Pattern and variation in jewellery production sequences: analysis of 4th millennium BC amber assemblages from the Latvian coast

Valdis Bērziņš¹, Agnese Čakare²
1 Institute of Latvian History, University of Latvia, Rīga, LV; valdis-b@latnet.lv
2 Institute of Latvian History, University of Latvia, Rīga, LV; agnese.cakare@inbox.lv

ABSTRACT – This study considers the production sequences of amber jewellery from Sārnate and Siliņupe, at the coast of present-day Latvia. Differences between the two sites in terms of the relative frequency of items discarded in various production stages may be related to the degree of integration into exchange networks. Within-assemblage variation in terms of the point within the processing sequence when perforation was performed indicates a strong element of heterodoxy with respect to amber processing within the communities, congruent with a domestic setting of production, even though the output consisted of a rather standardized range of forms.

KEY WORDS – amber; Neolithic; jewellery; chaîne opératoire; Latvia

Vzorci in variacije pri zaporedjih izdelave nakita: analiza zbira jantarna iz 4. tisočletja pr. n. st. z območja latvijske obale

IZVLEČEK – V študiji obravnavamo postopek izdelave jantarnega nakita iz najdišč Sārnate in Siliņupe na obali današnje Latvije. Razlike med najdiščema so z vidika pogostnosti predmetov, ki so bili odloženi v različnih fazah izdelave, povezane s stojnjo integracijo v menjalni krog. Kljub vidni standardizaciji oblik ugotavljamo pri obravnavanih jantarnih predmetih močna odstopanja v izdelavi, in sicer v fazi prebadanja, kar je skladno z domačo izdelavo.

KLJUČNE BESEDE – jantar; neolitik; nakit; operacijska sekvence; Latvija

Introduction

Amber has been a major focus of research into the concluding epoch of the Stone Age at the south-eastern and eastern shores of the Baltic Sea. Amber nodules washed up on the beaches were being widely collected and processed to make jewellery, and distributed via exchange networks far into the continental interior as well as northwards on the eastern side of the Baltic (Vankina 1970; Zagorska 2003; Zhulnikov 2008; Núñez, Franzén 2011; Loze 2001; 2003; 2008). While the role of amber within the social milieu of the time is, as yet, poorly understood, it is evident that the processing and exchange of amber was an important factor in coast-inland contacts and interaction starting from about 4000 cal BC, when this material makes its appearance in archaeological collections.

This article considers, from a comparative perspective, amber assemblages dated to 3600–2900 cal BC from two sites at the Latvian coast, seeking to characterize and interpret processing sequences through the analysis of semi-manufactured ornaments. Following the nomenclature widely utilized in this region of Europe, our sites fall within the
Neolithic, as defined by the presence of pottery, even though palaeoeconomic data indicate a predominant reliance on wild foods, especially fish and marine mammals in the case of these coastal settlements (Zagorska 2000; Bērziņš 2008.293–330; Bērziņš et al. submitted).

### The sites and amber assemblages

The Sārnate and Siliņupe sites (Fig. 1), providing the amber assemblages discussed here (both held at the National History Museum of Latvia), are coastland habitations yielding abundant evidence for the exploitation of a range of wild food resources, including terrestrial and marine mammals, fish and birds. Both were situated so as to provide good access to freshwater as well as marine environments.

Importantly, amber was a locally available raw material at both sites, since lumps of amber, transported by longshore sediment drift from the Sambian Peninsula, could be gathered on nearby beaches (Vankina 1970.350; Bērziņš et al. submitted).

This article analyses a subset of the amber assemblages from the two sites, namely the semi-manufactured and finished pieces belonging to the three main jewellery classes: button-shaped beads, tubular beads and pendants (i.e. disregarding comparatively rare forms, such as discs, rings and unusual forms of beads, and a small number of figurines and other atypical pieces). The quantities of unworked lumps and flakes are also considered, but without further analysis.

### Sārnate

The amber assemblage from Sārnate, located near the north-western coast of the Kurzeme Peninsula, was recovered in the course of excavations directed by Eduards Šturms in 1938–1940 and Lūcija Vankina in 1949 and 1953–1959 (Vankina 1970; Bērziņš 2008). It may be noted that this is a peat-bog site with excellent wetland preservation, yielding a diverse array of organic artefact finds. More relevant in the context of amber studies is the clustered pattern of artefact distribution on this extensive site. Distinct clusters of artefacts are in most cases associated with structural remains surrounding a hearth, and on this basis the collection has been subdivided into smaller assemblages relating to individual household units or ‘dwellings’. In view of the range of seasonally exploitable food resources, the substantial character of the living structures and the presence of fragile and bulky equipment, Sārnate is thought to have been occupied year round (Bērziņš 2008.381–383).

Sārnate has given a very large collection of amber finds, which includes 638 semi-manufactured and finished ornaments along with unworked lumps and a great quantity of debitage (Vankina 1970.Tab. 6). Here, however, for the purpose of direct comparison with the Siliņupe assemblage, we shall consider only that part of the Sārnate amber collection which was recovered from dwellings with pottery classed as Early Sārnate Ware, representing one of three phases of occupation on this site.

Importantly, the Early Sārnate Ware phase at Sārnate is also taken to include dwelling no. 2. This particular dwelling is quite exceptional, in that it produced a vastly greater quantity of amber finds than all of the rest. The dwelling consisted of an artefact cluster associated with a spread of sand measuring 4x8m, which seems to approximately reflect the size of the living structure (Bērziņš 2008.297). The ceramic assemblage from this dwelling was a very small one. Nevertheless, the distinct prevalence of porpoise tooth stamp (Bērziņš, Dumpe 2016; ‘tooth stamp’ in Bērziņš 2008.Tab. 10) among the various kinds of stamped pottery decoration serves to place it in the Early Sārnate Ware phase.
so that we may usefully compare its amber assemblage with the much smaller assemblages from the other dwellings of this phase.

