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JÄGALA JÕESUU V STONE AGE SETTLEMENT SITE IN NORTHERN ESTONIA: SPATIAL AND CONTEXTUAL ANALYSIS OF FINDS

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The settlement site of Jägala Jõesuu V is located in northern Estonia in the village of Jõesuu, about 200 m from the eastern bank of the Jägala River and about 2 km from the present-day coast of the Baltic Sea. It was discovered during the fieldwork in 2011, and 275 m^2 was researched during rescue excavations in the course of road renovation. The remains of one pit-house (partly excavated), several pits and fireplaces were found. The collection of finds (11 454 artefacts and ecofacts) consists of potsherds of Comb Ware, tools and debris of quartz and flint, burnt bones, hazelnut shells, etc. The excavation technique, as well as the fact that the site was a relatively short-term and undisturbed complex, provided a good basis for spatial analysis that identified at least five concentration zones of finds. The largest concentration (61% of all finds) is related to the filling of the pit-house, >2.8 × 5.3 m in size and with pits inside it. The second large concentration zone (10% of all finds) contains the same find categories as the pit-house, but in different proportions, and it is assumed to be the remains of an above-ground construction measuring about 6 × 3 m. Three other concentrations, which in one case mostly contain flint and quartz artefacts (diameter ca 2.5 m) and quartz in the other two cases (ca 1.5 and 3 m in diameter) can be associated with outdoor activities.

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Introduction

The lower reaches of the Jägala River basin in northern Estonia (Fig. 1: A–B) are rich in archaeological sites from different periods, from Mesolithic (9000–3900 calBC; prehistoric periods and cultural stages here and below are according

Fig. 1. Location of the settlement site Jägala Jõesuu V. A – Estonia (green) on the map of Europe. B – map of Estonia with the main rivers and settlement sites mentioned in the text, the research area is marked by a black rectangle (C): 1 – Undva, 2 – Loona, 3 – Naakamägi, 4 – Kaseküla, 5 – Lemmetsa I, 6 – Tallinna Vabaduse väljak, 7 – Kunda Lammasmägi, 8–9 – Narva-Jõesuu I and IIA, 10–11 – Riigiküla I and II, 12 – Tamula I, 13 – Villa I, 14 – Valma. C – research area of the Jägala River basin with all the recorded archaeological objects. a – Mesolithic, b – Neolithic, c – Bronze and Iron Ages, d – Iron Age, e – find location, f – settlement site, g – fossil field, h – fortified settlement/hillfort. Sites and find locations: 1 – Jägala Jõesuu Linnamägi, Early Iron Age settlement site; 2 – Jägala Jõesuu, Bronze and Early Iron Age fortified settlement/hillfort and Early Iron Age fossil fields; 3 – Jägala Jõesuu I, Neolithic settlement site; 4 – pottery of Mesolithic Narva stage find location; 5 – Jägala Jõesuu, fossil fields; 6 – Jägala Jõesuu V, Neolithic settlement site; 7 – Iron Age find location; 8 – Jägala Jõesuu IIA, pre-pottery Mesolithic stage settlement site; 9 – Jägala Jõesuu IIB, pottery Mesolithic Narva stage settlement site; 10 – Jägala Jõesuu III, pre-pottery Mesolithic stage settlement site; 11 – Neolithic find location; 12 – Jägala Jõesuu IV, Iron Age settlement site; 13 – Jägala-Joa I, fossil fields; 14 – Jägala-Joa II, fossil fields; 15 – Jägala-Joa IV, pre-pottery Mesolithic stage settlement site; 16 – Jägala-Joa IV, Iron Age settlement site; 17 – Jägala-Joa III, Iron Age settlement site (Base map: Estonian Land Board – archeological data by A. Kriiska, implementation by I. Khrustaleva).

to Kriiska et al. 2020, fig. 1) and Neolithic (3900–1750 calBC) settlement sites to settlement sites and fossil fields of the Bronze (1750–500 calBC) and Iron Ages (500 calBC–AD 1225), as well as an Iron Age hillfort (Johanson & Veldi 2006; Lõhmus & Oras 2008; Kriiska et al. 2009; Kriiska & Sikk 2014). Jägala Jõesuu V (59°28′0″ N; 25°9′58″ E) is one of the Stone Age settlement sites associated with the Late Comb Ware culture, dated to 3500–1750 calBC in Estonia (Kriiska et al. 2020, fig. 1). It is located in the village of Jõesuu, approximately 200 m from the eastern bank of the Jägala River and a little less than 2 km from the present-day coast of the Baltic Sea (Fig. 1: C).

Jägala Jõesuu V was discovered in 2011, and 275 m^2 was researched under the supervision of Raido Roog and Aivar Kriiska as rescue excavations during a road renovation (Fig. 2: 1–2; Roog & Kriiska 2019). The site was partially destroyed by an earlier road construction and to some extent also later during the renovation in 2011, but a large part of the cultural layer outside the road area remained intact. Thus, the excavation area comprised two main parts located on both sides of the road: the eastern part – excavation area A and the western part – excavation area B (Fig. 2: 5). Up to three prehistoric fossil field layers, alternating with layers of dune sands, covered the Stone Age settlement site (Fig. 2: 3–4). The cultural layer of reddish and red sand was about 0.1–0.25 m thick. The natural base layer was yellow sand.

During the excavations at the settlement site, the remains of one pit-house (only partially excavated), 20 charcoal spots and 18 pits of different sizes and shapes with dark sand filling were uncovered. The finds consist of Comb Ware sherds, tools and debris of quartz, flint and other lithic materials, burnt bones, hazelnut shells, etc. (in total, 11 454 artefacts and ecofacts; stored at the University of Tartu, collection No. TÜ 1972). The fieldwork was carried out through careful excavation with trowels in 5–10 cm thick technical layers and included documentation of lithological layers and measurement of all finds at their original find spots (± 5–15 cm). All finds, features and lithological layers were individually numbered and manually drawn on horizontal plans for each technical layer.

The visual analysis of the find distribution shows a correlation between a large concentration of finds and the pit-house in excavation area A and another large and more dispersed concentration in excavation area B, which is associated with two charcoal spots (Fig. 3). In contrast, finds were largely absent in other parts of the excavation, with the exception of three small zones related to other charcoal spots. A detailed spatial analysis of all materials suggests that, in addition to the pit-house, there was also some above-ground construction that restricted the distribution of some find categories, and at least three other outdoor activity zones at the site.

So far, only general information of the Jägala Jõesuu V settlement site and the excavated pit-house has been provided (Khrustaleva et al. 2020). In this paper, a thorough analysis of both the cultural layer and the spread of artefacts and ecofacts is presented. This enables a more precise description of the settlement site as a whole and the objects located in it as well as adjusts the existing knowledge about the pit-house. The quality of documentation allows us to use 3D spatial analysis, which is

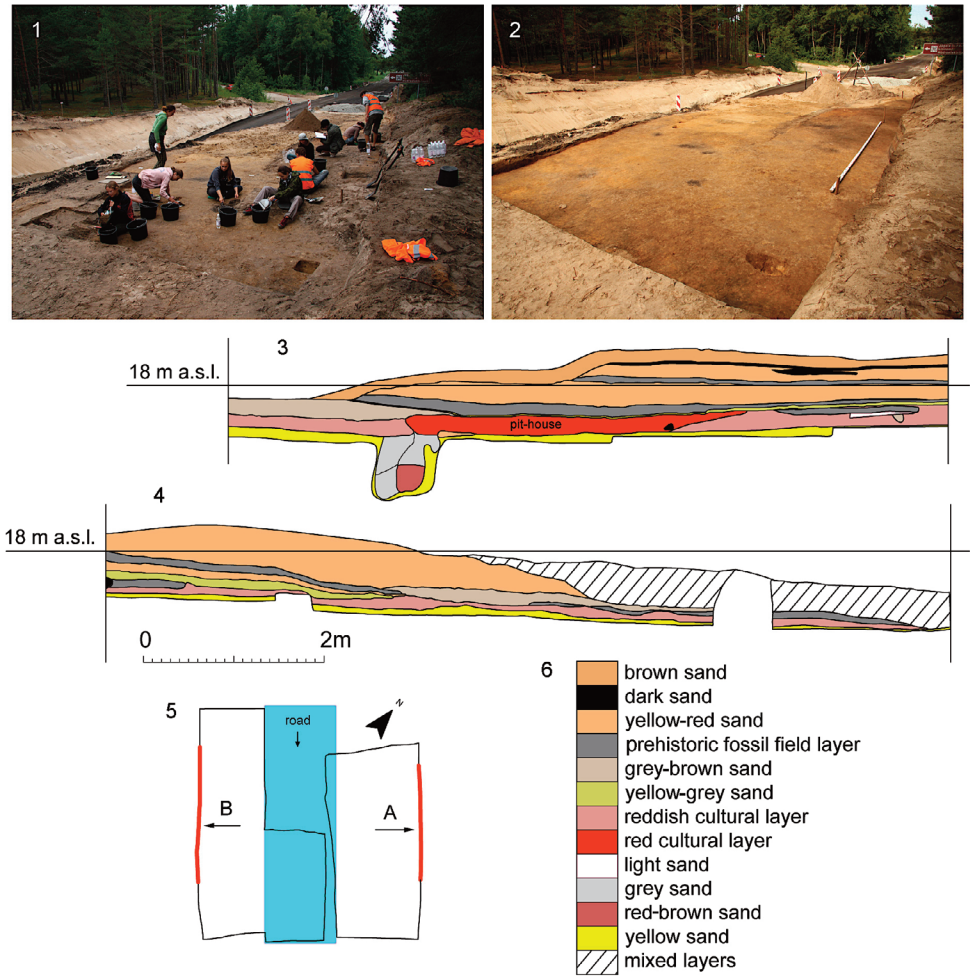

Fig. 2. Jägala Jõesuu V settlement site. 1 – excavation process in excavation area A; 2 – upper level of the cultural layer cleaned in excavation area A, the top of the red-coloured filling of the pit-house is visible under the scale rod; 3 – part of the stratigraphy on the eastern profile of excavation area A; 4 – part of the stratigraphy on the western profile of excavation area B; 5 – scheme of the excavated area with red lines indicating the location of stratigraphic sections (for a detailed plan, see Fig. 3); 6 – Key (photos by R. Roog; plans modified from Roog & Kriiska 2019 by I. Khrustaleva).

the basis of our research. A number of radiocarbon dates from different features of the site make it possible to determine their age. All this allows us to carry out a full spatial analysis of all the features and objects of the Jägala Jõesuu V site, to determine the chronology of the different parts of the settlement, and to differentiate the structure and interpretation of the features discovered. The main aim of the research is to present the finds (raw materials, artefact types, technologies, etc.) of the Jägala Jõesuu V settlement site and to discuss the discovered architectural

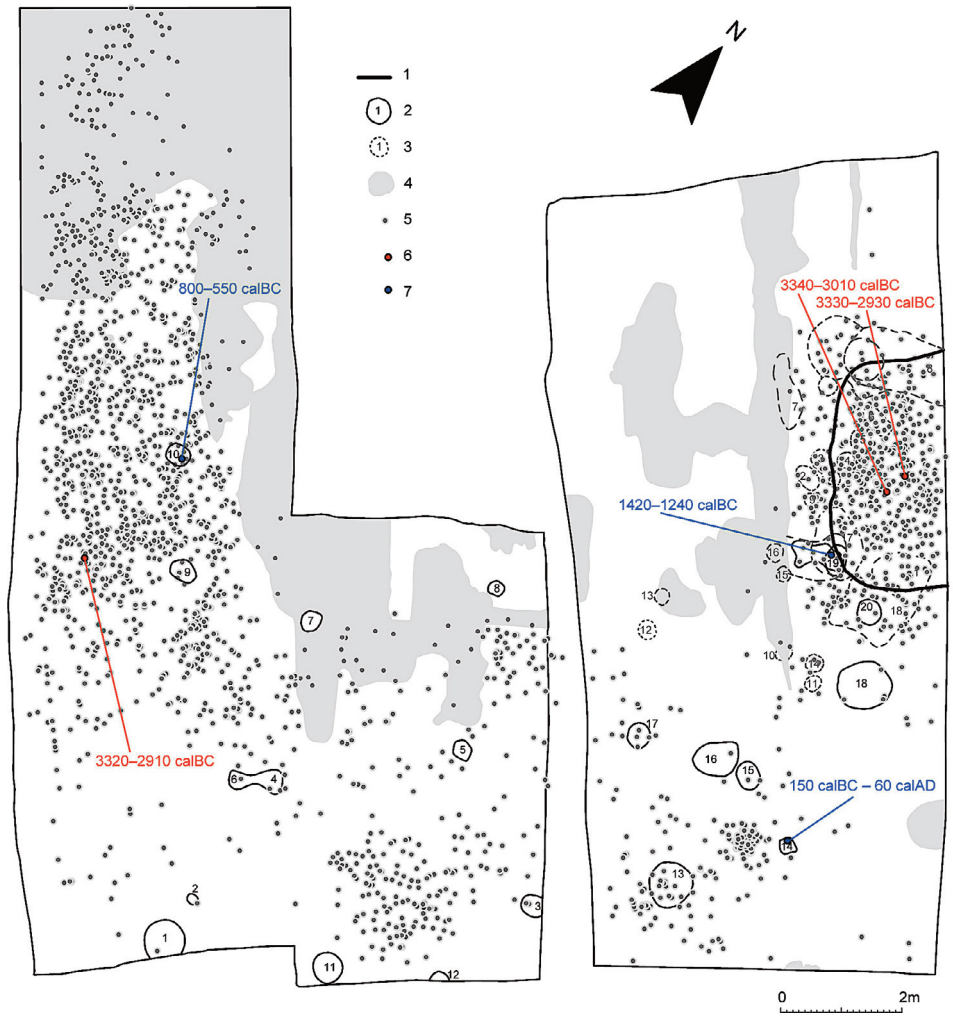

Fig. 3. Plan of the excavated part of the Jägala Jõesuu V settlement site. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – find, 6 – radiocarbon dated burnt hazelnut shell or burnt animal bone, 7 – radiocarbon dated charcoal pieces (plan modified from Roog & Kriiska 2019 by I. Khrustaleva).

elements in the context of the Estonian Stone Age and, if possible, in the wider Baltic Sea region as well.

