Abhandlung

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East meets west in the 6th millennium: Mesolithic osseous tools and art from Sise on the Latvian seaboard

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Zusammenfassung: Eine Sammlung von 141 Knochen- und Geweihwerkzeugen und Abfallstücken, die aus dem Fluss Užava nahe der Ortschaft Sise geborgen wurden, bildet die größte mesolithische Knochengruppe in Westlettland. Die Radiokarbondatierung von zwölf Stücken legt nahe, dass der größte Teil dieser Sammlung aus dem 6. Jahrtausend v. Chr. stammt. Die Autorinnen und Autoren präsentieren eine allgemeine Analyse, die typische und einzigartige Werkzeugformen, verzierte und skulptierte Stücke hervorhebt und die Sammlung in einem breiteren geografischen Kontext bewertet. In dieser reichhaltigen und vielfältigen Zusammenstellung dominieren schwere Geweihwerkzeuge: verschiedene Formen von Dechseln, Äxten und Hämmern sowie Zwischenfutter, die entweder aus Abwurfgeweih oder Geweih von gejagten Tieren hergestellt wurden. Sie umfassen auch zwei Stücke, die als T-Äxte klassifizierbar sind. Speer- und Pfeilspitzen sowie Dolche sind ebenso vorhanden wie Meißel, Keile, Ahlen und andere Werkzeuge. Zu den künstlerischen Darstellungen gehören fünf skulptierte und gravierte Objekte. Die schweren Rotwildgeweihwerkzeuge weisen Parallelen in der Region südlich der Ostsee auf, während die Knochenprojektilformen von den Fundstellen Kunda und Narva an der Ostsee bekannt sind. Die größte Ähnlichkeit besteht mit knöchernen Artefakten aus dem westlichen Litauen.

Schlüsselwörter: Ostsee, Lettland, Mittelsteinzeit, Knochenartefakte, Geweihartefakte, *Cervus elaphus*

Abstract: A collection of 141 bone and antler tools and debitage pieces recovered from the River Užava at the village of Sise constitutes the largest Mesolithic osseous assemblage in western Latvia. Radiocarbon dating of 12 pieces suggests that most of this collection dates from the 6th millennium calBC. We present a general analysis, highlighting typical and unique tool forms, ornamented and sculpted pieces, and assess the corpus in a wider geographical context.

Predominant in this rich and diverse collection are heavy duty antler tools: various forms of adzes, axes and hammers as well as sleeves, made either from shed antler or antler of hunted animals. They include two pieces classifiable as T-axes. Spear- and arrowheads as well as daggers are also present, along with chisels, wedges, awls and other tools. Artistic representations include five sculpted and engraved objects.

The heavy duty red deer antler tools have parallels in the region south of the Baltic Sea, whereas the bone projectile forms are familiar from Kunda and Narva Culture sites of the East Baltic; the closest similarity is with osseous assemblages from coastal western Lithuania.

Keywords: East Baltic, Latvia, Mesolithic, bone artefacts, antler artefacts, *Cervus elaphus*

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Tēzes: No Užavas upes Sises ciema teritorijā iegūta 141 kaula un raga rīku un apstrādes pārpalikumu kolekcija – lielākā Rietumlatvijā atrastā šāda veida mezolīta atradumu kopa. Divpadsmit priekšmetiem iegūti radioaktīvā oglekļa datējumi, pēc kuriem secināts, ka kolekcija pamatā attiecināma uz 6. g. t. pr. Kr. Šajā publikācijā dots vispārīgs materiāla raksturojums, pievēršot uzmanību gan tipiskajām, gan unikālajām rīku formām, aplūkojot ornamentētos un skulpturālos priekšmetus un izvērtējot šos atradumus plašākā kontekstā.

Bagātīgajā un daudzveidīgajā kolekcijā dominē masīvie raga rīki – dažāda veida kapļi, cirvji un āmuri, kā arī uzmavas, kas darināti gan no dabīgi nomestiem, gan arī no nomedīto briežveidīgo dzīvnieku ragiem. Pārstāvēti arī divi T-veida cirvji. Sastopami arī šķēpu un bultu uzgaļi, kā arī dunči, kalti, ķīļi, īleni un citi rīki. Pie mākslas priekšmetiem pieskaitāmi pieci skulpturāli un ornamentēti rīki.

Masīvajiem no staltbrieža raga izgatavotajiem darbarīkiem paralēles rodamas reģionā uz dienvidiem no Baltijas jūras, savukārt atrasto kaula metamo ieroču formas pārstāvētas Kundas un Narvas kultūru apmetnēs Austrumbaltijā. Vistuvākā līdzība ir ar Rietumlietuvas piejūras teritorijā iegūtajām kaula un raga rīku kolekcijām.

Atslēgas vārdi: Austrumbaltija, Latvija, mezolīts, kaula rīki, raga rīki, *Cervus elaphus*

Резюме: Коллекция, состоящая из 141 костяного и рогового орудия и хозяйственных отбросов, найдена на западном побережье Латвии – в реке Ужава (село Сисе) и является самой богатой такого рода находкой мезолитического времени в этом регионе. Двенадцать образцов, датированных радиоуглеродным методом, позволяют эту коллекцию относить в основном к 6-ому тысячелетию до н.э. Мы представляем общий анализ коллекции – типичные и уникальные формы этих орудий, орнаментированные экземпляры и скульптуры, которые рассматриваются в более широком географическом контексте.

В коллекции доминируют т. н. тяжелые орудия – топоры, тесла и муфты, сделанные из брошенных или добытых на охоте рогов благородных оленей. Найдены также два экземпляра т. н. „Т" образных топоров, несколько наконечников стрел и копий, кинжалы, шилья, резцы и другие изделия. Образцы искусства представлены скульптурами и орнаментированными предметами.

Некоторые роговые орудия имеют аналогии к юго-западу от Прибалтики, а другие (например, разные наконечники) характерны для Кундской и Нарвской культуры в северо-восточном регионе. Самые близкие аналогии находкам из Сисе найдены на западном побережье Литвы.

Ключевые слова: Восточная Прибалтика, Латвия, мезолит, костяные артефакты, роговые артефакты, *Cervus elaphus*.

Introduction

The East Baltic region has long been known for its rich array of Stone Age bone and antler stray finds, with major assemblages from the former Lake Kunda in north Estonia, the Pärnu river basin in west Estonia and Lake Lubāns in eastern Latvia, as well as individual objects from many locations in Lithuania, Estonia and Latvia. The region's rich legacy of Stone Age osseous artefacts was first given wider prominence by Grahame Clark in his general treatment of the Mesolithic in Northern Europe[1], and a range of studies have been conducted by researchers in all three Baltic States[2]. The information from the stray finds collections was significantly augmented by assemblages of bone and antler implements subsequently recovered from Pulli, Zvejnieki II, Osa and other stratified Stone Age habitation sites, revealing the chronological development of osseous artefacts and their role in subsistence strategies[3].

