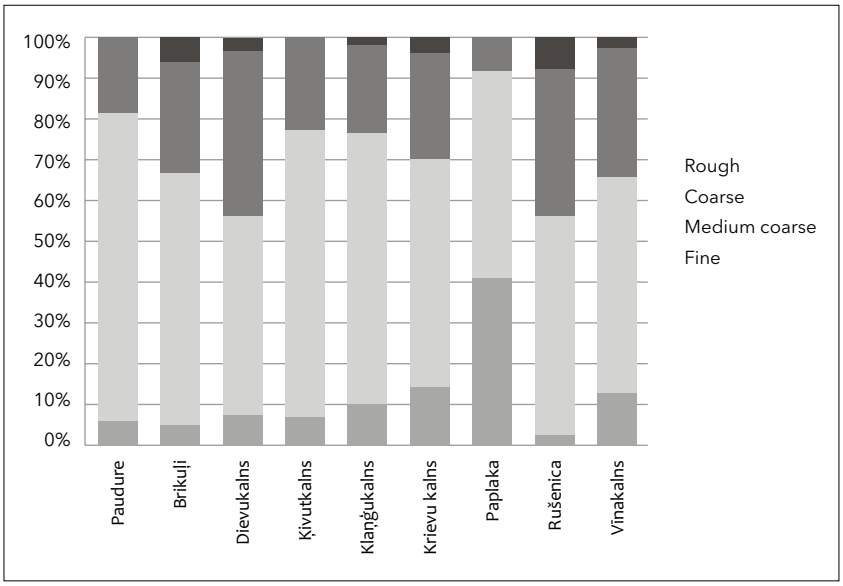

Fig. 5. **The amount of granitic rock qualities in the analysed ceramic collections.**

5. att. **Granītisko iežu variāciju procentuālais daudzums analizētajās kolekcijās.** No augšas uz leju – ļoti rupji, rupji, vidēji rupji, smalki.

Rušenica (36%). In 12% of all the samples, fine granitic rock tempering is present. The Paplaka collection makes up a notable exception with 41% of the samples having a fine granitic rock tempering. Rarest among all is rough granite tempering – only 4% of the samples belong to this group. This group does not occur in three collections – Ķivutkalns, Padure and Paplaka.

Petrographic analyses show that medium sized granitic rock tempering is added to clay matrix in larger quantity than other variations. It is notable that in two collections – Ķivutkalns and Klaņģukalns – coarse granitic rock tempering is added to clay matrix more often than other variations.

Grog tempering: By visual analysis, the author did not find any grog in clay matrix. A different situation is observed in the petrographic analyses. 8% of all samples contained grog tempering. Consequently, it is not widely distributed in this region. It is notable that in two collections – Dievukalns and Vīnakalns – this tempering material is not present. It is not known precisely, whether the absence of this material in these two collections is accidental (the chosen samples did not contain it) or it really was not used as a temper in these hillforts.

Grog was mainly from a different clay than the vessel clay matrix. In the sample BEL6, the clay of grog is fine, unsorted, only silt is common, whereas the vessel clay is fine, sorted, rich in silt and fine sand. The clay of sample BEL10 is fine, medium sorted, but the clay in the grog is coarse and unsorted, rich in fine sand and sand inclusions and with granitic rock temper. In the sample KIV8, the clay is coarse,

unsorted, rich in sand, whereas the clay of the grog grain is medium coarse, unsorted, rich in fine sand, with granitic rock temper. The clay matrix of the sample KRI9 is medium coarse, unsorted, rich in fine sand, whereas the clay in the grog grain is fine, sorted and with silt inclusions.

In some cases, the added grog grains are from the same clay. In the sample BR5, the clay is fine, sorted and rich in fine sand, the clay of the grog grains might be from the same clay bed, as it is with fine, sorted inclusions as well. The clay matrix of the sample KL2 is fine, unsorted, as well as the clay of the grog grains.

In some collections, grog tempering is used in clay with fine impurities: In Brikuļi, grog occurs in the first group of clay, in Padure in the first and second group and in Klaņģukalns – in the third group. In contrast, in the Ķivutkalns and Krievu kalns collections, grog tempering is used for medium and coarse clays (sixth and eight group). Grog is not present in three clay groups – fourth, fifth and seventh.