Methods and terminology

The research methods and techniques used to analyse the Jägala Jõesuu V materials included stratigraphic, typological and comparative analyses, refitting,

spatial (3D) analysis, and radiocarbon dating. Dates were obtained from charcoal pieces, burnt hazelnut shells and a fragment of burnt animal bone. The samples were dated by means of accelerator mass spectrometry (AMS). The analyses were conducted in the 14CHRONO Centre at Queen's University, Belfast (UBA) and the Poznań Radiocarbon Laboratory (Poz). The obtained dates were calibrated using the OxCal 4.4.4 program (Bronk Ramsey 2021) with the IntCal 20 atmospheric curve (Reimer et al. 2020); all dates in this article are given with a 95.4% probability.

The description of archaeological finds was made according to object categories and types of raw materials. Among the flint finds, three different raw materials (Silurian, Carboniferous and Cretaceous) were visually identified; the identification is based on the authors' personal experience with comparative material, including reference collections of Silurian and Carboniferous flint of the Department of Archaeology of the University of Tartu. Some mistakes are possible in these determinations, especially between Silurian and Carboniferous flint, as these can be quite similar in both grain size and colour, especially in the case of burnt samples, but these errors do not affect the overall picture. The term 'flake' refers to all types of chips and flakes. The 'blade' category includes flakes that are at least twice as long as their width, and 'microdebitage' stone flakes with a maximum dimension of less than 1 cm. 'Tool' is a general term for stone artefacts with visible retouching. Many stone items without retouching showed signs of use or reduction on the edges, especially quartz flakes, but since we have not carried out any use-wear studies, these items do not receive special attention in this work.

One of the main methods was a visual spatial analysis, which was used to determine the different zones of activity and the structure of the site (for spatial analysis see, e.g., Binford 1972; Hodder & Orton 1979; Blankholm 1991; Lancelotti et al. 2017). The coordinates (x, y, z) of all artefacts and ecofacts were determined according to their position on the drawings and entered with their descriptions in a digital table. This allowed further easy manipulation of this data in three-dimensional space using the computer programs AutoCAD 2013 Autodesk Software and Surfer 11 Golden Software. In order to determine all aspects of the distribution of objects and features in the cultural layer, spatial analysis was performed according to both documentation levels and individual find categories. In addition, all finds were analysed by both quantity and weight because depending on the find categories, such as pottery or bones, weight can be a more informative parameter than the number of fragments (e.g. Karjalainen 1996, figs 6–10; 2002).

Refitting is commonly used for lithic artefacts and has a long tradition in Palaeolithic archaeology, but is still quite rarely applied in Stone Age sites with pottery where vessels and other types of items can also be refitted (Cuenca-Solana et al. 2018, 904; Romagnoli & Vaquero 2019). In settlement site studies, refitting can help to delimit intra-site activity areas and define relationships between them through the distance between the refitted fragments (Petersen & Johansen 1996, 81–83; Boaz 1999, 135; Romagnoli & Vaquero 2019, 4387). In Stone Age dwellings, the directions and concentrations of links between the refitted fragments can reveal not only the so-called 'wall effect' (outlines of barriers that prevented

artefacts from spreading) but even the location of an entrance, if there is sufficient documentation available (Grøn 1998; Leonova 2004, 63; Gelhausen et al. 2009).

Site and finds

Features of the cultural layer of the settlement site

At the uppermost level of the cultural layer, a red-coloured rectangular sand patch with rounded corners measuring >1.8 × 4 m indicated the remains of the pit-house. The thickness of this red sand was about 0.2–0.25 m, and it was deepened into the yellow base sand. Only part of the pit-house was excavated, as the other part extended beyond the eastern edge of excavation area A. However, the concentration of finds as well as the location of several pits at the lower level of the pit-house indicated that it was larger, at least >2.8 × 5.3 m in size (Figs 4 and 5). No fireplaces were associated with the pit-house during the excavations. Two charcoal spots (Nos 19 and 20) were located in the territory of the house but outside

Fig. 4. Pit-house at the level of the base sand layer (Photo by A. Kriiska).

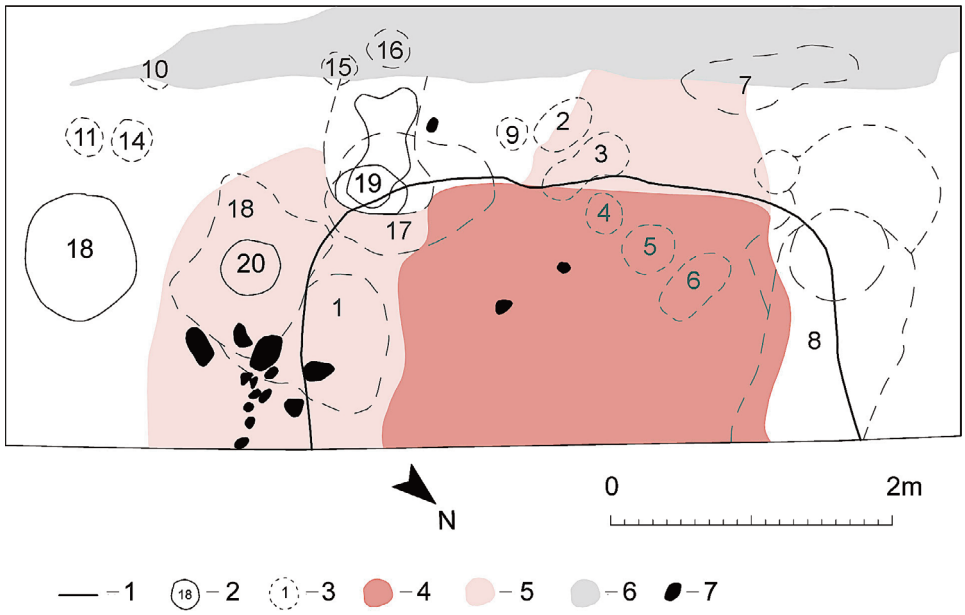

Fig. 5. Plan of the pit-house and the pits and fireplaces in its area. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit at the bottom of the cultural layer, 4 – red cultural layer in the filling of the pit-house at the middle level of the cultural layer, 5 – reddish cultural layer at the middle level of the cultural layer, 6 – mixed layers, 7 – stone (plan modified from Roog & Kriiska 2019 by I. Khrustaleva).

the red cultural layer. Situated in the southern corner of the pit-house, they could hardly have been fireplaces inside the building. Fireplace No. 19, oriented from east to west, was exposed at the upper level of the cultural layer and had an irregular shape with a size of about 0.8 × 0.3 m; at the lower level of the cultural layer, it was smaller, oval and approximately 0.5 × 0.35 m in size. Fireplace No. 20 was discovered at the lower level of the cultural layer and had a round shape with a diameter of ca 0.4 m. To the east of it, a number of sandstone fragments (whetstones?) were found.

The pit-house had a level floor, and several pits filled with dark sand were found under the red cultural layer. This means that they may have existed either earlier or during the building's use phase, but before the layer of red sand was formed. A total of 18 pits were uncovered at the site, 13 inside the pit-house and 5 more (most probably postholes with diameters between 0.24 and 0.3 m) to the south of the building. Of the 13 pits inside the house, some can also be interpreted as postholes with a diameter of 0.25–0.35 m.

In addition to two fireplaces in the area of the pit-house (Nos 19 and 20), 18 more, represented by round and oval spots measuring from 0.25 to 1 m and containing pieces of charcoal, were documented in different parts of the settlement site.

Fig. 6. Cross sections of fireplaces. A – fireplace No. 10, B – fireplace No. 14, C – fireplace No. 19 (photos by R. Roog).

Thirteen of them were visible at the top level of the cultural layer, the rest were located closer to its bottom. Most of these fireplaces appear to have been located above the ground, although their exact position is difficult to establish (Fig. 6). At the same time, those discovered in the upper part of the cultural layer may also be the result of later land use, including the clearing of trees by burning for agricultural purposes. In total, the cultural layer contained 46 natural stones in different parts of the site, including granite, sandstone, and feldspar. Six burnt stones were identified among them, including one granite piece, which could also be associated with fireplaces.

Finds

Our analysis includes 11 343 finds, which are presented in Table 1. Other items such as natural stones, pieces of charcoal, burnt organic matter and ochre, unclear fossils and ecofacts are excluded from the main statistics. In total, the main part of the collection consists of quartz artefacts (more than 40%), fragments of burnt bones (more than 30%) and potsherds (17%).

Almost all pottery fragments are identified as Late Comb Ware of the Stone Age (Fig. 7), with the exception of only one rim fragment of an Iron Age vessel from a

Table 1. Finds from the excavated part of the settlement site

Find category	Amount (pcs)	% (pcs)	Weight (g)	% (g)
Pottery	1938	17.1	1274	17.2
Clay figurine	91	0.8	92.7	1.2
Burnt clay	5	0.1	2.2	0.1
Quartz	4950	43.6	4838.3	65.4
Flint	287	2.5	101.7	1.4
Other stone	110	1	672.5	9.1
Amber	3	0.1	27.6	0.1
Burnt bone	3771	33.2	398.4	5.4
Hazelnut shell	188	1.6	10.7	0.1
Total	11 343	100	7394.8	100

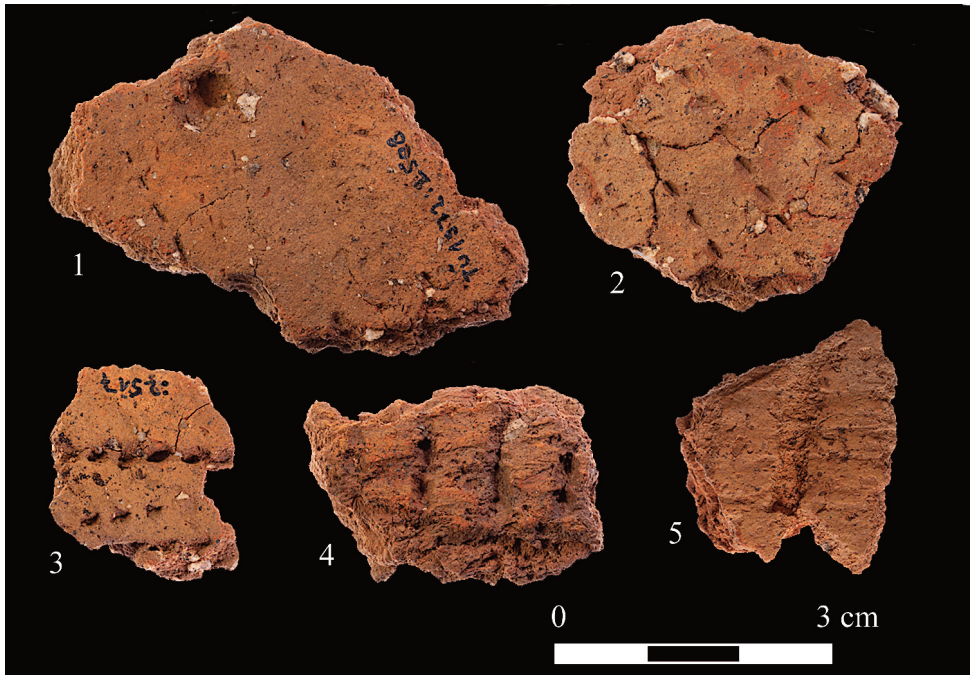

Fig. 7. Late Comb Ware fragments with mineral (1–3) and organic (4–5) admixtures (TÜ 1972: 2508, 2508, 2517, 2333 and 2348; photos by J. Ratas).

mixed part of the cultural layer. A total of 1937 fragments (total weight 1274 g) of Stone Age pottery were unearthed, of which almost 73% are with organic admixture (hereinafter CWo) and 27% with mineral admixture (hereinafter CWm). Only four

small fragments were not clearly assigned to a specific pottery group. The bulk of the potsherds is represented by small fragments, and it was not possible to reconstruct the shape of the vessels. Only eight Stone Age vessels can be identified (2 CWm and 6 CWo), six of them from rim fragments (2 CWm and 4 CWo). The exact number of vessels cannot be determined due to the generally small size of individual fragments.

Most of the CWm contains an admixture of rock debris, only one fragment contains an admixture of rock debris and grog. The inner or outer surface of some fragments is smoothed. The wall thickness is about 7–8 mm. Among the ornamental motifs are comb stamp impressions, pits and notches. There are three rim fragments from two vessels. The inner surface of these sherds is crumbling, so their shape can only be partially determined. In both cases the rim top is without ornamentation, inclined inward in one vessel and straight in the other.

The CWo mainly contains only an organic admixture, some fragments have organic and rock debris temper, single fragments have admixtures of organic and sand, organic and feather, organic and shell or organic and grog. Some fragments are striated and smoothed on the outer and/or inner surface. The wall thickness is 6–10 mm, sometimes 4 mm. The ornaments include comb stamp impressions, pits and notches. There are four rim fragments from different vessels. All of them have the rim tops decorated, three with comb stamps, and one with notches. Both surfaces are preserved only in one fragment, so their shape can only be partially determined. Three of the rims are slanted inward.

A total of 91 fragments of clay figurines were uncovered, most of them small pieces, which makes it impossible to determine their original shape (Fig. 8) (for a more detailed description, see Khrustaleva & Kriiska 2020). Perhaps a few of these fragments can be daub. Five unclear fragments of burnt clay that are not fragments of pots were also found.

Altogether 4950 quartz items (Fig. 9) were unearthed at the site (total weight 4838.3 g): 4271 flakes, 619 blades, 53 cores, 3 scrapers (2 of them side scrapers), 1 retouched flake and 3 nodules. Quartz is mainly represented by milky coloured minerals, less often by transparent glass-like, pink or yellow variants. Two flakes

Fig. 8. Clay figurines (TÜ 1972: 2498, 2400 and 1000; photos by J. Ratas).