Hitherto, there was very little evidence for characterising the Stone Age osseous industry of coastal western Latvia. This knowledge gap is beginning to close with the recent discovery of an extensive corpus of bone and antler artefacts recovered from the River Užava, at the west coast of the Kurzeme Peninsula, augmenting a relatively small set of previously known items. Almost all of the objects come from one particular reach of the river, where it flows through the hamlet of Sise, Ventspils district, evidently having been eroded from the banks (Fig. 1–3). Twelve of the artefacts have been radiocarbon-dated, and all except one fall in the time interval approximately 6000–5200 calBC, which, in terms of the periodisation used in Latvia[4], corresponds to the Late Mesolithic and the beginning of the Early Neolithic.

Comprising a formally and functionally diverse set of 141 tools and debitage pieces, this is the first sizeable bone and antler assemblage from the western part of present-day Latvia, providing an opportunity to characterise

1 Clark 1936.
2 Šturms 1939; Indreko 1948; Rimantienė 1994; Vankina 1999.
3 Zagorska 1993.
4 Larsson/Zagorska 2006, 3, Chronological scheme of the Stone Age in the Baltic region.

Fig. 1: Map of the East Baltic region showing the location of the Sise site and other sites mentioned in the article. Drawing Valdis Bērziņš.

the osseous material culture of this area and assess it in an East Baltic and wider North European context.

Origins of the collection

The first antler artefact from the Užava at Sise (Fig. 4,12) was dredged up in 1928[5]. More objects were recovered by local residents at this location in the early 1960s, prompting archaeologists to visit and assess the site. By the end of the decade the number of bone and antler artefacts totalled 18, most collected during survey work conducted by Stone Age specialist Ilze Loze in 1964[6].

Interest in the findspot was rekindled by a diving survey in 2010, and in 2011 local resident Aivars Priedoliņš presented to archaeologists an extensive corpus of objects he had retrieved in the course of intensive prospection – wading with an underwater viewer. Priedoliņš's collection is nowadays held in Ventspils Museum[7], whereas most of the earlier finds are in the National History Museum of Latvia[8].

Almost all the objects come from an approximately 500 m long stretch of the river channel, where it flows through the Sise hamlet (Fig 2; 3). Many pieces are excellently preserved, the lack of attrition suggesting that they have been eroded from the riverbank close to where they were found. However, limited prospection of the river channel upstream from Sise has brought to light some osseous artefacts as far as 1.5 km up the river, demonstrating that Stone Age activity was not restricted to this one location.

The collection seems to be a taphonomically mixed assemblage: there are intact artefacts, likely to have been lost or intentionally deposited during off-site activities, as well as debitage pieces from tool production, indicative of discard on or near a habitation site. The individual find locations are in many cases not known precisely, and accordingly we distinguish a stretch of the river channel where finds have been most abundant, as well as individual findspots further upstream (Fig. 2).

5 Šturms 1939.

6 Loze 2000. The collection of finds recovered from the Užava at Sise also includes Neolithic pottery, artefacts from Iron Age graves and objects of younger date, which are not considered here.

7 Accession nos. VVM3368; VVM3426; VVM7570; VVM31250; VVM31460; VVM32069.

8 Accession nos. A6952; A11817; A13899; VI109. A few pieces are also held at Kuldīga Museum (KM1527/A-384; KM1528/A-385) and at the nearby Ēdole Primary School (E-1725).

Fig. 2: The pool in the River Užava at Sise downstream from the remains of the old wooden bridge, where many of the objects were recovered (findspot a in Fig. 3). Photo Harald Lübke

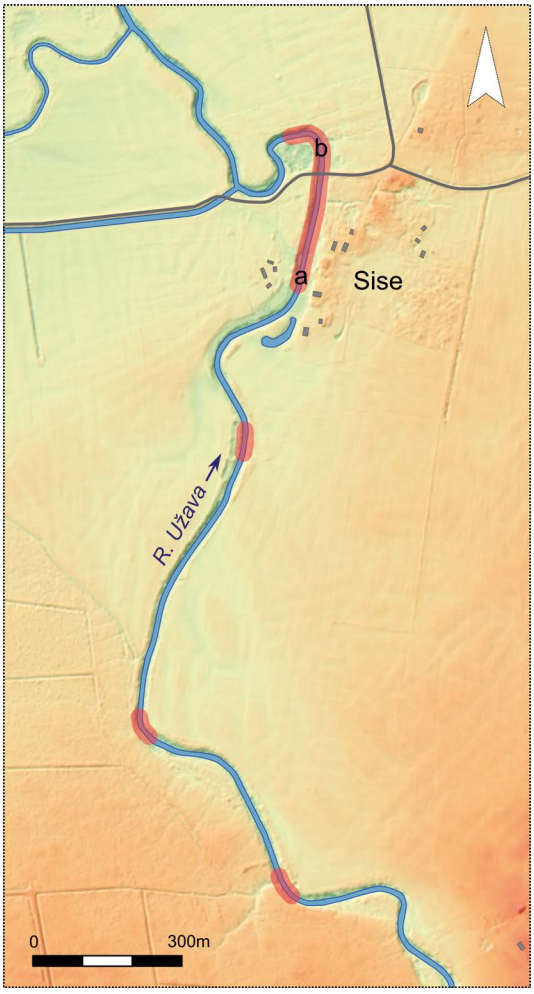

Fig. 3: Location map showing the reaches of the River Užava (in red) where osseous artefacts have been found. Many of the objects are recorded as having been recovered at the site of the old bridge (findspot a in map; Fig. 2) and along the first bend downstream of the extant bridge (findspot b in map). Digital elevation model: University of Latvia, Faculty of Geography and Earth Sciences, based on LiDAR data of the Latvian Geospatial Information Agency.

