THE NORTHERN FRINGE OF THE SWIDERIAN TECHNOLOGICAL TRADITION: SALASPILS LAUKSKOLA REVISITED

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Abstract

The earliest settlement of Latvia occurred at the very end of the Late Glacial, after the retreat of the ice sheet. Important evidence of this earliest occupation is the well-known site Salaspils Laukskola. Previous research has focused on the typological aspects of this assemblage, and the use of lithic raw materials, suggesting an affiliation to the Swidry tradition. However, a wider technological perspective on this assemblage comprising a rich lithic inventory has recently proven fruitful. We present a detailed new technological analysis of the Laukskola assemblage, as well as five small lithic assemblages from Latvia based on a chaîne opératoire approach. While supporting the Swidry connection, this allows for a renewed discussion of the Final Palaeolithic settlement of Latvia, and its relationship with adjacent areas of northeast Europe.

Key words: Final Palaeolithic, lithic technology, lithic raw material, chaîne opératoire, technological tradition, social network, mobility, eastern Baltic.

Introduction

The Salaspils Laukskola site, excavated in 1973 and 1974 by Ilga Zagorska, has since then been the main evidence for the earliest settlement of Latvia. The site was located on a riverbank in the palaeo-estuary of the River Daugava, some 20 kilometres southeast of Riga. The excavation demonstrated that the site was occupied after the formation of the river terrace. This gives the settlement an earliest possible geological date as the middle part of the Younger Dryas c. 10 500 cal BC, i.e. right after the Scandinavian Ice Sheet had retreated towards the north. The Salaspils Laukskola assemblage has been linked to the concurrent Swidry tradition, mainly based on similarities in point morphology, presenting a lower timeframe for the occupation, stretching into the first half of the Preboreal until c. 9000 cal BC (Zagorska, 1993; 1996; 1999; 2012). Several Latvian finds of bone and antler artefacts (harpoons, a single Lyngby axe and reindeer remains) have been radiocarbon dated to the same period. Based on these results, this northern settlement is placed within a larger Final Palaeolithic framework of European hunter-gatherers, with reindeer and their hunters entering Latvia from the south (Zagorska 2012). The affiliation between the Latvian finds and the Swidry finds from further south has until now been explored largely from a typological perspective (Zaliznyak 1999a; 1999b; Šatavičius 2016; however, see Sulgostowska 1997; 2002). In this article, we argue that a technological approach to the study of the Salaspils Laukskola assemblage, including a chaîne opératoire analysis and a comparison of the concepts of stone tool production, offers a deepened knowledge of this relationship. We present a detailed description and analysis of the stone technology, including an analysis of the raw material economy at the Laukskola site. The results disclose information about on-site activities, and the length and character of the occupation, contributing to our understanding of mobility patterns and communication in this period. Further, small lithic assemblages from other contexts are included in the discussion (Fig. 1; Table 1).

Techno-economic analysis of the Salaspils Laukskola lithic assemblage

Altogether, six flint concentrations were identified at the Laukskola site, interpreted as traces of separate settlement structures (Fig. 2). The flint concentrations (I-VI) were five by six metres wide, forming rounded find scatters. At the centre of some of the scatters, there was a concentration of burnt flint, suggesting the presence of a hearth. In addition, stray finds of single flint artefacts of a similar character were found in a larger area around the concentrations. The assemblage comprises 2,710 artefacts of chipped stone, including curated tools and production waste. Approximately 200 to 400 artefacts were found in each scatter. A use-wear analysis of flint tools from two concentrations suggests variation in hunting, hide processing and household activities (Zagorska, Winiarska-Kabacinska 2012).

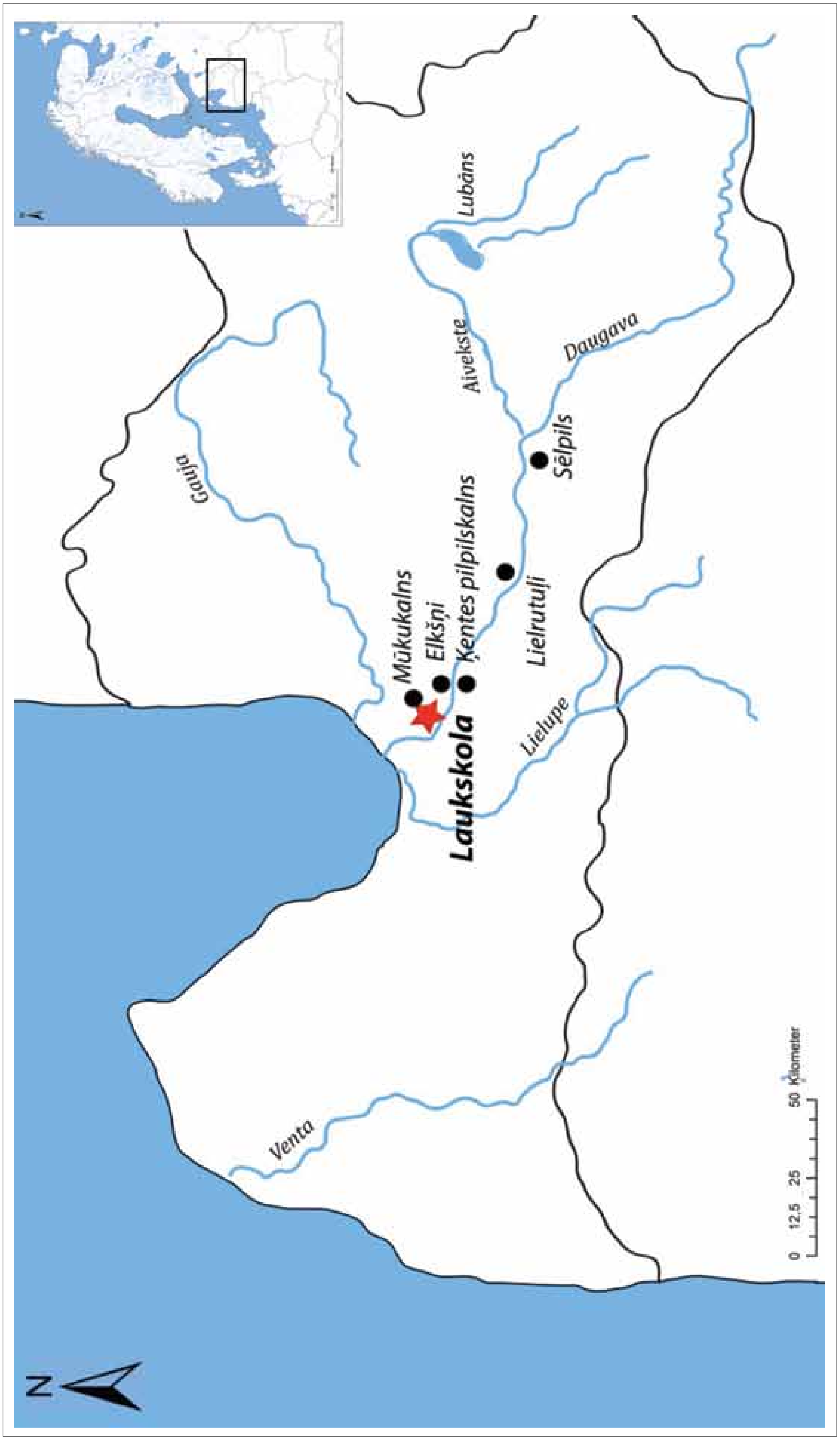

Fig. 1. Sites mentioned in the text.