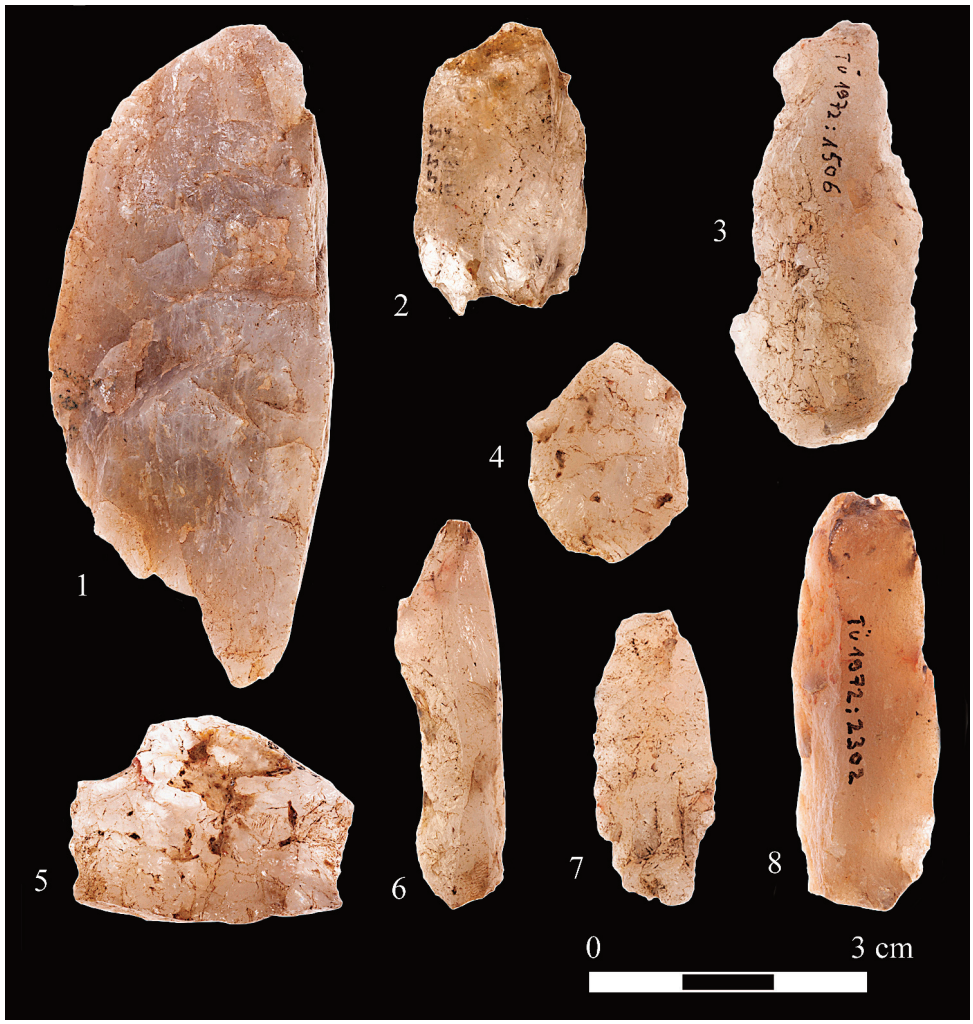

Fig. 9. Quartz finds. Bipolar blades (1, 3, 6, 7 and 8) and flakes (2, 4 and 5) (TÜ 1972: 1454, 2222, 1506, 2297, 2288, 2465, 1242 and 2302; photos by J. Ratas).

have been burnt. The knapping technique was determined for 1754 items (35.4% of all quartz), of which 1751 (99%) are bipolar and only 3 items are platform.

The total number of flint items is 287 with a total weight of 101.7 g (Fig. 10). Silurian (75), Carboniferous (89) and Cretaceous (121) flints were used at the settlement site. Silurian flint is mainly white, less often grey and beige. Carboniferous flint is mainly represented by grey material, some specimens are beige, brown, red or pink. Cretaceous flint has a colour from light to dark grey and is often transparent. The bulk of the flint inventory consists of flakes (251), with fewer blade fragments (23). Three cores were found and the tools are represented

Fig. 10. Flint inventory. Flakes (1, 5, 6 and 8), cores (2 and 7), blade (3), arrowhead (4). Carboniferous (1, 2 and 6), Silurian (3 and 7) and Cretaceous (4, 5 and 8) flint (TÜ 1972: 1602, 1769, 1810, 1927, 1778, 1479, 2491 and 1987; photos by J. Ratas).

by 10 items: 5 (micro)scrapers, 2 arrowheads (a triangular one with retouched edges, Fig. 10: 4, and a bifacial fragment), 1 point and 2 retouched flakes. Half of the tools were made of Carboniferous flint, and 26 flint items have traces of burning: three flakes of Silurian, two flakes and one blade of Cretaceous and two scrapers and 18 flakes (including one retouched) of Carboniferous flint. The knapping technique was determined for 126 specimens (43.9% of all flint items): 30 for Silurian, 60 for Cretaceous and 36 for Carboniferous flint. For 13 specimens (10%), the bipolar technique was determined (mainly Silurian and Carboniferous flint). The rest (113 specimens, 90%) were made by the platform knapping technique: 59 Cretaceous, 29 Carboniferous (1 of them platform on an anvil) and 25 Silurian flint (Fig. 10: 2, 3 and 8). For two flakes of Cretaceous flint and one flake of Carboniferous flint, the use of a soft hammer was determined. Altogether 24 flint flakes show remains of cortex on the surface: one Silurian, 17 Cretaceous (including 1 retouched) and six Carboniferous items.

Items of other stones number 110 and include feldspar (almost a quarter of this category), slate, sandstone, limestone and granite. Feldspar is represented by both mineral variants, pink alkali feldspar and grey plagioclase. A total of 76 stone flakes were found, including six specimens with traces of reduction (4 of them made of feldspar), nine blades mostly made of feldspar (5 specimens; Fig. 11: 5), but also of limestone, one bipolar granite core and one retouched feldspar flake. Stone tools include a fragment of a polished slate arrowhead with a rhombus-shaped cross-section (Fig. 11: 3), a side scraper with a steep convex blade, a knife, fragments of a slate adze (Fig. 11: 4), seven flakes of polished metatuff tools (the raw material was determined by geologist Juho Kirs using a binocular microscope; Fig. 11: 2), a sandstone whetstone (Fig. 11: 6), a possible hammerstone, two tool blanks and a fragment of a limestone pebble with a hole (Fig. 11: 1). In addition, seven

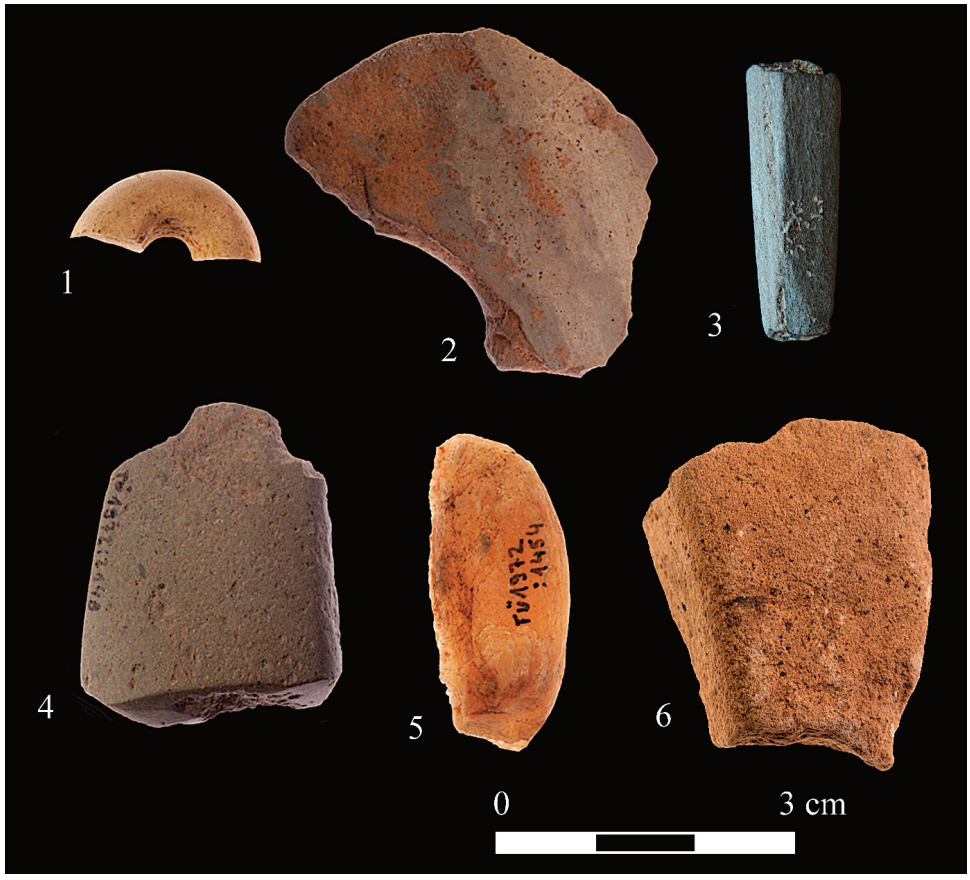

Fig. 11. Stone items. A limestone pebble fragment with a hole (1), a fragment (flake) of a polished metatuff tool (2), a fragment of a slate arrowhead (3), a fragment of a slate adze (4), a feldspar (plagioclase) blade (5) and a sandstone whetstone (6) (TÜ 1972: 2161, 2465, 52, 2148, 1454 and 2565; photos by J. Ratas and K. Roog).

sandstone fragments were unearthed. The knapping technique was determined for 18 stone flakes, mainly of feldspar, and was bipolar in all cases. Furthermore, three poorly preserved amber items (4.3 g) were found, including one pendant (Fig. 12: 2).

Bone finds are represented only by burnt calcined fragments (3771 pcs, 398.4 g), including six fragments of tools and 21 possible beads. The type of tools cannot be determined because the pieces are too small. The only exception is a fragment of a point with a drilled hole (Fig. 12: 1). No zoo-osteological analysis has been carried out and the composition of animal species uncovered at the site remains unclear.

The other finds include 188 fragments of hazelnut shells (10.7 g), 22 fragments of ochre (5.3 g), three fragments of burnt organic matter and 29 fossils and 'ecofacts'. Finally, individual metal objects were found in the mixed part of the cultural layer, including small unidentified fragments, cartridges and a ring.

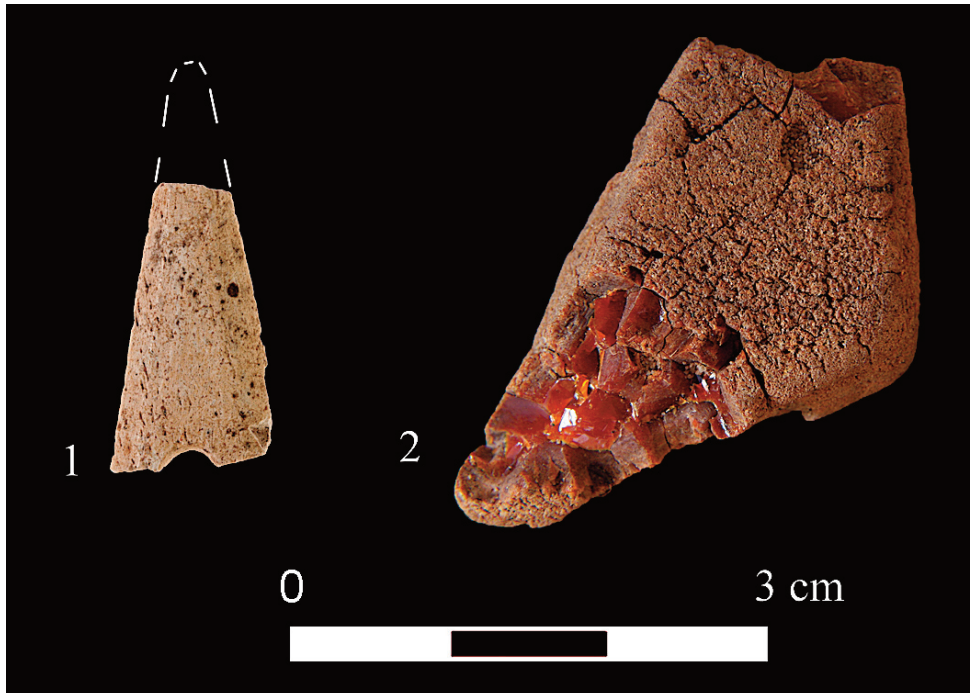

Fig. 12. A fragment of a bone point (1) and a broken amber pendant (2) (TÜ 1972: 2400 and 775; photos by J. Ratas and K. Roog).

Results

Spatial distribution of objects

A visual analysis of the distribution of all finds in the excavation area shows two main zones and a few small clusters of finds: the first large accumulation is associated with the remains of the pit-house in excavation area A, and the second one with excavation area B, where only two fireplaces (Nos 9 and 10) were found (Fig. 3). Before proceeding further, plans of three different levels were drawn up for different pottery groups distinguished by admixture (CWm and CWo) according to the documentation levels during the fieldwork: from 0 to 5 cm, from 5 to 10–15 cm and more than 15 cm from the surface. These plans showed no difference in the distribution of finds from different levels and further analysis included all the finds together.

The analysis revealed some features and differences in the distribution of certain object categories within the excavated area. Most of the CWm fragments were discovered in the pit-house, a few fragments were between fireplaces Nos 13, 15 and 16, and some in excavation area B (Appendix 1). Fragments of CWo were present in significant quantities not only in the pit-house but also in excavation area B, where the highest concentration was near fireplace No. 8 and a few fragments near

fireplace No. 12 (Appendix 2). Clay figurines were found mainly in the pit-house and in the large find concentration of excavation area B (Appendix 3). Only one fragment of a clay figurine was located in another area, near fireplace No. 12.

Flint of different origins was distributed in different ways at the site (Appendix 4). The main part of Carboniferous flint, including flakes, some blades and a retouched flake, is confined to the pit-house; mainly single blades were found in excavation area A between fireplaces Nos 13, 14, 15 and 16, and only a few flakes, a blade and a microscraper (Fig. 13: B) in excavation area B. Cretaceous flint is almost completely concentrated in excavation area A, between fireplaces (Nos 13, 14, 15 and 16), and is represented by flakes, a few blades, a retouched flake and a point. Silurian flint was mainly found in the pit-house (flakes, blades, a core and a scraper). Only a small number of flakes and a blade were uncovered in excavation area A between fireplaces (Nos 13, 14, 15 and 16), and some flakes in excavation area B. Thus, flint tools, cores and blades (with a few exceptions) are concentrated in excavation area A, in the pit-house and between fireplaces Nos 13, 14, 15 and 16.

