UNDERSTANDING GRAVETTIAN SETTLEMENT DYNAMICS THROUGH LITHIC EVIDENCE[1]

Case of Pavlov I – Southwest, area A

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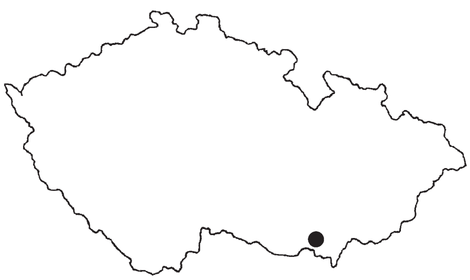

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The Upper Paleolithic Gravettian tradition, which dates from 34 to 24 kyr BP (*Lengyel/Wilczyński 2018*), is distinguished by advanced lithic technology and extensive cultural adaptations across Europe. The Pavlov I site (*Klíma 1954*), situated in the Moravian region of the southern Czech Republic, represents one of the most significant Gravettian settlements, characterised by a complicated spatial structure and an abundance of archaeological finds. This study analyses the lithic assemblages retrieved from Area A during the 2013–2015 excavations. The area, which has been identified as a settlement activity zone, yielded a total of 2,615 lithic artefacts, accompanied by a number of faunal remains, including mammoth bones and an almost complete wolf skeleton (*Sázelová et al. 2020*).
The research employs technological, typological, and spatial analyses to shed light on the lithic production processes and raw material economies of the area. Silicite, which is predominantly erratic flint, emerged as the dominant raw material, followed by radiolarite, chert, and other less frequently utilised varieties. The documentation of a complete lithic operational chain, encompassing core preparation, tool production, and waste management, serves to reinforce the area's significance as a centre for daily activities. The spatial analyses identified four distinct concentrations of artefacts, which were interpreted as zones for habitation, tool production, disposal, and specialised activity. These findings align with those of previous studies of Pavlov I, thereby reaffirming its importance in understanding Gravettian settlement dynamics, raw material utilisation, and technological sophistication. The results contribute to a comprehensive view of human adaptation and cultural organisation in Upper Paleolithic Central Europe.

INTRODUCTION

The Upper Paleolithic, spanning roughly 50,000 to 10,000 years ago, marks a transformative period in human prehistory, defined by advances in technology, social organization, and symbolic expression (*Boyle/Gamble/Bar-Yosef 2010*; *Jochim 2002*; *Zilhão 2014*). Among its cultural traditions, the Gravettian, emerging around 30,000 years ago, is notable for its sophisticated lithic technology and widespread distribution across Europe (*Bicho et al. 2017*; *Kozłowski 2015*; *Otte 1981*). Gravettian settlements, ranging from open-air sites to caves, reflect diverse adaptations and complex lifeways. Their characteristic lithic assemblages, provide key insights into these societies (*Klaric 2007*; *Polanská 2020*). Within this framework, the Moravian region stands out as one of the main focal points of Gravettian activity, mainly for its numerous large complex settlement sites (*Svoboda et al. 2000*; *Svoboda 2020*). The Pavlov I site, one of the largest and most complex Gravettian settlement agglomerations on the Pavlov Hills in the southern Moravia, has been known for decades (*Svoboda 2020*). The initial excavation of the site commenced in the 1950s (*Klíma 1954*) and has been subjected to further investigation during subsequent excavation seasons (1952–1958; 1960–1965; 1967–1971; *Svoboda 1994*; *1997*; *2005*). The most recent excavation of this site, conducted between 2013 and 2015, was prompted by the construction of Archeopark Pavlov museum building (*Svoboda et al. 2016*). This revealed several previously unexplored areas. One of these was area A, located

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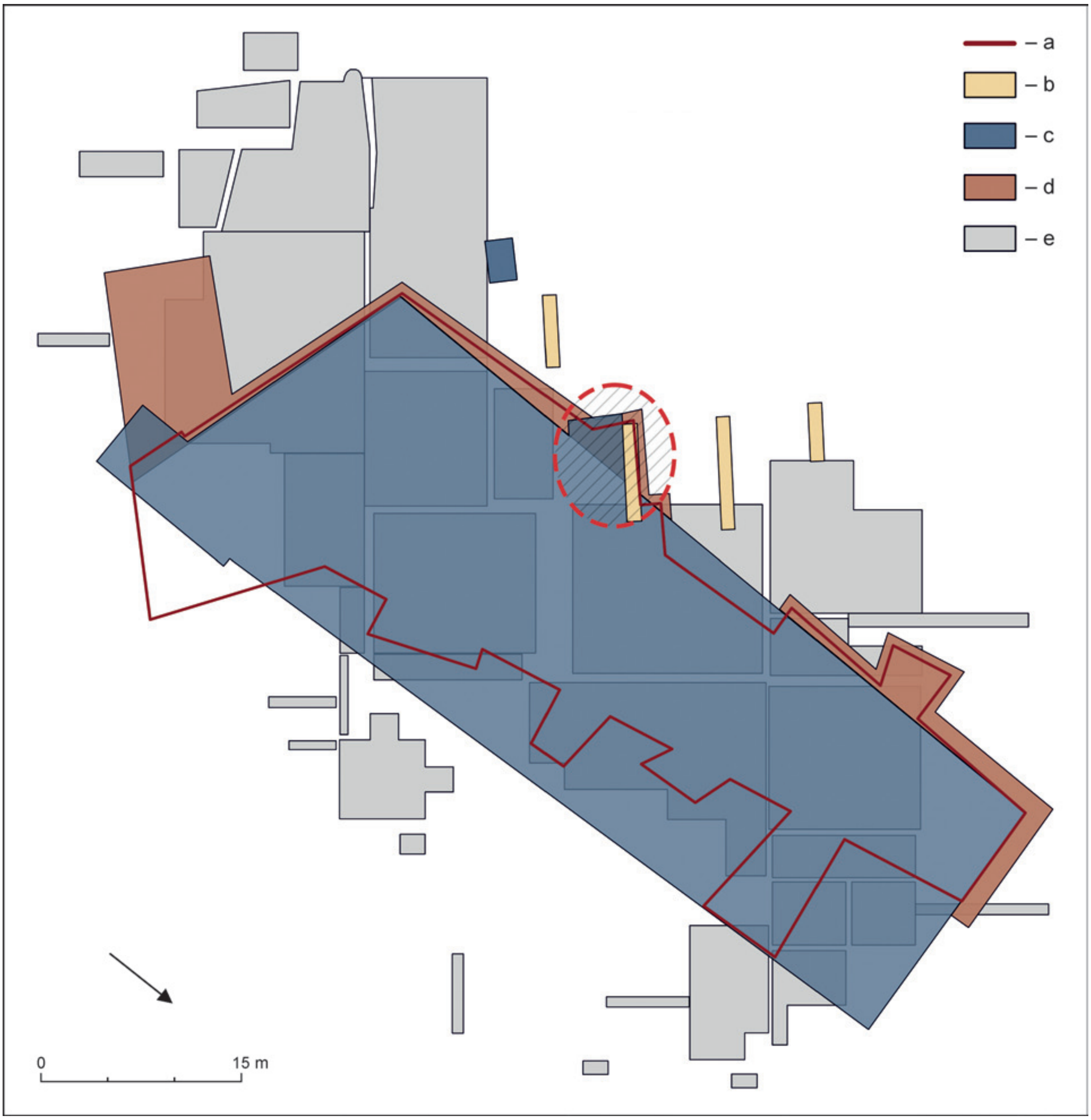

Fig. 1. General plan of the site showing the excavation of B. Klíma (1952–1972), the most recent excavation of J. Svoboda (2013–2015), and location of the analysed area A (hatched ellipse). Legend: a – building plan APP; b – excavation J. Svoboda (2013); c – excavation J. Svoboda (2014); d – excavation J. Svoboda (2015); e – excavation B. Klíma (1952–1972). Graphics O. Herčík, M. Novák.

in the south-western part of the site. The entire area comprises three trenches excavated separately in 2013, 2014, and 2015, covering a total of 42 m^2 (Fig. 1). It has the shape of a right triangle, which initially followed the construction plan of the Archeopark Pavlov museum building, with sides 9 and 7 m long. According to the character of the find situation, the area is considered a settlement activity zone with developed palimpsest microstratigraphy of the cultural deposit from 29 to 33 ka cal BP, consistent with the Middle and Early Gravettian (*Svoboda et al. 2016*). There were several hearths and depressions recorded in this area. Apart of these settlement structures and artefacts of lithic industry, bones of "Mammuthus primigenius" and distal parts of limps of various carnivores were recorded as well. Apart from fragmented parts of carnivores, an almost complete skeleton of "Canis lupus" was uncovered in its anatomical position (*Sázelová et al. 2020*).