Five samples from the Early Sārnate Ware dwellings at Sārnate have been dated. If we exclude two dates obtained from residue on pottery (Ua-33828 and Ua-15984), considered to be subject to the reservoir effect, we are left with three dates from charcoal that give an overall date range of 3516–2880 cal BC for the Early Sārnate Ware phase at Sārnate.

The amber ornaments from Sārnate considered here, namely the pieces identifiable as semi-manufactured and finished button-shaped beads, tubular beads and pendants from dwellings of the Early Sārnate Ware phase, number 152 in total. Dwelling 2 alone provides 117 of these, and the remaining 35 come from several other dwellings and one artefact cluster of this phase (dwellings D, E, MZA/MZR/MD, Pa, RZ/RD, IZ/ID, W and the artefact cluster recorded as ‘hearth 16’). In addition, seven unworked amber nodules and 2071 flakes were recovered from the dwellings of this phase, as shown in Table 2.

The typology of amber jewellery from Sārnate has been treated comprehensively by Vankina (1970. 105–114), which also offers a general discussion of amber processing and exchange. A new analysis was undertaken by Valdis Bērziņš (2003), focusing specifically on production stages and intrasite spatial analysis, and evaluating the evidence for craft specialization. The current article utilizes part of the data compiled in Bērziņš’s study, reconsidered in the light of recent experimental work and theoretical developments, and viewed from a comparative

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**Sample description** | Lab. no. | ¹⁴C age BP | Calibrated date, cal BC, 2σ | Notes
---|---|---|---|---
**Sārnate, Early Sārnate Ware dwellings**
Residue on potsherd with porpoise tooth impressions (A 11416:42), dwelling ′ | Ua-33828 | 5480±40 | 4443–4249 (95.4%) | Previously published in Bērziņš 2008. Tab. 2. Subject to freshwater and/or marine reservoir effect from vessel contents? (Not adjusted)
Residue on potsherd with porpoise tooth impressions (A 11417:313), dwelling M | Ua-15984 | 5065±75 | 4036–3655 (95.4%) |
Charcoal, dwelling R2/R0 | Tln-2918 | 4570±65 | 3516–3036 (95.4%) |
Charcoal, dwelling M | FTMC-UM96-5 | 4484±29 | 3342–3090 (92.3%) | 3054–3034 (3.2%)
Charcoal, dwelling D | FTMC-UM96-4 | 4300±31 | 3011–2880 (95.4%) |

**Sīliņupe, Early Sārnate Ware phase**
Charcoal (deciduous wood) extracted from pottery sherd no. 84 (with porpoise tooth decoration), area 7, level 3, 1989 | Poz-13269 | 5330±50 | 4326–4287 (8.6%) | 4266–4043 (85.2%) | 4012–3998 (1.7%) | Subject to freshwater and/or marine reservoir effect from vessel contents? (Not adjusted)
Wood charcoal, area 7, central part, level 4, squares 8–11/fg-h, 1988 | FTMC-UM96-3 | 4791±31 | 3640–3524 (95.4%) |
Wood charcoal, area 5, level 3, hearth, 1988 | FTMC-UM96-2 | 4743±31 | 3533–3500 (75.8%) | 3432–3380 (19.6%)
Bark roll – net float? (*Betula* sp.), inv. no. 292/539, area 7, S part, level 4, depth 1.1–1.3m, 25.07.1989 | Poz-123665 | 4690±40 | 3624–3580 (8.8%) | 3532–3368 (86.6%)
Wood charcoal, area 5, level 3, hearth, 1988 | FTMC-UM96-1 | 4545±30 | 3370–3306 (32.1%) | 3300–3282 (2.5%) | 3276–3266 (1.2%) | 3243–3102 (59.7%)
Bone (*Bos taurus*, centrotarsale), area 10, level 3, –0.5–0.8m, 1989 | Poz-137614 | 4490±35 | 3351–3089 (91.8%) | 3057–3033 (3.6%)
Bone (*Alces Alces*, phalami), area 7 (S part), level 3, –0.6–1.0m, 1989 | Poz-137613 | 4450±35 | 3337–3210 (40.0%) | 3194–3010 (51.9%) | 2981–2961 (2.0%) | 2951–2935 (1.6%)

**Tab. 1. Radiocarbon datings for the Early Sārnate Ware phase at Sīliņupe and Sārnate. Conventional ¹⁴C ages have been calibrated using OxCal v4.4 (Bronk Ramsey 2009) and the IntCal20 atmospheric curve (Reimer et al. 2020). Tln-2918 is a conventional radiocarbon dating; all the rest are AMS datings.**
perspective, setting it against newly obtained data for the Siliņupe assemblage.

**Siliņupe**

The Siliņupe site, at the south-western shore of the Gulf of Riga in the present-day village of Lapmežciems, was excavated by Vankina in 1954 and by Ilga Zagorska in 1988–1989 (Zagorska 2000; 2003; Bērziņš et al. submitted). The site occupies the slopes of a former beach ridge and a dune ridge running parallel to it, as well as a wet hollow between the ridges. Several occupation phases may be distinguished on the basis of ceramic wares, but the great majority of the pottery assemblage may be classed as Early Sārnate Ware. As with Sārnate, consideration of the seasonality of the food resources used at the Siliņupe site suggests year-round occupation (Bērziņš et al. submitted).

Six samples from strata at Siliņupe containing Early Sārnate Ware have been radiocarbon-dated. If we exclude sample Poz-133269, thought to be subject to freshwater and/or marine reservoir effect, then the remaining five datings give an overall range of 3640–2935 cal BC for the Early Sārnate Ware occupation phase, in good agreement with the date range for the equivalent phase at the Sārnate site, as given above.