Quartz was discovered almost over the entire excavated area, but its largest concentrations were noted in the pit-house and in excavation area B (Appendix 5). In excavation area B, two main accumulations of artefacts were identified. The first had a rectangular shape with a size of about 9 × 3 m and was located in the western part of the excavation area; another smaller one was located in the southeastern corner of excavation area B near fireplaces Nos 3, 11 and 12 and had a diameter of approx. 3 m. A less intensive concentration was noted in excavation area A, next to fireplace No. 13. A small number of cores were included in all main clusters, but most were found in the pit-house. Quartz microdebitage had the same distribution principle. The main concentration was in the pit-house, the second one in the western part of excavation area B, two other smaller concentrations with diameters of ca 1.5 and 2.5 m, respectively, in the eastern (near fireplace No. 8) and southeastern (near fireplaces Nos 3, 11 and 12) parts of excavation area B, and one more cluster in excavation area A between fireplaces Nos 13, 14, 15 and 16. Tools are rare and most were found in excavation area A, where two of the three scrapers were in the pit-house. One aim of the study was to analyse the spatial distribution of finds, in terms of both quantity and weight. For most of the finds, there are no significant differences between amount and weight, and weight distributions are not presented in this paper. Only quartz artefacts clearly show concentration zones according to weight, in contrast to quantity, in which a huge amount of micro-debitage blurs the outlines of the main concentration (Appendices 5 and 6).

Other worked lithics are also mainly related to the two main concentration zones, and only a few of them were found between fireplaces Nos 3, 5 and 12 and Nos 13, 16 and 17 (Appendix 7). Hazelnut shells are mainly confined to the pit-house, but some were also discovered in excavation area B, mainly in its central part (Appendix 8). The burnt bones generally show a similar positioning to the nutshells, except in excavation area B, where the bones were mostly present in the western part (Appendix 9). All small pieces of tubular bone that could be beads were unearthed only in the pit-house or in its immediate vicinity.

A total of 5045 finds were made in the red-coloured sand of the pit-house filling, but the total number of finds in the pit-house area is 6880, which is almost 61% of all finds from the site (Table 2). The largest categories of finds in the dwelling

Table 2. Finds from the pit-house

Find category	Total amount, pcs	Type	Amount, pcs
Pottery	1250	CWm	359
		CWo	891
Clay figurine	54		
Burnt clay	4		
Quartz	2071	Scraper	2
		Retouched flake	1
		Flake	1722
		Blade	329
		Core	16
		Lump	1
Flint	78	Scraper	2
		Arrowhead	2
		Retouched flake	1
		Flake	60
		Blade	11
		Core	4
Other stone	72	Knife	1
		Adze	1
		Polished tool fragment	4
		Retouched flake	1
		Flake	49
		Blade	5
		Sandstone	2
		Limestone pebble fragment with a hole	1
		Piece	4
		Lump	4
Burnt bone	3199	Bead	1
		Tubular bead?	20
		Point fragment	1
		Tool fragment	2
		Fragment	3175
Hazelnut shell	152	Fragment	152
Total	6880		

include burnt bones, quartz and pottery fragments. Hazelnut shells and flint finds are less numerous at the site, but are concentrated inside the dwelling. Fragments of clay figurines were also found in the pit-house.

The area of the concentration of finds in the pit-house is wider than the area of the red cultural layer and includes pits at the bottom of the building. Of the 13 pits in the pit-house, archaeological material was found in six of them (Nos 1, 2, 3, 4, 7 and 8). The pits contained burnt bones, quartz and pottery fragments. The largest of them (Nos 1 and 8) also included a few fragments of clay figurines and possible tubular bone beads. The pits located outside the pit-house were without finds, except for No. 12 (Table 3).

Only three fireplaces contained archaeological material from the Stone Age. Fireplaces Nos 4 and 16 both held a single quartz flake, while finds from fireplace No. 19 consisted of 51 fragments of CWo, 17 quartz flakes, four quartz blades, one stone flake, and 11 fragments of burnt bones. Nevertheless, find concentrations were recorded next to fireplace No. 3, and between fireplaces Nos 8, 11–12 and 13–16.

The locations of all stone objects with traces of fire exposure were analysed separately in order to identify fireplaces that may have been used in the Stone Age (Appendix 10). Three zones with such objects were distinguished. Two of them were located in excavation area A, in the pit-house and near fireplace No. 14, and the third in the western part of excavation area B, near fireplace No. 9.

Table 3. Finds from the pits

Find category/type		Pit 1	Pit 2	Pit 3	Pit 4	Pit 7	Pit 8	Pit 12	Total
Pottery	CWm					3	6		59
	CWo	19	1		1		29		
Clay figurine		2					1		3
Burnt clay							2		2
Quartz	Flake	12	1	3	1	6	41		92
	Blade						15	12	
	Core						1		
Flint	Flake		1				1		2
Other stone	Whetstone	1							5
	Sandstone	1							
	Flake	1					2		
Burnt bone	Tubular bead?	1					1		135
	Fragment	17	2	9	5	19	80	1	
Hazelnut shell	Fragment						2		2
Total		54	5	12	7	28	181	13	300

Table 4. Finds from concentration B (9 × 3 m)

Find category	Total amount, pcs	Type	Amount, pcs
Pottery	131	CWm	22
		CWo	109
Clay figurine	25		
Burnt clay	1		
Quartz	845	Flake	772
		Blade	68
		Core	5
Flint	13	Scraper	1
		Flake	11
		Blade	1
Other stone	18	Flake	13
		Core	1
		Piece	1
		Lump	3
Amber	2		
Burnt bone	98	Tool fragment	2
		Fragment	96
Hazelnut shells	14	Fragment	14
Total	1147		

The area with the largest concentration of finds in excavation area B measured approx. 9 × 3 m and contained ca 10% of all finds (1147 pcs). Quartz and a number of items of Carboniferous flint, fragments of CWo and clay figurines (including the only whole figurine from the site – an alleged harbour porpoise; Fig. 8: 3), amber items, as well as fragments of burnt bones and hazelnut shells were found there (Table 4). The distribution area of CWo fragments, bones, clay figurines and hazelnut shells was smaller than that of quartz material and amounted to about 6 × 3 m (Appendices 2, 3, 5, 8 and 9).

Refitting

Refitting was possible with only a few finds (Fig. 13). Four vessels with different numbers of fragments could be separated according to the used admixture, colour, surface treatment and ornamentation. One vessel with a mineral admixture, decorated with comb stamp impressions and small pits, is represented by 25 fragments, including two rim fragments. Almost all fragments of this vessel were found in different parts and at different levels of the pit-house and its filling, with

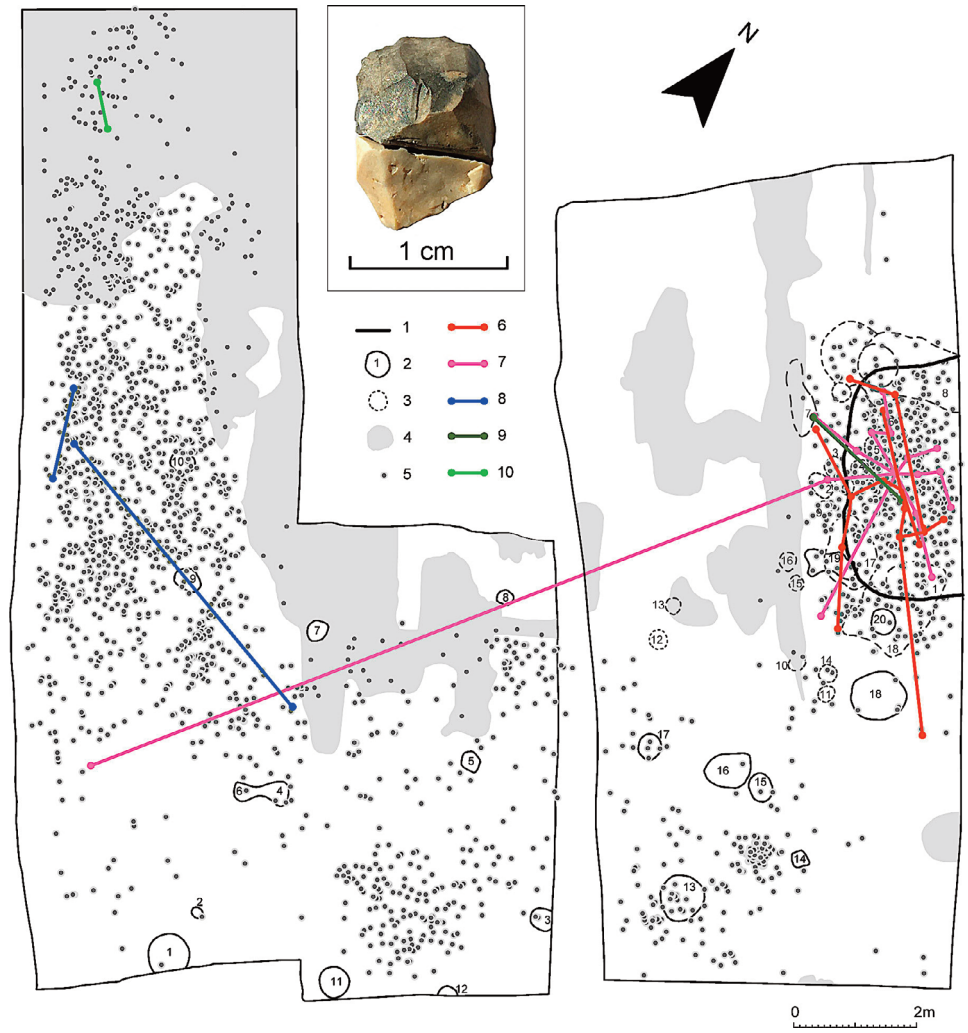

Fig. 13. Plan of the Jägala Jõesuu V settlement site with all finds and refitted items. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – find. Refitted items (6–10): 6 – CWo, 7 – CWm, 8 – flint, 9 – polished metatuff tool, 10 – quartz. Photo: refitted flint microscraper (photo by I. Khrustaleva; plan modified from Roog & Kriiska 2019 by I. Khrustaleva).

the exception of a fragment from excavation area B (south of the large concentration of finds), thus connecting the two excavated areas. Three other vessels have an organic admixture. One of them with a comb ornament is represented by eight fragments of fragile pottery and was located in the southwestern part of the pit-house. The second vessel with an organic admixture consists of three fragments, including one from the rim, and was located in the centre of the excavated part of

the pit-house. The third vessel has indistinct ornamentation on the outside and probable striations from a comb stamp on the inner surface. Seven fragments of this vessel were identified, six of which were uncovered in the eastern part of the pit-house, and one to the south of it.

In the case of quartz artefacts, it is usually impossible to identify fragments from the same piece of raw material – this time, two flakes of the same raw material were clearly different from the rest but could not be refitted either. They were located in the northwestern part of excavation area B, north of the large concentration of finds in the mixed part of the cultural layer.

From the metatuff finds, two flakes were identified as most likely parts of the same polished tool, but could not be refitted. They were both located inside the pit-house. Flint does not give many refitting links either. Two flakes of Silurian flint, both found in excavation area B, were refitted and they connect the main find concentration of this area with the southeastern part of the site. The second refitted flint artefacts were the two fragments of a microscraper made of Carboniferous flint from excavation area B (Fig. 13: B).

AMS radiocarbon dates

Radiocarbon dates for the Jägala Jõesuu V settlement site were obtained from pieces of wood charcoal, burnt bone and hazelnut shells. Two dates from the pit-house, one from a burnt terrestrial mammal bone (UBA-29062, 4438 ± 29 BP) and the other from a burnt hazelnut shell (Poz-115983, 4460 ± 35 BP), date the dwelling to 3330–2930 calBC and 3340–3010 calBC, respectively. One more dating was obtained from a burnt hazelnut shell found in the largest find concentration of excavation area B, and dates to 3320–2910 calBC (Poz-115982, 4400 ± 35 BP).

Dates obtained from charcoal pieces from three fireplaces show that they were not connected to the Stone Age settlement. Fireplace No. 10 (Fig. 6: A) in the area of the largest find concentration in excavation area B is dated to 800–550 calBC (Poz-139257, 2550 ± 30 BP), fireplace No. 19 (Fig. 6: C) in the pit-house area to 1420–1240 calBC (Poz-139270, 3070 ± 30 BP) and fireplace No. 14 (Fig. 6: B) in excavation area A to 150 calBC–calAD 60 (Poz-139271, 2045 ± 30 BP).

Discussion

The compact clustering of pottery sherds and their association with building remains and certain activity zones at the Jägala Jõesuu V settlement site demonstrate the contemporaneous use of Late Comb Ware with both mineral and organic admixtures by the same groups of people, which indicates that the use of different admixtures is not a typological or chronological marker. Although the same conclusion has been reached for several Estonian (e.g. Narva-Jõesuu I, Narva-Jõesuu IIA) and Finnish settlements (Pesonen 2004, 90; Kriiska & Nordqvist 2012, 30;

Mökkönen & Nordqvist 2018, 90; Khrustaleva et al. 2020, 14; Fig. 1: B), Jägala Jõesuu V is the most representative evidence of Estonia, coming from an extensively researched and well-dated site with a relatively short use life.