This article presents the results of technological, typological, raw material, and spatial analyses of lithic assemblage, that was recovered from this area. These results are then compared to those of previous analyses of the site (*Verpoorte 2005*). The main objective was to process all the investigated parts of the site in order to contribute to an overall picture of the site, while the attention was focused on the raw material and technological economy and possible identification of activity zones within the studied area.

MATERIAL AND METHODS

An assemblage of 3615 lithic artefacts was obtained in area A in total. The area is divided into 42 square sectors according to a unique 1m square grid with the squares labelled with numbers on the X-axis (1–9) and letters on the Y-axis (–A–F). The location of all archaeological findings (lithic artefacts, archaeozoological items and other objects) found during the excavation was recorded by the use of the coordinates in the unique local three-dimensional XYZ system through the use of a total station PENTAX W-825NX (in 2013 and 2014 excavation season) and by recording locations based on the square grid (in 2015). The finds discovered through the wet sieving of the excavated sediment were spatially documented within the corresponding sector and the relevant depth level. Although this may affect the analysis results to some extent, we exclude these finds in this study due to inconsistent wet-sieving excavation strategies in individual excavation seasons.

A detailed description of each lithic artefact was employed in the technological analysis of the assemblage, followed by the work of *Inizan et al*. (*1999*). This process focused on characteristics that could provide information about technology and "chaîne opératoire" of the production process. The typology of the retouched tools was determined based on classification by *Sonneville-Bordes/Perrot 1953*, modified by *Klíma 1956*. The raw material description was based on a macroscopic determination using a comparison of reference raw materials with analysed artefacts, which was subsequently compared to the work of *Přichystal 2013*.

The spatial analysis presented here employs visual inspection of recorded spatial data (e.g. *Nigst/Antl-Weiser 2012*). To illustrate the distribution patterns of artefacts across the area, we created filled contour maps displaying the location and density of individual lithic assemblage categories within 0.5 × 0.5 m squares of the excavation area grid system. The spatial data was computerised using the grid-based contouring and surface mapping software Surfer in version 16 (*Golden Software 2018*), where the interpolation method of "kriging" (*Davis 1973*, 381–390; *Wheatley/Gillings 2002*, 183–200) with Surfer-predefined parameters (*Golden Software 2018*, 243–248) was used to create the density maps.

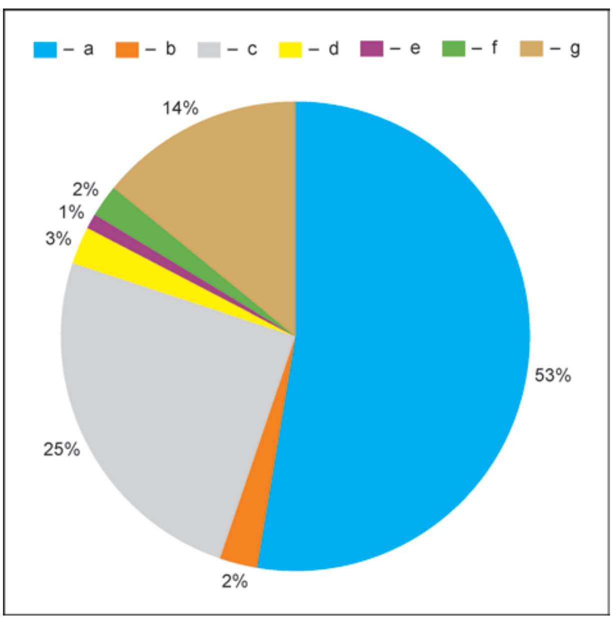

Fig. 2. Pavlov I, area A. Raw material composition of lithic assemblage as percentage. Legend: a – erratic flint; b – Krakow-Czenstochowa flint; c – silicite (not spec.); d – radiolarite; e – spongolite; f – hornstone; g – others.

RESULTS

Raw material composition

The macroscopic determination of the raw material composition of the assemblage indicates that silicite is the most dominant raw material, comprising 84% of the assemblage. As shown in the Fig. 2, the most dominant types are flint varieties, of which two different types were identified: erratic flint (53%) and Krakow-Czestochowa Jurassic flint (2%). Nevertheless, the precise identification of either of the flint varieties in the assemblage was not possible in 25% of the cases due to the heavy surface patination. Other identified raw materials in the assemblage include radiolarite (3%) and hornstone varieties (2%), while the remaining raw materials are categorised as other/non-determinable.

Tab. 1. Pavlov I, area A. Artefact totals by raw material types as numbers and percentages of each type.

	Erratic flint	Jurassic flint	Silicite (not spec.)	Radiolarite	Chert	Spongolite	X	Total	%
Flakes	160	21	60	8	12	4	11	276	11
Blades	272	30	112	10	18	9	21	472	18
Retouched	55	5	21	19	2	0	4	106	4
Cores	5	2	0	1	0	0	1	9	0.3
Microlithics	41	3	20	1	0	1	1	67	2.6
Burin spalls	12	0	7	0	3	0	0	22	0.8
Raw material	0	0	0	1	1	3	0	5	0.2
Fragments	783	6	77	15	13	3	281	1178	45
Chips	34	1	33	1	4	2	14	89	3.4
Other waste	14	0	319	12	5	5	36	391	15
All	1376	68	649	68	58	27	369	2615	100
%	53	3	25	3	2	1	14	100	

Technology and typology

The lithic assemblage was divided into ten categories, as shown in Tab. 1. The majority of the assemblage comprises non-specified fragments and non-retouched blades. Following that, the next largest category is the group of knapping waste. However, although in significantly lower number, there are also retouched artefacts, microblades, burin spalls, cores and other types present as well. The clear presence of artefacts in all production stage categories indicates the existence of a complete lithic production chain. This chain begins with the storage of raw material and continues through core preparation to the production of final tools, even including the possibility of reshaping and repair during use. The finer division of every technological category has enabled the identification of more concrete stages of core reduction. For example, the decortical phase, the repair of the striking platform, and the repair and transformation of tools.

Cores

Cores are present in the examined assemblage in the smallest ratio (0.3%), occurring immediately after raw materials (0.2%). The raw material used for cores was predominantly erratic flint, although two of them were made from Krakow-Czestochowa flint and only one was made from radiolarite. One piece remains undetermined.

With regard to the "chaîne opératoire", it can be stated that all cores were abandoned at an advanced stage of reduction or even completely exhausted (Fig. 3). However, the character of the cores varies. In three cases, it was possible to identify multiplatform cores, which were exploited for flakes and blades. Almost all of the unipolar and bipolar cores, with the exception of one, can be characterised as blade-like types. In general, the striking platform of the studied cores is flat. However, in one case, there are visible negatives of small flakes, which may indicate that the striking platform has been repaired. Some of the group has visible traces of abrasion or edge preparation. On six cores, it is possible to observe negatives of the so-called knapping failures, which resulted in the formation of hinged flakes or blades. All cores exhibiting knapping failures were made of erratic flint.

Non-retouched artefacts

The group of non-retouched artefacts represents the most numerous groups of this lithic assemblage. It includes intentionally created blank types as well as waste products from the whole knapping process, and unintentional pieces. The highest number in this group comprises unidentifiable fragments, where pieces differ greatly in size and shape and it is very difficult to identify the original blank type. However, the raw material analysis showed that the pieces are mostly made out of erratic flint. In contrast, the number of waste products is significantly lower. These include small chips and other types of waste.