A total of 316 semi-manufactured and finished ornaments have been found at Siliņupe, of which 104 pieces identifiable as button-shaped or tubular beads or pendants are considered here. In addition, 288 unworked nodules and 229 debitage pieces were recovered (Tab. 2).

A brief general treatment of the Siliņupe amber assemblage within the regional context of amber-working and exchange has previously been given by Zagorska (2003). In the present study, the material has been re-analysed from a technical perspective, determining the form, dimensions, degree of surface treatment and state of perforation, in order to classify the ornaments into specific production stages (Čakaire 2020), following the approach previously applied to the Sārnate collection.

**Jewellery forms**

Most frequent in the amber jewellery assemblage from the dwellings at Sārnate belonging to the Early Sārnate Ware phase are button-shaped beads, totalling 80 (Fig. 2.1–5). These beads normally have a V-shaped perforation visible only from the back, although pieces were often repaired by making a simple front-to-back perforation (Fig. 2.3,5). They are generally circular in plan, with the occasional rectangular or oval example, and the cross-section is biconvex or, less commonly, plano-convex.

The dwellings of this phase have yielded 15 tubular beads, almost all of them cylindrical (Fig. 2.6–8). These have a long, straight perforation, which could be drilled by different methods, from one or both ends.

There are 57 whole and fragmentary pendants from the dwellings of this phase (Fig. 2.9–14), the most common forms being trapezoidal and droplet-shaped. A variety of idiosyncratic pendant forms are also represented, as well as fragments of indeterminate form. The pendants have a short, drilled perforation, usually placed in the thinnest part of the margin. The perforation could be made from one or from both faces, thus resulting in a conical or biconical opening.

At Siliņupe, by contrast, amber processing was concentrated mainly on the production of pendants (Fig. 3.6–13), which number 71, constituting two-thirds of the amber jewellery from the site. Most characteristic of this site are trapezoidal and irregular pendants. The high frequency of irregular pendants may have to do with the straightforward production process: they were made from unworked pieces of amber, without any surface processing, simply drilling a hole where the margin of the piece is thinnest (Fig. 3.9). Pendants made in this way predominate among the pendants from sites of this period along the whole of the western shore of the Gulf of Riga (Zagorska 2003).

The other amber pendants from Siliņupe were given a specific form during the initial processing stage. Trapezoidal pendants (Fig. 3.8,11,12) are commonest, generally with a straight lower margin, this being a characteristic form of amber jewellery from graves in the Eastern European forest zone, in Latvia as well as further to the east. Trapezoidal pendants with a concave lower margin also occur. Present in smaller numbers are elongated and triangular pendants, as well as rarer pieces: rhombic pendants, pendants with one straight and one convex margin, and idiosyncratic forms that are not typologically classifiable. At Siliņupe, pendants drilled from both faces predominate among the finished, unbroken items.

Relatively large numbers of button-shaped beads (Fig. 3.1–5) were also produced, with a total of 26
finds. Commonest are circular beads with a V-shaped perforation, although oval beads were also found. They are most frequently plano-convex in cross section, less often biconvex.

The class of tubular beads is represented at Siliņupe by seven fragmentary cylindrical beads, all of them in a partially processed state (Fig. 3.4–5).

**Production methods and stages**

Our understanding of the processes applied in amber jewellery production and the assignment of the pieces to production stages is based on examination of the artefacts by naked eye, guided by the findings of previous analyses of amber-working by Vankina (1970), Ryszard F. Mazurowski (1984), Annelou van Gijn (2006; 2014) and Erik van Drenth (2013), and by the results of experiments performed by Eryk Popkiewicz (2012).

First, it was important to select the most suitable raw material for amber ornaments. Only hard and clear amber would be chosen, as it is less likely to fracture and spoil the work. If the natural cortex of the amber lump was to be removed, this could be done using a knife or grinding stone in the form of a sandstone or limestone slab, as attested by archaeological and ethnographic studies. There is ethnographic evidence of pre-processing heat treatment to improve the structure of amber (Popkiewicz 2012).

The process of shaping and surface treatment can be divided into several stages: subdivision of the nodule, flaking, grinding, and polishing. In the course of initial processing, a blank of suitable size would be obtained. Before further working, larger pieces of amber would be cut or divided into smaller ones, utilizing tools of bone, antler, flint or other stone (Mazurowski 1984). It has been shown experimentally that, when using a miniature axe, by controlling the point where the flint blade will strike the amber, it is possible to determine the size of the amber fragment that will detach (Popkiewicz 2012). Amber lumps can also be split by indirect percussion, using an antler punch to apply strong point pressure, or they can be subdivided by cutting with a wet thread (van Gijn 2006; Popkiewicz 2012).
Once a suitable-sized piece of amber was obtained, it would be shaped into the desired form. Various kinds of blanks may be distinguished: nodules, blocks, and flakes (van Gijn 2014). Unshaped amber lumps could be used for making pendants, but the blanks for more elaborate pendants and beads were shaped after splitting. Amber flaking involved similar techniques and instruments to those used for flint-knapping, with the difference that amber-working requires smaller tools that permit greater precision (Popkiewicz 2012). Flaking could be performed with a flint flake or miniature axe. This leaves traces of retouch on the amber surface, where small fragments of amber are detached by the pressure of the tool edge (Figs. 2.1, 7, 8, 11; 3.4–6; Popkiewicz 2012). This technique is comparable to retouching on flint (Vankina 1970:112–114). The size of the detached fragments depends on the pressure exerted on the amber and on the angle of the tool edge to the surface of the amber (Popkiewicz 2012).

