eISSN 2783-6843 | ISSN 1392-0316 | 10.37522/aaav.116.2025.288

# The amber gatherers: manufacturing techniques of button-shaped amber beads in western Lithuania during the 4th–3rd mill. BC

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Amber ornament manufacturing tradition in Lithuanian territory was established at the end of the Stone Age, c. 4th–3rd millennium cal BC. According to excavated sites in western Lithuania, this period demonstrates a variety of different amber ornament types. Button-shaped amber beads are one of these. This study presents an analysis of 35 such beads from three Stone Age sites in western Lithuania. Microscopic investigation was used to determine the production stages and techniques of oval, square, and boat-shaped beads. Results show that the manufacturing process for most of the analysed material is similar, but in some cases (e.g. boat-shaped buttons), it differs. Buttons were a fragile ornament, as many of them in the studied sites were broken either during production or use. Therefore, it seems more likely that they were used as beads.

*Keywords:* Button-shaped amber beads, manufacturing techniques, microscopic analysis, Stone Age, western Lithuania.

## Introduction

Button-shaped amber beads (from here on, 'buttons') are a common find in Neolithic[1] sites of western Lithuania. They were mostly found in the Daktariškės 5[2] and Šventoji[3] sites. In the Nida 1[4] site, for instance, their preservation is poor due to acidic soil[5]. This type of amber artefacts is also known from the famous amber collections of Juodkrantė (Schwarzort) and Palanga[6]. Buttons and other types of amber ornaments are an integral part of the Neolithic cultural heritage in the eastern Baltic, providing valuable information about the lifestyle of Stone Age societies, their perception of aesthetics, symbolic meanings, and the use of amber in general[7]. The artefacts also reflect the importance of amber as a unique and valued material in the Baltic region.

1 In this paper, the Neolithic is defined as the period when hunter-gatherers began using ceramics in their daily lives while still relying on foraging as their primary subsistence strategy. Chronologically, this period is placed between c. 5000–2000 cal BC.

2 Adomas Butrimas, *Biržulis. Medžiotojai, žvejai ir senieji žemdirbiai X–II tūkst. pr. Kr. Gintaras* (Vilnius: Vilniaus dailės akademijos leidykla, 2016).

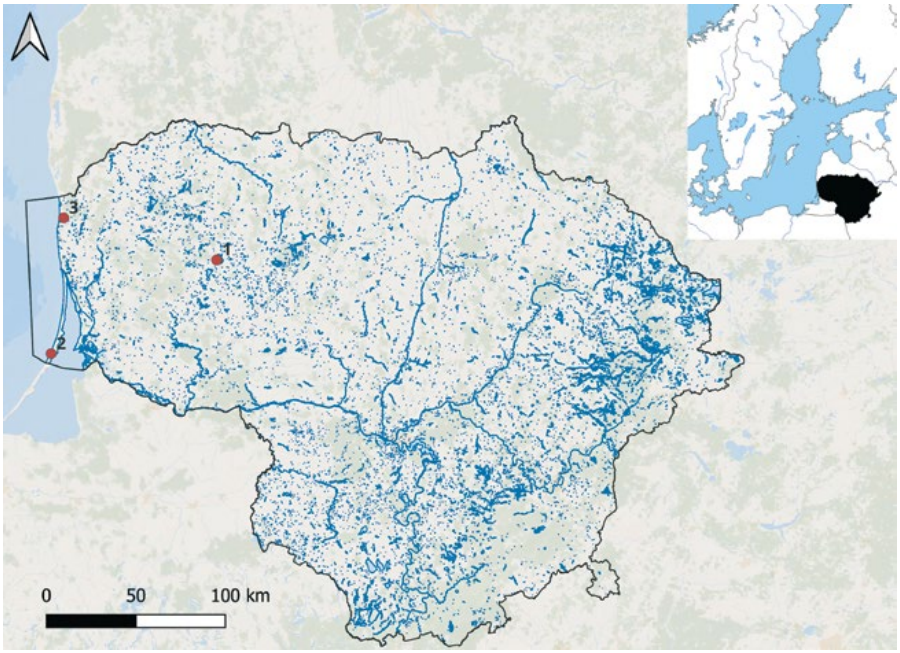
3 Rimutė Rimantienė, *Die Steinzeitfischer an der Ostseelagune in Litauen: Forschungen in Šventoji und Būtingė* (Vilnius: National Museum of Lithuania, 2005).

4 Since the excavations at the Nida site in 1974–1978, more Stone Age sites in Nida have been identified, therefore, in this paper, the Nida sites are numbered according to the research results published by Gytis Piličiauskas, "Kuršių nerijos archeologinių tyrimų strategijos," *Lietuvos archeologija* 39 (2013): 256.

5 Rimutė Rimantienė, *Nida. A Bay Coast Culture Settlement on the Curonian Lagoon* (Vilnius: National Museum of Lithuania, 2016), 236–241.

6 Richard Klebs, *Die bernsteinschmuck der steinzeit* (Königsberg: Physikalisch-Ökonomischen Gesellschaft zu Königsberg, 1882); Audronė Bliujienė, "Grafo Felikso Tiškevičiaus surinktas Palangos gintaro rinkinys ir jo mįslinga istorija," *Kultūros paminklai* 10 (2003): 17–30.

7 Marius Iršėnas, "Stone Age amber figurines from the Baltic area," *Acta Academiae Artium Vilnensis* 22 (2001): 77–85; Ilga Zagorska, "Amber graves of Zvejnieki burial ground," *Acta Academiae Artium Vilnensis* 22 (2001): 109–124; Ilze Loze, "Middle Neolithic amber workshops in Lake Lubāns depression," in *Amber in archaeology. Proceedings of the fourth international conference on amber in archaeology Talsi 2001*, ed. Curt W. Beck, Ilze B. Loze and Joan M. Todd (Riga: Institute of the History of Latvia, 2003), 72–89; Audronė Bliujienė, L*ietuvos priešistorės gintaras* (Vilnius: Versus Aureus, 2007), 103–190; Lars Larsson, "A double grave with amber and bone adornments at Zvejnieki in northern Latvia," *Archaeologia Baltica* 13 (2010): 80–90; Milton Núñez and Patrik Franzén, "Implications of Baltic amber finds in northern Finland 4000 – 2000 BC," *Archaeologia Lituana* 12 (2011): 10–24, https://doi.org/10.15388/ArchLit.2011.12.5128; Audronė Bliujienė and Tomas Rimkus, "Amber in the context of the Stone Age worldview images," in *The Klaipėda (Memel) region: from origins to the 17th century*, ed. Audronė Bliujienė (Klaipėda: History Museum of Lithuania Minor, 2018), 185–190.




1. Map with sites mentioned in the text, compiled by Tomas Rimkus

Žemėlapis su tekste minimomis vietovėmis, sudarė Tomas Rimkus

As is evident from the abundance of finds, amber buttons were used in the Narva, Globular Amphorae, Comb Ware, Corded Ware, and Bay Coast (Rzucewo) cultures[8]. They could have been used to decorate clothing or headgear by sewing them on or to make necklaces. For example, in the Late Neolithic Zlota culture (the upper Vistula basin) human burials, bracelets made of button-shaped beads have been found on the arms and legs of the deceased[9]. As the title of this paper suggests, amber buttons did not serve to fasten clothes, as they were too fragile. More likely, they were used as beads.

The buttons come in a variety of shapes – circular, oval, and square, with V-shaped holes hidden on the back side. Oval buttons are the most common in western Lithuania. These simple, medium-sized (1.5–2 cm Ø) buttons were used throughout the Neolithic. They have been found in Šventoji 3B, 10, 12, 15, 23, 25, 26, 28 (Lithuanian coastal zone), as well as in

8 Rimutė Rimantienė, "Die Bernsteinerzeugnisse von Šventoji," *Acta Academiae Artium Vilnensis* 22 (2001): 87–98.

9 Ryszard F. Mazurowski, "Bursztyn w epoce kamienia na ziemiach polskich," *Materiały starożytne i wczesnośredniowieczne* V (1983): 87–89.

the Sārnate[10] and Siliņupe[11] sites in Latvia. Later, segmental buttons appear alongside the oval type. Oval, quadrangular, and boat-shaped buttons are more typical of the Late Neolithic (3rd millennium cal BC)[12]. A beautifully shaped specimen, 6.6 cm in length with holes drilled through it, was found at Šventoji 6.

This paper presents the results of a technological analysis of button-shaped amber beads. This type of artefact is one of the most common in hunter-gatherer sites in the eastern Baltic region, but information on its production is still scarce. Therefore, this work aims to provide the first detailed analysis of amber buttons found in Stone Age sites in western Lithuania, chronologically dating back to the 4th–3rd millennium cal BC.