The lithic raw materials used at the settlement site originate from different sources. Local pebble quartz was most commonly used, while the natural sources of flint are located tens of kilometres away or even more: Silurian flint occurs in central and southern Estonia and in Latvia, Carboniferous flint refers to sources in the Valday Hills in central European Russia, and Cretaceous flint originates from Belarus or the southern part of Lithuania (Kriiska 2015, 109–110; Johanson et al. 2021). The ratio of quartz to flint is significant (96.4% versus 3.6%). The use of quartz in large quantities began in Estonia already in the pre-pottery Stone Age in the middle of the 7th millennium calBC (Kriiska & Sikk 2014, 51–52); its share decreased significantly during the Typical Comb Ware culture at the beginning of the 4th millennium calBC, but became common again in the Late Comb Ware culture in the second half of the same millennium (Kriiska et al. 1998, 35; Kriiska & Saluäär 2000, 13; Kriiska et al. 2020, 124). For example, in the Tallinna Vabaduse väljak settlement site, located ca 25 km from Jägala Jõesuu (Fig. 1: B) and dating to the turn of the 4th and 3rd millennia calBC, quartz accounts for up to 99.6% of all quartz and flint finds (Kadakas et al. 2010, 37). The decline in the use of flint over time is also characteristic of the Finnish Typical and Late Comb Ware cultures (Edgren 1984, 40; Mökkönen & Nordqvist 2016, Fig. 4; Mökkönen et al. 2017, 182).

Quartz was knapped in the Jägala Jõesuu V using the bipolar technique, with only a few exceptions. This knapping technique prevailed in quartz processing in Estonia throughout the Stone Age, including the period under discussion (e.g. Kriiska et al. 1998, 35; Kadakas et al. 2010, 37). The bipolar technique was also used on flint along with the platform technique throughout the Stone Age and became significantly more common towards the Late Comb Ware culture (Kriiska et al. 2020, 124–125).

A large amount of quartz debris indicates that active quartz knapping took place directly at the site and in the area of dwellings. Experimental work was carried out to estimate the original volume of the quartz raw material used there. This meant experimental bipolar knapping of a quartz nodule on a stone anvil with a hammerstone. The used milky quartz was visually and structurally similar to the mineral used at the Jägala Jõesuu V settlement. The quartz nodule was reduced until it matched the ‘medium size’ nuclei found at the site. In the experiment, about 10% of the mass of the original nodule was pulverised and lost: the initial weight of our quartz nodule was 186.5 g, and after knapping only 167 g of flakes and microchips were collected (Fig. 14). The loss of material in the form of microdebitage has been repeatedly observed in knapping experiments of quartz (and other lithic materials), including those which were conducted earlier by one of the authors of this article (e.g. Driscoll 2011; for discussion, see also Fladmark 1982; Diez-Martín et al. 2011). According to our experiment, the approximate initial weight of quartz used in the excavated part of the site is estimated to be more than 5300 g, excluding the items removed from the site during its use.

Fig. 14. Experimental bipolar knapping of a quartz nodule. A – raw material and tools used during the experiment: 1 – an anvil stone, 2 – a quartz nodule, 3 – a hammerstone. B and C – process of bipolar quartz knapping. D – result of bipolar quartz knapping (photos by A. Macāne, A. Kriiska and I. Khrustaleva).

Knapped feldspar is a very unusual and surprising find and has no analogues in Estonia or more generally in the eastern Baltic area and Finland. However, it can be related to the broader context of lithic use in the second half of the 4th millennium and the first half of the 3rd millennium calBC, marked by a noticeable increase in the exploitation of porphyritic and other rocks in Estonia (e.g. sites Loona, Naakamägi, Narva-Jõesuu IIA, Undva; Fig. 1: B) and in some areas of Finland (Jaanits et al. 1982, 86; Mökkönen 2008, 129 and references therein; Kriiska & Nordqvist 2012, 29). Metatuff originates from the territory of Karelia in Russia and was brought to Estonia mainly during the Typical and Late Comb Ware cultures as ready-made wood chopping tools (Kriiska et al. 2013, 333 and references therein).

A limestone pebble fragment with a hole (Fig. 11: 1), a pseudofossil, was uncovered in the pit-house. Such pebbles of natural origin have been found at archaeological sites of different ages in northern Estonia (for more details, see Johanson 2018, 107). It should be mentioned, however, that both pseudofossils and fossils with holes (including Gastropod fossils), some of them with clear traces of use, were discovered mainly (up to a few dozen pieces) in settlement sites of the Typical and Late Comb Ware cultures (e.g. Jägala Jõesuu I, Tallinna Vabaduse väljak, Kunda Lammasmägi; Kadakas et al. 2010, 38; Johanson 2018, 101; Fig. 1: B).

Stone tools make up a very small percentage of the Jägala Jõesuu V collection (less than 0.6%) and mostly consist of debris and small fragments. No clay vessels can be properly reconstructed due to the small size of pottery fragments, nor can the number of pots be counted; the material included only a few rim sherds and no bottoms. Generally, the lack of whole and large objects at Jägala Jõesuu V can indicate both active use and cleaning of the settlement site by the Stone Age inhabitants. They could have taken all their belongings with them when they moved to a new place, or discarded them somewhere nearby where no excavation has been conducted. Although there are only a few examples of cleaning the Stone Age dwellings in the research area (e.g. Kankaanpää 2002, 74), this practice was undoubtedly in use.

A common artefact type for the Late Comb Ware culture is slate arrowheads with rhombic cross-section (so-called Pyheensilta type), a fragment of which was

unearthed in the Jägala Jõesuu V settlement site (Fig. 11: 3). Such points are known at sites dating to the 4th and 3rd millennia BC from Finland and Karelia to Lithuania (e.g. Janits 1959a, 193; Loze 1979, 68; Edgren 1984, 87–88; Rimantienė 1996, 153; Zhulnikov 1999, 56, Fig. 47). In Estonia, about ten examples of Pyheensilta arrowheads are known from five sites of the Comb Ware stage (Kaseküla, Lemmetsa I, Loona, Tamula, Villa I; Kriiska et al. 1998, 36; Kriiska & Saluäär 2000, 20; Fig. 1: B).

The Jägala Jõesuu V settlement site contains all the most important components of the material culture of the Late Comb Ware culture in Estonia in addition to the pottery itself, and the three main 'exotic' materials (Carboniferous and Cretaceous flint, Karelian metatuff and Baltic amber), the bifacial flint processing technique and clay figurines are all present (e.g. Janits 1959a, 180–191; Kriiska 2015; Khrustaleva & Kriiska 2020). This set of finds points to the homogeneity of the Stone Age settlement materials, and the later human activities that took place here did not disturb earlier cultural layers. As evidenced by the dates obtained from charcoal pieces from three fireplaces and the few metal items found at the site, the next periods of active exploitation of this area took place during the Bronze and Iron Ages. These activities are related to the tilled field layer covering the Stone Age cultural layer, and also include the fireplaces associated with forest clearance that are visible on top of the cultural layer.

The pit-house is the most significant Stone Age feature discovered at the site. The detailed analysis of its remains and inventory shows that it was most likely a semi-subterranean structure with an almost rectangular shape and a depth of about 0.2–0.25 m. The excavated part of the building was at least >2.8 × 5.3 m in size. Refitting links also follow the same boundaries of the dwelling, which demonstrates the so-called 'wall effect' – the restriction of the distribution of refitted items by some structural element (for a detailed discussion of the 'wall effect', see Grøn 1998). The presence of postholes at the floor level of the pit-house and the rounded building contours most likely indicate a timber post construction. However, neither the location of the postholes at the bottom level of the house nor the distribution of finds revealed the location of the entrance to the pit-house. Fireplace No. 19, documented in the southern part of the pit-house, cannot be correlated to the use of the building according to AMS dates obtained from charcoal pieces (a little less than 2000 years younger; Fig. 3), and the chronological position of fireplace No. 20 cannot be verified.

The largest concentration of finds in excavation area B, a total of about 9 × 3 m, contains the same find categories as the pit-house, but in different proportions and in significantly smaller quantities (Table 5, Fig. 15). The distributions of different find categories overlap and show that clay figurines, burnt bones, worked stones, CWo, hazelnut shells and flints were found in almost the same oval or rectangular area, approx. 6 × 3 m in size (Fig. 16). Two fireplaces (Nos 9 and 10) were also documented within this cluster, but a radiocarbon date showed that fireplace No. 10 does not belong to the Stone Age context, and no data is available for fireplace No. 9. The distribution of quartz in area B is much wider and has no clear boundaries, as most of these finds are microflakes weighing <0.3 g. The presence

Table 5. Comparison of finds from the pit-house, concentration in area B and other excavated areas

Find category	Pit-house, pcs	Concentration B, pcs	Rest, pcs
Burnt bone	3199	98	474
Quartz	2071	845	2034
Pottery	1250	131	557
Hazelnut shell	152	14	22
Flint	78	13	196
Other stone	72	18	20
Clay figurine	54	25	12
Burnt clay	4	1	0
Amber	0	2	1
Total	6880	1147	3316

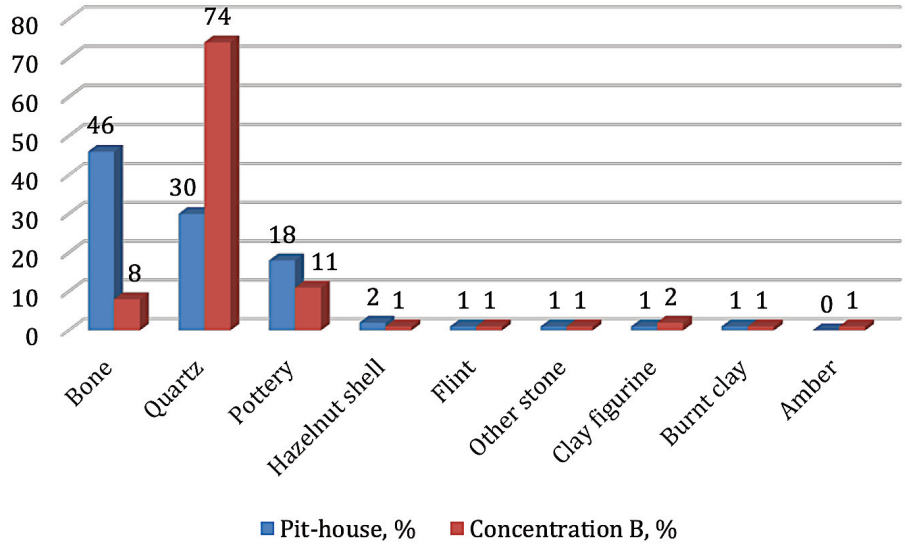

Fig. 15. Comparison of different find categories (%) from the pit-house and concentration in area B.

of clay figurine fragments, including what appears to be a harbour porpoise image, is particularly important, as clay figurines are in many cases part of the inventory of a dwelling (Zhulnikov 2006, 190; Pesonen 1998, 26; Karjalainen 1997, 23; Foss 1952, 213). Based on this evidence (see also below), we suggest that the remains of an above-ground structure (building) were found in excavation area B.

Stone Age above-ground buildings without remains of structural elements can often only be recognised by the concentrations of artefacts (e.g. Gelhausen et al.

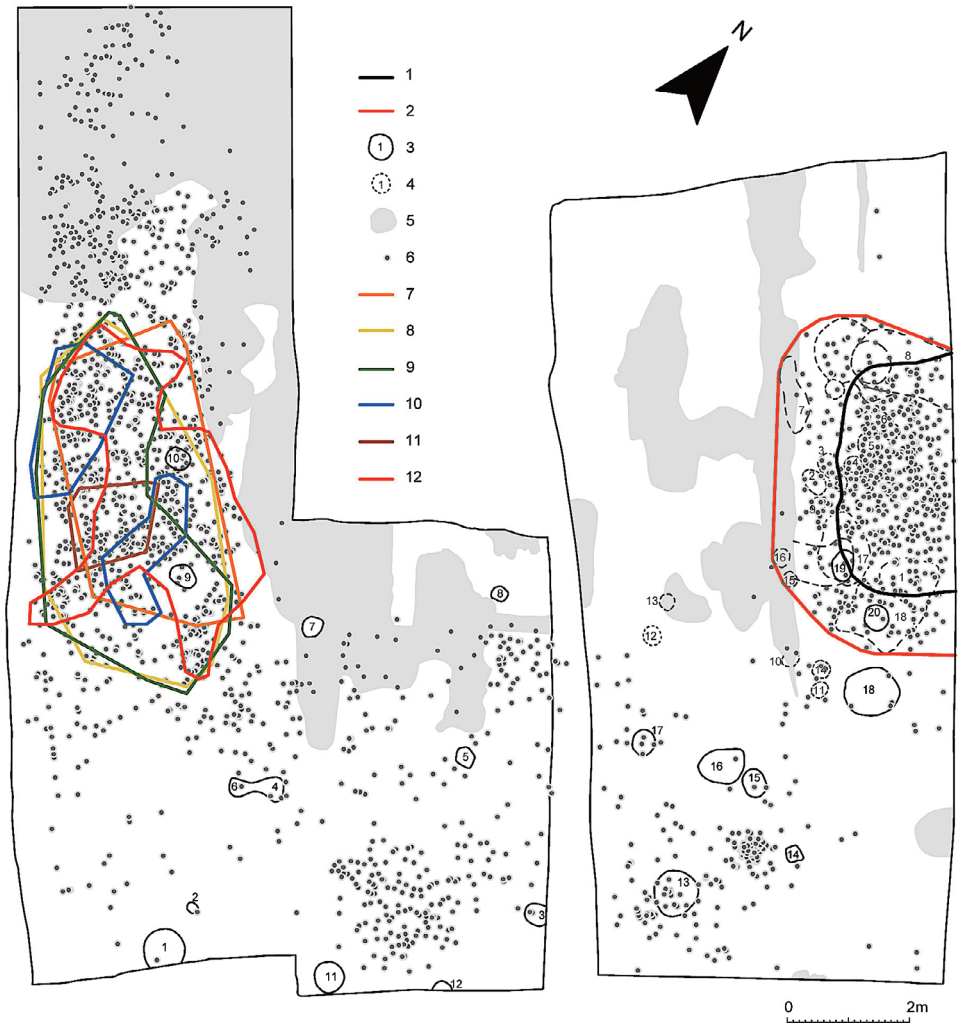

Fig. 16. Selected features at the Jägala Jõesuu V settlement site. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – outline of the pit-house at the bottom level, 3 – fireplace, 4 – pit, 5 – mixed layers, 6 – find, 7–12 – main distribution areas of different find categories in area B; 7 – clay figurine, 8 – burnt bone, 9 – worked stone, 10 – flint, 11 – hazelnut shell, 12 – CWo (plan modified from Roog & Kriiska 2019 by I. Khrustaleva).