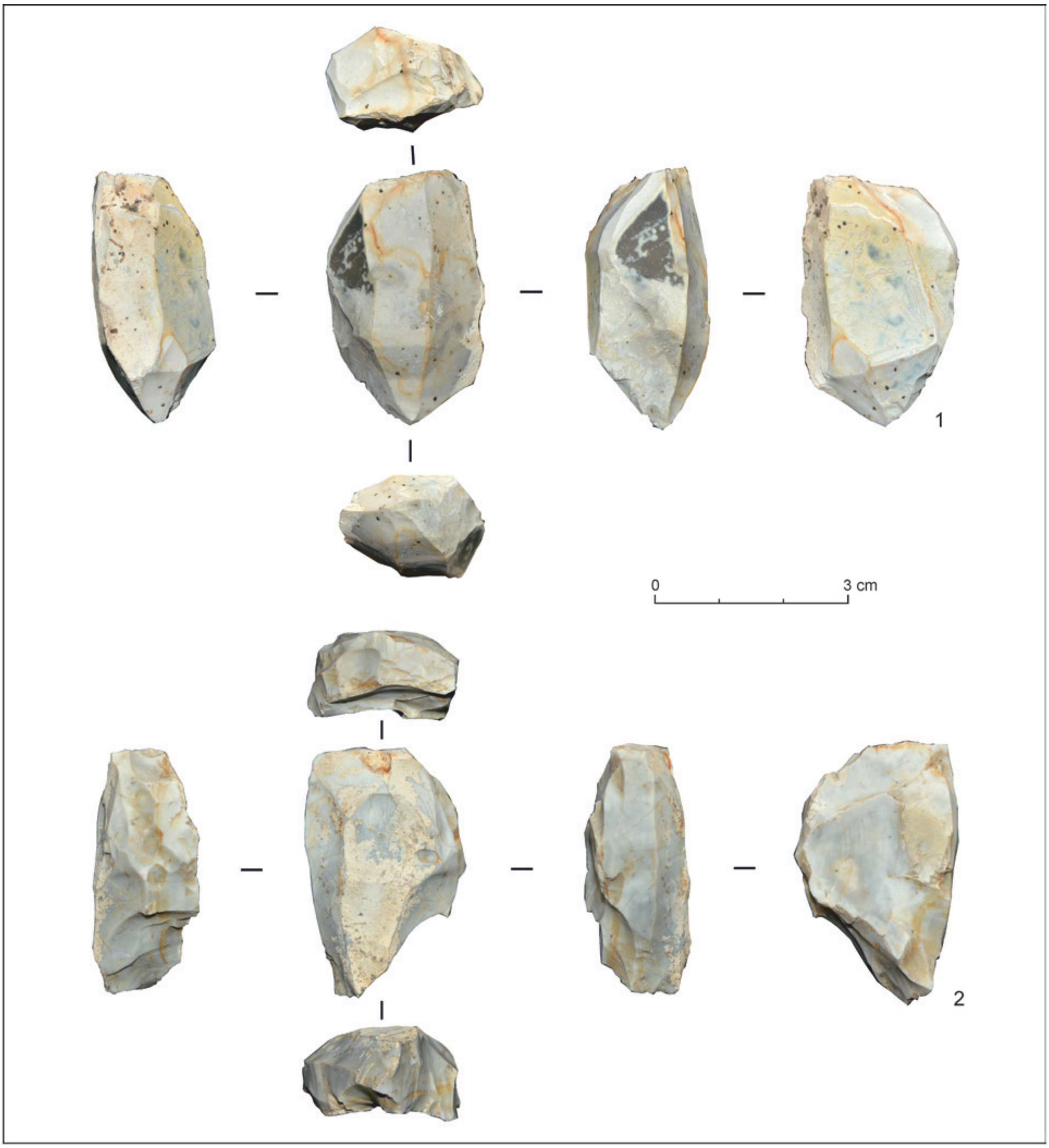

Fig. 3. Pavlov I, area A. Cores.

The flakes represent 11% of the assemblage. However, due to determinable features, it was possible to determine from which part of the knapping process they result (Tab. 2). The initial core preparation is demonstrated by cortical, or at least partially cortical flakes. This could indicate that the raw material was not modified elsewhere, but rather that the raw material in the form of undisturbed nodules was brought to the site to be worked. The stage of core reparation can be divided into at least two different stages based on the present flakes. First, the general preparation of the core surface can be assumed. Secondly, based on the presence of tablets, the reparation of the striking platform can be identified. However, the majority of the flakes could not be closely determined due to the scarce presence of relevant data. With regard to the percussion technique, based on the distinctive butt attributes (*Inizan et al. 1999*), it was possible to identify the use of predominantly organic, soft stone and hard stone hammers.

Tab. 2. Pavlov I, area A. Types of flakes as numbers and percentage.

Type	Total	%
Decortical	33	12
Reparational	87	32
Tablet	12	4
Plain debitage	3	1
Indeterminable	141	51
Total	276	100

Tab. 3. Pavlov I, area A. Types of blades as numbers and percentage.

Blade	Total	%
Plain debitage	272	58
Crested blade	15	3
Second crested blade	8	2
Side blade	7	1
Decortical	13	3
Reparational	49	10
Neo-crete	1	0
Indeterminable	107	23
Total	472	100

Tab. 4. Pavlov I, area A. Dorsal pattern of blades by type as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Unidirectional	175	1	–	1	2	50	14	243	51
Bidirectional	60	–	–	1	–	8	5	74	16
Transverse	9	7	4	1	2	11	19	53	11
Centripetal	2	1	–	1	–	–	1	5	1
Other	7	6	4	1	2	11	5	36	8
No negatives	1	–	–	1	4	1	–	7	1
Indeterminable	18	–	–	1	4	26	5	54	11
Total	272	15	8	7	14	107	49	472	100

Tab. 5. Pavlov I, area A. Butt of blades by type as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Cortical	1	–	–	–	3	1	–	5	1
Plain	83	1	1	1	3	17	19	125	26
Facette	1	–	–	–	–	3	–	4	1
Linear	23	–	2	1	–	4	5	35	7
Point	12	1	–	–	–	3	3	19	4
En éperon	4	1	–	–	–	1	2	8	2
Indeterminable	1	–	–	–	–	–	–	1	0
Fractured	14	1	1	–	–	3	5	24	5
Absent	133	11	4	5	8	75	15	251	53
Total	272	15	8	7	14	107	49	472	100

Tab. 6. Pavlov I, area A. Types of blade profile by type of blade as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Straight	166	7	1	3	5	25	9	215	46
Convex	76	6	5	–	5	8	23	124	26
Irregular	1	–	2	3	–	5	6	17	4
Indeterminable	29	2	–	1	4	69	11	117	25
Total	272	15	8	7	14	107	49	472	100

Tab. 7. Pavlov I, area A. Type of edge by type of blade as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Paralel	138	6	–	–	4	16	1	165	35
Convergent	42	6	5	1	–	5	2	61	13
Divergent	19	–	1	–	4	6	1	31	7
Oval	8	–	–	1	–	–	2	11	2
Irregular	21	1	2	3	–	8	18	53	11
Indeterminable	44	2		2	6	72	25	151	32
Total	272	15	8	7	14	107	49	472	100

Tab. 8. Pavlov I, area A. Type of cross section by type of blade as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Triangular	122	10	4	4	7	40	5	192	41
Trapezoidal	112	–	–	–	–	38	6	156	33
Polygonal	32	1	1	–	–	8	5	47	10
Irregular	5	4	3	3	2	4	30	51	11
Indeterminable	1	–	–	–	5	17	3	26	6
Total	272	15	8	7	14	107	49	472	100

Tab. 9. Pavlov I, area A. Dorsal pattern of bladelets as number and percentage.