### Research aims and methods

In contrast to lithics or osseous implements, the technologies of Stone Age amber processing, using modern microscopic and research methods, have been poorly studied in Lithuanian archaeology[13]. Previous studies have mainly analysed amber ornaments from the perspective of form and typology, and have reflected on their social and cultural importance in prehistoric communities[14]. Microscopic methods can provide more valuable information on amber artefacts, especially regarding their processing

10 Valdis Bērziņš, "Amberworking as a specialist occupation at the Sārnate Neolithic site, Latvia," in *Amber in archaeology. Proceedings of the fourth international conference on amber in archaeology Talsi 2001*, ed. Curt W. Beck, Ilze B. Loze and Joan M. Todd (Riga: Institute of the History of Latvia, 2003), 34–46.

11 Valdis Bērziņš and Agnese Čakare, "Pattern and variation in jewellery production sequences: Analysis of 4th millennium BC amber assemblages from the Latvian coast," *Documenta Praehistorica* 49 (2022): 434–449, https://doi.org/10.4312/dp.49.5; Valdis Bērziņš, Agnese Čakare, Mārcis Kalniņš, Lembi Lõugas, Ildze Mīlgrāve and Ilga Zagorska, "Amber wind and porpoise jaw: resource use at Siliņupe (fourth mill. BC) on the Baltic's Gulf of Riga coast," *Journal of Island and Coastal Archaeology* 19, no. 2 (2022): 398–419, https://doi.org/10.1080/15564894.2022.2125127

12 Rimutė Rimantienė, *Šventoji. Narvos kultūros gyvenvietės* (Vilnius: Mokslas, 1979), 97–98.

13 See more on the subject in Tomas Rimkus and Gvidas Slah, "Funkcinės paskirties nustatymo metodas," in *Metodai Lietuvos archeologijoje. Mokslas ir technologijos praeičiai pažinti, tomas* 2, ed. Algimantas Merkevičius (Vilnius: Vilniaus universiteto leidykla, 2024), 138–160.

14 e.g. Adomas Butrimas, "The amber ornament collection from Daktariškė 5 Neolithic settlement," *Acta Academiae Artium Vilnensis* 22 (2001): 7–19; Rimantienė, "Die bernsteinerzeugnisse."

and production technologies[15]. Thirty-five buttons from Daktariškė 5, Nida 1, and Šventoji (16 sites) were analysed in this study [Fig. 1; Table 1]. Daktariškė and Šventoji sites are the only ones demonstrating good preservation of amber artefacts in western Lithuania. These sites also contain an abundance of amber buttons. Thus, amber collections from these sites serve as the primary material for button studies. All analysed buttons are stored in the National Museum of Lithuania.

Specimens with variations in technological characteristics and the best-preserved ones were selected for microscopic analysis. They were examined using a stereoscopic microscope, Zeiss Discovery v12, which can magnify objects up to 450 times. In this study, amber buttons were usually analysed under a magnification of 16 times.

Table 1. Sites and brief characteristics of analysed button-shaped amber beads. Most of the buttons predominantly have two perforated V-shaped holes, but if more than two holes are present, this is specified in the table.
1 lentelė. Analizuotų sagos formos gintaro karoliukų radimvietės ir trumpos charakteristikos. Daugumoje sagučių vyrauja dvi pragręžtos V formos skylutės, tačiau jei yra daugiau nei dvi skylutė, tai nurodyta lentelėje.

| Site | ID | Characteristics of buttons |
|---|---|---|
| Šventoji 1 | EM 2070:226 | Square-type button with four holes. Length 1.35 cm, thickness 0.45 cm. |
| | EM 2070:352 | Oval type button. Ø 0.9 cm, thickness 0.3 cm. |
| | EM 2070:379 | Unfinished square-type button. Length 1.5 cm, thickness 0.6 cm. |
| | EM 2070:683 | Blank of a square-type button. Length 1.4 cm, thickness 0.5 cm. |
| | EM 2070:716 | Oval-type button. Ø 1.5 cm, thickness 0.4 cm. |
| Šventoji 3 | EM 2132:41 | Broken oval-type button. Ø 2.5 cm, thickness 0.75 cm |
| | EM 2132:43 | Broken oval-type button. Ø 2.5 cm, thickness 0.5 cm. |

15 Adomas Butrimas, Regina Ulozaitė and Marius Iršėnas, "Amber discs with cross decoration," *Archaeologia Baltica* 25 (2018): 140–160, https://doi.org/10.15181/ab.v25i0.1835; Dariusz Manasterski, Ewa Wagner-Wysiecka, Katarzyna Kwiatkowska and Aleksandra Cetwińska, "Provenance studies on Late Neolithic amber ornaments from North-East Poland," *Journal of Archaeological Science: Reports* 44 (2022): 103540, https://doi.org/10.1016/j.jasrep.2022.103540; Bērziņš and Čakare, "Pattern and variation"; Agnese Čakare, "An experimental approach to the study of amber processing in the Neolithic: technical analysis of the Siliņupe amber assemblage, 4th mill. BC, Latvia," *Praehistorische Zeitschrift* 99, no. 2 (2024): 459–478, https://doi.org/10.1515/pz-2023-2037

| | | |
|---|---|---|
| | EM 2132:400 | Broken elongated button. Ø 1.5 cm, thickness 0.4 cm. |
| Šventoji 4 | EM 2136:12 | Fragment of an oval-type button. Ø 1.7 cm, thickness 0.4 cm. |
| | EM 2136:16 | Square-type button. Length 1.1 cm, thickness 0.4 cm. |
| | EM 2136:18 | Fragment of an oval-type button. Ø 2.2 cm, thickness 0.8 cm. |
| | EM 2136:203 | Broken oval-type button. Ø 1.5 cm, thickness 0.4 cm. |
| Šventoji 6 | EM 2138:550 | Oval-type button. Ø 1.3 cm, thickness 0.4 cm. |
| | EM 2138:765 | Fragment of a boat-shaped button. Length 2.3 cm, thickness 0.8 cm. |
| Šventoji 10 | EM 2141:22 | Oval-type button. Ø 1.7 cm, thickness 0.5 cm. |
| Šventoji 12 | EM 2142:1 | Fragment of an oval-type button. Ø 2.1 cm, thickness 0.6 cm. |
| Šventoji 13 | EM 2143:3 | Oval-type button. Ø 1.3 cm, thickness 0.4 cm. |
| Šventoji 15 | EM 2071:2 | Oval-type button with four holes. Ø 2.2 cm, thickness 0.5 cm. |
| Šventoji 19 | EM 2148 | Fragment of an oval-type button. Ø 1.3 cm, thickness 0.4 cm. |
| Šventoji 20 | EM 2149:2 | Blank of an oval type button. Ø 1.8 cm, thickness 0.6 cm. |
| Šventoji 22 | EM 2071:36 | Blank of an oval-type button. Ø 2.2 cm, thickness 0.7 cm. |
| Šventoji 23 | EM 2110:119 | Square-type button. Length 1.75 cm, thickness 0.4 cm. |
| | EM 2110:159 | Oval-type button. Ø 1.05 cm, thickness 0.3 cm. |
| | EM 2110:788 | Fragment of an oval-type button. Thickness 0.6 cm. |
| Šventoji 25 | EM 2151:3 | Fragment of an oval-type button. Ø 1.9 cm, thickness 0.4 cm. |
| | EM 2151:4 | Fragment of an oval-type button. Ø 1.3 cm, thickness 0.4 cm. |
| Šventoji 26 | EM 2152:29 | Fragment of an oval-type button. Ø 1.2 cm, thickness 0.5 cm. |
| | EM 2152:51 | Oval-type button with three holes. Ø 1.5 cm, thickness 0.5 cm. |
| | 261 | Oval-type button with three holes. Thickness 0.5 cm. |
| Šventoji 27 | EM 2153:1 | Blank of an oval-type button. Ø 2 cm. thickness 0.4 cm. |
| | EM 2153:3 | Fragment of an oval-type button. Ø 1.7 cm, thickness 0.4 cm. |
| Šventoji 28 | EM 2154:57 | Fragment of an oval-type button. Ø 1.2 cm, thickness 0.4 cm. |
| Nida 1 | EM 2243; 5300 | Fragment of an oval-type button. Length 1 cm, thickness 0.2 cm. |
| Daktariškė 5 | EM 2245:2806 | Oval-type button. Ø 1.2 cm, thickness 0.4 cm. |
| | EM 2245:2843 | Fragment of an oval-type button. Ø 1.8 cm, thickness 0.4 cm. |

## Sites

The largest number of buttons in Lithuanian territory has been found at the Šventoji palaeolagoon site, which, in the Stone Age, was an important centre for various activities for fishermen, hunters, and amber collectors and craftsmen. The site demonstrates well-preserved organic finds and fishing structures, remaining in gyttja layers[16]. In the Middle and Late Holocene, people settled along the shores of an ancient lake. Around 60 sites have been found in Šventoji, attributed to human habitation or fishing activities. In addition to evidence of everyday human life, there is also evidence of what is thought to be amber processing sites[17]. The main sites of the Šventoji archaeological complex, where most of the amber artefacts were found, are described in more detail below.