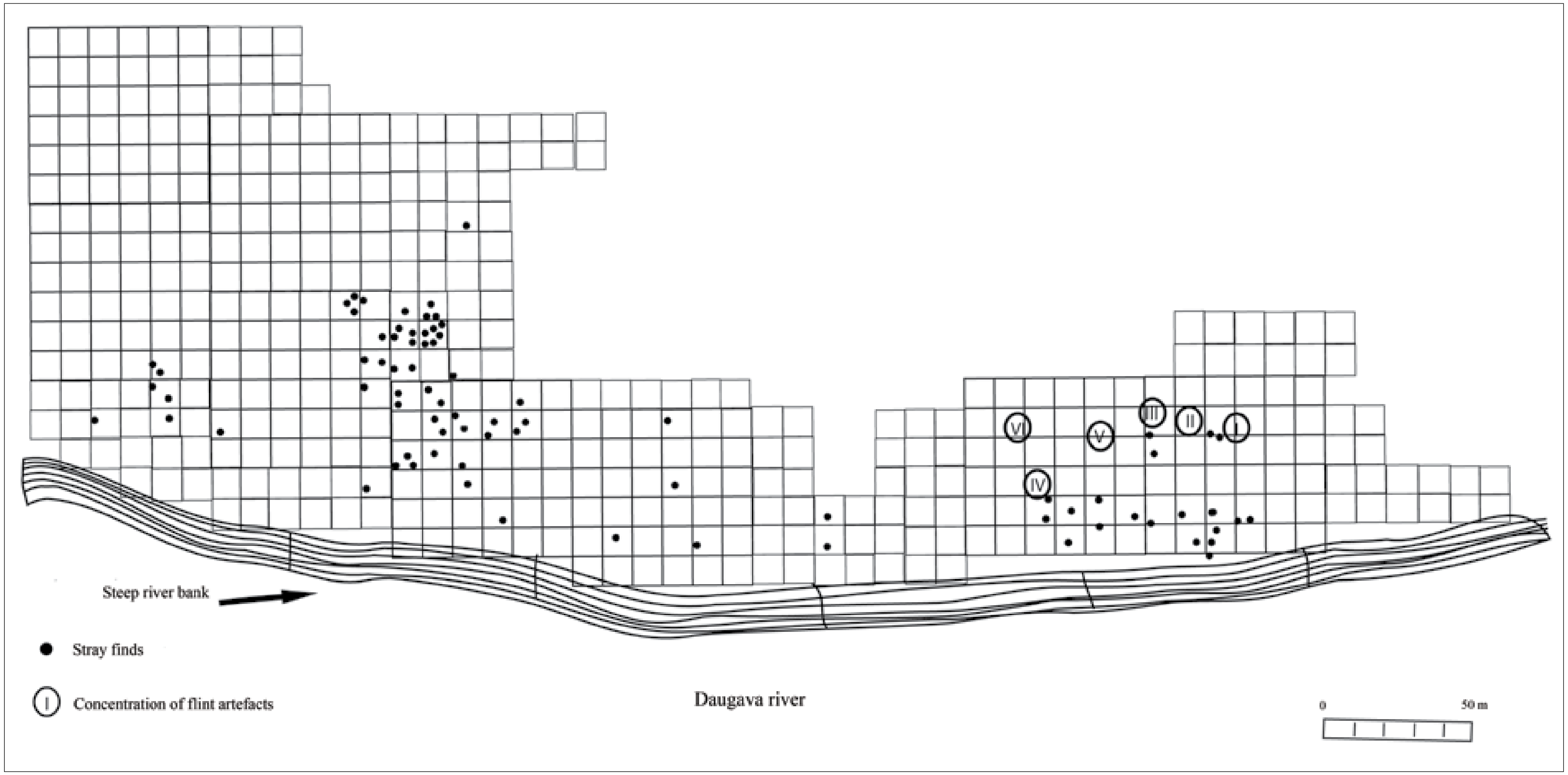

Fig. 2. A map of the Salaspils Laukskola site, displaying six find concentrations and stray finds.

Table 1. A list of sites/assemblages mentioned in the text and the number of analysed artefacts (n=complete assemblage).

Artefacts	Salaspils Laukskola*	Mūkukalns	Skrīveru Lielrutuli	Ikšķiles Elkšņi	Ķentes pil-skalns	Sēlpils
Complete blades	109	1	3	3	0	0
Blade fragments	116	0	0	0	0	0
Flakes	1	0	0	0	0	0
Cores	5	1	0	0	2	2
Core fragments	6	0	0	0	0	0
Platform flakes	1	0	0	0	0	0
Blocks/nodules	1	0	0	0	0	0
Points/Microliths	41	0	1	1	4	2
Scrapers	1	2	1	2	0	0
Burins	10	0	0	0	0	0
Microburins	18	0	0	0	0	0
Sum attribute analy-sis	309	4	5	6	6	4
100% (n=)	2170	4	12	6	6	40
Excavation; director, year (total area/context)	I. Zagorska 1973–1974 (2700 m2)	J. Graudonis 1959–1962 (stray find)	E. Šturms 1929; I. Briede 1974 (stray find)	A. Smiltnieks 1984 (survey)	A. Stubavs 1954–1958 (stray find)	E. Šnore and A. Zariņa 1963–1965 (stray find)
References	Zagorska 1993; 1996; 1999; 2012	Zagorska 2012	Zagorska 2012	Zagorska 2012	Zagorska 2012	Zagorska 2012

The present analysis is based on the technological approach developed in French sociology and archaeology, and further development within Scandinavian archaeology and the Nordic Blade Technology Network (Madsen 1996; Knutsson 1998; Apel 2008; Sørensen 2006a; 2006b; 2013; Knutsson et al. 2015; Damlien 2016; Berg-Hansen 2017a; 2018). The goal of the analysis is to describe the organisation of the stone technology, including concepts, methods and techniques for the production of tool blanks and tools, and the raw-material economy. The investigation focuses on the following questions:

What characterises lithic technology in terms of production concepts, methods and techniques, including the aims of production, the use of blanks, the chaîne opératoire, and the raw material economy?

Are there technological variations between the six concentrations at Laukskola?

What are the similarities and differences compared to Swidry blade technology?

To achieve this, we use a combination of dynamic-technological classification and reading of the complete chipped stone assemblage, a simplified chaîne opératoire analysis, and a detailed attribute analysis of selected artefacts (Table 1) (Schild 1980; Inizan et al. 1999; Eriksen 2000; Sørensen 2006a; 2006b; 2013; Berg-Hansen 2017a; 2017b; 2018, Berg-Hansen et al. 2019). In total, 14% (309 artefacts) of the chipped stone assemblage from Laukskola has been subjected to attribute analysis, comprising different parts of the blade and tool production, and several lithic raw materials.

Blade concept and tools

The analysis documents that the stone industry was oriented towards the production of blades as blanks for tools. A single blade concept could be identified, and there is no evidence of systematic flake production. Further, no specialised production of blades of certain sizes or shapes could be identified. Rather, blade size seems to diminish with the reduction of the cores. The size distribution of complete blades shows a relatively wide size range, the maximum measurement being between 21 and 88 millimetres in length, six to 31 millimetres in width, and two to 16 millimetres in thickness (Fig. 3; Table 2). The assemblage shows a great similarity in blade morphology and technological attributes between the concentrations. Generally, the blades from Laukskola are regular and straight, although irregular blades are also present. The majority have a trapezoidal cross-section, and although the distal ends show both straight transverse and pointed termination, straight termination is more common (72%) (Fig. 4; Table 2).