Fig. 4: Dated antler artefacts from the River Užava at Sise (for datings see Figure 5): 1–2) T-shaped axes; 3) worked antler; 4, 6, 7, 9) sleeves; 5) axe with sculpted butt; 8) worked tine; 10) adze; 11) chisel; 12) *bâton percée*. Photos Valdis Bērziņš, Harald Lübke. (1 – VVM31460:110 (KIA-50030); 2 – VVM31460:20 (KIA-48972); 3 – VVM31460:62 (OxA-36534); 4 – VVM31460:35 (OxA-X-2745-52); 5 – VVM31460:19 (OxA-36571); 6 – VVM31460:57 (OxA-36574); 7 – A13899:3 (KIA-43698); 8 – A13899:4 (KIA-43699); 9 – VVM31460:22 (OxA-36573); 10 – NHML (OxA-36439); 11 – VVM31460:18 (OxA-36752); 12 – A6952 (LuA-5396))

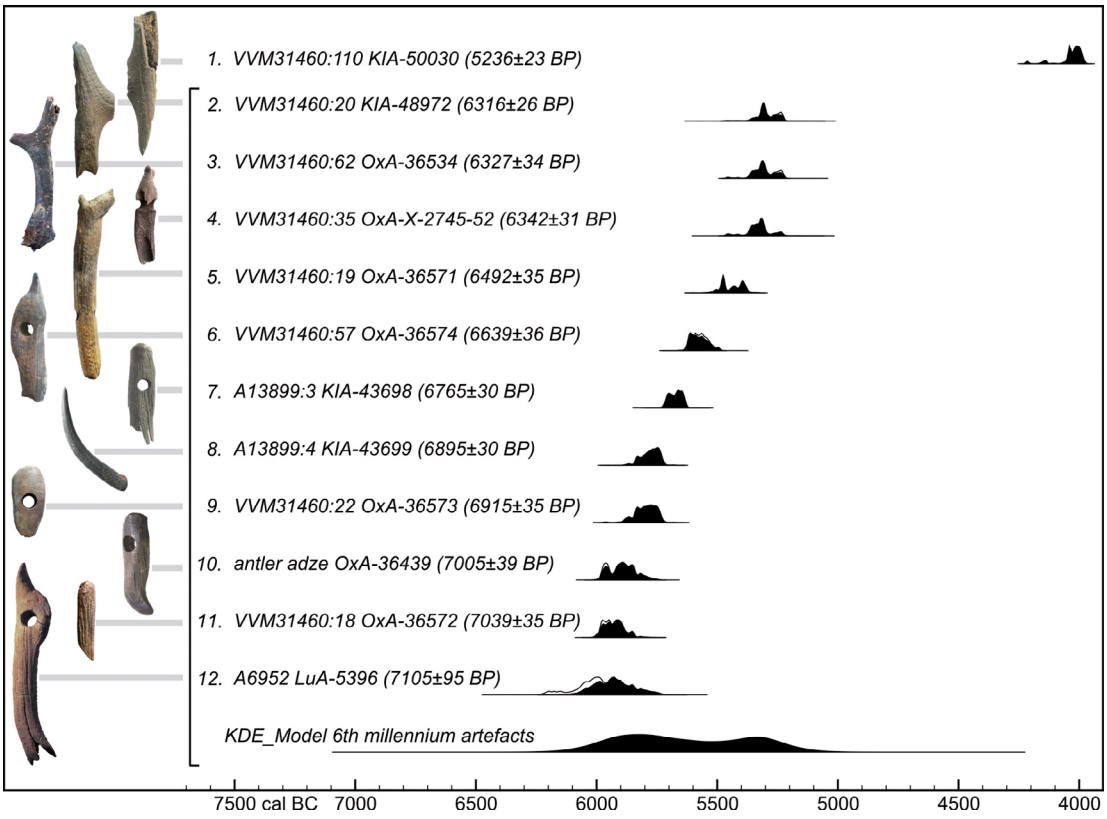

Fig. 5: Radiocarbon dates for artefacts from the River Užava at Sise (numbers correspond to those in Figure 4), including four previously published in Bērziņš *et al.* 2016. Datings calibrated using IntCal13 (Reimer *et al.* 2013) and OxCal v.4.3 (Bronk Ramsey 2009). OxCal's KDE_Model function (Bronk Ramsey 2017) has been used to summarise all dates except KIA-50030. The KDE_Model output suggests that these artefacts might represent two episodes of activity in the earlier and later 6th millennium calBC.

A focused effort was undertaken in 2010–2012 to discover the precise location and stratum from which the bone and antler was being eroded into the river – beginning with examination of exposures above and below the waterline, and continuing with terrestrial surface survey, excavation near the riverbank and geological investigation. Test trenches were excavated, but no archaeological layer with preserved osseous artefacts could be discovered[9].

Radiocarbon dating and landscape context

Radiocarbon dates have been obtained for 12 artefacts, all made of red deer antler[10]. The pieces selected for dating include characteristic osseous artefact forms of the Stone Age in the East Baltic region, in addition to which some idiosyncratic sculpted/engraved pieces were chosen. Collagen was extracted following standard laboratory procedures, combusted, graphitised and measured by Accelerator Mass Spectrometry, at four laboratories (Fig. 5; Tab. 1).

Although each date only represents the year of antler formation, it is considered unlikely that artefacts were made using antlers which were already old, or that they were discarded many years after production; thus the calibrated ^{14}C dates should correspond to episodes of human activity at Sise. Considering that all except one of the 12 datings, from a representative selection of artefacts, fall in the time interval approximately 6000–5200 calBC, it is reasonable to infer that a large proportion of the undated osseous artefacts belong to the same period.

The dated artefacts span a time interval that includes the rise in the level of the Baltic Sea basin during the transition from the freshwater Ancylus lake stage of the basin to the marine Littorina Sea stage, as well as the Littorina Sea maximum level, c. 5500 calBC. With the flooding of the

9 Bērziņš *et al.* 2016.

10 Four of the datings have previously been published in Bērziņš *et al.* 2016.

Tab. 1: Radiocarbon results (# previously published in Bērziņš *et al.* 2016). Conventional ^{14}C ages have been calibrated using OxCal v4.3 (Bronk Ramsey 2009) and the IntCal13 calibration curve (Reimer *et al.* 2013), with ranges for 95.4 % probability rounded outwards by up to 10 years. Radiocarbon dating laboratories and references to dating methods: LuA- Lund University, Sweden (Skog *et al.* 2010); KIA- Christian-Albrechts-University, Kiel, Germany (Grootes *et al.* 2004; Nadeau *et al.* 1998); RICH- Royal Institute of Cultural Heritage, Brussels, Belgium (Boudin *et al.* 2015); OxA- Oxford University Radiocarbon Accelerator Unit, United Kingdom (Brock *et al.* 2010, Bronk Ramsey *et al.* 2004).