**Šventoji 1** (c. 3200–2500 cal BC) was investigated by R. Rimantienė in 1967–1969 and covered an area of 1860 m$^2$. The finds were discovered at a depth of 0.5–1.7 m in lacustrine sediments. Amber artefacts at Šventoji 1 were scarce: a bead blank, a few unfinished tubular beads, and a few oval and square buttons and their blanks[18].

**Šventoji 3** (c. 3200–2500 cal BC) is located 150 m from Šventoji 1. It was investigated by R. Rimantienė in 1971–1972 and V. Juodagalvis in 2005[19]. An area of 784 m$^2$ was investigated. The finds were discovered in lacustrine sediments at a depth of 0.5–1.75 m. Amber artefacts were scarce: about 75 flakes, 36 natural pieces of raw material, a fragment of an amber ring, 6 broken pieces of oval-type amber buttons with flaked surfaces and V-shaped perforations.

**Šventoji 4** (2/4) (c. 3200–2500 cal BC) was investigated by R. Rimantienė (1967, 1969, 1972, 1986–1995), V. Juodagalvis (1997–2005), Dž. Brazaitis (2006), and G. Piličiauskas (2014)[20]. In total, an area of about

16 Rimantienė, *Die Steinzeitfischer an der*; Gytis Piličiauskas, Jonas Mažeika, Andrejus Gaidamavičius, Giedrė Vaikutienė, Albertas Bitinas, Žana Skuratovič and Miglė Stančikaitė, "New archaeological, paleoenvironmental, and $^{14}$C data from the Šventoji Neolithic sites, NW Lithuania," *Radiocarbon* 54, no. 3-4 (2012): 1017–1031, https://doi.org/10.1017/S0033822200047640

17 Rimantienė, *Šventoji. Narvos kultūros*.

18 Rimantienė, *Die Steinzeitfischer an der*, 260.

19 Rimantienė, Die Steinzeitfischer an der, 329–346; Vygandas Juodagalvis, "Šventosios archeologinis kompleksas," *Archeologiniuai tyrinėjimai Lietuvoje 2005 metais* (2006): 9–12.

20 Rimutė Rimantienė, "Investigations at the Šventoji find site 4 1986–1995," *Archaeologia Baltica* 3 (1998): 215–222; Vygandas Juodagalvis and David N. Simpson, "Šventoji revi-

2254 m² was excavated. Amber finds included oval and square-type buttons and their blanks, several large pendants, two rings, tubular beads and their fragments and blanks. The most abundant amber finds were small flakes and small natural raw material pieces, but there were also larger pieces measuring 4–7.7 cm in length.

**Šventoji 6** (c. 3200–2500 cal BC) is located south of the Šventoji 1, 3, and 2/4 sites. It was excavated by R. Rimantienė (1982–1988 (1980 m²)) and V. Juodagalvis (1997 (21 m²))[21]. About 1036 pieces of amber were collected, which were distributed over the entire excavation area. Only 196 were worked, with ornaments or their blanks concentrated in four smaller sub-areas, with more flakes and raw material nearby. The bulk of the amber artefacts consisted of buttons and their pieces, a total of 85 specimens. Most of them are oval-type, 1.5–2 cm Ø, with rarer ones measuring 0.8–1.1 cm and 3.5 cm. Three pieces of square-shaped button blanks and three pieces of segmented circular ones were found. A fragment of a boat-shaped button was found near the site. Two other similarly shaped but perforated fragments were found in the excavation layer. The preserved button is 6.6 cm long and 2.4 cm wide. A total of 49 amber pendants and their fragments and blanks, 27 tubular-shaped beads and their blanks, and three discs and their parts were found.

**Šventoji 23** (c. 3200–2500 cal BC) is located on the former eastern shore of the lagoon lake. It was investigated by R. Rimantienė in 1970–1971.[22] An area of 1268 m2 was excavated. The finds were discovered in peaty gyttja, at a depth of 0.4–0.8 m. Amber finds included 202 buttons and their blanks, 130 flakes, 49 pendants and their blanks, seven tubular beads and their blanks, two discs, three fragments representing figurative ornaments, 38 fragments of polished amber flakes, 298 blanks, and 4441

sited – the joint Lithuanian-Norwegian project," Lietuvos archeologija 19 (2000): 139–152; Džiugas Brazaitis, "Šventosios 1-osios, 4-osios, 36-osios radimviečių ir jų aplinkos tyrinėjimai," *Archeologiniai tyrinėjimai Lietuvoje 2006 metais* (2007): 35–42; Gytis Piličiauskas, Giedrė Vaikutienė, Dalia Kisielienė, Aldona Damušytė, Giedrė Piličiauskienė, Kęstutis Peseckas and Lukas Gaižauskas, "A closer look at Šventoji 2/4 – a stratified Stone Age fishing site in coastal Lithuania, 3200–2600 cal BC," *Lietuvos archeologija* 45 (2019): 105–143, https://doi.org/10.33918/25386514-045003

21 Rimantienė, *Die Steinzeitfischer an der*, 348–404; Juodagalvis and Simpson, "Šventoji revisited."

22 Rimantienė, *Die Steinzeitfischer an der*, 421–454.

pieces of raw amber. It is assumed that the Šventoji 23 site was an amber workshop[23].

**Šventoji 26** (c. 3400–2700 cal BC) was excavated by R. Rimantienė (1966, 1970–1971) and V. Juodagalvis (2002–2005)[24]. An area of 680 m² was investigated, and the finds were discovered in humic sandy loam at a depth of 0.3–0.65 m. This is a settlement area with abundant remains of amber processing. Around 130 buttons were found here, most of them broken. Their diameter ranges from 1 to 2.7 cm. There were two boat-shaped buttons, 54 pendants, 20 tubular beads, five rings, seven fragments of blanks, 413 flakes, and 207 natural raw material pieces. The most recent research at the site provided more amber finds[25]. Šventoji 23 and 26 remain among the largest amber artefact-yielding sites in Lithuanian territory.

Šventoji 28 (c. 3900–2600 cal BC) is located north of Šventoji 26. The site was excavated by R. Rimantienė in 1966 and 1970 and covered an area of 201 m².[26] The finds were discovered in 0.1–0.2 m thick sand. Fireplaces, pits, and finds indicate a former residential and amber processing area on the coast of the lagoon. Eighty buttons were found here, most of them of the oval type. Of these, 52 were flaked and 28 had a polished surface. Other amber finds consisted of a part of one boat-shaped button brooch, 559 worked fragments, 900 flakes, and two natural pieces of raw material.

The chronology of the other sites that contained amber finds in the Šventoji complex (Šventoji 10, 12, 13, 15, 19, 20, 22, 25, 27) is similar to the sites discussed above (c. 3100–2500 cal BC)[27]. Amber artefacts found there are scarce, mainly in the form of small flakes and pieces of raw material, but there are also some buttons or their blanks, and a few other types of ornaments, such as trapezoidal pendants and tubular beads.

**Daktariškė 5** (c. 5300–1600 cal BC)[28] is located in the northwestern part of Biržulis Lake, on the southern slope of a hill, probably a former

23 Rimantienė, *Die Steinzeitfischer an der*, 441.

24 Rimantienė, *Die Steinzeitfischer an der*, 441; Juodagalvis, "Šventosios archeologinis."

25 Tomas Ivanauskas, "Šventosios 26 radimvietė," *Archeologiniai tyrinėjimai Lietuvoje 2022 metais* (2023): 26–33; Matas Valauskas, Džiugas Brazaitis and Mantas Daubaras, "Šventosios 26 radimvietė," *Archeologiniai tyrinėjimai Lietuvoje 2022 metais* (2023): 56–62.

26 Rimantienė, *Die Steinzeitfischer an der*, 468–473.

27 Gytis Piličiauskas, "Lietuvos pajūris subneolite ir neolite. Žemės ūkio pradžia," *Lietuvos archeologija* 42 (2016): 25–103.