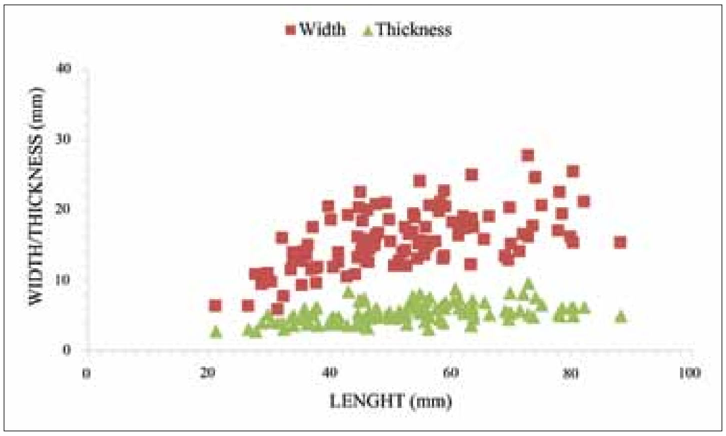

Fig. 3. Blade size distribution, all analysed blades from six concentrations at Salaspils Laukskola (compare Table 2) (n=225).

The blade concept can thereby be described as narrow, straight and regular blades of various sizes, with mainly straight transverse termination at the distal end. This does not correspond well with the so-called preferential blade production, as suggested for the Swidry tradition by Migal (2007). However, a possible explanation for this is offered by Galiński and Sulgostowska (2013), who suggest some variation in the blade production concept within this tradition, related to varied access to lithic raw materials. This suggests the application of a more standardised blade concept in connection with the exploitation of chocolate flint, and a less uniform concept in the utilisation of other flint types.

The curated tools include tanged points, scrapers and burins. All the points and most of the scrapers and burins were made from blades, while some were made from preparation flakes. Blades of different sizes were chosen as blanks for the tools: small, thin blades for points, and larger, thicker blades for scrapers and burins (Figs. 5, 6; Table 3). Blades with both triangular and trapezoid cross-sections were used to produce all types of curated tools.

In total, 39 points from the Laukskola assemblage were classified, all of which are small tanged points, Chwalibogowice points, which are characteristic of Swidry assemblages. The points vary in size, with a mean length/width/thickness of 39/13/four millimetres, and a mean weight of 1.6 grams (Fig. 6; Table 3). The majority (79%) display surface ventral retouch on the tang, and about 50% show lateral retouch in the tip. The points are made from blades with triangular (53%) and trapezoid (47%) cross-sections, demonstrating that blades of different shapes and from various parts of the production were used as blanks.

Core management and maintenance, and percussion technique

The analysis shows that a single concept for standardised blade production was used in all the six find concentrations at Laukskola, comprising one-sided production on cores with two opposed platforms. The cores display few production mistakes, indicating skilled production. This is supported by the presence of only 3% hinged blades. The five cores found at Laukskola are exhausted, hence the selection of raw material volumes cannot be identified, and information about the initial core preparation is limited. However, the preserved core remnants show elongated volumes with a narrow, curved front (both carènage and cintrage, cf. Inizan et al. 1999, p. 136; Dziewanowski 2006) (Fig. 4). Striking platforms are generally smooth, and formed by a single blow to the front. This operation detached a large flake or tablet, slightly plunging towards the back of the core, and creating an acute angle between the front and the platform(s). This is illustrated by the refitting in Fig. 4 (2), comprising a core, a platform tablet at one end, and a plunged blade struck from the opposite end. A specific primary preparation was observed on two of the cores, producing a triangular cross-section with a vertical centred ridge at the back. The ridge is slightly crested on both these cores.

Almost 6% (15) of the blades from the six concentrations are crested, indicating this was a common strategy for secondary core preparation. Further, so-called side blades making the flaking surface narrower (Grużdź et al. 2012, p. 250) are present, and thorough trimming and/or abrasion of platform edges characterises both cores and blades (cf. blade preparation in Table 2). Several large plunged blades demonstrate rejuvenation of the front by correction of hinges.

Fig. 4. Examples of blades (1) and cores (2) from Salaspils Laukskola (photograph by Inger M. Berg-Hansen).

Table 2. Descriptive statistics of essential blade attributes from Salaspils Laukskola (six concentrations). The sample comprises complete blades and blade fragments (n=225) (*Length is only measured for complete blades.)

Blade attributes	Concentration I	Concentration II	Concentration III	Concentration IV	Concentration V	Concentration VI	Sum all concentrations							
Length* (mm)	mm		mm		mm		mm		mm		mm		mm	
Mean	54		58		48		45		50		56		53	
Median	56		58		41		47		49		53		53	
Max	74		88		80		56		79		82		88	
Min	32		37		21		34		27		36		21	
Sum 100% (n=)	21		19		9		11		25		26		111	
Width (mm)														
Mean	17		17		17		14		16		15		16	
Median	17		17		16		13		16		15		16	
Max	28		28		31		29		30		27		31	
Min	8		10		6		8		6		9		6	
Sum 100% (n=)	34		29		26		30		51		55		225	
Thickness (mm)														
Mean	6		6		5		5		5		5		5	
Median	6		5		5		5		5		5		5	
Max	16		9		9		8		8		9		16	
Min	3		3		3		2		3		3		2	
Sum 100% (n=)	34		29		26		30		51		55		225	
Interior platform angle (degrees)	Degrees		Degrees		Degrees		Degrees		Degrees		Degrees		Degrees	
Mean	73.9		78.2		76.5		78.8		78.3		76.8		77.2	
Median	74.5		80.0		76.5		80.0		80.0		78.0		80.0	
Sum 100% (n=)	28		26		24		29		46		48		201	
Bulb morphology (%)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No	1	3	0	0	1	4	1	3	4	8	5	10	12	6
Yes	27	84	25	93	22	92	25	86	39	81	41	80	179	85
Double	4	13	2	7	1	4	3	10	5	10	5	10	20	9
Sum 100% (n=)	32		27		24		29		48		51		211	
Lip formation (%)														
No	7	22	2	7	0	0	3	10	4	9	4	8	20	10
Yes	25	78	25	93	24	100	26	90	43	91	47	92	190	90
Sum 100% (n=)	32		27		24		29		47		51		210	
Conus formation (%)														
None	17	53	20	71	12	50	21	72	25	51	32	62	127	59
Ring crack on butt	0	0	1	4	0	0	0	0	0	0	0	0	1	0
Ventral proximal fissures	6	19	3	11	3	13	3	10	11	22	6	12	32	15
Detached bulb	9	28	4	14	9	38	5	17	13	27	14	27	54	25
Sum 100% (n=)	32		28		24		29		49		52		214	
Butt morphology (%)														
Large	6	19	3	11	5	21	3	10	10	20	10	19	37	17
Thin oval	15	47	5	18	9	38	7	23	6	12	11	21	53	25
Small and thick	3	9	9	32	4	17	10	33	24	49	15	29	65	30
Small	5	16	9	32	6	25	9	30	5	10	13	25	47	22
Punctiformed	1	3	1	4	0	0	0	0	2	4	0	0	4	2
Broken	2	6	1	4	0	0	1	3	2	4	3	6	9	4
Sum 100% (n=)	32		28		24		30		49		52		215	
Butt preparation (%)														
Smooth	25	78	27	96	20	83	28	93	44	90	46	88	190	88
Two facets	2	6	0	0	2	8	0	0	0	0	3	6	7	3