Organics: Of all the possible organic materials, only plant remains were distinguished in this study. By visual analysis, some traces of plant stalks were identified in the clay matrix (in Krievu kalns and Ķivutkalns collections), whereas the petrographic analyses revealed that 42% of samples contain plant material remains. The author wants to emphasize that only some (VK1, BR1 and KL5) samples contained more than one piece of plant material. This raises serious doubts about this material as a temper. The plant material in the pottery ware might be accidental.

Lumps of iron compounds: This ferrihydrite group compound is quite a strange phenomenon in the clay matrix, which is not widely distributed in the ceramic collections of Late Bronze Age. This possible tempering material, of all the analysed, is common only in the collection of Krievu kalns. Therefore, further analysis is based on the data from this collection.

12% of Krievu kalns samples contain lumps of iron compound in their matrix. The distinguished ferrihydrites in the clay matrix are mainly in the shape of dark brown, brown or reddish brown elongate lumps. Their distribution in the clay matrix differs – in some, they are well sorted medium sized (2–4 mm), in others – unsorted, coarse (4–6 mm).

Iron compounds, as well as slag, are common in some Iron Age collections – Ķente,[12] Asote,[13] Tērvete[14] in Latvia and Siksälä Kalmetemagi in Estonia.[15] Ceramic researcher Baiba Dumpe defines these iron compounds as tempering material, as potters could have technological, practical, aesthetic and symbolical reasons for adding it in the clay.[16] In the opinion of the author, more extensive analysis of the lumps of iron compounds in the clay matrix should be carried out before assuming it as a temper.

Coiling techniques

The only distinguished vessel construction technique in all the analysed collections is coiling. There are three main variations of coiling techniques – N, H and U.[17] In the analysed ceramic collections, two coiling techniques were distinguished – N and U. In all the collections, the dominant coiling technique is N – Klaņģukalns (71% of all the identifiable techniques), Ķivutkalns (82%), Padure (86%), Paplaka (80%) and Krievu kalns (100%), Dievukalns (70%), Rušenica (84%), Vīnakalns (74%) and Brikuļi (55%). It is notable that Brikuļi is the only collection where U technique is used to make pottery in such a high proportion (45% of all identifiable techniques). The author must note that in Krievu kalns collection, as it is seen above, only N technique is present.

In some cases, it was possible to distinguish the height of clay coils used for vessel construction. The height mainly varies from three to five cm, but in some occasions, it can reach 10 cm (for example, in Padure: A13673:121 – 6 cm, A13673:114 – 7.5 cm; Ķivutkalns: X-5-4 – 9.2 cm; Brikuļi: A12405:444 – 8 cm, etc.). In the cases of N technique, the thickness of sherds varies from 0.4 to 1.6 cm, whereas U – 0.6 to 1.8 cm. These data show that the thickness of vessel wall is not one of the factors determining the choice of a specific coiling technique. Analysing the correlation between coiling techniques and surface treatment, it is observed that within all the treatment types the dominant is N technique (striated – in 73% of samples, smooth – 78% and coarse-slipped – 75%, textile impressed – 57%). It is notable that the textile impressed pottery is the only type, where U technique is used to make pottery in such a high amount (43%).

Traces of fingerprints from pressing the clay coils together were found on some pottery samples. For instance, in Vīnakalns collection, one striated sherd with impressions of fingers in the inner surface were found, whereas in Brikuļi (A12405:413) and Krievu kalns (A13957:58) the impressions of fingers were found on the bottom part of the vessels' outer surface. Such imprints, most likely, were caused by the potter pressing together the first coil with the bottom part of the vessel. In the opinion of the author, these impressions could also have been left on the surface for aesthetic reasons.

Size and shape

Based on the collected data, the pottery can be divided into four groups according to size: 1) miniature (2–6 cm in rim diameter); 2) small (6–10 cm); 3) medium (10–20 cm); 4) large (20–40 cm).

Miniature vessels: Pottery of this size makes up a small part of all the collections analysed (Ķivutkalns – 0.01%, Klaņģukalns – 0.11%, Vīnakalns – 1%, Brikuļi – 0.7%, Padure – 0.07% and Krievu kalns – 3%). In two collections – Dievukalns and Paplaka – the miniature vessels were not found.

Archaeologist A. Vasks argues that miniature vessels are made from one clay lump without adding any temper.[18] Analysing miniature pottery, it is seen that in 37% of samples no tempering material was added, whereas in 25% of samples sand is seen in the clay matrix. The author must note that it is not precisely known whether sand was added as a tempering material or already was present in the clay. It is notable that in some cases pieces of granitic rocks of various sizes (2–6 mm) were found in the clay. In the opinion of the author, these granite pieces were not used as a tempering material for these vessels. Most likely, they are accidental.