Grinding was employed to smooth the surface and round the sharp edges. Grinding stones with different grain sizes could be used for this, leaving regular striations running in various directions (Fig. 2.2, 3.6, 10). Subsequently, the surface would be polished using soft leather or fabric (Popkiewicz 2012).

Drilling was the most difficult operation in amber processing, and was a frequent cause of breakage. The piece could be drilled at any stage of processing.

Different kinds of drilled perforations may be distinguished, relating to the form of the ornament: pendants most commonly have short perforations; button-shaped beads have V-shaped perforations; and tubular beads have long, straight perforations. A different technique was used for each kind of perforation, and they differ in the degree of difficulty.

Pendants were simplest to perforate, as with such a short perforation, there was less chance of the ornament fracturing. A flint drill could be used for this purpose, drilling from one face or both and obtaining a conical or biconical perforation, respectively (Popkiewicz 2012). Drilling from both faces was the most common practice, possibly in order to reduce
the likelihood of breakage (Drenth 2013; van Gijn 2014). It was also the most common in cases of repeated perforation, undertaken in repairing items at Silinupe. Often, however, the placement of the two conical perforations was incorrectly judged, and so it was necessary to drill obliquely, which could lead to breakage (Popkiewicz 2012; van Gijn 2014). It has been confirmed experimentally that drilling may also be performed with a pointed piece of wood or antler, using a fine slurry, with this process leaving fine, regular, circular scratches (van Gijn 2014).

V-shaped perforations were provided for the button-shaped beads, drilling obliquely from two points on the same side, so that the perforations met to form the V shape.

The tubular beads required a long, straight perforation. Moreover, it was important for the perforation to be symmetrical in relation to the ornament, which was difficult to achieve. In order to obtain a correctly aligned perforation, the first step is to mark the drilling site, so that the drill does not slide across the surface of the amber, which can be done using the sharp edge of a flint tool (Popkiewicz 2012). For drilling the perforation itself, a longer instrument was required. In cases where a straight, cylindrical perforation is observable, a hollow drill could have been used, perhaps a bird bone, leaving a smooth perforation (van Gijn 2006; Drenth 2013). These perforations were drilled from one or both ends. A flint drill attached to a wooden shaft could also have been used for such longer, more difficult perforations (Popkiewicz 2012). The perforations of tubular beads broke or failed more commonly than those of other ornaments (Figs. 2.7; 3.4,5), reflecting the higher degree of difficulty.

The amber ornaments were classified into five production stages, taking into consideration both the character of the surface finish and the state of the perforation (Bērziņš 2003).

The following degrees of surface finish were distinguished:
- natural cortex all over;
- partially covered in natural cortex, partially flaked;
- surface entirely flaked;
- partially flaked, partially ground;
- surface entirely ground;
- partially ground, partially polished;
- surface entirely polished;
- front polished, reverse ground (mainly seen on button-shaped beads);
- partially natural cortex, partially polished (irregular pieces not shaped by flaking, only polished).

The following perforation states were distinguished:
- unperforated (piece intact);
- partly perforated (piece intact);
- perforation complete (piece intact);
- broken at the perforation, with perforation clearly incomplete;
- broken at the perforation, with perforation possibly or definitely complete;
- fragmentary piece not showing a perforation (e.g., the lower part of a pendant or the margin of a button-shaped bead).

The pieces were assigned to one of five production stages as follows:

1. **Unperforated pieces**: these are pieces abandoned either without completing pre-perforation working, or else leaving the piece ready for perforation without actually starting this operation. Such finds are taken to indicate shaping/surface treatment before perforation or the stocking of unperforated blanks.

2. **Pieces with an unfinished perforation**: either intact or broken at the perforation. These indicate failed or interrupted drilling. In the case of some broken pieces, it is not evident whether the perforation was complete at the time of breakage. For the purpose of assigning such pieces to a production stage, pieces which have a flaked but not ground surface are included in this stage, taking into account that flaking most commonly preceded perforation (as shown in Table 3). On the other hand, if such a broken piece has a ground surface, the state of surface treatment does not give any indication as to whether it broke during perforation or during subsequent finishing, and such pieces are classed as “production stage indeterminate”.

3. **Pieces with a finished perforation, but unfinished surface treatment**: i.e. not all of the surface (or the front in the case of button-shaped beads) has been polished. Such pieces indicate that post-perforation finishing was being conducted, and that work on this piece was abandoned before this operation was completed.

4. **Finished products**: pieces with a finished perforation, where the whole surface (or the front in the case of button-shaped beads) has been polished.

5. **Pieces with a secondary perforation**: these are cases of repair after breakage at the perforation.
### Production stage

<table>
<thead>
<tr>
<th>Production stage</th>
<th>Button-shaped beads</th>
<th>Tubular beads</th>
<th>Pendants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sārnate, dwelling 2</td>
<td>Sārnate, other dwellings with Early Sārnate Ware</td>
<td>Silinupe</td>
</tr>
<tr>
<td>1. unperforated</td>
<td>6 (10%)</td>
<td>2 (10%)</td>
<td>3 (12%)</td>
</tr>
<tr>
<td>2. incomplete perforation</td>
<td>7 (11%)</td>
<td>6 (32%)</td>
<td>17 (65%)</td>
</tr>
<tr>
<td>3. completed perforation, unfinished surface treatment</td>
<td>14 (23%)</td>
<td>2 (10%)</td>
<td>– 16 (15%)</td>
</tr>
<tr>
<td><strong>Total semi-manufactured pieces (stages 1–3)</strong></td>
<td>27</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>4. finished artefact</td>
<td>27 (44%)</td>
<td>8 (42%)</td>
<td>5 (19%)</td>
</tr>
<tr>
<td>5. artefact repaired by secondary perforation</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Production stage indeterminate</strong></td>
<td>7 (11%)</td>
<td>1 (5%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td><strong>Total (all stages)</strong></td>
<td><strong>61</strong></td>
<td>19</td>
<td>26</td>
</tr>
</tbody>
</table>