	Total	%
Unidirectional	52	78
Bidirectional	3	4
Transverse	3	4
Other	3	4
No negatives	3	4
Indeterminable	3	4
Total	67	100

Tab. 10. Pavlov I, area A. Type of edge by type of bladelet as number and percentage.

	Total	%
Convergent	11	16
Divergent	3	4
Oval	3	4
Parallel	28	42
Irregular	9	13
Indeterminable	13	19
Total	67	100

Tab. 11. Pavlov I, area A. Type of hammer used for production of bladelets number and percentage.

	Total	%
HS	–	–
SS	5	7
OP	10	15
X	52	78
Total	67	100

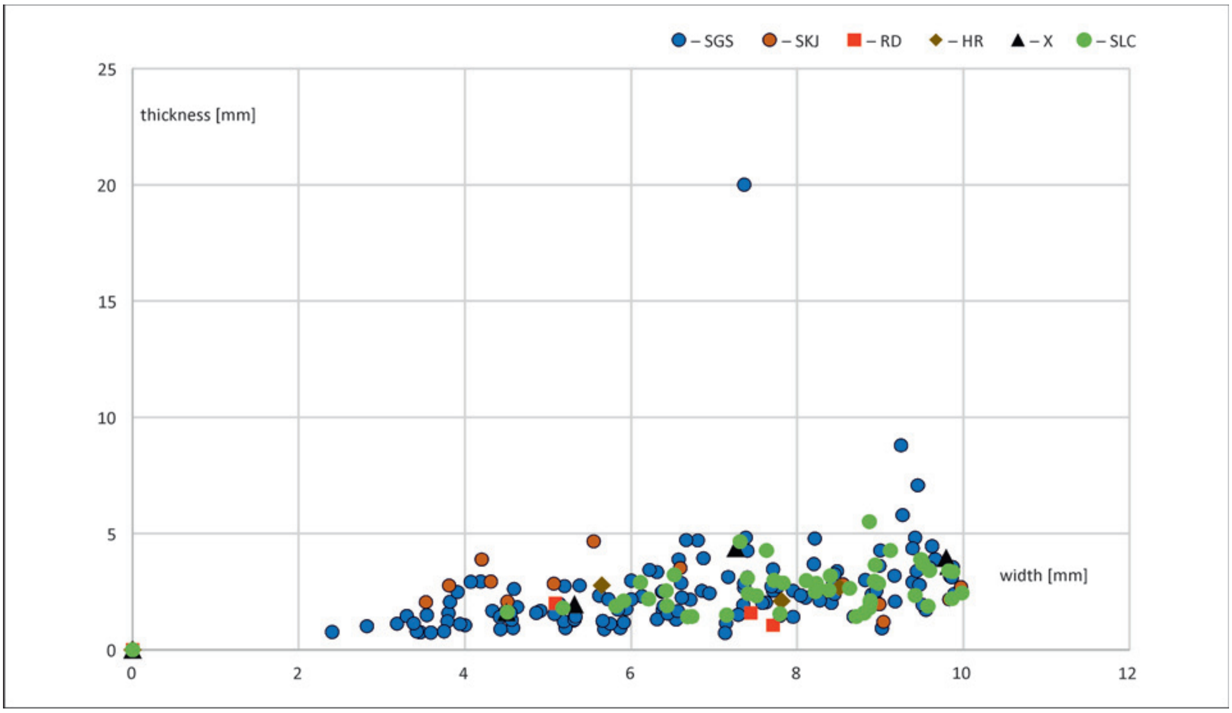

Fig. 4. Pavlov I, area A. Width to thickness ratio of blades by raw material. Legend: SGS – erratic flint; SKJ – Krakow-Czestochowa silicite; RD – radiolarite; HR – hornstone; X – indeterminable; SLC – indeterminable silicite.

The most prevalent type of blades and bladelets is "plain debitage" representing the final product of blank production (Tab. 3). In addition to this type of blades, blades resulting from core modification, either reparative or preparative, have been identified. However, they are relatively uncommon. The majority of these blades are crested, with some exhibiting a second crested morphology. In a very small percentage of cases, the decortical blade was also identified. In general, it can be stated that the majority of blades classified as "plain debitage" exhibit unidirectional (51%) or bidirectional (16%; Tab. 4) dorsal scar patterns, have absent (53%) or plain (26%) butt (Tab. 5). Their profiles are mostly straight (46%) or convex (26%; Tab. 6), they have parallel shape (35%; Tab. 7) and triangular cross section (Tab. 8). In 75% of cases, it was not possible to determine the hammer used, primarily due to the state of preservation or lack of determining features. However, in cases where it was possible to determine the hammer used (25%), it was found that organic hammers were used unequivocally (21%). In contrast, soft stone hammers were used only in 4% of cases. It is important to note that the use of hard stone hammer was certainly detected only in a single case.

With regard to the group of bladelets, it can be observed that they typically exhibit a unidirectional dorsal scar pattern (78%; Tab. 9), a parallel shape (28%; Tab. 10), and were created by an organic hammer (15%; Tab. 11). However, due to the state of fragmentation, it was not possible to determine the exact type of hammer used in the majority of cases.

According to a comparison of the width and thickness, there is no dividing line between blades and bladelets, and thus a continuous pattern can be observed. However, in Fig. 4, where only the morphometry of blades is being compared, a clear preference is visible in width of 10–15 mm and thickness of 0.2–5 mm, regardless of the raw material.

Conversely, when comparing the morphometry of bladelets (Fig. 5), the preferred width and thickness were 5.8–10 mm and 0.1–5 mm, respectively. These results indicate that bladelets and blades in general adhere to a thickness of 5 mm. There was no significant morphometric preference based on the raw material evident in this assemblage.

Retouched artefacts

The group of retouched artefacts represents only 4% of the total assemblage. However, it includes a variety of tools, as visible in the Tab. 12, including microliths and endscrapers. In general, erratic flint or silicite of Krakow-Czestochowa Jura is the dominant raw material in every category of tools.

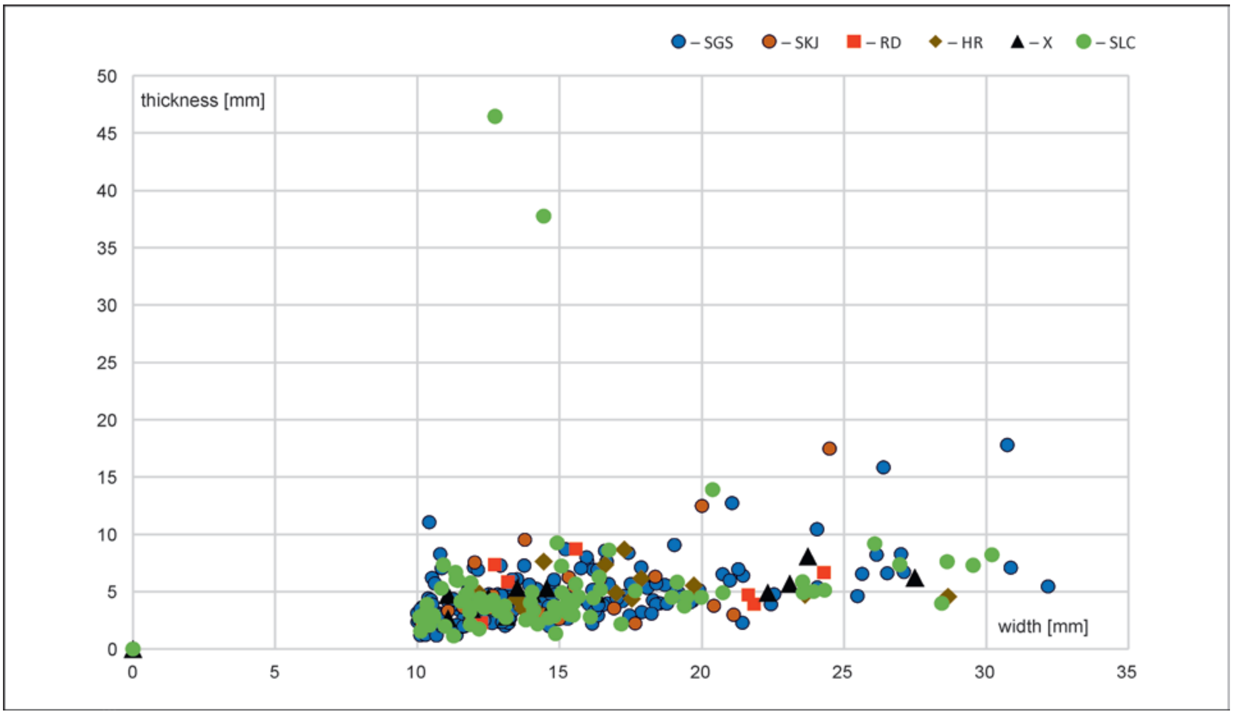

Fig. 5. Pavlov I, area A. Width to thickness ratio of bladelets by raw material. Legend: SGS – erratic flint; SKJ – Krakow-Czestochowa silicite; RD – radiolarite; HR – hornstone; X – indeterminable; SLC – indeterminable silicite.