The dominant sizes for miniature vessels varies from five to six cm (54% of all the analysed), less common are those three to four cm in diameter (39%). Only in two collections – Ķivutkalns and Rušenica – there were vessels with a diameter of two cm. It could be possible that there have been such small vessels in other settlements, as well, but that they have not been preserved. Wall thickness for this size of pottery varies from 0.5 to 1.6 cm. As the number of samples is insufficient, it is problematic to study statistics of dominant wall thickness of vessels of this size. Hence, the correlation between wall thickness and miniature pottery size will not be discussed in this study. The shape of these vessels is mainly IC, only in Krievu kalns collection there is a pot whose profile form is slightly curved (possibly CS?).

The Late Bronze Age miniature pottery has no ornamentation on the surface. In 89% of the samples the surface is smooth,

while in Krievu kalns some vessels with slightly striated surface have been found (11%). This might indicate a local tradition in this settlement. Overall, miniature pots and their technological aspects are similar in all the analysed collections.

Small vessels: Although small vessels are present in all the analysed collections, they are present in limited numbers (Dievukalns – 8%, Vīnakalns – 5%, Klaņģukalns – 4%, Brikuļi – 8%, Rušenica – 9%, Padure – 4%, Paplaka – 8% and Krievu kalns – 9%). The exception is Ķivutkalns, where the small vessels make up 19% of sherds with identifiable size.

The dominant sizes for small vessels vary from 9 to 10 cm in rim diameter (in 52% of cases). Quite common are the pots with diameter of seven to eight cm (48%). Wall thickness for this size of pottery varies from 0.4 to 1.6 cm. The most common are thin (0.4 to 0.6 cm) and medium thick (0.6 to 0.9 cm) walls, while thick walls (0.9 to 2 cm) are rare. To the clay matrix of small vessels, mainly 2 to 5.5 mm of max. grain size were added as tempering material. It is notable that in three samples (Brikuļi, vessel size – 8 cm; Ķivutkalns – 7 and 8 cm) no tempering material was added.

The dominant profile form for small vessels are IC (60% of samples), quite common is CS (37%), rare – S (3%). The last profile form was found only in Krievu kalns collection. The surface of these pots is mainly striated or smooth, in some cases – coarse-slipped.

Medium sized vessels: The pots of this size are the dominant in all the analysed collections (Dievukalns – 62% of all vessels of identifiable diameter; Ķivutkalns – 62%. Klaņģukalns – 68%, Vīnakalns – 62%, Brikuļi – 57%, Rušenica – 76%, Padure – 76%, Paplaka – 74% and Krievu kalns – 70%).

The dominant sizes for medium sized vessels vary from 15 to 20 cm in rim diameter (in 70% of cases), less common are 10 to 15 cm (30%). Wall thickness for this size of pottery varies from 0.4 to 1.8 cm. The dominant wall thickness, unlike in small vessels, is medium (52%) and thick (46%), rarely – thin (2%). In clay matrix of medium sized vessels, mainly one to nine mm of max. grain size was added as a tempering material. Overall, the clay matrix of medium sized vessels is coarser than that of small pots.

The dominant profile form for medium sized vessels is IC (52%), CS is common (37%), less – S (10%), rare – IK (1%). The last profile form is distinguished only in Krievu kalns collection. All the variations of surface treatment are common in the vessels of this size group.

Large vessels: The pots of this size are the second most common in all the analysed collections (Dievukalns – 30%, Klaņģukalns – 27.8%, Ķivutkalns – 19%, Vīnakalns – 32%, Brikuļi – 34.3%, Rušenica – 14.8%, Krievu kalns – 18%, Padure – 19.9% and Paplaka – 18%).

The dominant sizes for largwe vessels vary from 20 to 30 cm in rim diameter (94% of the cases), the pots with diametrical size from 30 to 40 cm (6%) are a rarity. The wall thickness in this size of pottery varies from 0.4 to 1.8 cm. The dominant wall thickness is thick (67% of the cases), medium thick is also common (31%), while thin is rare (2%). This result indicates that vessel wall thickness overall depends on the size of the vessel. In the clay matrix, grains with sizes from two to nine mm were added as a tempering material to vessels of this size group.