### Production stage

<table>
<thead>
<tr>
<th>Production stage</th>
<th>Total of 3 ornament classes</th>
<th>Total finished/semi-manufactured items</th>
<th>Unworked nodules</th>
<th>Debitage pieces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sārnate, dwelling 2</td>
<td>Sārnate, other dwellings with Early Sārnate Ware</td>
<td>Silinupe</td>
<td>Total</td>
</tr>
<tr>
<td>1. unperforated</td>
<td>7 (6%)</td>
<td>7 (20%)</td>
<td>6 (6%)</td>
<td><strong>20 (8%)</strong></td>
</tr>
<tr>
<td>2. incomplete perforation</td>
<td>13 (11%)</td>
<td>7 (20%)</td>
<td>53 (51%)</td>
<td><strong>73 (28%)</strong></td>
</tr>
<tr>
<td>3. completed perforation, unfinished surface treatment</td>
<td>31 (26%)</td>
<td>4 (11%)</td>
<td>14 (13%)</td>
<td><strong>49 (19%)</strong></td>
</tr>
<tr>
<td><strong>Total semi-manufactured pieces (stages 1–3)</strong></td>
<td><strong>51</strong></td>
<td>18</td>
<td>73</td>
<td><strong>142</strong></td>
</tr>
<tr>
<td>4. finished artefact</td>
<td>37 (32%)</td>
<td>13 (37%)</td>
<td>12 (12%)</td>
<td><strong>62 (24%)</strong></td>
</tr>
<tr>
<td>5. artefact repaired by secondary perforation</td>
<td>–</td>
<td>–</td>
<td>5 (5%)</td>
<td><strong>5 (2%)</strong></td>
</tr>
<tr>
<td><strong>Production stage indeterminate</strong></td>
<td>29 (25%)</td>
<td>4 (11%)</td>
<td>14 (13%)</td>
<td><strong>47 (18%)</strong></td>
</tr>
<tr>
<td><strong>Total (all stages)</strong></td>
<td><strong>117</strong></td>
<td>35</td>
<td>104</td>
<td><strong>256</strong></td>
</tr>
</tbody>
</table>

Tab. 2. Amber finds belonging to the main ornament categories from the Early Sārnate Ware phase at Sārnate and from Silinupe, classified according to production stage.
Table 2 and Figure 4 give the numbers of button-shaped and tubular beads and pendants assigned to each of the production stages in the assemblages from Särnate dwelling 2, from the other dwellings belonging to the Early Särnate Ware phase at Särnate, and from Silinupe. Out of a total 256 ornaments, 209 (82%) could be assigned to a specific production stage.

The chaîne opératoire and its variation

The basic classification according to production stages is a logical starting point for elaborating the chaîne opératoire. Analysis of the semi-manufactured pieces reveals, however, that the production steps do not follow a fixed sequence. While shaping/surface treatment proceeds from flaking to grinding to polishing, there is considerable variation in terms of the point within this sequence at which the piece was perforated. This is apparent if we consider the state of surface treatment only for those semi-manufactured ornaments, 41 in total, which clearly display an incomplete perforation (Tab. 3), almost all of them fragmentary pieces that evidently broke during perforation.¹

Table 3 shows that among the pieces exhibiting a failed perforation, seven had been flaked all over the surface (with no grinding traces) before they were perforated; eight had been flaked and only partially ground; and the greatest number – 12 – had already been ground all over. There are also smaller numbers of incompletely perforated pieces in various other states of shaping/surface treatment, ranging from completely unshaped (with natural cortex all over) to completely polished.

All three ornament classes – both kinds of beads as well as pendants – show considerable variation in the degree of shaping/surface treatment carried out in advance of perforation. And such variation occurs within all three assemblages. Even the assemblage from Särnate dwelling 2, which must be regarded as representing the output of a relatively restricted human group (a household or small workshop), shows an element of variation in this respect.

Accordingly, the generalized chaîne opératoire for amber ornament production on these sites cannot be viewed as a sequence of steps performed in a set order, of the kind often visualized in schematic form in studies on processing sequences for lithic materials (e.g., Inizan 2008.Figs. 8–10), bone (e.g., David 2006.Fig. 2) or ceramics (e.g., Perry 2016.Fig. 11).

The kind of chaîne opératoire indicated by the amber assemblages, where a particular operation may come at various points in the processing sequence, is challenging to represent schematically. We have chosen to view it as consisting of two independent sub-chains: (1) the sequence of shaping/surface treatments, and (2) perforation (Fig. 4).

The same kind of variation in the position of perforation within the order of production steps is noted by van Gijn (2014) in her study of a Neolithic amber assemblage from Zeewijk in the Netherlands. It is likewise observed in Stone Age assemblages in Poland and in collections from medieval amber workshops in the Baltic Sea region (Popkiewicz 2012 and reference therein to Wojitasik 1990.147–148).

Proceeding from his amber processing experiments, Popkiewicz (2012) highlights the ergonomic and labour-saving aspects of this process: (1) a piece still in the initial stage of processing, and hence larger, is easier to hold or fix in position for drilling the perforation; and (2) because drilling is the most difficult part of the work, presenting the greatest risk of failure, less time/labour will have been wasted in the case of breakage while drilling, if this operation is performed on a little-worked piece than on a piece already in an advanced stage of completion.