Blade attributes	Concentration I	Concentration II	Concentration III	Concentration IV	Concentration V	Concentration VI	Sum all concentrations							
Multi-facetted	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concave	3	9	0	0	2	8	0	0	2	4	0	0	7	3
Cortex	0	0	0	0	0	0	1	3	1	2	0	0	2	1
Broken	2	6	1	4	0	0	1	3	2	4	3	6	9	4
Edge faceting	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum 100% (n=)	32		28		24		30		49		52		215	
Blade preparation (%)														
Cortex	0	0	0	0	0	0	1	3	0	0	0	0	1	0
Unprepared	3	9	5	18	4	17	2	7	8	16	6	12	28	13
Trimming	8	25	7	25	3	13	8	27	16	33	17	33	59	27
Trimming and abrasion	11	34	11	39	12	50	11	37	12	24	12	19	69	32
Abrasion	10	31	5	18	5	21	8	27	13	27	17	33	58	27
Sum 100% (n=)	32		28		24		30		49		52		215	
Regularity (%)														
Irregular	6	19	8	29	4	17	5	20	13	28	8	15	44	21
Regular	24	75	18	64	16	70	17	68	26	57	39	74	140	68
Very regular	2	6	2	7	3	13	3	12	7	15	6	11	23	11
Sum 100% (n=)	32		28		23		25		46		53		207	
Curvature (%)														
Straight	22	79	22	92	12	92	13	93	29	78	43	88	141	85
Distal	1	4	2	8	0	0	0	0	0	0	0	0	3	2
Even	5	18	0	0	1	8	1	7	8	22	6	12	21	13
Proximal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum 100% (n=)	28		24		13		14		37		49		165	
Cross section (%)														
Triangular	12	36	8	27	7	27	7	23	12	24	16	29	62	27
Trapizoidal	22	64	21	73	19	73	23	77	39	76	39	71	163	73
Sum 100% (n=)	34		29		26		30		51		55		225	
Termination (%)														
Straight, transverse	7	33	15	83	7	88	6	55	17	68	21	75	80	72
Pointed	14	67	3	17	1	13	5	45	8	32	7	25	31	28
Sum 100% (n=)	21		18		8		11		25		28		111	
Fragmentation (%)														
Complete	21	62	17	59	9	35	11	37	25	49	26	47	109	48
Fragment	13	38	12	41	17	65	19	63	26	51	29	53	116	52
Sum 100% (n=)	34		29		26		30		51		55		225	

All the technological features described above correspond to the core preparation strategy found in Swidry assemblages, thereby confirming that the same production methods and concepts were used at the Laukskola site (compare, e.g. Fiedorczuk 1995; 2006, Fig. 7: 4; Sulgostowska 1999; Zaliznyak 1999b; Dziewanowski 2006; Migal 2007; Schild et al. 2011, Figs. 10.87:1, 10.138, 10.151; Sobkowiak-Tabaka 2011; 2016; Grużdź et al. 2012; Galiński, Sulgostowska 2013; Grużdź 2018). A possible difference from the Swidry tradition is, as mentioned above, that specialised production of preferential blades (Migal 2007) was not observed in the Laukskola assemblage.

Also, in accordance with the Swidry tradition, the attribute analysis of the blades indicates that a direct percussion technique with a soft stone (medium hard) or soft organic hammer was used for blade production (Fig. 4) (Madsen 1996; Dziewanowski 2006; Sørensen 2006b; Migal 2007; Grużdź et al. 2012; Damlien 2015; Grużdź 2018). The large portion of regular blades at Laukskola demonstrates this. The six concentrations comprise between 57% and 75% regular blades, and otherwise mostly irregular blades, while very regular blades are present only in low numbers. Further, the interior platform angle is generally sharp, at circa 80º. The blades show a present bulb and lip, while a detached bulb occurs in 25% of the assemblage, varying between the concentrations by 14% to 38 % (Table 2).

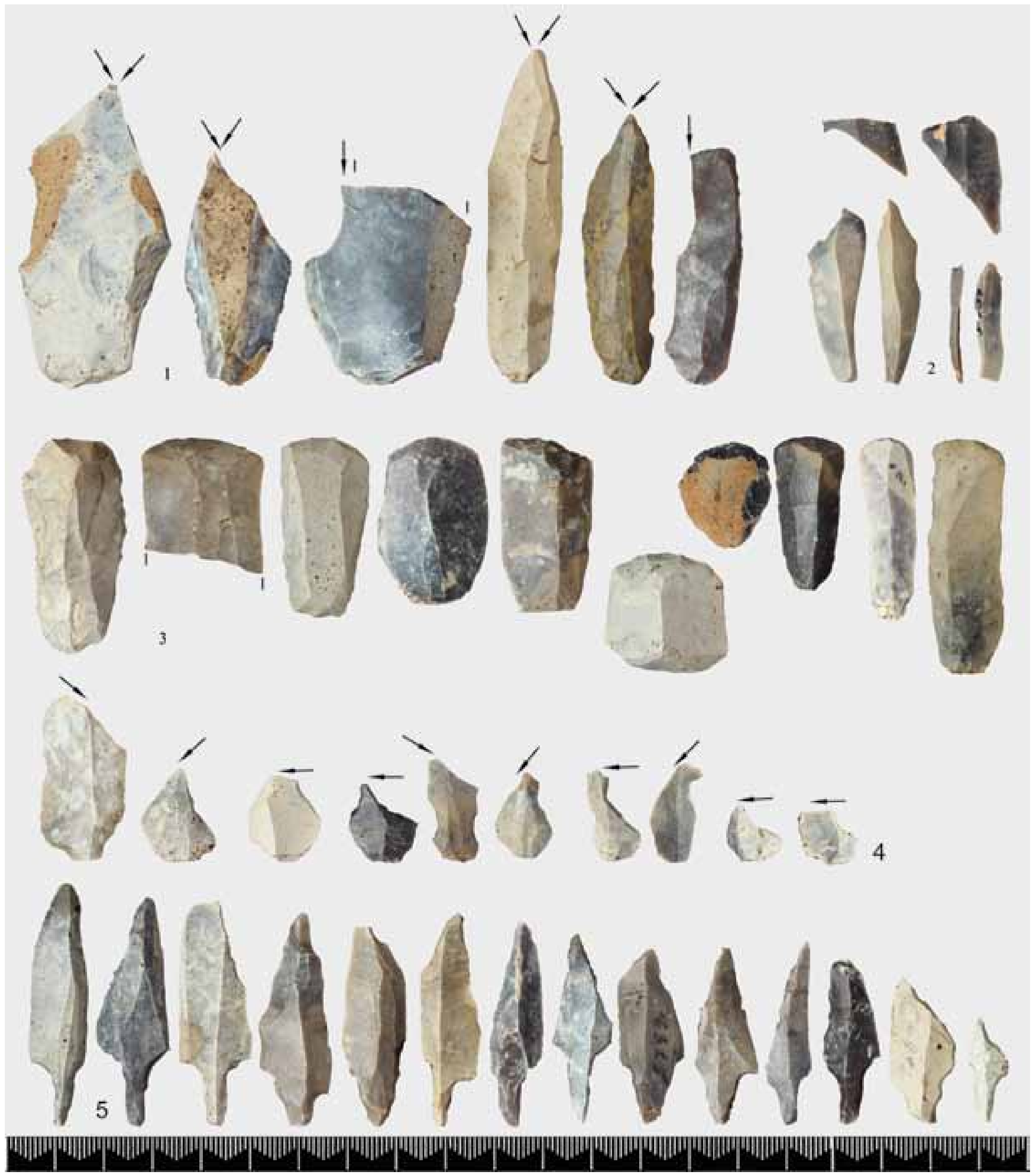

Fig. 5. Examples of tools and production waste from Salaspils Laukskola: burins (1), burin spalls (2), scrapers (3), microburins (4), and points (5) (photograph by Inger M. Berg-Hansen).

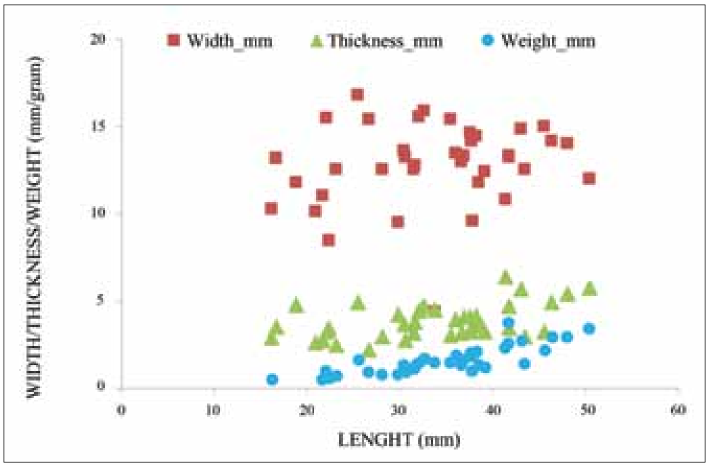

Fig. 6. Point size distribution, all analysed points from six concentrations at Salaspils Laukskola, including point fragments (compare Table 3) (n=38).