Sample description	Lab. no.	Collagen yield (%)	δ^{13}C (‰)	^{14}C age (BP)	Calibrated date (calBC, 95.4 % probability)	Notes
perforated antler shaft, *Cervus elaphus*, A6952	LuA-5396#			7105±95	6210–5770	
antler chisel, *Cervus elaphus*, VVM31460:18	OxA-36572	4.4	–22.5	7039±35	6000–5840	
antler adze, *Cervus elaphus*, prospection 2012	OxA-36439	2.9	–22.7	7005±39	5990–5790	
antler adze sleeve, *Cervus elaphus*, VVM31460:22	OxA-36573	8.8	–23.1	6915±35	5880–5720	
antler tine, *Cervus elaphus*, A13899:4	KIA-43699#	17.2	–21.0	6895±30	5850–5720	
antler sleeve, *Cervus elaphus*, A13899:3	KIA-43698#	14.6	–21.7	6765±30	5720–5630	
antler sleeve, *Cervus elaphus*, VVM31460:57	OxA-36574	2.68	–23.1	6639±36	5640–5490	
antler axe, *Cervus elaphus* VVM31460:19	OxA-36571	3.9	–22.1	6492±35	5520–5370	
antler sleeve, *Cervus elaphus,* VVM31460:35	OxA-X-2745-51	6.2	–23.2	6140±32	rejected	Sample extracted and dated twice by Oxford laboratory, as part of its normal quality assurance. The results are statistically inconsistent. Although acceptable, atomic C/N ratios in both extracts are relatively high (3.4), and could indicate some contamination; collagen was brown (T. Higham, pers. comm.). As contamination from the burial environment is typically younger, we regard the older ^{14}C age as more reliable, although it is probably less reliable than other measurements in the series.
	OxA-X-2745-52	6.4	–23.0	6342±31	5470–5220	
worked antler, *Cervus elaphus*, VVM31460:62	OxA-36534	1.7	–23.2	6327±34	5380–5210	

Tab. 1 (continued)

Sample description	Lab. no.	Collagen yield (%)	$\delta^{13}C$ (‰)	^{14}C age (BP)	Calibrated date (calBC, 95.4 % probability)	Notes
T-shaped antler axe, *Cervus elaphus*, VVM31460:20	KIA-48972	10.9	−22.8	6316±26	5360–5220	Sample extracted and dated independently in two laboratories. The Kiel extract was dated twice (independent combustion, graphitisation and measurement), with consistent results (6344±42 BP, $\delta^{13}C$ −22.9; 6299±33 BP, $\delta^{13}C$ −22.5), whose weighted mean (6316±26 BP) is inconsistent with the Brussels result (T=8.7, T'(5 %)=3.8, df=1; Ward/Wilson 1978). Given the overall spread of results, the older date is probably more reliable (cf. VVM31460:35).
	RICH-22183	4.0	−22.0	6182±37	rejected	
T-shaped antler axe, *Cervus elaphus*, VVM31460:110	KIA-50030#	14.5	−21.8	5236±23	4230–3970	The Kiel extract was dated twice (independent combustion, graphitisation and measurement), with consistent results (5216±32 BP, $\delta^{13}C$ −21.6; 5255±31 BP, $\delta^{13}C$ −22.1), whose weighted mean is reported as the ^{14}C age of this sample.

low-lying coastal terrain at this time and formation of the Ventspils Bay/Lagoon, this locality, at or near the Užava mouth, would have become a prime fishing location. One test trench did indeed yield waterlogged remains: a wooden pile, probably from a fishing structure, together with two wooden tools. However, these finds have been dated to 8500–7700 calBC, much earlier than any of the dates obtained from artefacts in the osseous assemblage: they relate to a previous high-water phase that occurred during the Ancylus lake stage[11].

Taxonomic and anatomical analysis

The overall aim of this analysis was to identify the raw material used for making tools, including bone and antler pieces fragmented by humans but not further modified (Fig. 6).

The dominant raw material is red deer (*Cervus elaphus*) antler, identified in 75 cases. Tools have been made from red deer antler bases, various parts of the beams and tines. Twenty-six of the pieces are detached tines without further modification. On 13 tools the burr at the antler's base is present, indicating that these items have been made from shed antler. On the other hand, four antler specimens include part of the skull (pedicle), and these definitely derive from hunted animals.

Elk (*Alces alces*) antlers are less numerous, with 19 specimens altogether, of which at least three had been shed. The artefacts and waste indicate that raw materials for tool-making also included bones and tusks of wild boar (*Sus scrofa*), and bones of brown bear (*Ursus arctos*) and dog (*Canis familiaris*).

Unfortunately, since one section of the artefacts (harpoons, knives, etc.), made from ungulate long bones, have been extensively altered and well polished, precise identification is impossible by morphological criteria. Accordingly, 25 long-bone specimens were identified only as belonging to large mammals (ungulates). As such tools require straight, thick and compact bone parts, in these

11 Bērziņš *et al.* 2016.

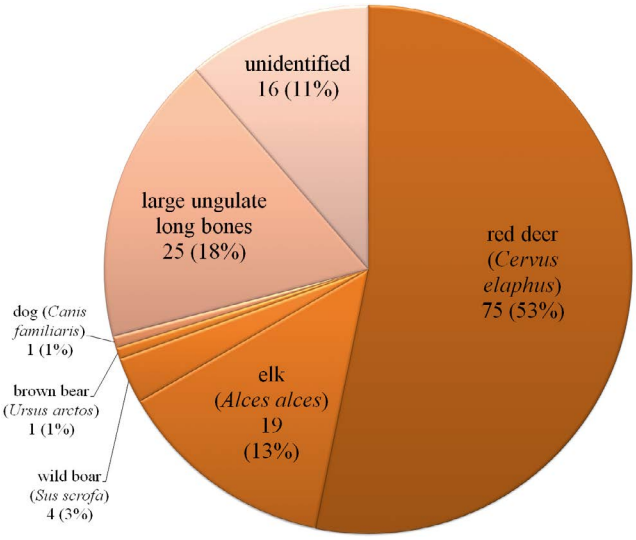

Fig. 6: Osseous artefacts and debitage in the Sise collection classified according to raw material species/animal group. Faunal analysis Lembi Lõugas.

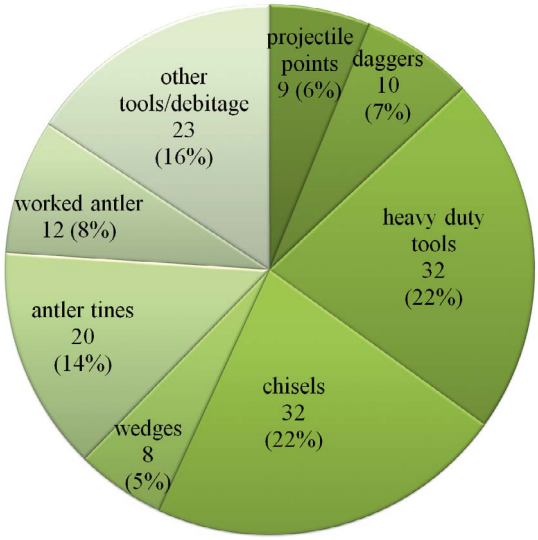

Fig. 7: Division of the Sise assemblage into artefact classes.

cases they are likely to have been made from metapodials of elk or possibly aurochs. The other large animals, such as red deer or brown bear, do not have a bone suitable for making these kinds of tools. A further 16 antler and bone fragments were not identifiable.