This begs the question: why did amber-workers nevertheless often leave drilling until after grinding, or even after polishing? There are evidently technical issues at play here, presumably relating to the particular drilling technique employed and the means of fixing or holding the piece for drilling, as well as the form of the unworked lump, the kind of ornament it was to become, and the kind of perforation required for the particular ornament. All of these aspects deserve attention in future experimental work.

Leaving aside these practicalities, what does the occurrence of variation in the sequence of processing tell us? Following the theoretical approach taken by Gwendolyn O. Kelly (2016) in her study of stone bead production in Early Historic South India, we are witnessing an element of heterodoxy within the

¹ Unlike in the assignment of production stages in Table 2, pieces where the perforation is assumed to be incomplete because the surface is flaked but not ground are excluded from this analysis to avoid any ambiguity.
communities producing the ornaments. Thus, there was an acceptance of alternative practices, in this case with respect to the order in which the operations of producing an amber ornament were carried out – in contrast to an orthodox attitude, where only one set of practices is acceptable.

In her discussion of the Zeewijk assemblage, Van Gijn (2014) proposes that the variability observed in the exact production sequence of amber beads supports the assumed domestic production of the ornaments, with different people having slightly different techniques, whereas if the beads had been produced in workshops a more standardized production sequence would be expected.

Such a conclusion may also be valid with respect to amber processing in the Neolithic of the Eastern Baltic. Thus, in addition to the evidence for intensive amber-working from Särnate dwelling 2 (not just the amber assemblage itself but also grinding stones and certain lithic tool types that probably constitute amber-working gear), this dwelling also yielded a number of flint spear- and arrowheads, two pebble net sinkers and a significant amount of pottery (Van-kina 1970.75–76, Tab. 3, Fig. 133; Bērziņš 2008:Tabs. 10, 18), providing evidence of engagement in subsistence activities. In other words, amber processing appears to be taking place in what may be described as a domestic context. Lithic debitage was also abundant, showing that not just amber but also lithics were being intensively processed.

It appears that the domestic production of amber ornaments provided a context in which heterodoxy in processing practices could thrive, which is an important observation, if we consider that the output, in terms of the dominant classes of amber ornaments, was actually rather standardized. Thus, the makers of amber ornaments, apparently dispersed across a great many household production settings, were following somewhat different methods, even though they were aiming to produce standard ornament forms of recognized value for participation in a supra-regional exchange network.

Intensity of amber-working and production of different jewellery classes

The absolute quantities of amber recovered (Tab. 2, ‘Total finished/semi-manufactured items’, ‘Un-worked nodules’, ‘Flakes’) and the number of finds per square metre give at least some indication of the relative intensity of amber-working. In this respect, Särnate dwelling 2, with an excavated area of 86m², is in a class of its own, with its 126 (1.47/m²) semimanufactured and finished items and 2027 (23.57/m²) pieces of debitage (but no unworked nodules recorded!). The other Early Särnate Ware phase dwellings at Särnate, with a combined excavation area of 524m², are relatively very impoverished in terms of amber finds, together yielding only 43 (0.08/m²) finished/semi-manufactured items, seven (0.01/m²) unworked nodules and a mere 44 (0.08/m²) debitage pieces. Siliņupe lies in between these extremes: here, an excavated area of 336m²...
Valdis Bērziņš, Agnese Čakare

Valdis Bērziņš, Agnese Čakare

has given 316 (0.94/m²) finished/semi-manufactured items, 288 (0.86/m²) unworked nodules and 229 (0.68/m²) debitage pieces.

It should be added that in the case of Šiliņupe (but not Sārnate), the natural strata at the base of the archaeological sequence also contain amber lumps, transported by longshore drift in the sea and deposited along with other sediment (Bērziņš et al. submitted), so we cannot be certain that all of the recovered unworked amber on this site was actually collected by the inhabitants.

The general situation is clear enough: dwelling 2 at Sārnate was a locus of very intensive amber-working activity, starkly contrasting with a very low level of amber-working in the other dwellings of this phase, while Šiliņupe falls in between. Because the Sārnate collection can be subdivided into separate dwelling assemblages which we can equate with small-scale social groups, a pattern is revealed where one such group within a larger community – that associated with dwelling 2 – was engaging much more intensively in amber-working than others. Accordingly, dwelling 2 was previously regarded as an amber workshop (Vankina 1970.114), and has subsequently been considered through the theoretical lens of craft specialization (Bērziņš 2003). We cannot exclude the possibility that there was a similar concentration of amber-working in the hands of a subset of the community at Šiliņupe, too. However, on this site the artefactual remains cannot be split into separate dwelling assemblages, and thus such patterns are not clearly detectable.

We may next compare our three assemblages in terms of the proportional representation of the three classes of ornaments among all the semi-manufactured pieces (Tab. 2, “Total semi-manufactured pieces (stages 1–3”), which should, at least to some degree, reflect how much of the amber production effort was in each case being devoted to the making of particular classes of ornaments. There are also salient differences in this respect. Thus, at Sārnate dwelling 2, button-shaped beads are the most common among semi-manufactured pieces, numbering 27, or 53% of the total number of semi-manufactured pieces in the assemblage belonging to the three ornament classes; tubular beads are somewhat less common, represented by 10 pieces (20%), while pendants number 14 pieces (27%).

The situation is broadly similar for the other Early Sārnate Ware dwellings at Sārnate: 10 semi-manu-
factured button-shaped beads (56%), just one tubular bead (6%) and seven pendants (39%). The main difference from dwelling 2 is the virtual absence of semi-manufactured tubular beads (and no finished examples of such beads occur, either).

From Siliņupe we have 20 semi-manufactured button-shaped beads (27%), six tubular beads (8%) and 47 pendants (64%). Thus, in contrast to both of the Sārnate assemblages, pendant production appears to have dominated at Siliņupe.