2009; Larsson & Sjöström 2013, 506–508; Kriiska et al. 2016; Rostedt & Kriiska 2019, 18). It is quite difficult to distinguish and analyse such objects and thus there is very little data on above-ground buildings in general and on the Comb Ware stage in particular (e.g. Pesonen 2002, 11; Zhulnikov 2003, 19). No structural details were found of the above-ground building of Jägala Jõesuu V either. Only the oval or rectangular shape of the construction with a size of ca 6 × 3 m could be determined

according to the find distribution, but the two fireplaces documented within the concentration could not be related to the use period of the building.

The three fireplaces placed to the Bronze and Iron Ages by radiocarbon show that it is impossible to determine the age of these objects at Jägala Jõesuu V without obtaining dates for them. At the same time, the clustering of artefacts, including burnt stones, around some of them suggests that at least a few fireplaces may be related to the Stone Age. The size and shape of the fireplaces do not contradict this assumption, and stoneless fireplaces have been associated with the Comb Ware cultures in most parts of Estonia (Sikk 2016, 30). Based on the location of knapped quartz and flint, as well as CWo fragments and some other categories of finds, we can outline at least three activity zones that correlate with the fireplaces. The first of them is between fireplaces Nos 13–16, the second between fireplaces Nos 3, 11 and 12, and the third near fireplace No. 8. Most likely, these represent areas of stone knapping (either flint or quartz) and/or zones of other outdoor activities.

The Jägala Jõesuu V settlement site clearly differs from a number of Pottery Stone Age sites in Estonia, for which a short-term seasonal use can be assumed due to their characteristics, such as the presence of animal bones indicating hunting at certain times of the year (e.g. seal pups), or physical space constraints not suitable for permanent habitation (e.g. small islands). Dozens of such short-term seasonal hunting and fishing sites are known on the islands and coast of western Estonia, which are quite similar in the low diversity of finds and especially in the absence or scarcity of pottery sherds, ground stone and wood chopping tools (e.g. Lõugas et al. 1996, 204–206; Jussila & Kriiska 2004, 4; Kriiska 2002; for a more detailed discussion of the Stone Age settlement seasonality and mobility on the west coast of Estonia, see Sander & Kriiska 2021).

Ethno-archaeological research has shown that clear dwelling structures and a diversity of waste can occur at long-term seasonally re-used settlements (e.g. Grøn & Kuznetsov 2003). However, comparison of the materials of Jägala Jõesuu V with contemporaneous sites in Estonia, the large number and variety of finds as well as the remains of a substantial permanent dwelling construction suggest, in our opinion, a preferably sedentary use of the Jägala Jõesuu V settlement site, although this cannot be proved unequivocally. The term 'sedentism' has various explanations in the archaeological literature (e.g. Kelly 1992, 49–50; Mökkönen 2011, 61; Piezonka 2021); we support the one that emphasises settlement continuity. Presumably, Jägala Jõesuu V was a stationary settlement that was inhabited by at least part of the community (nearly) all year round. An additional argument in favour of this assumption can also be the principle of choosing the habitation area on the seashore and near the river mouth, which provided livelihoods from various resources. Overall, the presence of the pit-house remains distinguishes Jägala Jõesuu V from other Comb Ware stage sites in Estonia. Dwelling remains are generally rare for the Stone Age sites of Estonia (Khrustaleva et al. 2020), and among the 60 (Typical and Late) Comb Ware culture settlement sites discovered there (Sikk et al. 2020, 93) only Jägala Jõesuu V has clear remains of a dwelling with substantial permanent constructions. The Riigiküla I settlement site in northeastern Estonia

(Fig. 1: B) contained also (Late?) Comb Ware culture building structures, but the details of their construction cannot be specified (Khrustaleva et al. 2019). A few above-ground dwellings were also discovered at the site Valma in central Estonia (Fig. 1: B) due to the concentrations of finds around fireplaces on the round areas cleaned from stones (Janits 1959b).

The same cultural context of the artefacts and the way they were distributed at the site, together with radiocarbon dates obtained from burnt bones and hazelnut shells, suggest a relatively short use period (is unlikely to exceed several centuries) for the site at the end of the 4th millennium calBC. This also distinguishes Jägala Jõesuu V from many other Stone Age sites discovered in Estonia, the territory of which was repeatedly used. Both constructions – the pit-house and the above-ground building – can be dated, on average, to 3100 calBC, and the different number and density of finds in them are explained by different constructions, functions and durations of use. A refit link between fragments of Late Comb Ware sherds with mineral admixture connects the two excavation areas (A and B) and shows that both were used at the same time; however, this does not mean that all the objects at the site were built and used simultaneously.

Conclusions

A full-scale analysis of the finds (raw materials, artefact types, technologies, etc.) and architectural elements of Jägala Jõesuu V show that the site is an unmixed and clean complex of the Late Comb Ware culture. It contains the main components of the Late Comb Ware culture, including pottery with both mineral and organic temper, the three main 'exotic' materials (Carboniferous and Cretaceous flint, Karelian metatuff and Baltic amber), the bifacial flint processing technique, and clay figurines. The predominance of quartz along with the bipolar knapping technique is also an important characteristic of this period in Estonia.

Spatial analysis of all finds revealed some concentrations that are related to various features of the cultural layer. A pit-house with the main concentration of artefacts had already been uncovered during the excavations at the site. However, a careful study of all the details of this building and a refitting analysis allowed us to clarify its size (at least >2.8 × 5.3 m, with a depth of 0.2–0.25 m) and construction (timber posts). The scrutiny also revealed a second concentration, which contained a fairly similar composition of artefacts to the pit-house (pottery, quartz and flint artefacts, and even clay figurines), and likely indicates the remains of an above-ground building measuring 6 × 3 m. No structural elements of this building were found. In addition to the two buildings, three other concentrations of mostly lithic artefacts, likely related to open fireplaces, were identified. The finds demonstrate that both closed and open spaces were actively used by Stone Age people.

Radiocarbon dates indicate that the Stone Age site was used for a relatively short period of time at the end of the 4th millennium calBC: both houses date approximately to 3100 calBC. However, this does not mean that all activity areas

at the site or both buildings were used at exactly the same time. Nearly 2000 years later, human activity also took place in the same area, as evidenced by the data from three fireplaces that spatially overlap the two buildings and the open-air part of the site and are radiocarbon-dated to the Bronze and Iron Ages. They, and probably many other fireplaces (especially those visible on top of the cultural layer), must be connected to the tilled field layer that covered the Stone Age cultural layer and may be the result of agricultural land use, including burning trees to clear the fields. That is not to say that none of the fireplaces could have been from the Stone Age, but this cannot currently be verified without additional radiocarbon dating.

The small number of stone tools and the lack of large artefacts can indicate both active use and cleaning of the site by its residents. On the other hand, the number of small finds and their composition suggest that this site was probably permanently inhabited for some period of time. This is also supported by the presence of substantial building remains, which are rare for Estonian Stone Age sites. All this, together with the finds and the geographical position in comparison to the obviously short-term seasonal hunting and fishing sites in Estonia, suggests a sedentary character of habitation at the Jägala Jõesuu V site.

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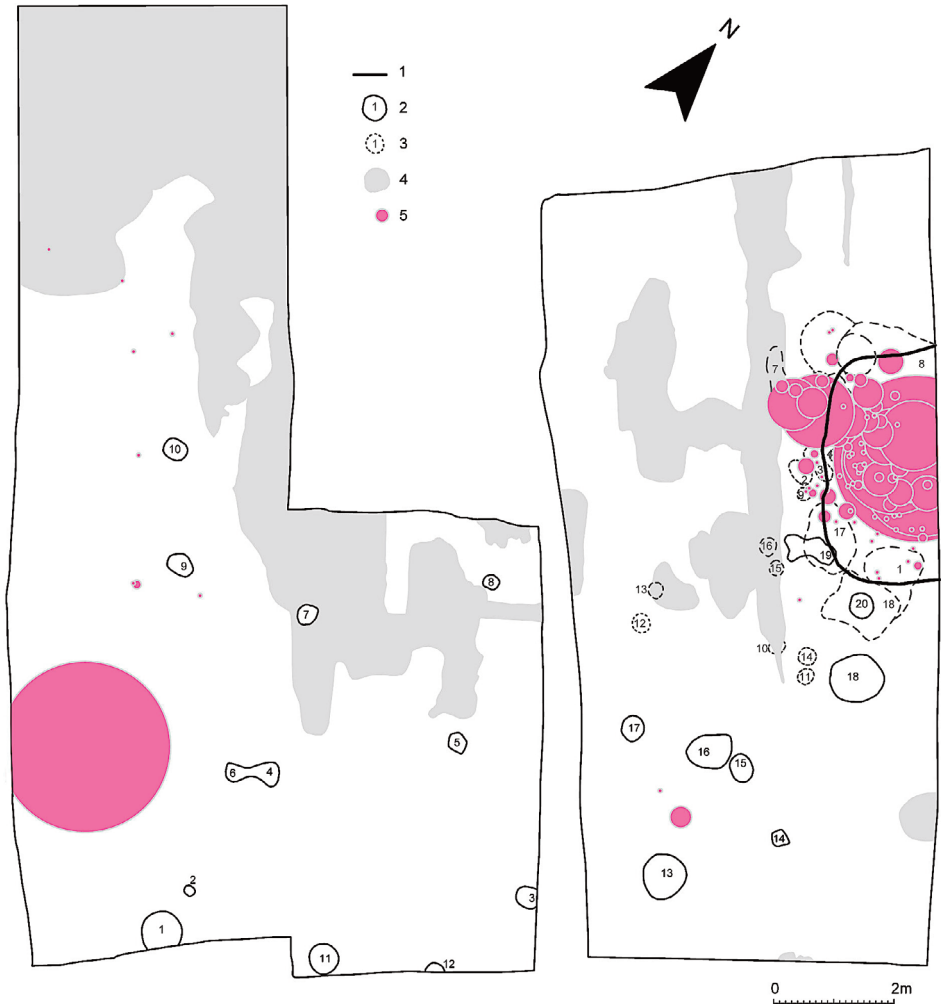
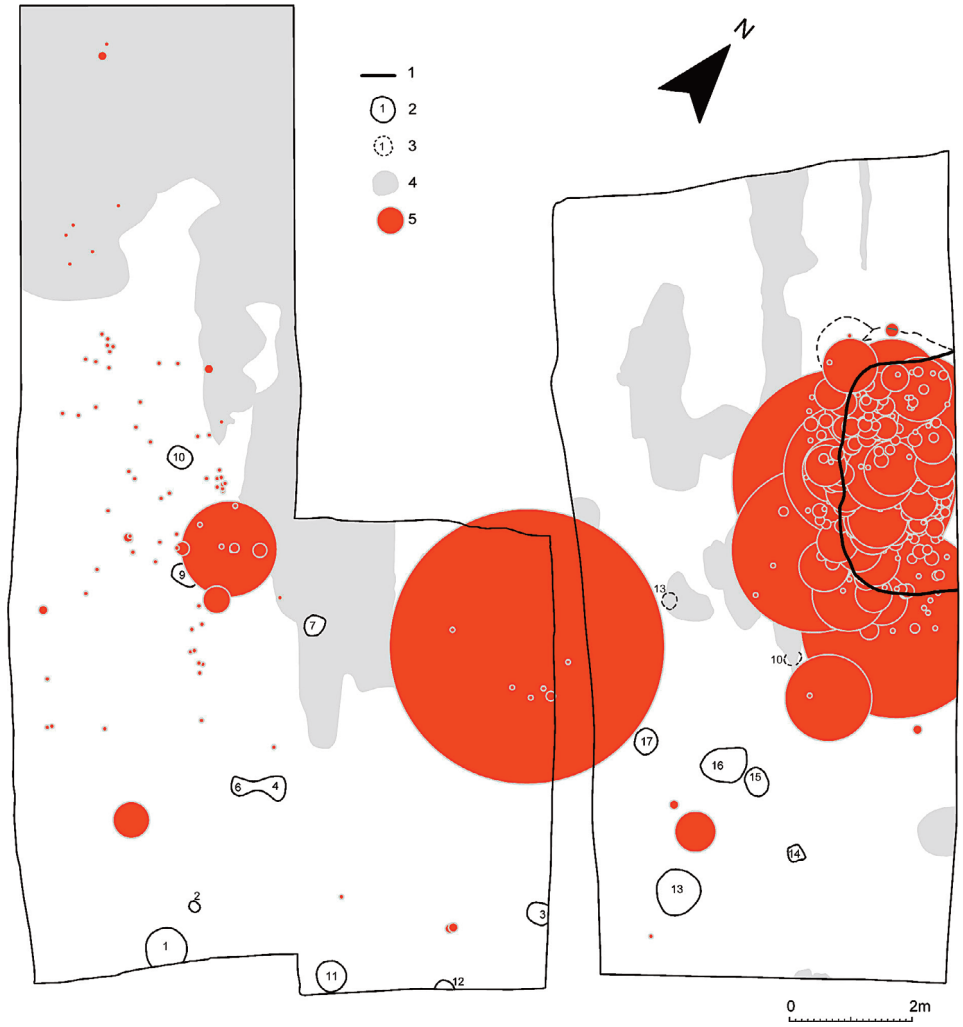
APPENDIX 1

Spatial analysis. Distribution of CWm. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – CWm (the size of the points depends on the number of fragments catalogued under the same field number, from 1 to 39 pcs).