28 Recent research shows that the chronology of Daktariškės 5 is quite broad. The oldest AMS $^{14}$C date from T-shaped antler axe is 5375–5213 cal BC (Tomas Rimkus, Adomas Butri-

lake island. It is the largest wetland settlement on the shores of Biržulis Lake in the Samogitian Uplands. In 1987–1990, it was investigated by A. Butrimas[29]. At that time, an area of 648 m2 was investigated. The collection of amber finds from Daktariškė 5 consists of 132 pieces, including amber ornaments, blanks, pieces of raw material and production waste[30]. In 2016, G. Piličiauskas investigated 13 test pits (36 m2) and 19 boreholes, as well as two trenches (24 and 24.6 m2). During this excavation, four amber ornaments were found: two buttons, a pendant and a fragment of a either button or a disc[31]. Additionally, seven flakes were also found.

Nida 1 (c. 3200–2600/2500 cal BC) originally was located on the western shore of the Curonian Lagoon, in a wooded landscape[32]. The largest excavation at the site was conducted in 1974–1978 by R. Rimantienė[33]. An area of about 4640 m2 was investigated. The amber found during the excavation was mainly in the form of blanks. These are poorly preserved,

mas, Harald Lübke and John Meadows, "T-shaped antler axes in Lithuania: previously unrevealed Middle Holocene hunter-gatherer technology," Archaeologia Baltica 30 (2023): 49, https://doi. org/10.15181/ab.v30i0.2563), whereas the latest dates would fall in the Early Bronze Age (Gytis Piličiauskas, *Virvelinės keramikos kultūra Lietuvoje 2800–2400 cal BC* (Vilnius: Lietuvos istorijos institutas, 2018), 61.). The types of amber artefacts found at the site are identical in shape and types to those found at Šventoji, which are dated to between the 4th and 3rd millenniums cal BC. The available AMS dates (currently about 50 available) indicate that the most intensive episodes of occupation at the Daktariškė 5 site are distributed between the 4th and 3rd millenniums cal BC (Piličiauskas, Virvelinės keramikos, 61; Adomas Butrimas, Tomas Rimkus, Marius Iršėnas and Dalia Ostrauskienė, "Socketed antler toggle harpoon head – a unique hunter-gatherer fishing implement in western Lithuania's freshwater lake environment," Estonian Journal of Archaeology 28, no. 1 (2024): 20, http://dx.doi.org/10.3176/arch.2024.1.01). Thus, it is most likely that amber artefacts from the site also date back to these periods.

29 Adomas Butrimas, *Biržulis. Medžiotojai, žvejai ir senieji žemdirbiai X–II tūkstantmetyje pr. Kr. Paminklų tyrinėjimai* (Vilnius: Vilniaus dailės akademijos leidykla, 2019), 164–190.

30 Butrimas, "The amber ornament."

31 Piličiauskas, *Virvelinės keramikos*, 51.

32 Mindaugas Pilkauskas, Gytis Piličiauskas and Rokas Vengalis, "Reljefas eolinėje aplinkoje. Nidos senovės gyvenvietės paviršius," *Archaeologia Lituana* 20 (2019): 10–23, https://doi.org/10.15388/ArchLit.2019.20.1; Kęstutis Peseckas, Mindaugas Pilkauskas and Gytis Piličiauskas, "Woodland in the Curonian spit during the 3rd millennium BC based on anthracological evidence from Neolithic sites," *Journal of Archaeological Science: Reports* 57 (2024): 104677, https://doi.org/10.1016/j.jasrep.2024.104677

33 Rimutė Rimantienė, *Nida. Senųjų baltų gyvenvietė* (Vilnius: Mokslas, 1989); Rimutė Rimantienė, *Kuršių nerija archeologo žvilgsniu* (Vilnius: Vilniaus dailės akademijos leidykla, 1999), 59–93.

as erosion and acidic soil damaged their surface. Therefore, it is sometimes difficult to determine which were genuine blanks and which were fragments of ornaments. In some places, they lay in piles, like small treasures. A concentration of five large and one medium-sized amber pieces was found. There were a number of burnt pieces, especially large ones. In 2011–2013 and 2016, excavation at the site was continued by G. Piličiauskas[34]. One button from the collection of amber finds from the Nida 1 site was analysed in this study.

### Results

According to the studied material and its microscopical analysis, the processing of amber buttons was divided into several stages. The first stage was cutting the raw amber and shaping it into the required form. The shape was obtained by knapping and pressure-flaking the amber. One specimen from the Šventoji 3 site shows one side of an unfinished button with a surface that has been flaked by pressure in one direction[35]. Features of a pressure-flaked surface are manifested by shell-like fractures visible on the surface of the button blanks [Fig. 2].

There are buttons with a flaked surface, minimally polished, with holes drilled completely or left unfinished. Microscopic examination revealed that the majority of them had some defects in the manufacturing process, which sometimes led to the discontinuation of production [Fig. 3].

The planes of the buttons were formed by smoothing their surface in one direction. Visible wear suggests that the material used for this work had an abrupt surface [Fig. 4]. This method helped to keep the piece in a stable position, as smoothing back and forth changes the angle of inclination of the piece and can result in uneven and damaged edges. After smoothing, the holes were drilled. A specimen from the Šventoji 6 site demonstrates that breakage occurring during the drilling of the holes prevented further processing of the button [Fig. 5].

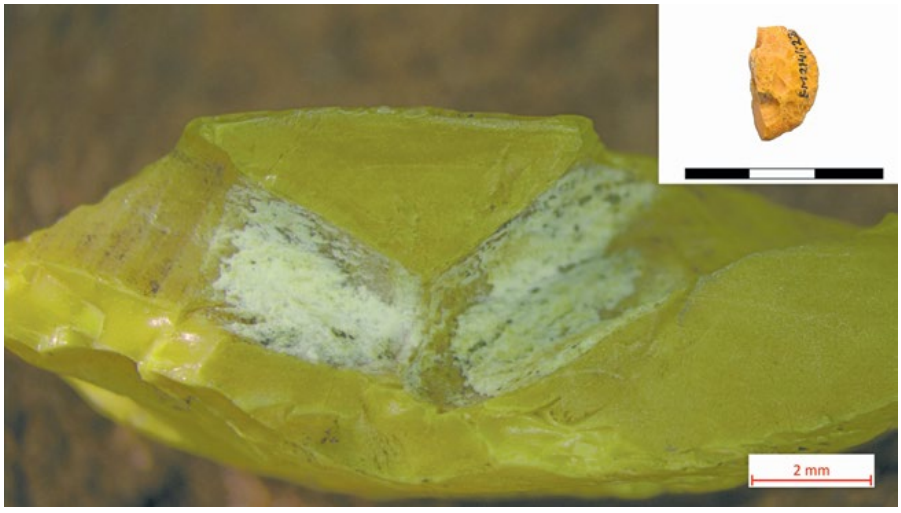
The intersecting holes were perforated from one side at an angle of c. 35–45 degrees. We assume that the perforations were made using a lithic drill, as it leaves specific marks. Perforation marks from a flint drill on

34 Piličiauskas, *Virvelinės keramikos*, 94–95.

35 Klaus Hirsch, "Bernsteinverarbeitung in der Jungsteinzeit," *Archäologische Informationen* 10, no. 2 (1987): 185–193.

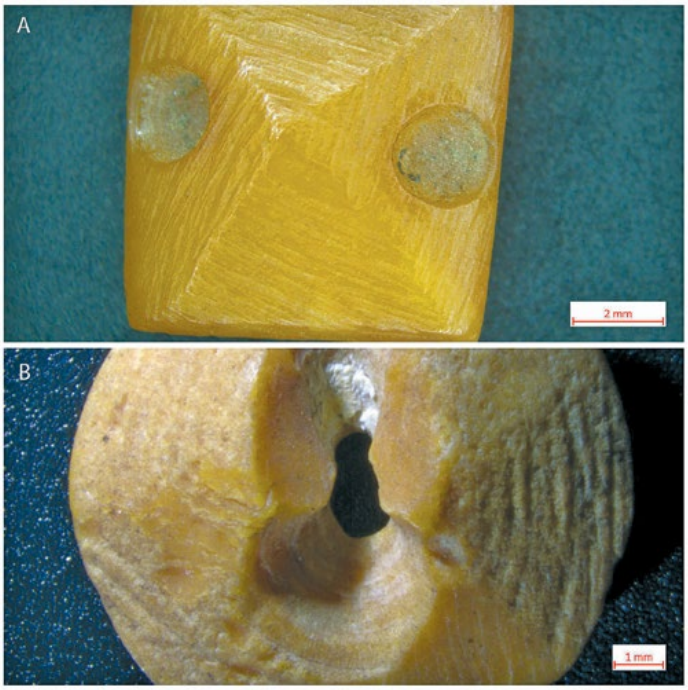

2. Flaked surface of a fragment of an oval-type button from Šventoji 3 (EM 2132:41). ■ indicates flaking direction, photos by Gvidas Slah