Table 3. Point measurements in the Salaspils Laukskola assemblage: length/width/thickness/weight (n=38). (*Length is measured for complete points, the maximum length for incomplete points is given in brackets.)

Point measurements	Concentration I	Concentration II	Concentration III	Concentration IV	Concentration V	Concentration VI	Sum all concentrations
Length* (mm)							
Mean	43 (36)	- (30)	43 (39)	42 (38)	34 (29)	32 (30)	39 (33)
Median	43 (43)	- (32)	42 (40)	41 (38)	37 (23)	32 (30)	39 (35)
Max	43 (46)	- (32)	50 (50)	46 (46)	39 (48)	34 (39)	50 (50)
Min	43 (16)	- (26)	37 (27)	38 (32)	22 (17)	30 (22)	22 (16)
Sum 100% (n=)	2 (5)	0 (3)	3 (6)	3 (7)	4 (9)	2 (8)	14 (38)
Width (mm)							
Mean	13	15	14	13	12	12	13
Median	13	16	13	13	13	12	13
Max	15	17	15	15	15	16	17
Min	10	13	12	10	8	4	4
Sum 100% (n=)	5	3	6	7	9	8	38
Thickness (mm)							
Mean	4	4	4	4	4	4	4
Median	3	4	4	4	4	4	4
Max	6	5	6	6	5	5	6
Min	3	3	2	3	2	3	2
Sum 100% (n=)	5	3	6	7	9	8	38
Weight (gram)							
Mean	1,5	1,4	2,4	1,8	1,6	1,1	1,6
Median	1,4	1,5	2,2	1,5	1,6	1,2	1,5
Max	2,7	1,6	3,8	2,9	2,9	1,7	3,8
Min	0,5	1,1	0,9	1	0,6	0,5	0,5
Sum 100% (n=)	5	3	6	7	6	8	35

*Length is measured for complete points, - maximum length for incomplete points are given in brackets.

Chaîne opératoire

The chaîne opératoire and dynamic-technological analysis show that several stages of lithic production were performed at Salaspils Laukskola, which documents that both blades and tools were produced at the site (Table 4). When comparing the six concentrations, some variations in the composition of artefact types were observed (Table 4). However, when comparing the representation of the different parts of the production process, there are fewer differences. Characteristic of all concentrations is the low frequency of waste from the pre-production stages. Unprepared blocks and waste from primary core preparation are generally missing, although present in very low numbers in the form of large cortex flakes in concentrations IV and V, and a block of raw material in concentration II, indicating that primary preparation in some cases was carried out at the site (Fig. 7; Table 6). However, the scarce finds of these artefact types do not alter the general tendency, demonstrating that the primary preparation of cores was generally performed outside the Laukskola site, while pre-prepared cores were brought to the site.

On the other hand, waste from secondary core preparation, primary and secondary blade production, non-diagnostic waste, and tool production, are present in all six concentrations. A limited amount of waste from the secondary preparation of cores, including trimming flakes from different raw materials, is generally present. Further, there are blades from different parts of the production process, including blades from both primary and secondary production (Fig. 4: 1; Table 2; Sørensen 2006b; 2013). This demonstrates that blade production was carried out in all six concentrations. In addition, blades, tools and preparation waste in several flint raw materials that is not represented by cores were also identified in the assemblage, signifying that some cores were exploited at the Laukskola site before they were removed, and probably taken somewhere else for further exploitation (Table 6).

Curated tools are also present in all six concentrations, including all tool types, i.e. points, scrapers and burins. Further, both simple and twin microburins and burin spalls are represented (Tables 1 & 4). The presence of microburins and burin spalls confirms the production of points and burins, and the rejuvenation of burins at the site (Fig. 5). The occurrence of both simple and twin microburins, in the assemblage demonstrates the use of variable microburins techniques in the production of points. Many tools show macroscopic use-wear, and a minimum of ten points have impact fractures indicating use as projectiles, as well as signifying different activities, including retooling.

Table 4. The steps in the chaîne opératoire represented in concentrations I-VI from Salaspils Laukskola (method based on Schild 1980; Eriksen 2000; Sørensen 2006b; 2013).

Step	Part of production process	Artefact category present	I	II	III	IV	V	VI
1	Primary core preparation	Large cortex flakes	-	-	-	X	X	-
		Prepared and discarded fragments and blocks	-	X	-	-	-	-
		Prepared, unexploited cores	-	-	-	-	-	-
2	Secondary core preparation	Diverse cortex flakes	-	X	X	X	-	-
		Core preparation waste	X	X	X	X	X	X
		Trimming flakes	X	X	X	X	X	X
3a	Primary core exploitation	Crested blades with cortex	X	-	-	-	-	X
		Blades with cortex	X	X	X	X	X	X
3b	Secondary core exploitation	Exploited or exhausted blade cores	-	X	-	-	X	X
		Core fragments	-	X	-	X	X	X
		Platform flakes and/or tablets	-	X	-	-	-	-
		Crested blades without cortex	X	X	X	X	-	X
		Blades without cortex and with less than 50 % dorsal traces of core preparation	X	X	X	X	X	X
4	Tools and tool production waste	Tools	X	X	X	X	X	X
		Microburins	X	X	X	X	X	X
		Burin spalls	X	X	X	X	X	X
-	Non-diagnostic waste	Undetermined flakes/fragments	X	X	X	X	X	X
		Small preparation flakes	X	X	X	X	X	X

Table 5. Occurrences of flint types in concentrations I-VI.

The sum classified refers only to the number of artefacts where raw material could be identified by attribute analysis from each concentration. The relative amount of each raw material in the table corresponds to the distribution of different flint types observed during the dynamic-technological reading of the complete assemblage. Flint types: 1) probably largely cretaceous flint, generally with heavy white patina; 2) cretaceous flint, dark grey/brown, translucent; 3) cretaceous flint, light grey/yellow, opaque; 4) presumed chocolate flint, brown, translucent; 5) unknown flint type, light grey with white dots, opaque. (*Only a few artefacts were observed, none were classified.)

Collection	**Raw materials**	**Sum catalogued**				
	1	2	3	4	5	
I	26	12	2	X*	-	40
II	14	19	3	5	6	47
III	20	12	1	5	2	40
IV	35	5	4	X*	-	44
V	47	13	5	X*	1	66
VI	71	1	-	-	-	72
Sum collection I-VI:	213	62	15	10	9	309

Raw material procurement and use

The main part of the Laukskola assemblage is characterised by a heavy patina. A certain determination of flint types is therefore impossible (type No 1), although at least four different high-quality flint raw materials were identified: two cretaceous flint types (Nos 2 and 3), one probable chocolate flint (No 4) and one undetermined type (No 5) (Fig. 7; Table 5).

The main portion of the assemblage is most likely made of cretaceous flint of good knapping quality from several cores (flint type No 1), as are flint type Nos 2 and 3, with the nearest known source in Lithuania, Poland and Belarus (Sulgostowska 2006; Baltrūnas et al. 2007; Johanson et al. 2015). These flint types are represented in all concentrations, as well as by most artefact types, and all steps of the chaîne opératoire (Tables 5 & 6).