Another raw material was almost entirely absent from the category of retouched artefacts. However, it is important to note that there is a visible preference for certain raw materials in relation to specific tool types. As illustrated in Tab. 12, radiolarite was almost exclusively used for retouched microliths (58%).

The most dominant type of retouched artefacts are microliths (31%). They vary greatly in typology, with five different types present. Backed bladelets (Fig. 6: 1), for which production was primarily based on erratic flint, account for 38% of retouched microblades. The second largest group is represented by so-called microgravettes, which account for 36%. By identifying different types of microgravettes, it was even possible to divide this group more finely, with examples from Milovice (Fig. 6: 2), Dolní Věstonice (Fig. 6: 3) and also so-called oval elements (Fig. 6: 4; *Polanská/Michalík 2015*). The total number of pieces is six, and the last dominant microlith type in this assemblage is microsaws, also known as denticulate pieces (18%; *Novák 2016*). Radiolarite was used for the oval elements and microgravettes (Tab. 13).

The second largest category among retouched artefacts is retouched blades (25%). The type of retouch among this category is variable, however, majority of retouched blades have been retouched only unifacially and on one edge. In 88% of cases, they were made of silicite, although radiolarite (8%), chert (4%) and non-identifiable raw material were also detected.

Tab. 12. Pavlov I, area A. Retouched artefacts total by raw material types as numbers and percentages of each type.

Type	Flint (erratic + jurassic)	Radiolarite	Chert	Spongolite	Total	%
Retouched blades	23	2	1	–	26	25
Retouched microlithics	20	11	1	1	33	31
Burins	12	–	–	2	14	13
Scrapers	6	2	–	1	9	8
Partially retouched tools	11	–	–	–	11	10
Points	5	4	–	–	9	8
Combinations	4	–	–	–	4	4
Total	81	19	2	4	106	100

Fig. 6. Pavlov I, area A. 1 – backed bladelet; 2 – microgravette Milovice type; 3 – microgravette Dolní Věstonice type; 4 – oval element; 5 – dihedral burin; 6 – angle burin; 7 – point; 8 – combination tool; 9 – endscraper on blade; 10 – endscraper on flake. Scale: a – 1–4; b – 10–15.

Tab. 13. Pavlov I, area A. Types of microliths by rawn material types by number and percentage.

Type	Silicite	Radiolarite	Total	%
Microsaws	6	–	6	18
Microgravettes	5	7	12	36
Backed bladelet	11	2	13	39
Oval elements	–	1	1	3
Other types	2	–	1	3
Total	24	10	33	100

Tab. 14. Pavlov I, area A. Burin types by raw material types as numbers and percentage.

Type	Erratic flint	Radiolarite	Total	%
Angle	5	–	5	36
Dihedral	6	1	7	50
Double	2	–	2	14
Total	13	1	14	100

Burins represent 17% of the retouched tools and occur in three distinct types. As shown in the Tab. 14, the majority of burins can be characterised as dihedral burins (50%; Fig. 6: 5) or angle burins (36%; Fig. 6: 6). In three cases, it was possible to identify double burins (14%). For all of the burins in this assemblage, except for one edge burin made of radiolarite, erratic flint was used as a raw material.

Other tool types, including endscrapers (8%), points (9%; Fig. 6: 7), combination tools (4%; Fig. 6: 8), and partially retouched artefacts (6%), were also present. The majority of endscrapers were made on blades (78%; Fig. 6: 9), with only two created on flakes (Fig. 6: 10). Interestingly, for one of them, which is also the only one, radiolarite was used as a raw material. Regardless of the specific type, endscrapers exhibit retouch at the distal end, which in most cases continues to one (or occasionally both) sides of the artefact. Combination tools are exclusively composed of erratic flint, and in all cases, they represent combinations of an endscraper and a burin. Exactly half of them were made on flakes, and the other half on blades.

Tool production debitage

A further category of importance is that of debitage, which is defined as the waste resulting from the production of specific tool types. Two different types of this kind of debitage were identified: firstly, burin spalls, which constituted 92% of this tool type category, and secondly, waste from the production of backed bladelets, which constituted only 8% of this tool type category.

Spatial distribution patterns

In general, the highest artefact density is located in the row A, specifically at 2–3 square (Fig. 7). However, although these squares contain the highest number of artefacts, together with also high concentrations in surrounding squares (B/3–4) they form a significant concentration of finds in the more or less central part of the area. On the other hand, there is a second significant concentration of artefacts that is divided from the rest of the part of the area by a complete absence of artefacts. This concentration is located in the most northern part of the area, in squares –A/6–8 and A/7.

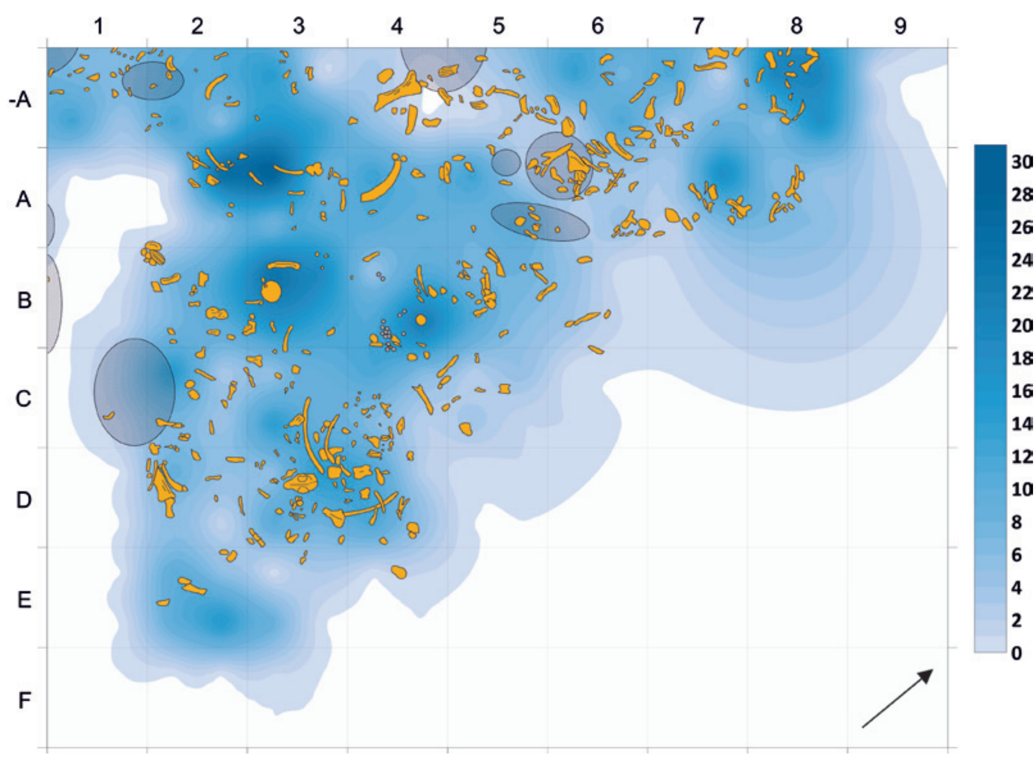

Fig. 7. Pavlov I, area A. General plan (excavation 2013–2015) and spatial distribution density map of 3-D recorded lithic artefacts. Hatched ellipse areas: hearths and charcoal concentrations; grey dots: Dentalia shells. Graphics O. Herčík and M. Novák, after the original plan of J. Svoboda.