Ovalo formos sagos fragmento iš Šventosios 3 (EM 2132:41) apdirbtas paviršius. ■ žymi nuspaudimo kryptį, Gvido Slah nuotrauka



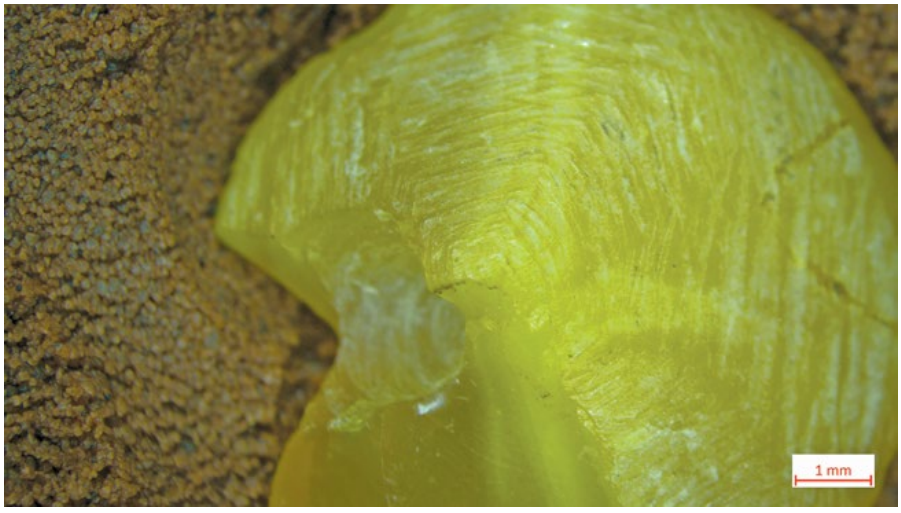

3. A fragment of an oval-type button from Šventoji 10 (EM 2141:22) with 35–45 degree angle perforations, photos by Gvidas Slah

Ovalaus tipo sagos fragmentas iš Šventosios 10 (EM 2141:22) su 35-45 laipsnių kampo pragręžimais, Gvido Slah nuotrauka




**4.** Square and oval-type buttons with smoothed surfaces. A. Square button from Šventoji 1, EM 2070:379; B. Oval button from Šventoji 26, no. 26, photos by Gvidas Slah

Kvadratinės ir ovalaus tipo sagos su nugludintais paviršiais. A. Kvadratinė saga iš Šventosios 1, EM 2070:379; B. Ovali saga iš Šventosios 26, Nr. 26, Gvido Slah nuotrauka




**5.** Damage that occurred during the perforation of the hole. An example from Šventoji 6, EM 2138:550, photo by Gvidas Slah

Pažeidimai, atsiradę gręžiant skylę. Pavyzdys iš Šventosios 6, EM 2138:550, Gvido Slah nuotrauka

amber buttons appear as horizontal, regular linear scratches visible on the walls of holes or cavities. Experimental work suggests that water was used as a softening material during drilling[36].

On some specimens, amber dust adhering to the walls of the holes can be observed [Fig. 6]. According to an experimental study by Klaus Hirsch[37], the amber dust adhering to the walls is an indication of drilling speed. If the holes are drilled without a special mount, the dust usually does not stick to the walls. When drilling with a tow-type drill, the speed is higher, and the amber dust sticks to the walls due to friction, though not excessively. However, the drilling rate is much higher using a bow mount compared to other methods, resulting in a significant amount of amber dust forming on the walls from friction. Microscopic analysis and published experimental studies suggest that either a tow or bow mount may have been used to perforate some of the analysed buttons in this study.

The final stage in the production process was surface polishing. According to experimental data, several methods could have been applied, such as polishing with a whetstone, using fine chalk, ash, chamois or linen cloth[38].

Holes may have been perforated in several ways. For example, they could be drilled at a 35–45 degree angle from the start, or, as some specimens from the Šventoji 6 and 23 and Daktariškė 5 sites show, first at a 90 degree angle and then at 45 degrees [Figs. 7 and 8]. Some buttons have small holes on the obverse. These appear to result from drilling the holes on the back surface of the buttons. By drilling and joining two holes, the inner wall of the object flattened and became more fragile. As a result, it sometimes broke, creating a hole [Figs. 9 and 10].

According to the studied material, the manufacturing stages of different types of buttons (oval or square types) do not differ. However, boat-shaped buttons can be considered an additional type of button. In this paper, such an amber ornament from the Šventoji 6 site is analysed. Their manufacturing technique is similar to that of oval and square-type buttons,

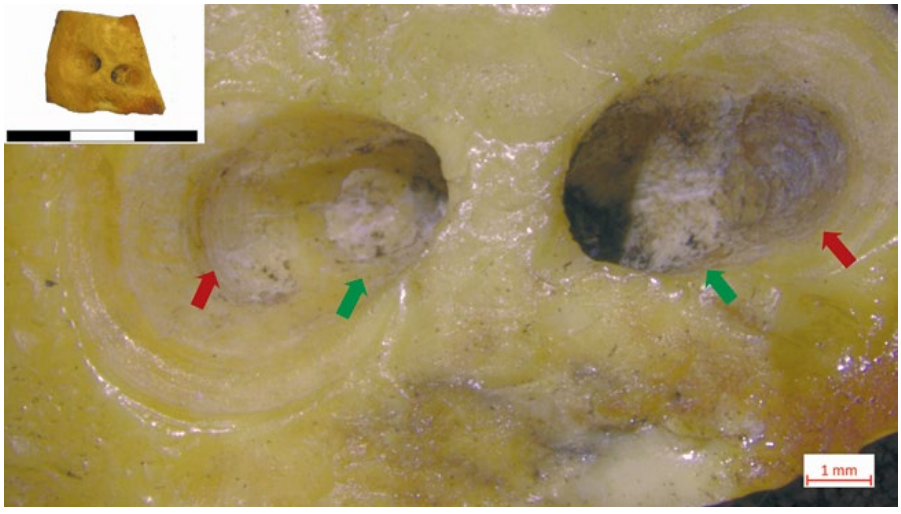
36 Personal communication (GS) with amber craftsmen Ruslanas Aranauskas and Gintaras Markevičius (Experimental archaeology club "Pajauta").

37 Klaus Hirsch and Liversage David, "Ravforarbejdning i yngre stenalder," *Nationalmuseets Arbejdsmark* (1987): 193–200.

38 Eryk Popkiewicz, "Rekonstrukcje narzędzi, technik i technologii obróbki bursztynu z epoki kamienia," *Prace Muzeum Ziemi* 50 (2013): 522–525.


6. ■ indicates the amber dust that accumulated during the perforation. ■ shows marks of the drilling. Šventoji 10, EM 2141:22, photo by Gvidas Slah

■ rodo gręžimo metu susikaupusias gintaro dulkes. ■ rodo gręžimo žymes. Šventoji 10, EM 2141:22, Gvido Slah nuotrauka




7. Button-shaped bead most likely reworked from a broken pendant. ■ indicates perforation at a 90 degree angle, whereas ■ shows the changed direction into a 35–45 degree angle. Šventoji 23, EM 2110:788, photo by Gvidas Slah