A visual inspection supports previous suggestions that some artefacts are made from chocolate flint (flint type No 4) originating from the well-known source in central Poland (Sulgostowska 1997; 2002; 2016; Schild et al. 2011), although a geological analysis should be performed to confirm this. This flint type is present in five concentrations, represented by core preparation waste without cortex, i.e. from the secondary preparation, and blades without cortex from the secondary exploitation, in addition to tools (points, scrapers and burins) and tool production waste (microburins and burin spalls) (see also Sulgostowska 2002, p. 13). Hence, the primary steps in the chaîne opératoire from the exploitation of this raw material, as well as cores, is lacking at the site, indicating both the import of pre-prepared core(s), and the removal of core(s) from the site. Still, the variation of artefact types, blades, preparation flakes, different tools and microburins and burin spalls from this flint type demonstrates on-site (secondary) preparation of at least one core, as well as blade and tool production (Fig. 7; Table 6).

Flint type No 5 differs from the others by its matte and opaque appearance, and by being present in only a few artefacts. The source of this flint is unknown. However, based on visual inspection, it displays similarities with the Silurian flint that is found as small beach pebbles along the Latvian west coast, and which was exploited for tool production in the Mesolithic (Baltrūnas et al. 2007; Johanson et al. 2015; Damlien et al. 2018). Hence, a so far unidentified local or regional source is possible. This flint type is present in three concentrations. While only present in a low amount, it is represented by artefacts from all steps of the chaîne opératoire. Although lacking cores, an unprepared block, blades and waste are present in concentration II, a blade fragment in concentration V, and two tanged points in concentration III (Tables 5 & 6).

The raw material economy shows similar patterns between the concentrations, although the white patina hampers a detailed picture, and our data does not support complete information about the distribution. The raw material types seem to be unevenly distributed between the concentrations. Still, the various types of artefact demonstrate blade and tool production at the site in all raw materials. Even the less frequent lithic raw materials are present in several of the concentrations. Further, the distribution of artefact types and the chaîne opératoire steps reveal some variation between the raw material types (Table 6).

Table 6. The steps in the chaîne opératoire that is present in the various raw materials at Salaspils Laukskola (based on Schild 1980; Eriksen 2000; Sørensen 2006b; 2013).

Step	**Part of production process**	**Artefact category present**	**Raw material types**				
			1	2	3	4	5
1	Primary core preparation	Large cortex flakes	x	x	x	-	-
		Prepared and discarded fragments and blocks	-	-	-	-	x
		Prepared, unexploited cores	-	-	-	-	-
2	Secondary core preparation	Diverse cortex flakes	x	x	x	-	-
		Core preparation waste	x	x	x	x	x
		Trimming flakes	x	x	x	x	-
3a	Primary core exploitation	Crested blades with cortex	x	-	-	-	-
		Blades with cortex	x	x	x	-	x
3b	Secondary core exploitation	Exploited or exhausted blade cores	x	x	-	-	-
		Core fragments	-	x	-	-	-
		Platform flakes and/or tablets	x	x	-	-	-
		Crested blades without cortex	x	x	x	-	-
		Blades without cortex and with less than 50 % dorsal traces of core preparation	x	x	x	x	x
4	Tools and tool production waste	Tools	x	x	x	x	x
		Microburins	x	x	x	x	-
		Burin spalls	x	x	-	x	-
-	Non-diagnostic waste	Undetermined flakes/fragments	x	x	x	x	x
		Small preparation flakes	x	x	x	x	x

According to present knowledge, none of the flint types are found in geological deposits in Latvia, possibly apart from flint type No 5 (Baltrūnas et al. 2007; Johanson et al. 2015). The generally small amount of primary preparation waste and the import of pre-prepared cores at the Laukskola site should most likely be seen in relation to the use of non-local lithic raw materials. By bringing with them prepared cores, the people at Laukskola reduced the weight load, and at the same time ensured access to raw material of suitable quality. It has previously been suggested that ready-made blades and tools were imported to Laukskola, and that only some rejuvenation of tools was performed at the site (Zagorska 1996; 2012, p. 106; Zagorska, Winiarska-Kabacinska 2012, p. 17), while Sulgostowska (1997; 2002) concludes that both blades and tools were produced from non-local flint at the site. The Laukskola assemblage contains a relatively large portion of tools compared to the amount of waste material (Sulgostowska 1997; 2002; Zagorska, Winiarska-Kabacinska 2012, pp. 10, 15). This situation could indeed be the result of the import of prepared blades and tools. However, we suggest that this would largely be a consequence of the primary preparation of cores being mainly executed before they were brought to the site, resulting in the absence of waste material from this stage in the production process. Combined with a highly skilled production (cf. above), with limited need for rejuvenation and correction of the cores, this would reduce the amount of preparation waste left at the site.

Technological organisation, activities and occupation at Salaspils Laukskola

Our analysis allows for a renewed review of the six concentrations of stone material at Salaspils Laukskola. Although only parts of the material were subject to detailed analysis, the dynamic-technological reading and assessment of the complete assemblage revealed which artefact types and raw material types are present in each concentration (cf. above). Examination shows that all concentrations display the same blade concept, and the use of the same method and percussion technique, as well as similar tool types (cf. above). Further, a corresponding raw material economy is documented, with the same variation in the frequency of each flint type, and in the presence of steps in the chaîne opératoire. Hence, there are no distinct differences in technological organisation between the six concentrations. Based on this, we can assume that the material from the concentrations reflect corresponding situations and activities. However, we are unable to decide whether it was deposited simultaneously, or if the concentrations represent repeated visits over time from the same

Fig. 7. Examples of raw materials from Salaspils Laukskola: block of raw material no 5 (1), tools and waste in assumed chocolate flint (2), general production waste from the primary and secondary part of preparation and production in various flint types (3) (photograph by Inger M. Berg-Hansen).

group, although the use of the very same raw materials, e.g. the assumed chocolate flint (No 4) and the flint of unknown origin (No 5), in several concentrations indicates concurrency.

The technological organisation provides various indications of what kind of activities were performed at the site, and gives us some idea about the character of the Laukskola site, as well as the length of occupation. The tool kits consisting of points, scrapers and burins suggest the hunting and processing of game as central on-site and off-site activities (compare Zagorska, Winiarska-Kabacinska 2012 for a similar argument). In addition to blank and tool production, evidence of re-tooling and rejuvenation of tools is documented. Our results show that a significant number of points display impact fractures, supporting the assumption that they were used as projectiles, and that the shafts were brought back to the site for re-tooling.

Further, lithic technology can be used as a basis for discussing the nature of the Laukskola settlement. Models for interpreting the character of the site and the length of occupation based on technological organisation have been argued by several authors (e.g. Larson, Kornfeld 1997; Inizan et al. 1999, Fig. 3; Knell 2012; Damlien 2016). Larson and Kornfeld (1997, p. 13, Table 2) describe different scenarios affecting the technological organisation mirrored in lithic assemblages. The scenarios include variations in the time available for chipped stone production, which is connected to the duration of occupation, and the predictability of future events. The model presupposes easy access to lithic raw materials; however, it is our view that it has a general relevance to how we can interpret tendencies in lithic technology. The basis for this is that variations in the presence of steps in the chaîne opératoire (artefact types) in an assemblage reflect variations in the raw material economy, i.e. strategies in the procurement and exploitation of stone raw materials. The model in Larson and Kornfeld (1997, p. 13) demonstrates that in a situation with plenty of time available for tool production, and a predictable need for specific tools in the future, the complete production process should be expected to be present in the assemblage, along with examples of partial production sequences and imported blanks and tools. This is as opposed to situations where the time is short and the future is unknown; then the lithic assemblage will be characterised by partial production sequences, concentrating on the production and maintenance of tools, as well as the common occurrence of imported blanks and tools.