Since red deer antler was more commonly used for making tools than elk antler, it may be presumed that red deer dominated periodically over elk in the fauna around Sise. The predominance of red deer (and, e. g., aurochs) over elk during the Atlantic chronozone, when the broadleaved forest spread as far north as northern Estonia, is proved by archaeozoological assemblages from stratified archaeological contexts. However, it should be noted that, while the dominance of red deer is confirmed by the contemporaneous faunal material from the Palanga site in western Lithuania[12], elk continues to predominate in eastern Latvia and Estonia. Thus, at the Zvidze site in eastern Latvia, the ratio of elk to red deer is about 2:1, while somewhat further north, at Kääpa in Estonia, the dominance of elk is much greater: 98 % elk *vs*. 2 % red deer bone fragments[13].

Artefact forms

The assemblage of worked bone and antler consists of 141 finds: tools, items with traces of working and debitage pieces. They have been classified according to function, after which morphological types and subtypes have been singled out, employing a classification scheme elaborated for bone and antler artefacts from the East Baltic[14]. The radiocarbon results support the existing classification of particular tool types as characteristically Mesolithic or Neolithic. On the other hand, some of the chisels, awls, knives and worked antler tips are forms that could have been used in any period of the Stone Age.

The tools and waste pieces show the application of a range of bone- and antler-working techniques: shaft wedge-splinter, sawing, drilling, scraping, breakage and others[15]. Here, however, we focus primarily on the typology, chronology and function of the artefacts. The bone and antler collection may be divided into: 1) hunting and fishing equipment; 2) heavy duty tools; 3) smaller implements, such as chisels, awls, knives and wedge-shaped pieces; 4) worked antler; and 5) indeterminate fragments and debitage.

Hunting and fishing equipment

Hunting and fishing gear, represented by 19 pieces, constitutes only a small part of the collection. The arrowheads are small, measuring 7–9 cm in length, cut from long bones,

12 Piličiauskas *et al*. 2015.
13 Lõugas 2017.
14 Zagorska 1983.
15 David 2006; 2009; 2019.

Fig. 8: Bone, antler and boar's tusk artefacts from the Sise collection: 1–3) spearheads; 4) arrowhead; 5) awl; 6) bodkin; 7) wedge; 8, 12, 13) chisels; 9–11) worked antler tines; 14) dagger. Photos Valdis Bērziņš
(1 – VVM31460:3; 2 – VVM31460:100; 3 – VVM31460:99; 4 – VVM31460:2; 5 – VVM31460:13; 6 – VVM31460:8; 7 – VVM3426; 8 – VVM31460:56; 9 – VVM31460:45; 10 – VVM31460:55; 11 – VVM31460:103; 12 – VVM31460:102; 13 – VVM31460:74; 14 – VVM31460:26)

droplet-shaped in cross section, with a broadened midpart and an extended tang (Fig. 8,4). There are four uniserially barbed bone spearheads: one intact 11 cm long example (Fig. 8,1) and three fragmentary pieces (Fig. 8,2.3), which have either slanting barbs or fine barbs at right angles to the edge. In addition, there are three smooth-sided spearheads made from long bones, oval or triangular in cross section.

The daggers have been made mainly from elk long bones, notably the ulna, which offers a natural form eminently suited to this function. One piece has been fashioned from an elk antler tine (Fig.8,14).

Of particular interest is a fragmentary bone dagger (Fig.10,3), both faces of which have been smoothed and engraved with figurative scenes. One face depicts a hunting quarry – a cervid; the other shows a hunting weapon – a

harpoon – along with an unidentifiable figure (a hunter?). This piece is discussed elsewhere[16].

Another unique piece is a 22.5 cm long knife (Fig.10,1) made from an elk (?) metapodial, with a constriction near the butt end and small carved notches around the margin of the spatulate butt and along both edges of the blade close to this end. The carefully shaped object has been interpreted as a representation of a lamprey – these cyclostomes (jawless fish) are still caught in the River Užava today. Such a knife could have served for scaling fish[17].

Heavy duty tools

This group, forming the core of the collection, includes intact and broken adzes and axes, some of them with sleeves, and hammers. These heavy implements, predominantly made from red deer antler, total 34. They are made from antler bases or various parts of beams, 12–33 cm in length, with a drilled shaft-hole up to 2 cm in diameter in the upper or middle part of the tool, and with a blade, or a recess for receiving a blade, either parallel or perpendicular to the shaft-hole.

The butt is variously shaped: generally rounded or terminating in a straight cut; in some cases the burr has been smoothed into a ridge encircling the butt – a distinctive feature of this collection (Fig. 4,4; 9,5). At least four tools have the pedicule from the skull incorporated into the butt, which in two cases has been flattened into a chisel-like form (Fig. 4,6.12). These items could derive only from a hunted animal, not from a shed antler.

Tine stumps have generally been smoothed over, otherwise retaining the natural surface of the antler. The blade may be symmetrical or bevelled, in some cases retaining the natural curvature. Axe and adze sleeves are very characteristic (Fig. 9,2.4.6.7), with a recess in the lower part of the tool, where the spongy inner part of the antler has been removed so that a separate lithic or smaller antler blade could be inserted for more effective use.

In some cases the sleeve has been made from the mid-section of an antler beam, without a shaft-hole. One such sleeve is covered on all its faces by an elaborate geometric design, consisting of short, parallel engraved lines, triangles and even an image of a harpoon (Fig. 10,2). One of the adzes has an incised design between the rounded butt and the shaft-hole, consisting of two rows of chevrons (Fig. 4,10).

A long axe made from an antler beam (Fig. 4,5), with a shaft-hole in the lower part of the tool and a bevelled blade, has a butt shaped into a naturalistically represented cervid head, exploiting the natural form of the antler. Unfortunately, one ear has broken off.

Two of the red deer axes are classifiable as T-shaped axes: made from the mid-section of an antler beam, they have an oval shaft-hole at the place of attachment of the tine. One is better preserved (Fig. 4,2): on this piece, 23.6 cm long, the tine stump has been retained and the working edge bears strong traces of use. The other axe (Fig. 4,1), 25.0 cm long, is more fragile and extensively damaged; in this case the tine stump has been smoothed over, with an elongated oval shaft hole.