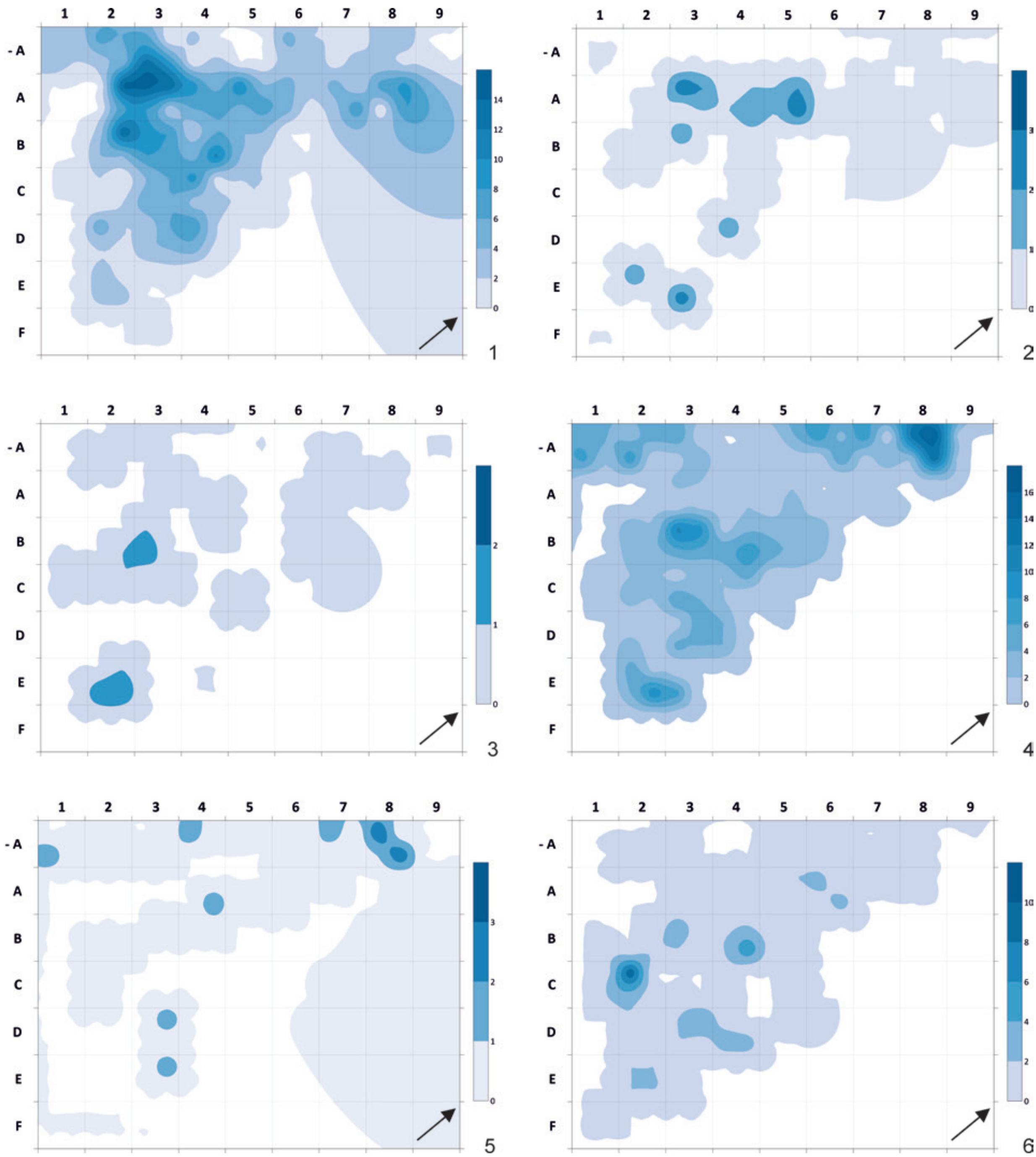

Fig. 8. Pavlov I – southwest, area A, excavation 2013–2015. Spatial distribution of the lithic artefacts in individual categories according to the raw materials. 1 – erratic flint; 2 – flint of Krakow Jurassic type; 3 – radiolarite; 4 – undetermined silicite; 5 – hornstone; 6 – undetermined raw materials.

Based on the individual raw material distribution maps (Fig. 8), it is possible to observe several points. It is not possible to observe any regularity in the spatial distribution of hornstone, as it was found in 7 different parts of the area A. However, it's higher number is concentrated only in the square –A/9. Map of radiolarite spatial distribution is showing its concentration only in two squares of the whole area A, these squares being B/3 and E/2. Unidentifiable silicite and erratic flint, although with visible concentration, are distributed among the whole area A.

Spatial distribution of retouched artefacts shows, that tools are not dispersed throughout the whole area, but are rather concentrated at individual spots (Fig. 9). The most prominent concentration is lo-