At Laukskola, three technological strategies can be distinguished. The main technological strategy that characterises most of the finds (raw material Nos 1-3) comprises the transport of completely or partially prepared cores to a site where the production of blanks and several types of curated tools were carried out. Cores, blanks, waste and tools were discarded, and tools were rejuvenated. The primary preparation of cores was mainly performed outside the site, although some examples of such preparation demonstrate the occasional presence of the complete chaîne opératoire. A second strategy represented by raw material No 5 also involves the complete chaîne opératoire, and even includes the import of an unprepared block to the site, as well as discard of the block. However, the core(s) from this raw material are missing in the assemblage, signifying transportation from the site. The third strategy identified by raw material No 4 comprises the production sequence from blank production to the discard of blanks and curated tools, while pre-prepared core(s) were brought to the site and later transported away from the site.

The Laukskola assemblage encompasses a relatively limited number of lithic artefacts, which when isolated could be seen as an indication of a short-time occupation. However, the site was heavily disturbed by several post-depositional activities: an Iron Age site, a Medieval graveyard, and ploughing in historical times. Furthermore, the topsoil was removed by tractor before excavation, which probably resulted in the removal of a substantial number of artefacts. The excavation documented a number of stray finds scattered in a larger area, confirming the disturbance. Besides this, the technological organisation paints another picture. Based on the model outlined above (Larson, Kornfeld 1997) the occupation at Laukskola can be characterised as more than a short stop or a series of stops. On the contrary, the evidence shows an occupation of some duration, including opportunities to plan for and carry out multiple activities (see also Zagorska, Winiarska-Kabacinska, 2012, p. 11, for similar conclusions based on use-wear indicating scraping of dry hides).

Building on the technological organisation, tool types and variation in activities, we can therefore outline the most likely interpretation of the Laukskola site and the six concentrations of chipped stone as an occupation by a group comprising several social units and using several dwellings simultaneously, although revisits to the Laukskola site are also likely. Further, this was probably an occupation of some duration, including a variety of activities such as tool production and retooling, as well as hunting and hide preparation. Simultaneously, variations in technological organisation and the raw material economy demonstrate a mobile adaptation. As is noted above, the little evidence of primary stages in the Laukskola assemblage can probably be explained by limitations in raw material access. This implies a need for lithic raw material transport over long distances, which is documented in the presence of exotic raw materials and the moving of cores and raw materials both into and away from the site.

Traces in the larger landscape

The Salaspils Laukskola site has since its discovery remained the main evidence for Final Palaeolithic presence in Latvia, but it is not unique (Kalniņš 2018). In addition to the Salaspils Laukskola site, five small collections from Latvia are also included in our study: Sēlpils, Kentes pilskalns, Ikšķiles Elkšņi, Skrīveru Lielrutuli and Mūkukalns (Fig. 1; Table 1). They all represent stray finds, or finds from the excavation of Iron Age sites in the Daugava Valley (Zagorska 1993; 1996; 1999; 2012; Berg-Hansen et al. 2019). Each assemblage comprises just a few artefacts, and generally lacks preparation waste and a larger number of blades. Our attribute analyses of these assemblages therefore only include cores and points (Table 1).

All assemblages are seen as being affiliated to the Swidry tradition by the presence of willow leaf points, and technological characteristics such as blade production on one-sided dual-platform cores made from high-quality flint. The blade concept seems to be similar to Laukskola, and blades were used as blanks to make willow leaf points, and tools such as scrapers and burins. The various technological features thereby suggest a date in Final Palaeolithic similar to Salaspils Laukskola, as well as linking the assemblages to the Swidry tradition. However, apart from belonging to this tradition, we have no possibility of making a more precise dating of these finds. The relation to the Laukskola site is therefore unknown. Still, the five small collections are all found inland, with a varying distance to the contemporaneous Baltic Sea coast. In addition to documenting that repeated visits to the region took place in the Final Palaeolithic, these finds also demonstrate the exploration and exploitation of various landscapes, from the Baltic coast and far into the inland.

The northern fringe of the Swidry tradition

Our analysis has demonstrated great similarities between the Salaspils Laukskola assemblage and the Swidry technological tradition, concerning not only the tool kit and tool morphology, but also the Swidry blade production concept and method as described by several authors (e.g. Sulgostowska 1999; Dziewanowski 2006; Migal, 2007; Galiński, Sulgostowska 2013; Grużdź et al. 2012; Grużdź 2018). Previous research has emphasised the high degree of standardisation of this blade production concept and method, as well as the need for protracted training, including guidance from a skilled person to be able to master this production (Fiedorczuk 1995; Dziewanowski 2006; Migal 2007; Sobkowiak-Tabaka 2016, p. 204; Grużdź 2018). Our analysis of the Salaspils Laukskola assemblage displayed exhausted cores with few technical mistakes, as well as examples of precise corrections of knapping mistakes and a blade population showing uniform characteristics. This reveals that the level of skill and standardisation in Laukskola production is on par with the skills that are generally recognised in Swidry assemblages.

Building on the theory concerning the significance of the transmission of cultural knowledge in the execution of craft traditions, this demonstrates a strong link between the Laukskola site and the Swidry core area. In the French-Scandinavian technological approach, it is argued that the performance of a handicraft, such as the production of stone tools, builds on distinct concepts and methods that vary between technological traditions. This makes it possible to recognise technological traditions in archaeological assemblages by identifying and comparing technological concepts and methods (e.g. Shennan 2001; Schlanger 2006; Sørensen 2006b; Tostevin 2007; Apel 2008; Perdaen et al. 2008; Stout et al. 2010; Darmark 2012; Pelegrin 2012; Weber 2012; Jordan 2015; Damlien 2016; Berg-Hansen 2017a; 2018). The background for this is that technological knowledge is generally transmitted from one person to another through social learning, entailing theoretical knowledge and physical training, together with practical guidance from someone who has mastered the technology (e.g. Pelegrin 1990; Pigeot 1990; Sørensen 2006a; Apel 2008). In this way, direct and continued interaction and communication are vital in the transmission and maintenance of cultural knowledge (e.g. Mauss 1973 [1935]; Cavalli-Sforza 1986; Guglielmino et al. 1995; Henrich 2004; Tostevin 2007; Jordan 2015). In the case of handicrafts, transmission involves both cognitive and practical knowledge, which includes shared memories of operation sequences and the skill to use the proper gestures in working the tools, as well as social and cultural practices involved in the execution (e.g. Pelegrin 1990; Lemonnier 1992; Leroi-Gourhan 1993 [1964], pp. 253, 258–259; Dobres 2000). On the other hand, the lack of such interaction and contact will make the knowledge difficult to maintain over time, and result in a loss of tradition, and ultimately cultural change (Durkheim 1989 [1893], pp. 229-242; Berg-Hansen 2017a; 2018). Therefore, the transmission of culture-specific knowledge reflects social relations, which makes it possible to track social processes on a societal level in the way handicrafts are performed. On this basis, the similarities in production concepts and methods demonstrate not only a close cultural affiliation between the Salaspils Laukskola assemblage and the Swidry find group, but regular contact between the areas. People visiting Laukskola had fully mastered the Swidry blade production concept, which implies that they had learned the skill through direct social interaction and communication with the core area of the Swidry tradition (Berg-Hansen et al. 2019). They were thus part of the Swidry stone craft tradition. Only through such contact within a social network would the transmission and maintenance of the technological knowledge have been possible.