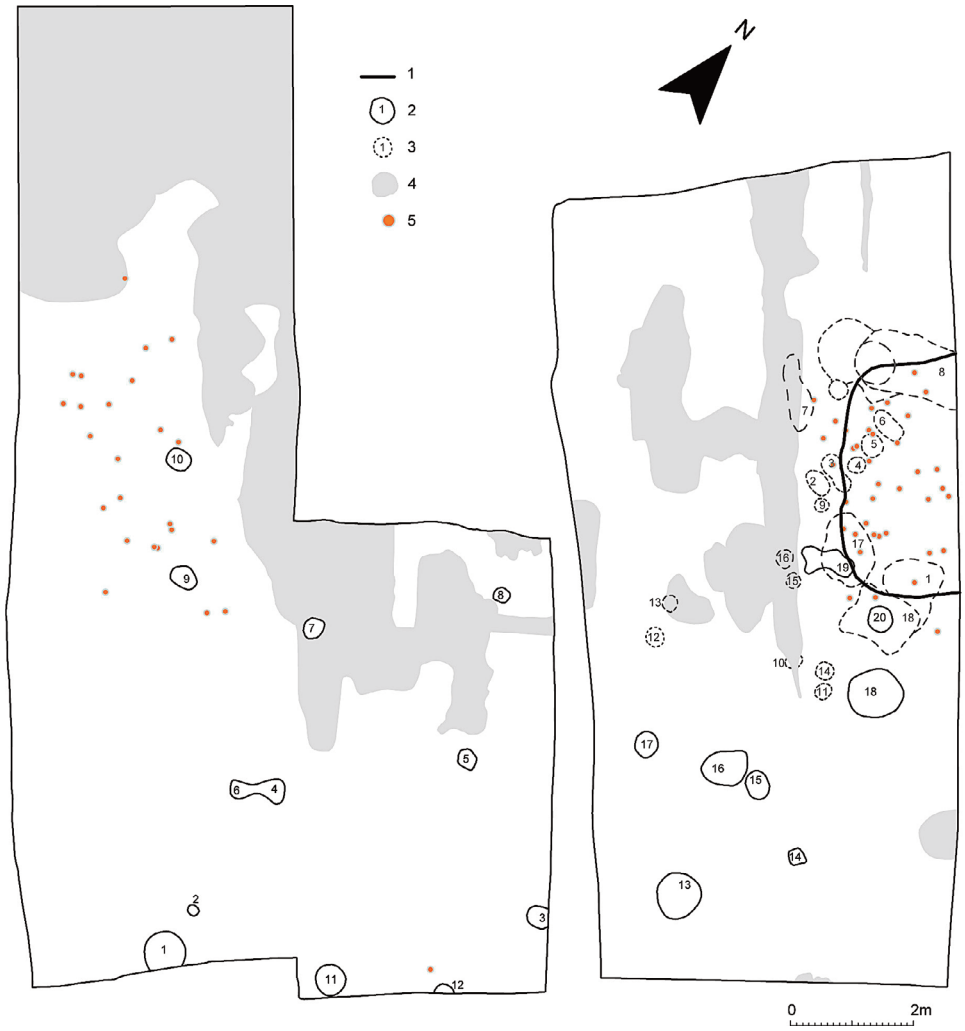
APPENDIX 2

Spatial analysis. Distribution of CWo. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – CWo (the size of the points depends on the number of fragments catalogued under the same field number, from 1 to 60 pcs).



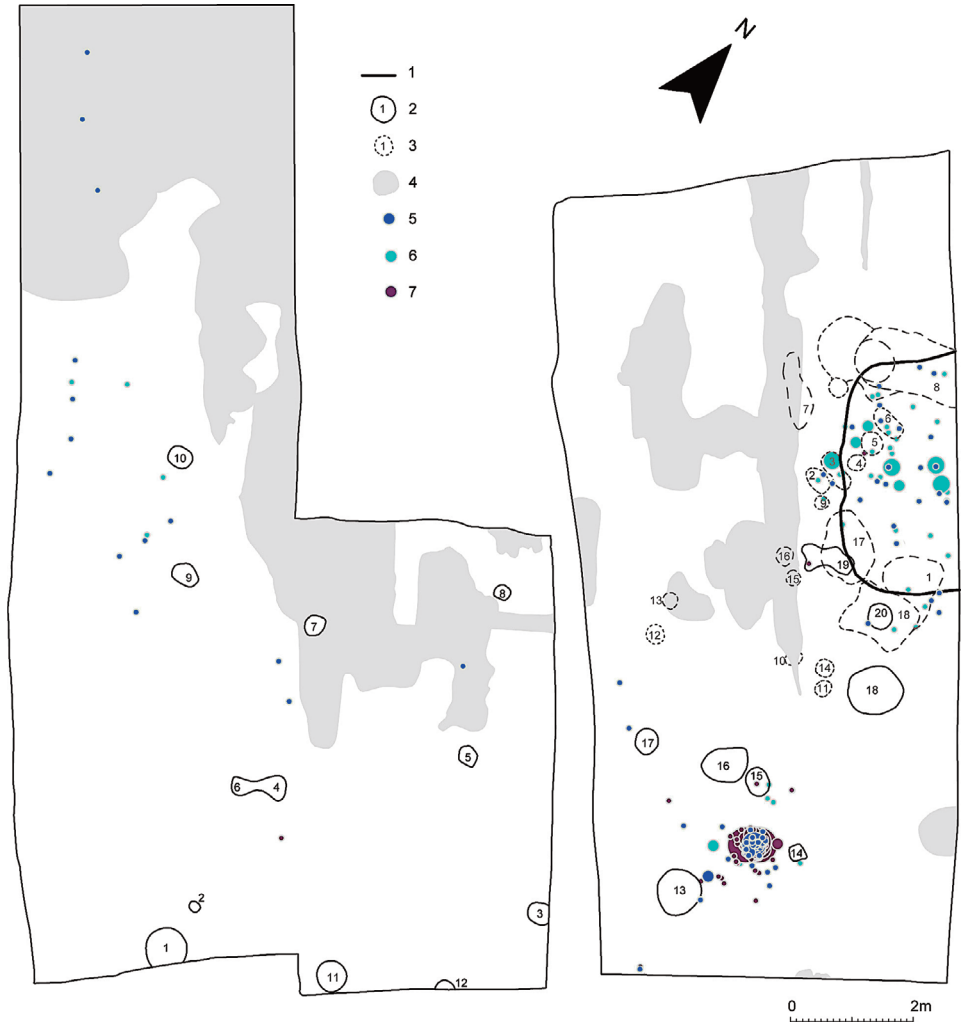
APPENDIX 3

Spatial analysis. Distribution of clay figurines. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – clay figurine.



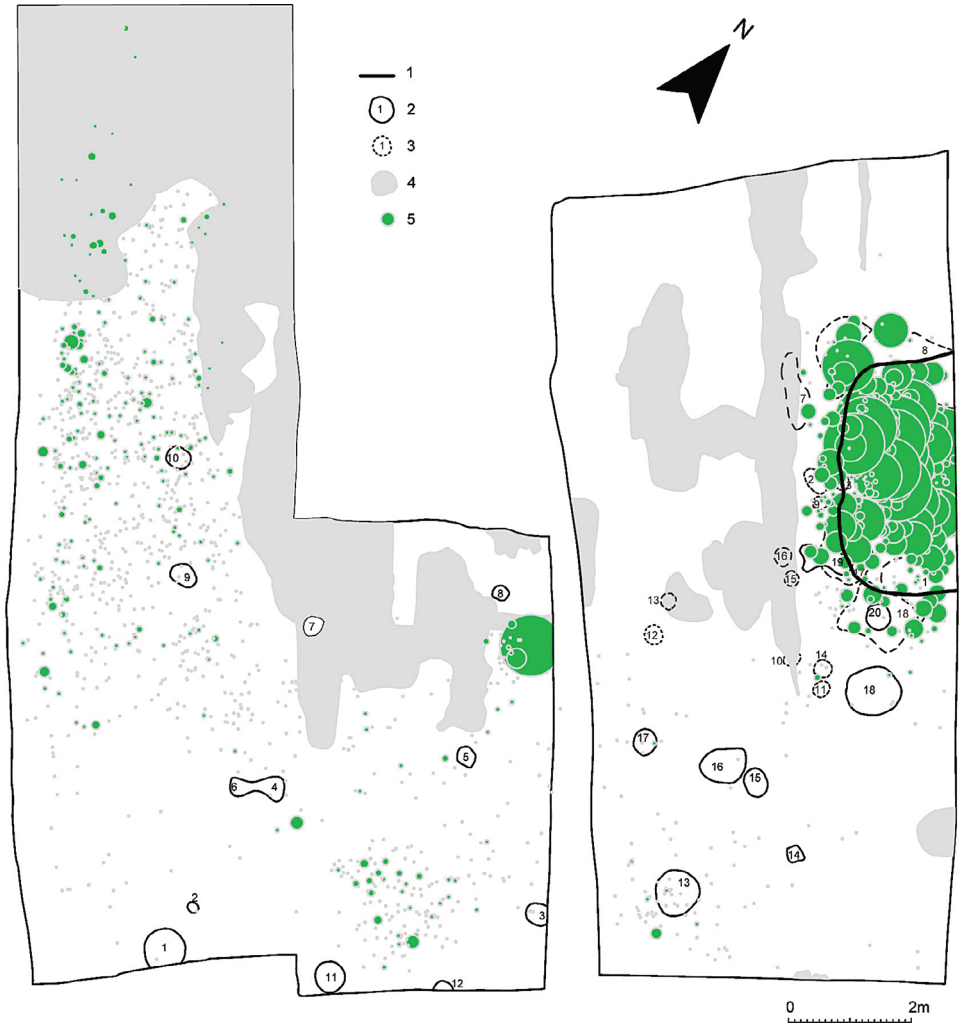
APPENDIX 4

Spatial analysis. Distribution of flint. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – Carboniferous flint, 6 – Silurian flint, 7 – Cretaceous flint (5–7 – the size of the points depends on the number of items catalogued under the same field number, from 1 to 6 pcs).



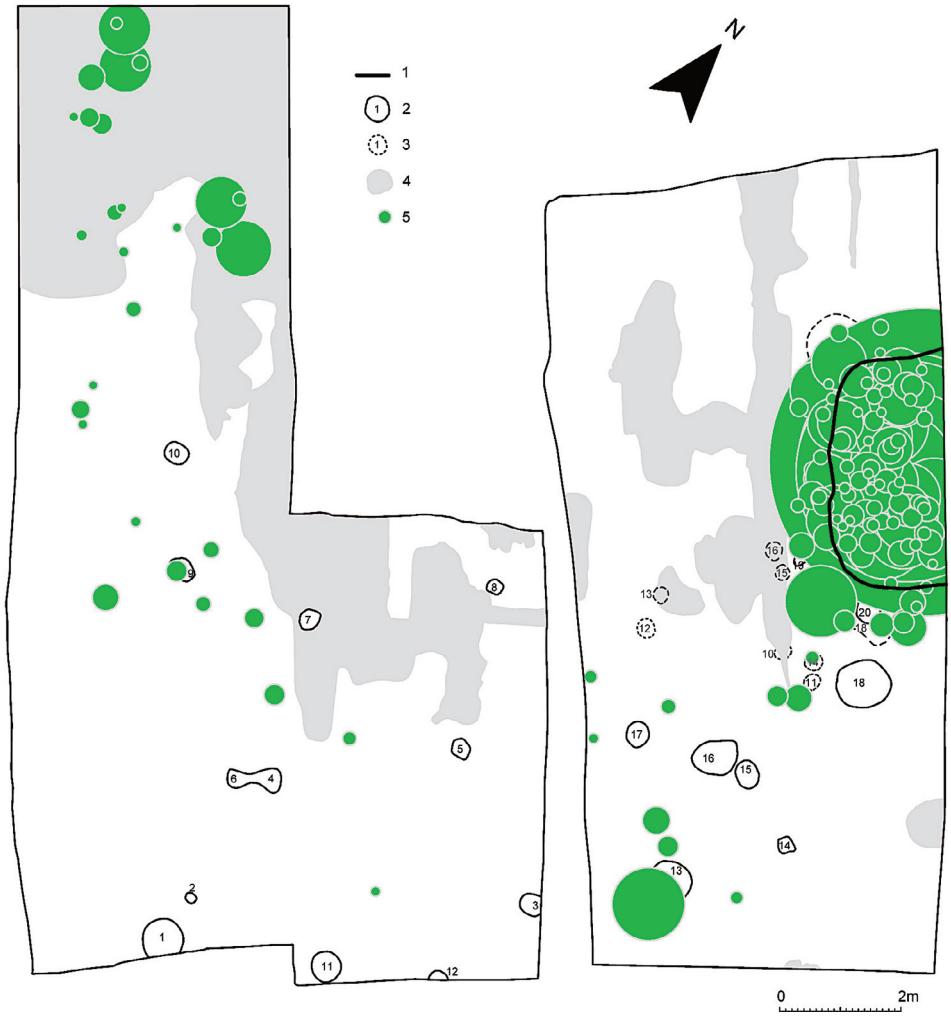
APPENDIX 5

Spatial analysis. Distribution of quartz. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – quartz (the size of the points depends on the number of items catalogued under the same field number, from 1 to 157 pcs).



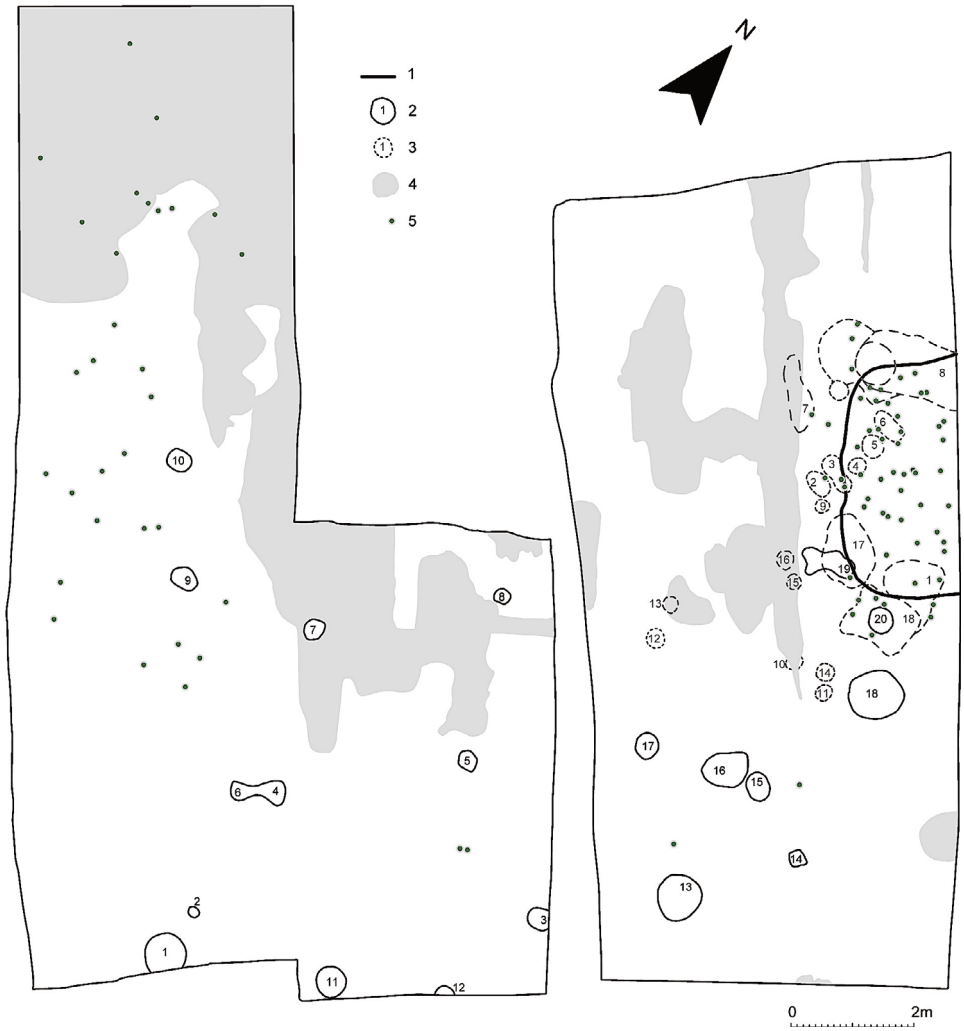
APPENDIX 6

Spatial analysis. Distribution of quartz. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – quartz (the size of the points depends on the weight of items catalogued under the same field number, from 0.1 to 374.8 g).