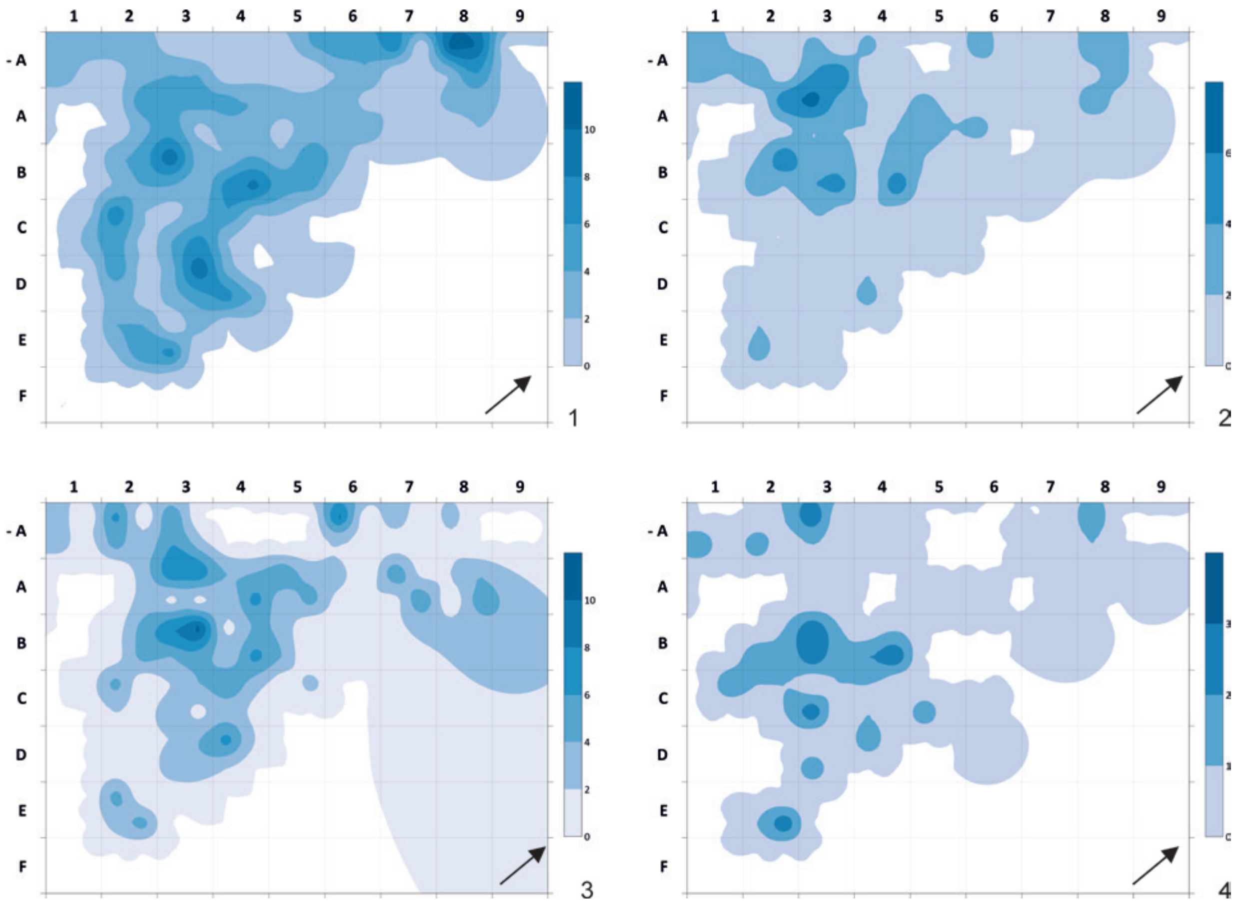

Fig. 9. Pavlov I – southwest, excavation 2013–2015. Spatial distribution of the lithic artefacts in individual categories according to the major technological groups. 1 – debris and fragments; 2 – flakes; 3 – blades; 4 – retouched tools.

cated in squares B/3–5. On the other hand, fragments, although also forming some concentrations, are dispersed throughout the whole area A. Blades are mainly concentrated in the "central" part of the area, mainly in squares B3 and A3, while to some extend matching the dispersion of flakes. These are concentrated in square B/2–3 but mainly in square A3.

DISCUSSION

The majority of the described raw materials originate from the northern and eastern regions, far from the site. The raw materials originate in the north from Pavlov I and include erratic flint, which is derived from Pleistocene glacial and fluvioglacial sediments in Northern Moravia, Silesia and Southern Poland. Additionally, Krakow-Czestochowa Jurassic flint is present, which can be found in the Jurassic limestone in the Krakow area or in glacial sediments of South Poland as a secondary deposit (*Přichystal 1997*). The most probable origin of the radiolarite utilised in Pavlov I is the Carpathian Mountains, specifically the West Slovakian sources (*Verpoorte 2005*). The sources of the present cherts are the Miocene coastal sandy gravels in the Krumlovský les area (Krumlovský les chert), the dendation relic of Jurassic limestone in Brno (Stránska skála chert) and the Pleistocene gravels of the Svitava, Svratka and Dyje rivers (Spongolitic chert; *Přichystal 1997*). The results of the raw material description correspond with those of the Pavlov I assemblages previously studied, thereby confirming the preference for certain raw materials at complex Gravettian sites in South Moravia that had already been identified (*Svoboda 2005*; *Verpoorte 1997*).

In addition to the exploitation and utilisation of specific raw materials, it is also important to describe the raw material economy of each assemblage. As is widely known, the manner in which each raw material was worked can vary considerably even within a single assemblage, which was likely formed by

Tab. 15. Pavlov I, area A. General comparison between assemblages of different areas of Pavlov I site. 1954A, 1954B, 1956, 1963A, 1964 after *Verpoorte 2005*; 1958 after *Verpoorte 1997*.

	1954A		1954B		1956		1958		1963A		1964		Southcentral		Southwest	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Flakes	92	5.7	149	5.6	437	8.9	1317	7.6	465	14	36	11	10743	5.1	276	11
Blades	205	12.7	387	14.6	846	17.2	2173	12.5	957	28.7	74	22.7	15176	7.2	247	18.1
Cores	44	2.7	152	5.7	132	2.7	79	0.5	92	2.8	17	5.2	486	0.2	9	0.3
Tools	1169	72.4	1779	67.1	3097	62.8	689	4	1432	43.1	152	46.6	8506	4.1	106	4

Tab. 16. Pavlov I, area A. Typological comparison between assemblages of different areas of Pavlov I site. 1954A, 1954B, 1956, 1963A, 1964 after *Verpoorte 2005*; 1958 after *Verpoorte 1997*.

	1954A		1954B		1956		1958		1963A		1964		Southcentral		Southwest	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Endscrapers	100	8.6	127	7.1	167	5.4	48	7	96	6.7	9	6	575	6.8	9	8.6
Burins	222	19	372	20.9	591	19.1	163	23.4	339	23.7	44	29	1842	21.7	14	13.5
Microlithic elements	308	26.3	524	29.5	995	32.1	61	9	192	13.4	19	12.5	2071	24.3	33	31.2
Retouched blades	89	7.6	130	7.3	213	7	107	15.5	145	10	22	15.5	801	9.4	25	24
Points	37	3.2	43	2.4	87	3	33	5	23	1.6	4	2.6	256	3.1	9	8.6
Combinations	42	3.6	100	5.6	95	3	22	3.2	55	3.8	11	7.2	308	3.6	4	3.8

a single group. As shown in Tab. 1, erratic flint was used the most, and thus is also the most dominant raw material in each of the technological categories. It is notable that a considerable number of artefacts belong to the category of fragments or waste. This may indicate a somewhat lack of frugality in the utilisation of this specific type of raw material. Conversely, Krakow-Czestochowa flint is observed to have been employed for the production of non-retouched blades and flakes. A similar pattern can be observed in the category of chert and spongolite. These two raw materials were not particularly highly used, although a certain preference for technological types that can be characterised as semifinished products is visible. In contrast, radiolarite shows an opposite phenomenon, with the use focused on retouched tools, which based on the total number of artefacts in this technological category is also the highest ratio. Only in a relatively small number was it left in the semifinished stage of production. The presence of a considerable quantity of debitage within the assemblage may indicate that the artefacts were subjected to further processing, including reshaping and repair.

By looking at the techno-typological composition of the assemblage from studied area, there are some differences visible by comparison with other parts of Pavlov I. In case of general composition (Tab. 15), production of blades was focused in the areas 1963A, 1964 and Southwest. In contrast with Southcentral part of the site, where blades make up only 7.2% of the general composition. Interesting observation can be made in the category of cores, as they are generally a minor component, consistently below 6% across all areas. This may suggest that primary reduction was either minimal directly at the site or cores were removed after reduction. On the other hand, tools make up the largest percentage in most areas. However, in the area excavated in 1958 and Southcentral part they make up only 4%, which could indicate a focus on production rather than the use of tools. The stable percentages of endscrapers could indicate that they were a general-purpose tool that was used across different parts of the site (Tab. 16). Burins are present in the highest number in areas 1964 (28.9%), 1963A (23.7%) and Southcentral (21.7%), which suggest burin production and/or use was mostly focused here. On the contrary, Southwest area with only (13.5%) of burins may suggest focus on different activities. There are significant differences able to be observed in the number of microlithic elements across different areas of the site. This may indicate highly diverse shift in the use of different parts of the site, however, the excavation technique and consistency of wet sieving highly affect the ability to retrieve these types of artefacts from the sediment. This is logically mainly due to their size. Since different areas were excavated in different seasons, while it is expected that different approach could have been imploded, evaluation microliths in the comparison is not reliable enough. Nevertheless, even this basic comparison between assemblage compositions originating from different parts of the site shows a possible activity differentiation between areas.

Based on described spatial distribution patterns it is possible to observe four main concentrations in the area A. First one, also being the most significant, is located in the squares −A−B/2−4. There are retouched tools as well as blades and flakes heavily concentrated here. Moreover, this concentration is located directly in the middle between surrounding hearths. Based on these facts, it is possible to speculate that this area could have been used as a main part of the area A, used for daily activities. Second concentration is separated from the rest of the area by a complete absence of artefacts, located in the squares −A−A/6−8. In this concentration there is a high number of fragments, artefacts from unidentifiable silicite and bones. Moreover, this concentration is separated from others by a complete absence of artefacts (which are in fact hearths). This could indicate that this was a disposal part of the area A. Third concentration is located in squares C−D/3−4, and matches the location of in situ wolf skeleton. Last concentration, also the least visible, is located in squares E/2−3. It is not that significant in terms of number of artefacts, but nevertheless, it stands out on the map. However, there were concentrated mainly retouched artefacts, fragments and blades. The occurrence of other types of artefacts, for example bone fragments, was not as prevalent within this area.