These patterns may be considered in relation to the level of difficulty involved in the different kinds of perforation required for the three ornament classes, as indicated by the experimental work of Popkiewicz (2012) and by the occurrence of characteristic broken pieces. Pendants would have been the simplest items to perforate: only a straight, relatively short perforation was needed. The V-shaped perforation of button-shaped beads is harder to achieve, while most difficult is the drilling of the long perforation of the tubular beads.

In all three assemblages, the proportion of semi-manufactured tubular beads is lowest among the three ornament classes, and on this basis they may be considered rather ‘exclusive’, presumably being made only from very good quality amber nodules and only by individuals with advanced drilling skills. The virtual absence of such pieces from the Early Sārnate Ware dwellings other than dwelling 2 suggests that within this community the skills (and perhaps also equipment) needed to make these pieces were only possessed by the people working in this dwelling.

This difficulty of producing tubular beads also colours our view of the sets of amber ornaments provided as grave goods in this period. Thus, for example, the set of 12 tubular beads provided for child burial 194 at the Zvejnieki cemetery (Zagorska 2001; Zagorska 2004.Pl. 17) represents a particularly valuable item of jewellery in terms of the amount of highly skilled labour invested in it. Likewise very valuable from this perspective was a set of tubular beads found on the Abora site in eastern Latvia (Loze 1975.Fig. 10; 2008.125).

**Representation of different production stages**

If we now proceed to examine the production-stage data for our three main ornament classes (Fig. 5; Tab. 2, "Total of 3 ornament classes"), then we find that each assemblage shows a somewhat different picture in this respect as well. Sārnate dwelling 2 is distinguished by a large number of pieces with a completed perforation but unfinished shaping/surface treatment (stage 3). The other Sārnate dwellings have a high proportion of unperforated (stage 1) pieces. Meanwhile, Siliņupe has a very large share of incompletely perforated pieces (stage 2); pieces in this stage are also fairly common in the other Sārnate dwellings, but comprise only a small percentage in dwelling 2. Siliņupe stands out in having a much lower proportion of finished ornaments (stage 4) than dwelling 2 or the other Sārnate dwellings.

When considering the button-shaped beads specifically, the pattern is similar but not quite the same: many perforated but incompletely finished pieces (stage 3) from Sārnate dwelling 2; a high proportion of finished pieces (stage 4) from dwelling 2 as well as the other dwellings at Sārnate; and a very marked predominance of incompletely perforated beads (stage 2) from Siliņupe. In this particular ornament class, the proportion of incompletely perforated pieces is also high in the other Sārnate dwellings.

As noted above, tubular beads are much less abundant in general, and are virtually absent from the other Sārnate dwellings. Although the absolute numbers are small, we still see a similar difference between Sārnate dwelling 2 and Siliņupe to that observed in the case of button-shaped beads: namely, at Sārnate dwelling 2 completely perforated but incompletely finished pieces (stage 3) predominate, while Siliņupe has produced almost exclusively pieces with an incomplete perforation (stage 2), which seems to reflect the difficulty of perforating tubular beads – a high proportion were evidently ruined at this stage.

In the case of pendants, within the relatively small assemblage from the other Sārnate dwellings there is a large share of unperforated (stage 1) pieces. Siliņupe has many incompletely perforated (stage 2) pendants. The proportion of pendants with a completed perforation (stage 3) is higher from Sārnate dwelling 2 and Siliņupe than in the case of the other Sārnate dwellings. Finished pendants (stage 4), on the other hand, are commonly represented from the other Sārnate dwellings, while Siliņupe stands out as the only assemblage with pendants repaired by secondary perforation (stage 5). If we consider the proportions of the different production stages for the pendants in relation to the propor-
tions for the other two ornament classes, then the most salient common characteristic to emerge is that Siliūnape has a high proportion of incompletely perforated (stage 2) pieces.

We are not in a position to attempt a comprehensive interpretation of all the patterns identifiable in these statistics. More detailed technical analysis would no doubt permit a clearer understanding of the factors behind the representation of the different production stages. However, the current understanding of Neolithic amber-working and our knowledge of the sites from which the assemblages originate does permit us to try to account for at least some of the variation between them.

The previous treatment of amber-working at Sārnante by Bėrziņš (2003) noted a degree of complementarity in the data for dwelling 2 and for the other Early Sārnate Ware phase dwellings: thus, the relatively high proportion of pieces in the early stages of processing (stages 1 and 2) in the material from the latter suggested that perforated and unperforated blanks may have been supplied from these dwellings for further processing (by specialists) in dwelling 2. The absence of unworked nodules in dwelling 2 also points to such a scenario. This is still seen as a valid hypothesis – although for a proper appreciation of such patterns we would really need to gain a clearer insight into the small-scale social relationships linking household groups within these communities. It is not, unfortunately, possible to ascertain whether dwelling 2 was inhabited simultaneously with other excavated dwellings of this occupation phase.

The most salient overall difference between the assemblages, applying to all three ornament classes, is that Siliūnape has a much higher proportion of pieces abandoned during the perforation process (stage 2), i.e. failed perforations, than either Sārnate dwelling 2 or the other Sārnate dwellings, while both of the Sārnate assemblages are dominated by finished ornaments (along with perforated but incompletely finished pieces in the case of dwelling 2).

In the knowledge that amber ornaments were important as exchange items, distributed from the coast along waterways far into the continental interior, we might indeed expect a high proportion of finished items to have been removed from our production sites, leaving mainly pieces that broke during processing or were considered in some way defective. The pattern seen at Siliūnape appears to accord well with such a scenario: here, it seems that if the perforation succeeded, then the ornament was almost always brought to completion and taken away. But this was apparently not quite so at Sārnate, especially in the case of the intensive amber-working activity in dwelling 2. Here, a high proportion of successfully perforated pieces were also being retained. In many cases post-perforation finishing was left incomplete, but many finished pieces were also kept.