Supporting this argument is the origin of the lithic raw material that was exploited at Laukskola. The main portion of the raw material was brought to Latvia from areas far away, either by the people at Laukskola themselves, or through exchange networks. The closest known source of cretaceous flint (flint type Nos 1-3) is in southern Lithuania, more than 200 kilometres to the south, and the probable chocolate flint is found about 600 kilometres to the south in central Poland (Sulgostowska 1997; 2002). The presence of these raw materials at Laukskola suggests some form of contact with the areas of origin of these lithic raw materials. Furthermore, the techno-economic organisation of the assemblage, and the concepts we can read from this, presents us with information about technological strategies and social practices in a mobile society. When transporting lithic raw materials over such a distance, one would expect a strategy involving pre-preparing the cores, or even only carrying tool blanks or ready-made tools to reduce the transport weight. However, our analysis has produced evidence our analysis has produced evidence that blank and tool production, and in some cases initial core preparation, was performed at Laukskola, while at the same time it is likely that some import to the site of ready-made blades and tools took place. We interpret this as a manner to counteract uncertainty or deficiency in raw material availability (Knell 2012; Damlien 2016, e.g. p. 399; Berg-Hansen 2017a, pp.168-173). Based on this, we can assume either that the people at Laukskola lacked knowledge of the resource situation, or that they already knew that there was a deficiency of high-quality flint in the area. The fact that several cores are missing in the assemblage supports this, demonstrating a non-wasteful raw material strategy, where it was important to ensure the efficient exploitation of a valuable lithic resource. Further, this also suggests that the transport and the weight of the lithic raw material was not a problem, which points to a possible use of some form of means of transport, like boats or sledges.

In the Swidry tradition, the distribution of lithic raw materials is proposed to have been characterised by two different strategies; one linked to seasonal mobility, and the other to exchange networks (Sulgostowska 1997; 2002; Galiński, Sulgostowska 2013). Settlement sites and specialised workshops have been identified, and several authors have suggested that ready-made blades and tools were distributed from the latter in large numbers (Fiedorczuk 1995; Sulgostowska 2006; Schild et al. 2011, pp. 213-223, 397). The waste from the production of blanks and tools at the Laukskola site is therefore of special significance, suggesting that this formed an integral part of the daily activities. By bringing the lithic raw material to the site, seemingly over long distances, the supply was ensured; suggesting, however, preparations for a period cut off from the possibility to replenish. Regardless of whether access was guaranteed by the people at Laukskola themselves transporting the raw materials, or whether it was acquired through exchange networks, maintaining contact with the social network in the south would be crucial (Whallon 2006; Berg-Hansen 2017a; 2018). This implies a highly mobile life, travelling long distances, probably as part of a seasonal or annual mobility system. The finds in Latvia from this period, in addition to Laukskola, confirm repeated visits to the region. The movement from the coast where the Laukskola site was located, along the River Daugava inland, where several finds are known, probably represents the early stages of landscape enculturation, where the large rivers offered good opportunities for transport and navigation (Zagorska 2012). Although the traces of people exploring the landscape in Latvia in the Early Post-Glacial are still few and scattered, possibly representing fringes of the Swidry area, they demonstrate a close affiliation and connection with this tradition.

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ŠIAURINIS SVIDRŲ KULTŪROS TECHNOLOGINĖS TRADICIJOS PAKRAŠTYS – SALASPILIO LAUKSKOLA

INGER M. BERG-HANSEN, HEGE DAMLIEN, ILGA ZAGORSKA

Santrauka

Ankstyviausios žmonių gyvenvietės Latvijoje atsirado pačioje vėlyvojo ledynmečio pabaigoje. Vieni svarbiausių to įrodymų aptikti 1973–1974 m. tyrinėtoje Salaspilio Laukskolos gyvenvietėje. Gyvenvietė surasta ant Dauguvos upės kranto, prie buvusių jos žiočių, apie 20 km į pietryčius nuo dabartinio Rygos miesto (1 pav.). Ši vieta buvo apgyventa iškart po upės terasos susiformavimo, o tai galėjo įvykti paskutinio driaso viduryje, apie 10 500 cal BC. Laukskolos teritorijoje buvo nustatytos šešios titnago radinių koncentracijos, aiškinamos kaip atskirų gyvenviečių struktūros pėdsakai. Titnago koncentracijos buvo 5 x 6 m pločio (2 pav.). Laukskolos rinkinyje yra 2 710 skaldytų akmenų, įskaitant įrankius ir gamybos atliekas. Titnago radinių koncentracija buvo susieta su Svidrų kultūros tradicija, kurios gyvavimo laikas čia tęsėsi iki pirmosios preborealio pusės, maždaug iki 9 000 cal BC. Kartu su to paties laikotarpio kaulo ir rago artefaktais ši šiaurinė Svidrų kultūros gyvenvietė įsiterpia į platesnį kontekstą Europos medžiotojų-rinkėjų, kurie atvyko į dab. Latvijos teritoriją iš pietų.

Ankstesniuose tyrimuose daugiausia dėmesio buvo skiriama šio rinkinio tipologiniams aspektams ir uolienų žaliavų naudojimui nagrinėti. Tačiau remiantis platesne technologine perspektyva, pagrįsta chaîne opératoire metodu, mūsų tyrime gilinamasi į apie Svidrų kultūros uolienų apdirbimo tradiciją. Pristatoma nauja Salaspilio Laukskolos akmens apdirbimo technologija, penkių smulkių uolienų rinkinių iš Latvijos technologinė analizė ir aprašymas. Rezultatai suteikia duomenų apie čia gyvenusių žmonių veiklą ir Laukskolos okupacijos trukmę bei pobūdį, papildant informaciją apie bendruomenių judumo modelius ir šio laikotarpio komunikaciją. Tai leidžia atnaujinti duomenis apie vieną iš geriausiai žinomų Latvijos paleolito gyvenviečių ir jos ryšį su gretimomis Šiaurės rytų Europos teritorijomis.

Apibūdinant akmens technologijos organizavimą, įskaitant įrankių ruošinių ir įrankių gamybos koncepcijas, metodus bei žaliavų ekonomiką, darbe išsamiai analizuojama dinamiškos technologinės klasifikacijos, chaîne opératoire ir atrinkti artefaktai.

Analizė parodė Salaspilio Laukskolos ir Svidrų kultūros technologinės tradicijos, susijusios ne tik su įrankių rinkiniu ir morfologija, bet ir su skelčių gamybos koncepcija ir metodu, panašumus. Nustatyta viena standartinė skelčių gamybos koncepcija, apimanti skaldymą nuo dvigalių skaldytinių su priešingose pusėse esančiomis skaldymo aikštelėmis, naudojant tiesioginio smūgio metodą su minkštu akmeniu (vidutinio kietumo) arba minkštu organiniu plaktuku (3–7 pav.). Penkių mažų titnago koncentracijų rinkinių analizė palaiko šiuos Laukskolos rinkinio tyrimo rezultatus (1–6 lent.).

Gamybos koncepcijų ir metodų panašumas rodo glaudų kultūrinį ryšį tarp Salaspilio Laukskolos rinkinio ir Svidrų kultūros tradicijos bei tarp pietinių ir šiaurinių teritorijų. Laukskolos gyventojai visiškai perėmė Svidrų kultūros skelčių gamybos koncepciją, o tai reiškia, kad jie tai padarė tiesiogiai sąveikaudami ir bendraudami su pagrindine Svidrų kultūros sritimi pietuose. Tyrimo rezultatai rodo, kad žmonių gyvenimo būdas buvo labai mobilus, įskaitant keliones ilgais atstumais. Be šio laikotarpio radinių Salaspilio Laukskoloje, tokie pat radiniai patvirtina pakartotinius apsilankymus dab. Latvijos teritorijoje. Patogus didžiųjų upių tinklas įgalino mobilų gyvenimo būdą, kurio metu bendruomenės užmegzdavo kontaktus ir įveikdavo didelius atstumus.

I

PAPERS READ AT THE XVIII° UISPP WORLD CONGRESS IN PARIS (4-9 JUNE 2018), SUB-SESSION XVIII-2 „FINAL PALAEOLITHIC IN EASTERN BALTIC“