On one piece with a broken butt and a shaft-hole (Fig. 9,1) the beam section terminates in a rounded, shaped working end – this could be a hammer tool. Many suggestions have been made concerning the function of these heavy duty tools (felling trees, splitting timbers, removing bark and even butchering marine mammals at coastal sites). In a recent treatment, it has been proposed that such heavy antler tools had the potential for use in a range of different activities[18].

Other implements

This group includes a variety of antler and bone chisels, wedges, awls and other forms, totalling 40 pieces. There are sixteen chisels made from antler beams or tines (Fig. 4,11; 8,12), 7–17 cm in length, oval or circular in cross section, and generally with a bevelled blade. The longer, heavier pieces could have been used on their own, whereas the relatively lighter ones may have served as inserts for the antler sleeves described above, i. e. as "insert axes".

Chisels shaped from split bones (Fig. 8,8.13), 10–22 cm in length, sometimes retain the natural form of the epiphysis, but most have been made from the diaphysis of a long bone, the blade shaped from both sides. Blades may be straight or rounded.

Wedge-shaped implements are also present, where a working end has been formed by splitting the distal end obliquely from both sides so as to obtain a sharp edge (Fig. 8,7). These could be cutting tools.

Naturally worn-down wild boar tusks may also have served as chisels, and one broad tusk with carefully ground edges could have been a knife. A boar's tusk tool narrowing to a sharp point (Fig. 8,6) could have been used as a bodkin.

16 Loze 2000; Płonka 2003; Zagorska *et al.* 2019.

17 Bērziņš 2018.

18 Elliott 2015.

Fig. 9: Heavy duty antler tools from the Sise collection: 1) hammer; 2, 4, 6, 7) sleeves; 3, 5) axes. Photos Līga Palma, Valdis Bērziņš (1 – VVM31460:16; 2 – VVM31460:111; 3 – E-1725; 4 – KM1527/A-384; 5 – VVM31460:109; 6 – VVM31460:24; 7 – A11617)

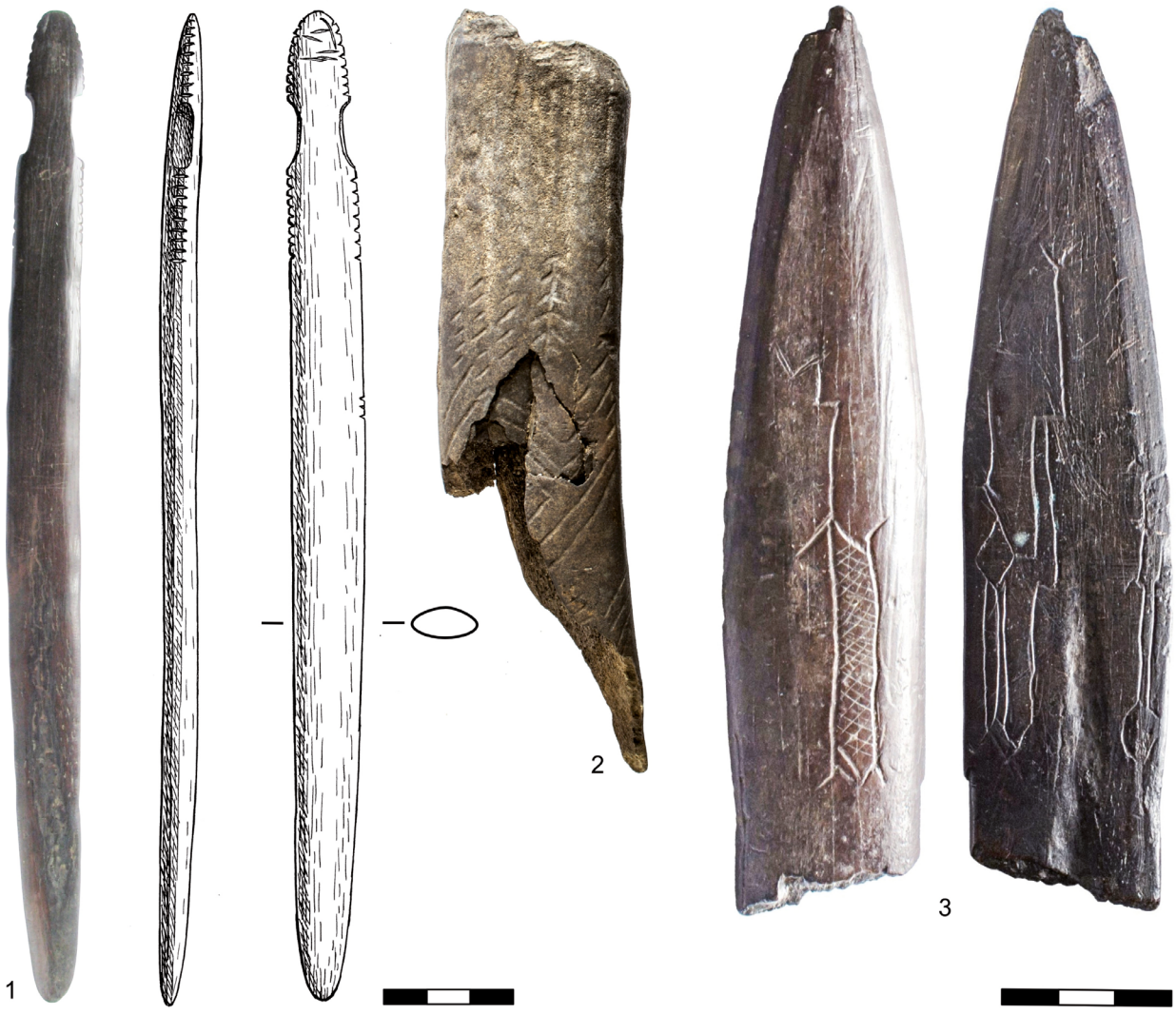

Fig. 10: Ornamented and sculpted pieces from the Sise collection: 1) sculpted bone knife; 2) decorated fragmentary antler tool; 3) decorated bone dagger. Drawing Anda Bērziņa; photos Līga Palma, Valdis Bērziņš
(1 – VVM31460:1; 2 – NHML; 3 – VI109:5)

Worked antler

Various parts of red deer antler (32 in total) retain working traces: these are mainly beams including the whole base, mid-sections with tines as well as parts of the crown and separate tines.