In seeking to explain this difference, we may consider the geographical positions of the two sites in relation to exchange networks in the region east of the Baltic Sea. From such a perspective, Siliūnape appears to be much more centrally located, since it lies close to the mouths of two major waterways, the Daugava and the Lielupe. The River Daugava, in particular, along with its tributaries, has been viewed as a major route for amber distribution – to the Lake Lubāns basin in eastern Latvia as well as much further eastwards into present-day Belarus and Russia (Loze 2001; 2003; Charniauski 2001). The Lielupe and its tributaries connect with present-day northern Lithuania. By comparison, Sārnate can be seen as occupying a rather peripheral location: it is fairly close to the River Venta, but this river has a much smaller drainage basin than the Daugava, and is, moreover, oriented southwards, connecting with a region not so distant from the coast of present-day Lithuania, where amber was likewise available locally.

We would expect, then, that the people at Siliūnape had much greater opportunities to engage in the eastwards-oriented exchange networks than the community at Sārnate. Hence, at Siliūnape there would have been a stronger stimulus to maximize amber ornament production and supply the great majority of the finished pieces (perhaps even those considered second rate or slightly defective) to the exchange network. It might also have been an incentive towards the utilization of less-than-perfect amber nodules and the involvement of a wider circle of individuals in the working of amber, even those with inferior skills – both of which would have increased the frequency of failure during perforation, as reflected in the assemblage.

The relatively high proportion of semi-manufactured pendants at Siliūnape (noted in the previous section) might, once again, be linked to this community’s intensive involvement in exchange, in which context it was perhaps advantageous to focus on the simpler-to-make forms.
Meanwhile at Sārnate, with its disadvantageous location for participation in the exchange network, there could have been a tendency for finished pieces to accumulate on the site, perhaps only those considered the best being selected for exchange, and in such a situation we might expect there to have been less incentive to bring to completion all of the successfully perforated pieces by undertaking the laborious process of polishing. This would explain the high percentages of perforated but incompletely finished (stage 3) as well as finished (stage 4) pieces from Sārnate dwelling 2.

There is another important difference between the sites, which must have affected patterns of amber-working and may also partially account for the above-discussed differences between the assemblages – namely access to various lithic raw materials. Thus, recent studies by Mārcis Kalniņš reveal that the inhabitants of the Early Sārnate Ware phase dwellings at Sārnate, including dwelling 2, were largely reliant on Silurian flint, which could be collected from the beaches along that stretch of the coast; at Silinupe, by contrast, the dominant lithic raw material is Cretaceous flint, which came from present-day southern Lithuania or Belarus, at least 200km away, while the surrounding area apparently lacked good locally available lithic raw materials (Berg-Hansen et al. 2019; Kalniņš, submitted; Bērziņš et al. submitted).

The pattern of lithic raw material use thus not only provides additional evidence that the Silinupe community was more intensively participating in long-distance exchange than the community at Sārnate. It was also much more dependent on exchange, because the exchange networks were providing the lithic material used for toolmaking. And moreover, as described above, flint tools had an important role in amber-working itself.

Zagorska (2003), in her initial treatment of the Silinupe amber assemblage, emphasizes the importance of amber exchange with respect to this site, noting the prevalence of broken semi-manufactured items in the assemblage, and our comparison with Sārnate brings this into sharper relief. One further remark needs to be made here, namely that considerations of geographical location and material flows are in themselves inadequate for a proper understanding of amber exchange (and long-distance exchange in this region of Europe in general). We also require a better grasp of the social context in which exchange was embedded, and this is an important task for future research (see Zhulnikov 2008 for an attempt to characterize the regional flow of amber ornaments in terms of prestige item exchange serving to establish and strengthen social ties).

Fig. 5. The representation of different ornament production stages in the amber assemblages from Sārnate dwelling 2, the other dwellings at Sārnate with Early Sārnate Ware and the Silinupe site (data from Table 2): 1 unperforated; 2 incomplete perforation; 3 completely perforated, unfinished surface; 4 finished artefact; 5 artefact repaired by secondary perforation; 6 production stage indeterminate.
Conclusions

Our approach to amber assemblages from production sites, looking at the relative intensity of production of different jewellery forms, the representation of different production stages among the pieces remaining on the site and the sequence in which the processing operations of shaping/surface finishing and perforation were performed, has revealed major differences in the overall character of the amber assemblages from the two sites as well as intra-site (i.e. intra-community) variation in working practices.

The differences in representation of the various production stages of amber jewellery at Sārnate and Silinupe would appear to be at least partially explicable in terms of the Silinupe community’s closer integration into amber exchange networks, owing to the advantageous geographical location for participation in long-distance exchange as well as the high dependency upon lithic raw materials obtained through the exchange network.

Meanwhile, the variation within the site assemblages in terms of the point within the processing sequence when perforation is performed indicates a strong element of heterodoxy with respect to amber processing practices within the communities engaged in this activity, congruent with a domestic setting of production – even though the actual output, in terms of the major jewellery classes, was rather standardized.

These questions deserve further attention in future research on the technical as well as the social aspects of ancient amber-working and exchange.

ACKNOWLEDGEMENTS

The preparation of this article has been funded by the Latvian Council of Science, project “People in a dynamic landscape: tracing the biography of Latvia’s sandy coastal belt,” Izp-2018/1-0171. Study of the Silinupe amber assemblage has been undertaken by Agnese Čakare in the frame of her undergraduate and master’s degree studies at the Faculty of History and Philosophy, University of Latvia. The authors are most grateful to Ilze Milgrāve for assisting in data collection, and to Ilga Zagorska for valuable comments on a draft of this article.

References