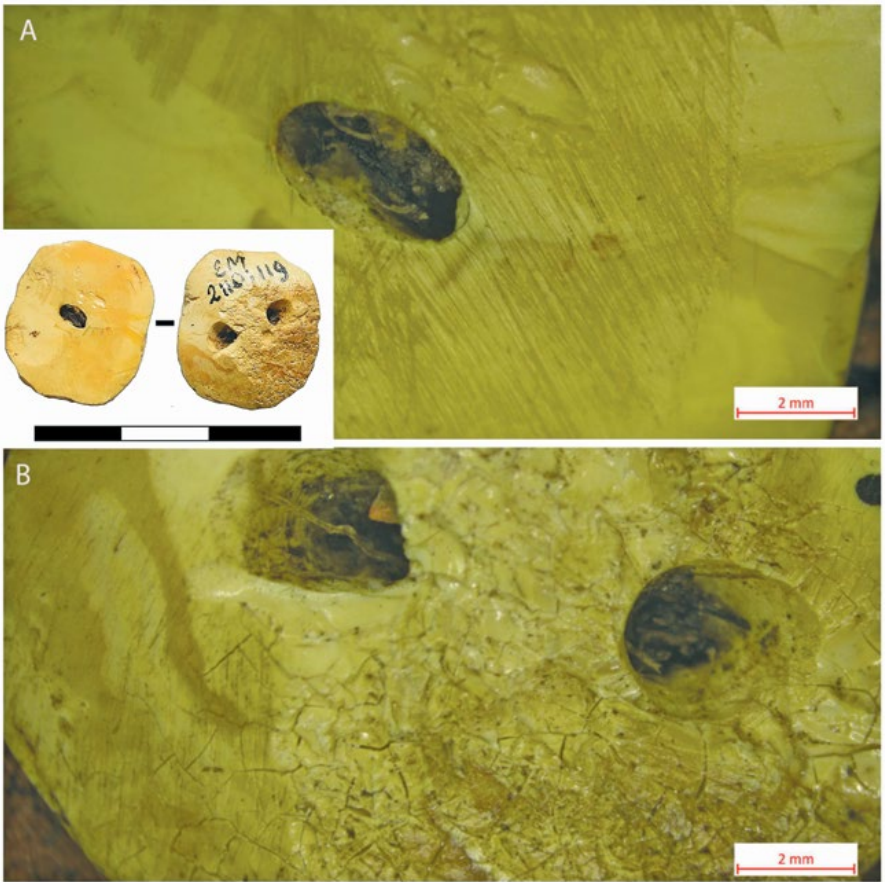
Sagos formos karoliukas, greičiausiai perdarytas iš sulaužyto pakabuko. ■ rodo gręžimą 90 laipsnių kampu, o ■ rodo pakeistą kryptį į 35-45 laipsnių kampą. Šventoji 23, EM 2110:788, Gvido Slah nuotrauka


8. A. A hole was perforated on the obverse side at a 90 degree angle; B. Perforation of the holes continued at a 35–45 degree angle on the reverse side. Šventoji 26, EM 2152:51, photos by Gvidas Slah

A. Averso pusėje skylutė gręžta 90 laipsnių kampu; B. Averso pusėje skylučių gręžimas buvo tęsiamas 35-45 laipsnių kampu. Šventoji 26, EM 2152:51, Gvido Slah nuotrauka

but with some differences. Their surface was flaked and, at the end of the manufacturing process, scraped with a sharp-edged tool, probably a flint flake. After the amber shape was processed, holes were drilled at a 90 degree angle from both ends, but the button broke during drilling [Fig. 11].

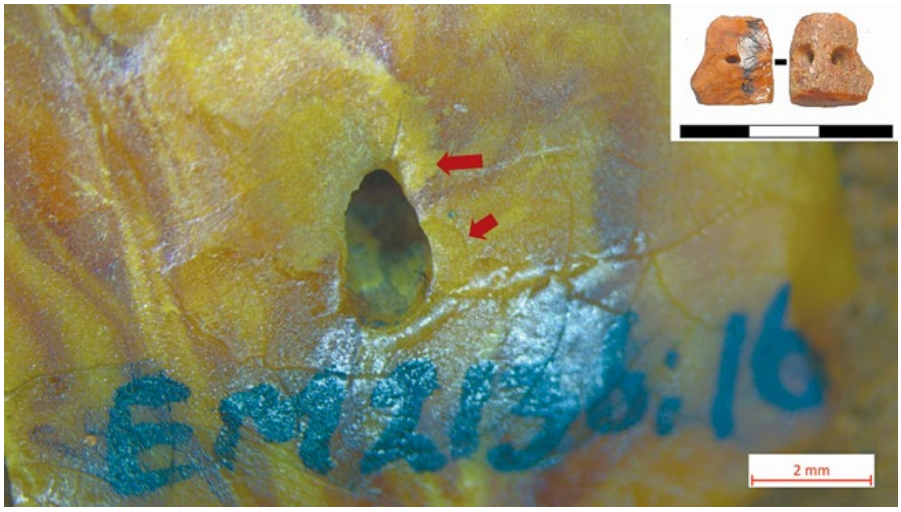
The analysis identified a significant number of buttons that were defective due to either manufacturing or wear. For instance, artefacts with a broken partition between the holes. As amber is characterised by shell




9. A. Damaged button that created a hole on the obverse side. B. Perforated holes at a 35–45 degree angle on the reverse side. Šventoji 23, EM 2110:119, photos by Gvidas Slah

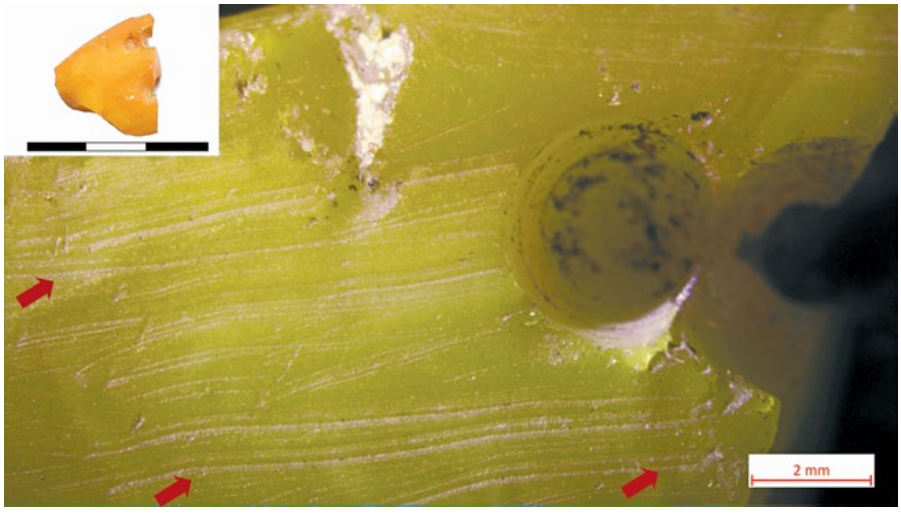
A. Pažeista sagutė, kurios averso pusėje atsirado skylutė. B. 35-45 laipsnių kampu padarytos skylutės reverso pusėje. Šventoji 23, EM 2110:119, Gvido Slah nuotrauka

fracture, the direction of the fracture can be used to determine where the contact zone was (previous damage, start of damage – impact, pressure or support). Judging by the direction of the fracture, it has been possible to identify several reasons why or how the piece broke. It appears that one of the most common causes of breakage was drilling. Pieces also broke during flaking, but in this study, there are no examples of pieces that broke during this stage of the manufacturing process.



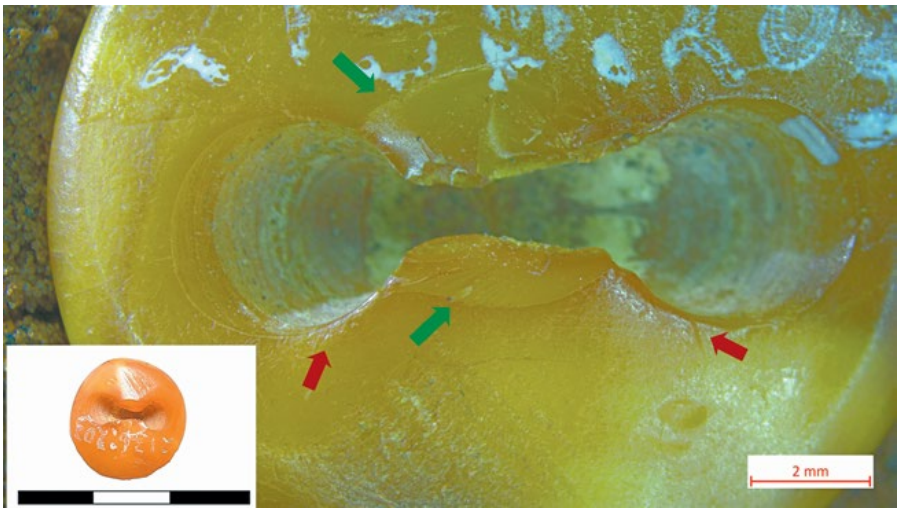

10. Perforation of the holes created a hole on the obverse side of the button. ■ shows spots of small, crumbled flakes. Šventoji 4, EM 2136:16, photo by Gvidas Slah

Gręžiant skylutes susidarė kiaurymė sagos averso pusėje. ■ matyti smulkių, ištrupėjusių nuoskalų vietos. Šventoji 4, EM 2136:16, Gvido Slah nuotrauka