Antler tines of 15–30 cm length have generally been detached by cutting, after which the basal end has been carefully shaped. In some cases the tines (brow, bez and trez) have simply been broken, without any traces of further working at the base. Tine tips display various kinds of alteration at their extremity, showing detachments and polish (Fig. 8,9–11). These could have been used as chisels, smoothing artefacts, punch tools or pressure sticks for flint knapping[19]. In the case of antlers with a broken base as well as a polished tip it is hard to assess whether they have been worked, because polish on tines also results from antler-rubbing by the deer[20]. Antler beams cut and shaped at one or both ends, retaining one or more tines, could be performs. Certain whole red deer and elk antlers also show minor working traces.

19 David/Sørensen 2016, 131.
20 Elliott 2012, 194.

Indeterminate fragments and debitage

Some of the osseous artefacts (~23 pieces) are highly fragmented and cannot be precisely identified; we characterise them simply as worked bone/antler. There are preforms and debitage, including split long bones. In some cases the whole length of the long ungulate bone is present; there are also diaphysis fragments as well as epiphyses cut off obliquely or with bone strips extracted for further processing.

Artefact chronology

Many of the artefacts are problematic to date on morphological grounds, since they represent forms that were apparently in use during a long period of the Stone Age. By contrast, the fishing and hunting weapons and likewise the adzes, axes and antler sleeves do possess chronologically diagnostic features. The series of twelve radiocarbon dates from Sise, obtained from a representative selection of osseous artefacts, confirms and supplements the typological schemes.

The earliest dated piece – 6210–5770 calBC (LuA-5396, 7105±95 BP) – is a *bâton percé* shaped from the antler of a hunted red deer (Fig. 4,12); such forms occur from the European Early Upper Palaeolithic onwards, continuing into the Mesolithic of Northern Europe[21].

Adzes and axes with sleeves are likewise associated with the Northern European Mesolithic, although they also occur later[22]. Two such pieces from Sise are among the older ^{14}C-dated finds, belonging to the Late Mesolithic (Fig. 4,7.9), whereas a fragmentary piece with a ridge around the butt has given an Early Neolithic date (Fig. 4,4).

Antler adzes/sleeves with carefully smoothed bodies, typically ~12–15 cm long, have hitherto been typologically assigned to the Neolithic in terms of the Latvian/Lithuanian chronological scheme, i. e. the ceramic Stone Age[23]. The relatively early date for the example from Sise (Fig. 4,9) suggests that this assumption may need to be revised.

A relatively early ^{14}C date has likewise been obtained for an antler chisel with an asymmetrically formed blade (Fig. 4: 11); such forms are commonly also encountered on later Stone Age sites in Latvia[24]. The sculpted antler axe (Figure 4,5) falls in the middle of the sequence of dates.

We have no dates for the Sise bone spears, but the fine-barbed fish spears in this collection (Fig. 8: 1–3), exhibiting a different form of barb from those of the 7th/8th millennia calBC found elsewhere[25], can probably be regarded as later forms, contemporaneous with the dated artefacts from Sise.

Among the many red deer antler tines with worked tips from Sise, one dated piece falls relatively early in our sequence, corresponding to the Late Mesolithic (Fig. 4,8), although such pieces could have been used later as well.

Two small bone arrowheads, broadened in the middle (Fig. 8,4), probably relate to the younger end of our dating sequence. These pieces are typical of the earliest hunter-fisher sites in Latvia and Estonia where ceramics are present (termed Early Neolithic in Latvia)[26]. Both of the T-shaped axes (Fig. 4,1.2) have been dated to the same period, albeit separated by a millennium. Indeed, the older axe is the earliest such find in the East Baltic region[27].

On typological grounds and on the basis of the radiocarbon datings, the Sise osseous collection can mainly be assigned to the interval c. 6000–5000 calBC, corresponding to the Late Mesolithic–Early Neolithic in the Latvian chronological scheme.

Discussion

The assemblage of osseous finds from Sise constitutes a significant corpus of material for studies of the antler and bone industry of the East Baltic and the Baltic Sea basin as a whole. In order to place it in such a context and assess its significance, we need to consider the assemblage in relation to previously known Stone Age osseous finds in the region.

The finds from Sise differ cardinally from the array of bone and antler artefacts recovered at the Zvejnieki II site, by Lake Burtnieks in northern Latvia, which date from the Preboreal and early Boreal. Predominant at Zvejnieki II are barbed Kunda-type fish spears, biconical arrow- and spearheads, as well as arrowheads and daggers with flint inserts[28]. These finds have parallels further to the north and east: in Kunda Bog, northern Estonia[29] as well as in the north of present-day Russia at Lake Onega (the "Vere-

21 Osipowicz *et al.* 2017.
22 Groß/Lübke 2019.
23 Vankina 1984; Rimantienė 1994.
24 Zagorskis 1973.
25 Zagorska 1974.
26 Zagorskis 1973; Jaanits 1968.
27 Kabacinski *et al.* 2014; Elliott 2015; Groß/Lübke 2019.
28 Zagorska/Zagorskis 1989.
29 Indreko 1948.

tye-type" sites)[30] and in the Upper Volga region[31]. All of these finds belong to the Kunda Culture and the related Butovo Culture tradition, which prevailed during the early part of the Holocene[32].

What is more significant, we may also observe differences if we compare the Sise assemblage with contemporaneous (Late Mesolithic–Early Neolithic) assemblages from eastern Latvia, namely those of the Osa and Zvidze habitation sites on the Lubāns Plain[33]. The prevailing artefact forms on these sites are biserially barbed spears, biconical arrowheads, simple and composite fish-hooks, and asymmetric chisels cut from long bones at a 45° angle. Heavy duty tools occur as well, represented by some hammers and axes, and in particular by antler chisels made from antler beams or tines with a curved blade; however, the forms are somewhat different, because the artefacts from eastern Latvia are predominantly made from elk antler. Similar finds are known in Estonia – at the Narva and Kääpa habitation sites[34]; they relate to the Narva Culture, which represents a partial continuation of the Kunda tradition.

Accordingly, the unusual character and significance of this assemblage from Sise in western Latvia should be emphasised. Here, mainly red deer bone and antler was utilised for production of the osseous inventory, and moreover it is predominantly shed antler that has been used. There is a high proportion of heavy duty tools, notably axes and chisels with sleeves. The antler implements show considerable diversity, with particular unusual details, for example the smoothed ridge surrounding the butt. The extensive use of antler tines should also be highlighted, these being utilized as tool inserts or as tools in their own right. The discovery of T-shaped axes at Sise is also significant, representing the furthest easterly occurrence of this artefact form in the Baltic Sea basin. There are unique examples of art in bone and antler: an antler axe with a butt shaped as a cervid head, a knife shaped into a form identified as a lamprey, a richly ornamented antler sleeve and a carving on a bone dagger depicting a scene of a cervid being hunted with a harpoon.