APPENDIX 7

Spatial analysis. Distribution of other stones. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – other stones.

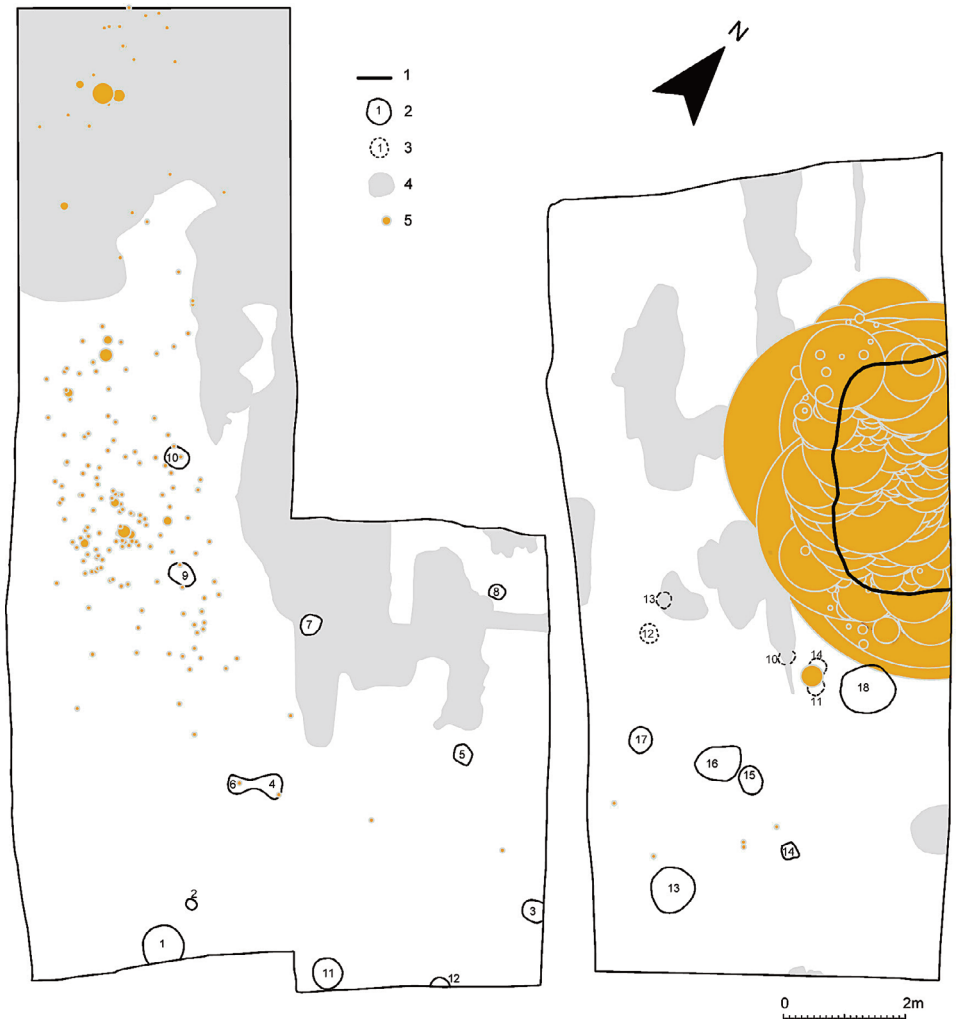


APPENDIX 8

Spatial analysis. Distribution of hazelnut shells. 1 – outlines of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – hazelnut shell (the size of the points depends on the number of fragments catalogued under the same field number, from 1 to 13 pcs).

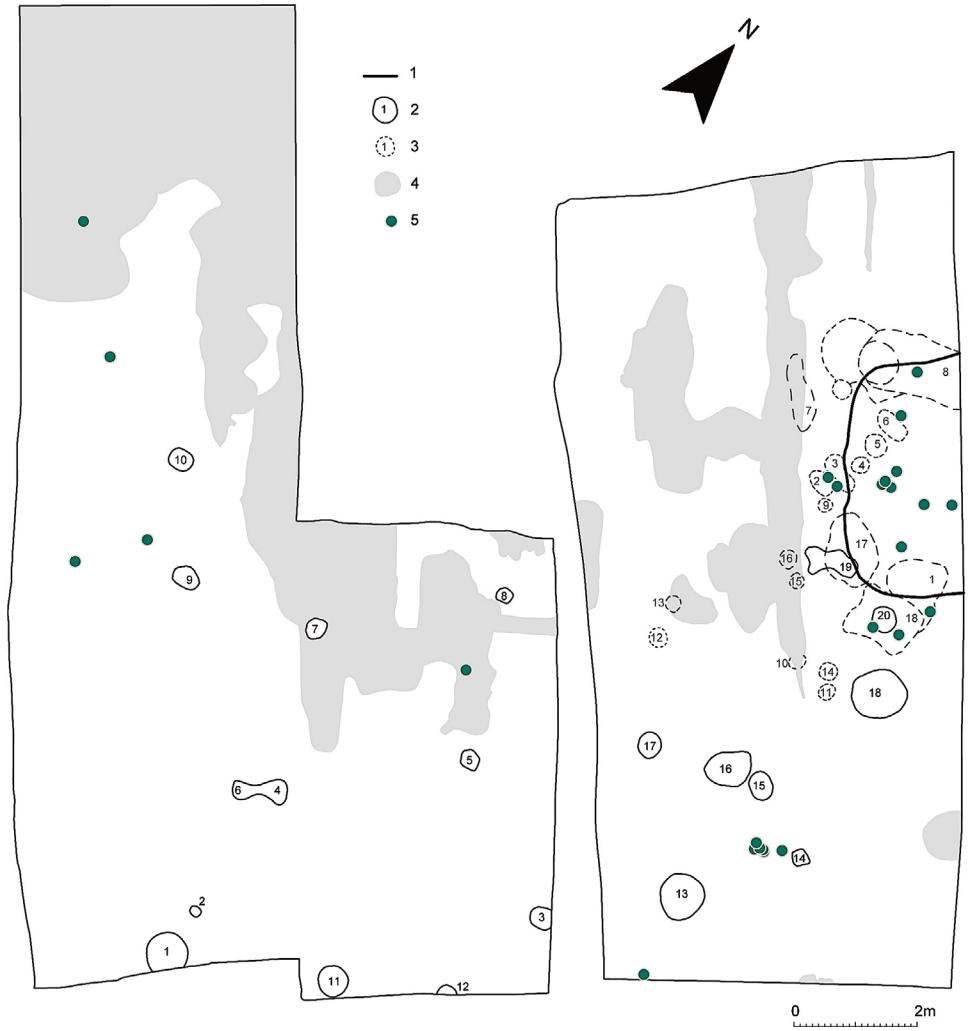
APPENDIX 9

Spatial analysis. Distribution of burnt bones. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – burnt bone (the size of the points depends on the number of fragments catalogued under the same field number, from 1 to 79 pcs).



APPENDIX 10

Spatial analysis. Distribution of burnt stones. 1 – outline of the red-coloured pit-house filling at the upper level of the cultural layer, 2 – fireplace, 3 – pit, 4 – mixed layers, 5 – burnt stone.



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JÄGALA JÕESUU V KIVIAEGNE ASULAKOHT PÕHJA-EESTIS: LEIDUDE RUUMILINE JA KONTEKSTUAALNE ANALÜÜS

Resümee

Jägala Jõesuu V asulakoht paikneb Põhja-Eestis Jõesuu külas u 200 m kaugusel Jägala jõe idakaldast ja u 2 km kaugusel tänapäevasest Läänemerest (joonis 1). Muistis leiti ning uuriti 275 m^2 ulatuses seoses maantee renoveerimisega toimunud päästetöödel 2011. aastal (joonised 2 ja 3). Kiviaegset kultuurkihti katavad kuni kolm fossiilsete põldude ja neid eristavate luiteliivade kihti (joonis 2). Välja kaevati osa ühest süvendpõhjalisest hoonest (joonised 4 ja 5), 18 maapinda süvendatud lohku ja 20 tuleaset (joonis 6). Kahest söestunud pähklikoorest ja ühest põlenud loomaluust tehtud radiosüsinikudateeringute järgi elati selles paigas millalgi vahemikus 3340 kuni 2910 aastat eKr (joonis 3). Kolmest tuleasemest kogutud söetükkide dateeringud jäävad vahemikku 1420 aastat eKr kuni 60 aastat pKr (joonis 3), osutades, et vähemalt osa tulepesade jäänuseid seonduvad pronksi- ja rauaaegse põlluharimisega.

Leiuaines (11 454 esemeleidu ja ökofakti) koosneb hilise kammkeraamika kildudest (17%), kvartsist (enam kui 40%), tulekivist tööriistadest ja kivitöö tootmis-

jääkidest, põlenud loomaluudest (enam kui 30%), sarapuupähkli koortest jne (tabel 1). Savinõud on valmistatud orgaanilise (73% kilde) või mineraalse (27% kilde) lisandiga savist. Leitud killud, millest osal on kammivajutistest, lohkudest või täketest moodustatud ornament, pärinevad vähemalt kaheksast nõust (joonis 7). Suhteliselt arvuka leiurühma moodustavad keraamiliste figuuride katked (joonis 8). Nii arvuliselt kui ka kaalult leiti kõige rohkem kvartsi (4950 leidu kogukaaluga 4838,3 g), mis on töödeldud pea eranditult (99% määratud juhtudest) bipolaarses lõhestustehnikas (joonis 9). Rohked kvartsi töötlemise jäätmed ei jäta kahtlust, et seda mineraali lõhestati asulakohal, sh elamutes. Arvestades eksperimentaalarheoloogiliste tööde tulemusi (joonis 14) võidi läbikaevatud alal lõhestada enam kui 5,3 kg kvartsi. Tulekivi osakaal on tagasihoidlik – 287 leidu kogukaaluga 101,7 g. Kasutatud on nii Karboni (42,5%), Kriidi (31,2%) kui ka Siluri (26,3%) ladestutes tekkinud tulekivi (joonis 10), mida töödeldi platvorm- (90%) ja bipolaarses (19%) lõhestustehnikas. Mõnevõrra esineb ka päevakivist, metatufist, kiltkivist, lubjakivist, graniidist, merevaigust ja luust artefakte (joonised 11 ja 12). Leiuaines on homogeenne, sisaldades kõiki hilise kammkeraamika kultuurile omaseid elemente nii esemelises koosluses, toorainete (sh „eksootilised" materjalid) valikus kui ka töötlustehnikates.

Väljakaevamiste metoodika (sh leidude 3D dokumenteerimine) ning asjaolu, et asulakoht oli suhteliselt lühiajaline ja hilisemast inimtegevusest vähe mõjutatud, andsid hea võimaluse ruumianalüüsiks (vt lisad 1–10). Kaevandis on võimalik eristada viit selgemat leidude kontsentratsiooniala. Suurim kontsentratsioon (61% kõigist leidudest) seondub >2,8 × 5,3 m suuruse peaaegu ristkülikukujulise tõenäoliselt postkonstruktsioonis hoone süvendi ja selle sees olnud lohkude täitepinnasega (tabelid 2 ja 3; joonised 15 ja16). Teine suur kontsentratsiooniala (10% kõigist leidudest) sisaldab süvendpõhjalise hoonejäänusega samu leiukategooriaid, kuid erineb nende osakaal (tabelid 4–5, joonis 15). On tõenäoline, et seal paiknesid u 6 × 3 m suuruse maapealse ehitise jäänused (joonis 16). Hoone ehitusviis ei ole selge. Samast leitud anumatest või esemetest pärit katkete nn tagasisobitust oli võimalik teha vaid väheste leidudega, millest enamus asetses süvendpõhjalises elamus (joonis 13). Erinevate tegevustega väljaspool ehitisi seonduvad kolm leidude kontsentratsiooniala, mis ühel juhul (läbimõõt u 2,5 m) sisaldas peamiselt tulekivi ja kvartsi ning kahel juhul (läbimõõt u 1,5 ja 3 m) kvartsileide.

Jägala Jõesuu V võrdlus Eesti teiste kiviaegsete asulakohtadega osutab leidude mitmekesisusele ja suhteliselt suurele hulgale. Lisades siia juurde süvendpõhjalise elamu, mis on Eestis seni ainus omalaadne hilise kammkeraamika kultuuris, ning erinevate ressursside kasutust võimaldava paiknemise jõe suudme lähedal mereranas, oletame, et Jägala Jõesuu V asustuskoht oli kasutuses püsiva elupaigana, kus vähemalt osa kogukonnast elas enamuse aja aastast.