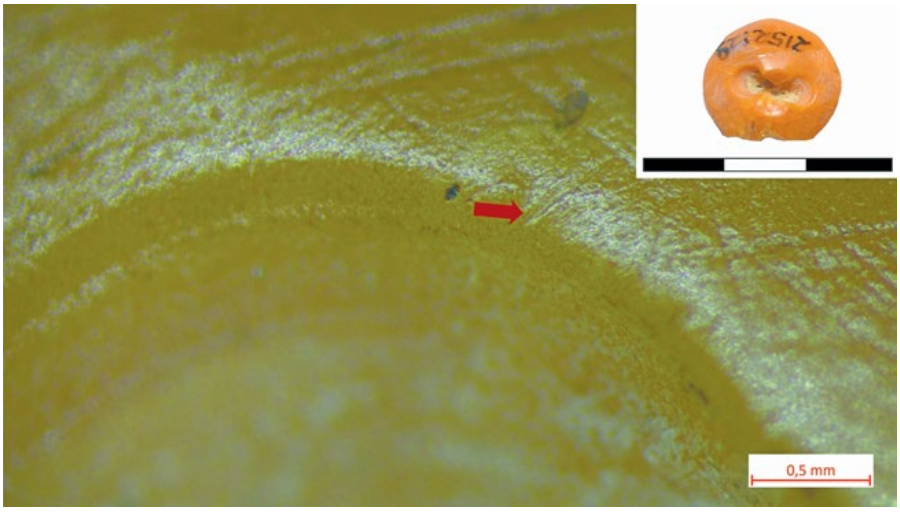

11. The surface of a fragment of a boat-shaped button, showing linear marks of scraping with a sharp tool. Šventoji 6, EM 2138:765, photo by Gvidas Slah

Laivelio formos sagos fragmento paviršius, ant kurio matyti linijinės aštriu įrankiu gremžimo žymės. Šventoji 6, EM 2138:765, Gvido Slah nuotrauka




12. ■ indicates a broken wall, whereas ■ shows possible marks of cord. Šventoji 4, EM2136:203, photo by Gvidas Slah

■ rodo suskilusią sienelę, o ■ rodo galimą virvutės pririšimo vietą. Šventoji 4, EM2136:203, Gvido Slah nuotrauka

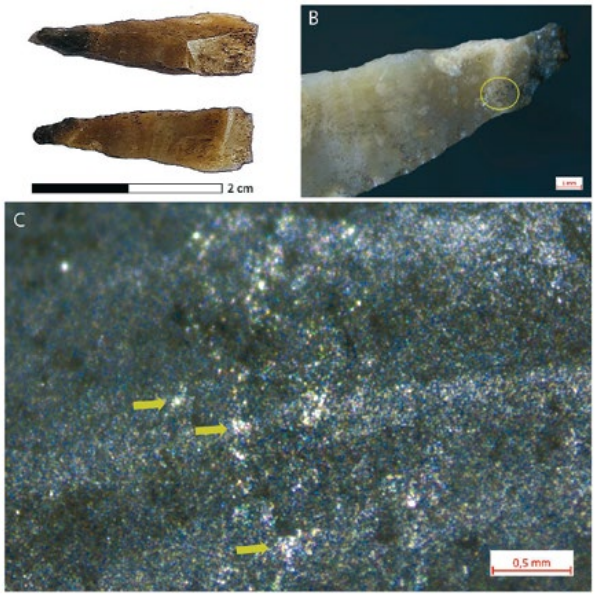



13. ■ indicates possible imprints of cord. Šventoji 26, EM 2152:29, photo by Gvidas Slah

■ rodo galimus virvutės pririšimo pėdsakus. Šventoji 26, EM 2152:29, Gvido Slah nuotrauka

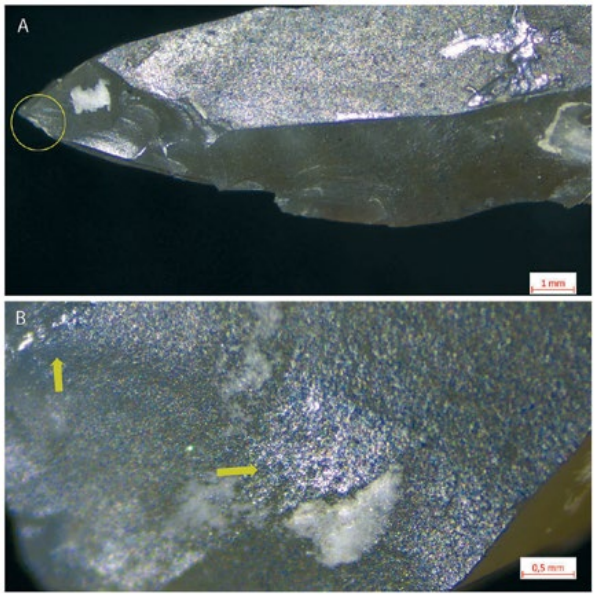

**14**. Repaired oval-type button with four perforated holes. Šventoji 28, EM 2154:57, photo by Gvidas Slah

Remontuota ovalaus tipo sagė su keturiomis pragręžtomis skylutėmis. Šventoji 28, EM 2154:57, Gvido Slah nuotrauka



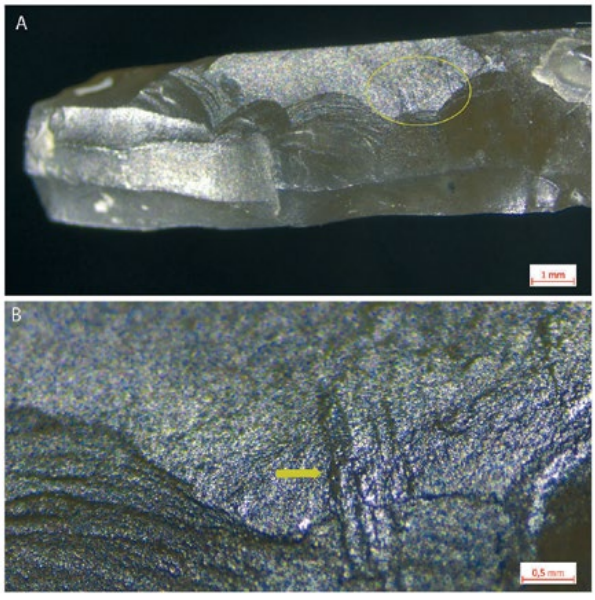

**15**. A. Flint drill from the Šventoji 26 site; B. Flint drill from the reverse side with a marked area where wear traces were found; C. Arrows indicate linear horizontal wear traces, which might have formed during amber drilling, photos by Džiugas Brazaitis and Gvidas Slah

A. Titnaginis grąžtelis iš Šventosios 26 radimvietės; B. Titnaginio grąžtelio vazidas iš reverso pusės su pažymėta vieta, kurioje rasta nusidėvėjimo pėdsakų; C. Rodyklėmis pažymėti linijiniai horizontalūs nusidėvėjimo pėdsakai, kurie galėjo susidaryti gręžiant gintarą, Džiugo Brazaičio ir Gvido Slah nuotraukos



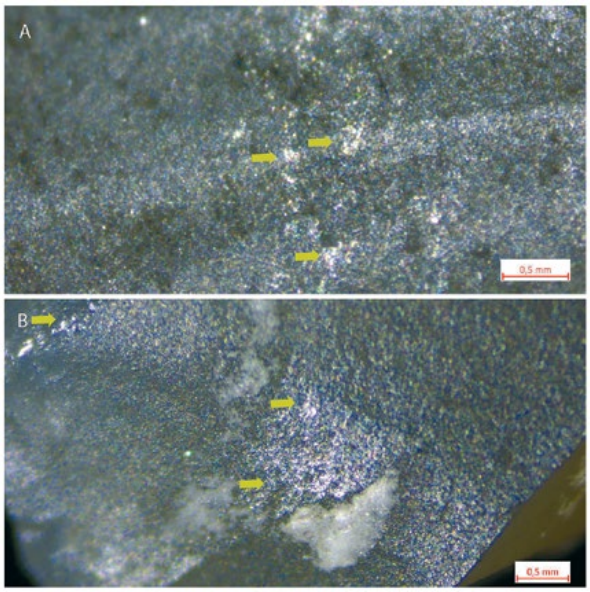

**16.** A. Experimental flint drill used for amber perforation from a side view, with marks of the area where wear traces were located; B. Arrows pointing to the spots where linear traces were formed, photos by Gvidas Slah

A. Eksperimentinis gintaro gręžimui naudotas titnago grąžtelis iš šono, su pažymėtomis vietomis, kuriose buvo rasti nusidėvėjimo pėdsakai; B. Rodyklėmis pažymėtos vietos, kuriose susiformavo linijiniai pėdsakai, Gvido Slah nuotrauka




**17.** A different view of an experimental flint drill used for amber drilling, with marked (A) concentrations of wear traces and linear traces (B), photos by Gvidas Slah

Eksperimentinio gintaro gręžimui naudoto titnaginio grąžtelio vaizdas su pažymėtomis (A) nusidėvėjimo pėdsakų koncentracijomis ir linijiniais pėdsakais (B), Gvido Slah nuotrauka




**18.** Magnified view of linear traces (A) on the experimental drill and spots where linear traces concentrate on the drill from the Šventoji 26 site (B), photos by Gvidas Slah

Padidintas linijinių pėdsakų vaizdas (A) ant eksperimentinio grąžtelio ir linijinių pėdsakų susitelkimo vietos ant grąžtelio iš Šventosios 26 (B), Gvido Slah nuotrauka

The second most common cause of damage is the breakage of the wall left between the holes while the piece was worn. The wall, holds the piece in place when attached to clothing, is the thinnest and weakest part of the button. Once attached, the piece experiences the greatest load or stress at the partition, which might cause it to break. In the archaeological material examined, such examples occur frequently, as seen from the Šventoji 4 site [Fig. 12].