The dominant profile form for large vessels, just like in other size groups, is IC (51%), common is CS (38%), less common – S (6%) and IK (5%). All the variations of surface treatment are common in vessels of this size group.

Conclusions

Clay which was used by potters can be divided into eight groups according to the coarseness and sorting of natural inclusions. Late Bronze Age potters in this region mainly used clay with fine inclusions, however, coarse clay was common for vessel production, as well. Samples containing the seventh clay group were found only in Dievukalns collection. This might indicate that in this region other clay beds were emptied, and potters had to use what was left or the potters here had other preferences.

As tempering material, granite was mainly used. The uniform size of the granitic rock grains indicate that a mesh might have been utilized to prepare this tempering material before adding it to clay. Tempering materials other than granite rock are much less common. In all the pottery clay recipes granite is present, at times next to other tempering materials.

The most common coiling technique is N. Brikuļi is the only collection, where U technique was used for coiling more often than in other hillforts. This might indicate a local technological tradition in this settlement.

The dominant shape of vessels does not change due to size. In all cases, the most common are IC and CS shapes, less frequent – S and IK shapes. The correlation between vessel size and wall thickness has been observed in this study. The main tendency is that a bigger pot has thicker walls. This result is to be expected, as for a bigger vessel to be more stable, thicker walls are needed.

Overall, similar pottery production technological aspects are seen in all the analysed collections. In some cases local variations are distinguished, however, they are not significantly different from the dominant tendencies in this region. These local variations might indicate knowledge transmission from other regions.

Abbreviations

A – inventory code of National History Museum of Latvia for archaeological artefacts.

BR, BEL, DK, KIV, KRI, SKRU, KL, PAP, RU, VK – codes of ceramic thin sections (from first – Brikuļi, Padure, Dievukalns, Ķivutkalns, Krievu kalns (SKRU, as well), Klaņģukalns, Paplaka, Rušenica, Vīnakalns).

XRF – X-ray fluorescence analysis.

Ts – thin section.

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[4] Vasks, Keramika epokhi pozdnei bronzy, s. 21.

[5] Valdis Bērziņš. Sārnates apmetnes klasifikācija un statistiskā analīze. In: Arheoloģija un Etnogrāfija XXI, 2003, pp. 53–74, here pp. 54–55.

[6] Rimute Rimantienė. Die Steinzeitfischer an der Ostseelagune in Litauen. Vilnius 2005, p. 45.

[7] For example: Meredith Aronson, James Skibo, Miriam Stark. Production and Use Technologies in Kalinga Pottery. Kalinga Ethnoarchaeology: Expanding Archaeological Method and Theory 1994, pp. 88–89.

[8] Also known as sedimentary clay. It is a clay that has been geologically transported from the site of its formation and redeposited elsewhere.

[9] Valdis Segliņš, Austra Stinkule, Ģirts Stinkulis. Derīgie izrakteņi Latvijā. Rīga 2013, p. 54.

[10] Ibidem.

[11] Thomas Eriksson. Grog tempering during Scandinavian Bronze Age. In: Naturwissenschaftliche Analysen vor- und frügeschichtlicher Keramik III: Anwendungsbereiche, Auswertungsmöglichkeiten, 2013, pp. 331–351, here p. 355.

[12] Baiba Dumpe. Podniecība Ķentes pilskalnā – pa Ādolfa Stubava pētījumu pēdām. In: Arheoloģija un Etnogrāfija XXVIII, 2014, pp. 32–48.

[13] Baiba Dumpe. Spodrinātā un gludinātā keramika Asotes pilskalna keramikas kolekcijā. In: LNVM Zinātniskie lasījumi 2007.–2010. Rīga 2013, pp. 95–107.

[14] Baiba Dumpe. Bezripas keramika Tērvetes senvietās. In: LNVM Zinātniskie lasījumi 2011–2013. Rīga 2014, pp. 23–32.

[15] Juri Peets. Early Iron Age Iron Production in Siksälä and Southern Estonia. In: A Community at the Frontiers. Iron Age and Medieval, No. 10. Tartu 2007, pp. 161–166, here p. 162.

[16] Dumpe, Bezripas keramika Tērvetes senvietās, 26. lpp.

[17] Detailed information about coiling techniques is presented here: Birgitta Hulthén. On Ceramic Technology during the Scanian Neolithic and Bronze Age. Stockholm 1977 (Thesis and papers in North-European Archaeology, 6), pp. 25–26.