The closest parallels to the Sise assemblage, both in terms of artefact forms and in chronological terms, are to be found further south along the same stretch of the Baltic coast. These are finds from small habitation sites on the west coast of Lithuania, at Palanga and in the town of Klaipėda at Smeltė – sites at the mouths of minor rivers that entered lagoons[35]. Of these two sites, Smeltė is somewhat earlier, c. 5830–5000 calBC, corresponding to the age of the Sise collection. The finds are also closely similar: there are mainly mattocks and axes from red deer antler, an antler tine pressure tool, as well as bone chisels and awls. Palanga is somewhat younger, c. 5000 calBC; predominant here are mattocks, axes as well as axe/adze inserts made mainly from red deer antler. A T-shaped axe found here corresponds in age to the younger of the two examples from Sise: 4230–3970 calBC[36]. Thus, the assemblages from these sites, along with separate finds of barbed spearheads and small arrowheads from the Lithuanian coast[37], constitute a unified cultural area in the Late Mesolithic/Early Neolithic.

The osseous tool inventory from Sise is linked to more distant areas along the southern shore of the Baltic by the numerous finds of heavy duty tools made from red deer antler that have been found on Mesolithic sites or as stray finds in Poland, northern Germany and Denmark[38]. As at Sise, many of these tools have been made from shed antler[39]. Special mention should be made of the T-shaped axes, which are well attested across Northern Europe from southern Scandinavia to northern Germany and Poland, with dates covering the late 6th and the whole of the 5th millennium calBC[40]. They are also known to occur in the Low Countries and France[41]. And in fact the distribution of this axe form also extends to the eastern shore of the Baltic. Apart from the two pieces found at Sise, the only other example in Latvia comes from Lake Semba, just 3 km away[42]. T-shaped axes are represented on the Palanga and Šarnelė sites in Lithuania and also further south – on the Zedmar sites in today's Kaliningrad Region of Russia[43].

The East Baltic T-shaped axes fall within the same time period – the late 6th and the 5th millennium calBC.

30 Oshibkina 1989.
31 Hartz *et al.* 2010
32 Zagorska/Zagorskis 1989; David 2006.
33 Zagorskis 1973; Loze 1988, 23–30, Plates IV–XIII.
34 Jaanits 1968.
35 Piličiauskas *et al.* 2015.
36 5240±40 BP (Poz-66588), Piličiauskas *et al.* 2015, 8. Age calibrated (95.4 %) as for datings in Table 1.
37 Rimantienė 1994, Plate 21.
38 Pratsch 2011; Kabacinski *et al.* 2008; Diakowski 2011; Groß/Lübke 2019; Mathiassen 1948. Timofeev 1998 notes that during the Atlantic climatic period the main material for the production of antler tools in Central Europe and Southern Scandinavia was red deer antler, whereas in the east, where red deer was rare, tools were mainly made from elk antler, and observes that differences in the natural characteristics of the blanks significantly affected the typology of the artefact industry.
39 David 2019, 133.
40 Elliott 2015; Kabacinski *et al,* 2014.
41 Elliott 2015.
42 Vankina, 1970, 98, Fig. 143.
43 Timofeev 1998a; 1998b; Piličiauskas *et al.* 2015.

One of Sise axes, dated to 5360–5220 calBC, is the earliest in the eastern Baltic, and also slightly pre-dates the pieces from Belgium (Schelde A) and north-west Germany (Stralsund)[44]. Numerous T-shaped axes have also been found in southern Lithuania and in the north-western part of Belarus[45], where some of them have been dated to the mid 6th millennium. Earlier, when T-shaped axes were known mainly in north-western Europe, specifically in the Ertebølle Culture context, pieces discovered further east were regarded as indicating influences from that cultural area[46]. However, since T-axes are now known to occur across a very wide swathe of Northern and Eastern Europe[47], and since the earliest datings are in the south-east and east[48], this view needs to be reconsidered.

At the same time, we may note the influences from the area of the Kunda Culture and the succeeding Narva Culture, indicated by the occurrence of Kunda-type fish spears at Sise, the stray finds of barbed spearheads in western Lithuania, and the small arrowheads with a broadened midpart and biconical arrowheads represented at Sise and Smeltė, which may be dated to the Early Neolithic. All of these are artefact forms absent from Western European assemblages[49].

The idea of interaction between these two – eastern and western – cultural regions at the eastern shore of the Baltic is by no means new. Starting already from the mid 20th century, the Russian Stone Age researcher Nina Gurina emphasised the predominant role of the Narva Culture throughout the East Baltic[50], whereas Lūcija Vankina also identified Maglemose and Ertebølle influences[51].

In this connection it is interesting to note that a recent lithic study has revealed differences in terms of pressure blade technology between the north-eastern and western areas of Latvia[52]. Platform faceting is commonly observed in northern Scandinavia and the East Baltic, whereas this practice is not identified in areas along the southern shore of the Baltic – in Poland, south-eastern Denmark and southern Sweden[53]. The west coast of Latvia may now be included in the latter region. Further, experimental knapping suggests that in western Latvia and likewise in areas of the southern Baltic coast a change to a strategy of minimizing platform preparation for pressure-blade production might be attributed to the small size of the locally available raw material (flint pebbles), requiring a knapping strategy where as little mass as possible is removed before and during blade production[54].

Regional differences in the available raw material would thus appear to have played a significant role in the development of lithic technological traditions in the Mesolithic of the Baltic Sea region. The same is much more demonstrably true of the osseous artefact traditions, particularly with respect to antler: thus, the considerable differences in morphology between red deer and elk antler (and shed antler versus antler from hunted animals) have been essential in determining the strategy for subdividing the antlers and the repertoire of artefact forms obtainable from the various antler elements. Accordingly, the boundary and overlap between the red deer and elk population ranges in the East Baltic region during the Holocene is crucial for the interpretation of osseous artefact traditions.

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44 Elliott 2015.
45 Charnyauski 2006
46 Vankina 1984, 93; Timofeev 1998b, 232.
47 Elliott 2015.
48 Lübke *et al.* 2017; Lübke *et al.* 2018. Publication in progress.
49 Gramsch 2009/2010. That east-west differences are particularly apparent in osseous hunting equipment has been emphasised in Timofeev 1998.
50 Gurina 1967.
51 Vankina 1984, 99
52 Damlien *et al.* 2018.
53 David/Sørensen 2016.
54 Damlien *et al.* 2018.

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