Amber is a soft material, so traces of the attaching material (e.g. cord) can be observed on some buttons that were used and have a broken wall [Figs. 12 and 13]. It can be noticed that some buttons with broken walls between the holes were repaired. An attempt was made to fix them by perforating another two holes in a different direction from the already existing ones. Examples of such repairs have been found on an oval-type button from the Šventoji 15 and 28 sites [Fig. 14]. On the reverse, they contain four holes, which are worn and have a few linear striations.

Experimental data show that flint drills were suitable for perforating amber in order to produce various ornaments[39]. Flint tools have been found

39 Eryk Popkiewicz, "Rekonstrukcje narzędzi"; Eryk Popkiewicz, "Eksperymentalne rekonstrukcije techniki i technologii obróbki bursztynu dla wczesnego średniowiecza," *Stargardia* V (2010): 25–47.

in Daktariškė 5, Nida 1 and the Šventoji sites, but it is unclear whether any of them were used to perforate amber, as no such studies have been conducted. However, a recently found drill at the Šventoji 26 site suggests that it could have been used to perforate amber. It is made from a small flint blade fragment. The upper part of the split has a 1.2 mm wide drilling point, but the widest part, where some striations were observed, reaches up to 3.5 mm in width. The point was shaped by pressure flaking its edges and applying retouch on both sides. The drilling point could have been reshaped as small flakes detached during the drilling. A magnified view of the reverse side at the very tip revealed polished, shiny areas [Fig. 15). Horizontal linear striations can be seen at certain angles, but it was not possible to capture a full image of these due to the low magnification of the microscope. However, the nature of these traces does not reflect heavy working marks; therefore, this suggests that soft material (e.g. amber) could have been worked with this drill. However, this needs to be confirmed by applying high-power microscopic analysis of the object.

For comparison, an experimental flint drill used for amber drilling was observed under the microscope. The drill was used for approximately three hours for intensive amber drilling. Polished shiny areas and the morphology of striations are comparable with the archaeological specimen from Šventoji 26. Yet to confirm this hypothesis, further studies are required [Figs. 16–18].

### Discussion

Results demonstrate that the production sequence of amber buttons was not too difficult and required a minimal set of tools (a flaking or splitting tool, drill, polishing stone and a smoothing object). However, the most difficult and skilled step was the drilling of the holes. Due to the small size of the product and the need to drill the holes at a certain angle, this process was quite challenging. This is also reflected in the archaeological material, with almost half of the analysed artefacts having been broken (48.5%). The number of repaired amber buttons in the analysed collection is c. 10%. The majority of broken buttons were not attempted to be repaired.

**19.** Variety of button-shaped amber beads from Šventoji sites, photo by Arūnas Baltėnas

Gintaro sagučių įvairovė iš Šventosios radimviečių, Arūno Baltėno nuotrauka

Research and experiments carried out by Klaus Hirsch[40] and Eryk Popkiewicz[41] have shown that amber working techniques in the Late Holocene Danish and Polish areas are similar and some can be compared with the results from the present analysis[42]. For example, the technique of surface flaking was applied in both territories, and the drilling was similar, either by means of tow or bow drill. These amber processing techniques are also observed on the button-shaped beads in western Lithuania. However, the technique used to cut the amber differs, with the use of thread cutting in some regions. No traces of thread cutting were found in the material we examined.

Another important aspect is the question of how buttons were worn. Judging by the wear, they were either worn for a long time or are broken at the wall. Due to the fragile nature of amber, especially when it is heavily processed by smoothing and drilling, it is more likely that amber buttons were simply sewn onto clothing or used as beads, as the examples from Stone Age burials mentioned in the beginning of the paper demonstrate. It

40 Hirsch and David, "Ravforarbejdning i yngre."

41 Eryk Popkiewicz, "Rekonstrukcje narzędzi."

42 Besides published data, Klaus Hirsch and Eryk Popkiewicz consulted one of the authors of this paper (GS) for regional differences and similarities on Stone Age amber processing aspects.

is unlikely that they served as functional buttons for fastening clothing, as they easily broke.

Amber buttons are one of the dominant amber ornament types in the discussed sites [Fig. 19]. Buttons required smaller size amber raw material, which, even today, is abundant on the eastern coast of the Baltic Sea.

## Conclusions

The manufacturing techniques of 35 button-shaped amber beads from Daktariškė 5, Nida 1, and selected Šventoji sites were analysed. Microscopic investigation shows various macro traces of separate manufacturing stages, as well as damage resulting from the use of the buttons. The analysed collection for the observation of the following button production stages: amber splitting, surface flaking, hole drilling, smoothing, and polishing. For the most part, a similar production sequence was applied to the majority of the buttons, regardless of their type. However, in some cases, the stages differed. A slightly different situation was observed with the boat-shaped button, which contained surface scraping by a sharp tool and had double-sided hole perforation. In some cases, signs of repair also were observed.

The question remains whether the manufacturing differences and similarities can be attributed to chronological context or cultural tradition. As seen from the presented sites, some have chronological phases lasting up to 1000 years or even longer. Thus, a separate study would be required to compare amber ornament manufacturing techniques across different Stone Age periods and examine any possible changes.

## Acknowledgements

We are grateful to professional amber craftsmen Ruslanas Aranauskas, Gintaras Markevičius, and Eryk Popkiewicz, as well as archaeologists Klaus Hirsch, for their consultations and useful insights on experimental Stone Age amber processing. The comments of two anonymous reviewers improved the previous version of this paper.

Received —— 2024 12 30

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Santrauka

# Gintaro rinkėjai: sagučių formos gintarinių karolių gamybos būdai Vakarų Lietuvoje IV–III tūkst. pr. Kr.

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*Reikšminiai žodžiai:* Sagutės formos gintaro karoliai, gamybos technikos, mikroskopinė analizė, akmens amžius, Vakarų Lietuva.

Gintaro sagutės iš neolito laikotarpio Lietuvos teritorijoje yra vienas dažniausiai pasitaikančių gintaro dirbinių tipų, todėl tikėtina, kad ir akmens amžiuje tai buvo vienas labiausiai naudotų papuošalų tipų. Tuo pačiu jos buvo ir svarbus to meto žmonių materialinės kultūros objektas. Nors jų aptinkama nemažais kiekiais, tačiau jų gamybos technikos Lietuvos teritorijoje iki šiol nebuvo išsamiai analizuotos. Šiame straipsnyje analizuojamos gintarinių sagučių tipo gamybos technikos, pasirenkant geriausiai tai reprezentuojančius pavyzdžius iš Daktariškės 5-osios, Nidos 1-osios ir 16-os Šventosios radimviečių Vakarų Lietuvoje. Pagal anksčiau nustatytą šių radimviečių chronologiją, čia rastas gintaro sagutes galima talpinti į IV–III tūkst. pr. Kr. chronologiją. Stereoskopinio mikroskopo analizės metu ant sagučių paviršių matyti įvairūs makroskopiniai skirtingų gamybos etapų pėdsakai, taip pat pažeidimai, likę nuo jų dėvėjimo ar pririšimo. Analizuota kolekcija leido pastebėti atskirus sagučių gamybos etapus: gintaro dalijimą, paviršiaus retušavimą, skylučių gręžimą, gludinimą į rupų paviršių ir galiausiai poliravimą. Panaši gamybos seka dažniausiai buvo taikoma daugumai šių dirbinių, nepaisant jų tipo, tačiau kai kuriais atvejais pastebėti ir skirtumai. Šiek tiek kitokia situacija yra su vienintele tirta laivelio formos sagute iš Šventosios 6-osios radimvietės. Jos paviršius buvo skutamas aštriu įrankiu, o skylutės pragręžtos iš abiejų pusių – tai nebūdinga ovalioms ir keturkampėms sagutėms. Kai kuriais atvejais pastebėta ir taisymo požymių. Dėl savo pakankamai trapios būklės sagutės, matyt, buvo naudojamos kaip karoliukai, o ne kaip tikros sagos.