[18] Andrejs Vasks. Brikuļu nocietinātā apmetne: Lubāna zemiene vēlajā bronzas un dzelzs laikmetā: 1000. g. pr. Kr. – 1000. g. pēc Kr. Rīga 1994, p. 53.

KOPSAVILKUMS

Pētījumā aplūkoti keramikas trauku izgatavošanas tehnoloģiskie aspekti deviņu vēlā bronzas laikmeta pilskalnu materiālā. Rakstā analizēta keramikas trauku veidmasa, pievienotie liesinātāji, trauku izmērs, forma un sienu biezums. Lai gan virsmas apdares veidi un apdedzināšanas process ir būtiski jautājumi šajā aspektā, tie nav sīkāk aplūkoti. Virsmas apdare un tās izplatība šajā reģionā ir plaši pētīts temats. Savukārt apdedzināšanas process ir komplekss jautājums, kas ietver specifiskas analīzes, kuras pētījuma autorei nav pieejamas.

Kopumā konstatētas astoņas māla masas grupas (no smalkiem līdz rupjiem dabiskajiem piejaukumiem ar dažādām variācijām). Aplūkojot māla masas grupu daudzuma attiecību analizētajās keramikas kolekcijās, tika konstatēts, ka vēlā bronzas laikmeta podnieki galvenokārt izmantojuši tādu mālu, kurš bijis ar smalkiem piejaukumiem (1.–3. grupa). Salīdzinoši bieži izmantots arī māls ar rupjiem piejaukumiem (8. grupa). Septītā māla masas grupa konstatēta tikai Dievukalna keramikas kolekcijā. Šāda izvēle neatbilst kopējām pilskalna podnieku māla masas izvēles tendencēm. Iespējams, ka tajā brīdī, kad

šie trauki izgatavoti, cits māls reģionā nav bijis pieejams vai arī šādai izvēlei bijuši citi iemesli.

Analizētajiem paraugiem konstatētas četras liesinātāju recepšu variācijas: 1) māla masa + granītiskie ieži; 2) māla masa + granītiskie ieži + organika; 3) māla masa + dzelzs savienojumi + granītiskie ieži; 4) māla masa + šamots + granītiskie ieži. Granītisko iežu liesinātājs ir pats izplatītākais visās analizētajās kolekcijās. Lielākajā daļā gadījumu veidmasai pievienoti vidēja izmēra (2–4 mm) vai salīdzinoši bieži rupji (4–6 mm) granītiskie ieži. Šādi konstanti izmēri norāda uz to, ka granīta sagatavošanā pirms pievienošanas veidmasai ticis izmantots siets vai tamlīdzīgs priekšmets.

Keramikas trauku izgatavošanai vēlā bronzas un senākā dzelzs laikmeta podnieki izmantojuši tikai māla kārtu sastiprināšanas tehniku. Analizētajos pieminekļos konstatēti divi kārtu sastiprināšanas paņēmieni – N un U. Visās analizētajās keramikas kolekcijās dominējošā kārtu sastiprināšanas tehnika ir N. Interesanti, ka Brikuļos, atšķirībā no pārējām kolekcijām, bieži trauku darināšanā izmantota arī U tehnika. Šāds rezultāts, iespējams, liecina par individuālām trauku izgatavošanas tradīcijām Brikuļu pilskalnā. Trauku konstruēšanai paredzēto grīztu garums nepārsniedz 10 cm, tas saistāms ar trauku tehniskajiem aspektiem, respektīvi, garākas kārtas apgrūtina trauka formas izveidi.

Visiem traukiem neatkarīgi no to izmēru grupas dominējošā profila forma ir IC, bieži sastopama arī CS, reti S un IK. Miniatūrajiem traukiem pārsvarā sastopama mucveida forma, izņemot Krievu kalnā, kur vienam traukam ir viegli profilēta forma. Tika konstatēts, ka sienu biezums ir atkarīgs no trauka izmēra. Šāds rezultāts ir loģisks, jo lielākam traukam nepieciešamas biezākas sienas, lai tas būtu pietiekami stabils. Tomēr sastopami arī tādi lielie trauki, kuru sienas ir plānas, un tas, visticamāk, ir saistīts ar trauka funkciju.

Kopumā analizētajās kolekcijās novērojami līdzīgi keramikas trauku izgatavošanas tehnoloģiskie aspekti, vien atsevišķos gadījumos konstatēti lokāli varianti, kas varētu norādīt uz zināšanu pārnesi un ietekmēm no citiem reģioniem.

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