CONCLUSION

The analysis of the lithic assemblage from Area A of the Pavlov I site offers valuable insights into the raw material economy, technological strategies and spatial organisation of the Gravettian inhabitants. The prevalence of erratic flint throughout the lithic production sequence highlights its pivotal role in the raw material economy of this region. The utilisation of other materials, such as radiolarite and Krakow-Czestochowa flint, is more specialised and often associated with specific tool types, including microliths. The high proportion of debitage and the evidence of complete lithic reduction chains indicate that on-site knapping activities were conducted, encompassing the preparation, production, and maintenance of tools.

The results of the spatial analysis indicate the presence of distinct activity zones within Area A. The concentration of artefacts in the vicinity of hearths indicates the existence of a primary zone for daily activities, including tool production and potentially other communal tasks. The northern concentration, which is isolated from other artefact clusters, is likely to have been a disposal or discard zone, thereby emphasising the differentiation of activities in terms of space. The proximity of the *in situ* wolf skeleton to lithic artefacts in the third concentration zone suggests the possibility of a symbolic or specialised activity area. Finally, the smaller concentration in the south-east, dominated by retouched artefacts and blades, may indicate the presence of a secondary or specialised production zone.

Comparisons with other areas of Pavlov I indicate a continuity in raw material preferences and technological practices, although based on the comparison of techno-typological composition between different areas, the site was very probably functionally divided. These results are thereby reinforcing the view of Pavlov I as a major Gravettian settlement with a complex spatial organisation tailored to diverse and specialised activities. This study of the area A contributes to a more detailed understanding of Gravettian lifeways and provides insights into the intersection between raw material economy and spatial organisation, and their role in supporting the needs of Upper Paleolithic communities. However, since this study presents only preliminary results of elemental techno-typological and spatial analysis, combination with others, more complex, analyses of this assemblage and incorporation of other types of artefacts from this site into the interpretation would make it even more relevant.

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Dynamika gravettienského osídlenia na základe kamennej industrie

Prípadová štúdia lokality Pavlov I – juhozápad, časť A

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Súhrn

Mladopaleolitická kultúra gravettien, datovaná medzi 34 a 24 tis. BP (*Lengyel/Wilczyński 2018*), je charakteristická pokročilou technológiou štiepanej kamennej industrie a extenzívnou kultúrnou adaptáciou naprieč Európou. Lokalita Pavlov I (*Klíma 1954*) reprezentuje jedno z najdôležitejších gravettienskych sídelných lokalít, ktoré sa vyznačuje komplikovanou priestorovou štruktúrou a množstvom archeologických nálezov.

Táto štúdia prezentuje výsledky techno-typologickej a priestorovej analýzy, ako aj surovinového opisu súboru štiepanej kamennej industrie získaného z časti A počas terénneho výskumu v rokoch 2013–2015, s cieľom objasniť procesy výroby štiepanej kamennej industrie a surovinovej ekonomiky v tejto časti. Oblasť, ktorá bola identifikovaná ako zóna sídelnej aktivity (*Svoboda et al. 2016*), poskytla celkovo 2615 kusov štiepanej kamennej industrie, sprevádzanej množstvom zvieracích pozostatkov, vrátane mamutích kostí a takmer kompletnej kostry vlka (*Sázelová et al. 2020*).

Analýza štiepanej kamennej industrie z oblasti A, lokality Pavlov I, prináša cenné poznatky o hospodárení so surovinami, technologických stratégiách a priestorovej organizácii gravettienskeho obyvateľstva. Dominancia eratického silicitu v celom výrobnom reťazci podčiarkuje jeho kľúčový význam v surovinovej ekonomike tejto oblasti. Využívanie ďalších materiálov, ako je rádiolarit či krakovsko-čenstochovský pazúrik, sa javí ako špecializované a často sa spája s konkrétnymi typmi nástrojov, najmä mikrolitmi. Vysoký podiel odpadu z výroby spolu s dokladmi o celom redukčnom reťazci nasvedčujú, že na mieste prebiehala výroba nástrojov vrátane prípravy jadier, samotnej produkcie aj údržby nástrojov.

Priestorová analýza poukazuje na existenciu viacerých funkčne odlišných zón v rámci časti A. Koncentrácia artefaktov v okolí ohnísk poukazuje na primárnu zónu každodenných aktivít, ktorá pravdepodobne zahŕňala výrobu nástrojov i ďalšie spoločné činnosti. Severná koncentrácia, oddelená od ostatných klastrov artefaktov, bola pravdepodobne využívaná ako odpadová zóna, čo naznačuje priestorové odlíšenie jednotlivých aktivít. Blízkosť takmer kompletnej kostry vlka ku kamenným artefaktom v tretej koncentrácii môže naznačovať špecifickú aktivitu. Menšia juhovýchodná koncentrácia, dominovaná retušovanými artefaktmi a čepeľami, môže predstavovať sekundárnu alebo špecializovanú výrobnú zónu.

Porovnanie s inými časťami lokality Pavlov I naznačuje kontinuitu vo výbere surovín a v technologických postupoch. Na základe techno-typologickej analýzy medzi rôznymi oblasťami sa však zdá, že lokalita bola funkčne rozčlenená. Tieto výsledky tak posilňujú interpretáciu Pavlova I ako významného gravettienského sídliska s komplexnou priestorovou organizáciou, prispôsobenou rôznym špecializovaným činnostiam. Štúdia oblasti A prispieva k podrobnejšiemu pochopeniu spôsobu života gravettienskych lovcov a poskytuje náhľad na prepojenie medzi surovinovou ekonomikou a priestorovou organizáciou, ako aj ich význam pre udržanie potrieb komunít mladého paleolitu. Keďže však ide o predbežné výsledky základnej techno-typologickej a priestorovej analýzy, ďalšie komplexnejšie štúdie tohto súboru a zapojenie iných typov artefaktov z tejto lokality do interpretácie by významne obohatili výpovednú hodnotu výskumu.

Obr. 1. Pavlov I. Celkový plán lokality s vyznačením výskumu B. Klímu (1952–1972), posledného výskumu J. Svobodu (2013–2015) a polohy predmetnej analyzovanej plochy A (šrafovaná elipsa). Legenda: a – pôdorys stavby APP; b – výskum J. Svoboda (2013); c – výskum J. Svoboda (2014); d – výskum J. Svoboda (2015); e – výskum B. Klíma (1952–1972). Grafika O. Herčík, M. Novák.

Obr. 2. Pavlov I, plocha A. Percentuálne zastúpenie surovín v súbore kamennej štiepanej industrie. Legenda: a – nerovnomerný kremeň; b – krakovsko-čenstochovský kremeň; c – silicit (nešpecifikovaný); d – rádiolarit; e – spongolit; f – rohovec; g – ostatné.

Obr. 3. Pavlov I, plocha A. Jadrá.
Obr. 4. Pavlov I, plocha A. Pomer šírky a hrúbky čepelí podľa surovín. Legenda: SGS – eratický silicit; SKJ – silicit Krakowsko-Czestochowej jury; RD – rádiolarit; HR – rohovec; X – neurčené; SLC – neurčený silicit.
Obr. 5. Pavlov I, plocha A. Pomer šírky a hrúbky mikročepelí podľa surovín. Legenda: SGS – eratický silicit; SKJ – silicit Krakowsko-Czestochowej jury; RD – rádiolarit; HR – rohovec; X – neurčené; SLC – neurčený silicit.
Obr. 6. Pavlov I, plocha A. 1 – čepieľka s otupeným bokom; 2 – mikrograveta typu Milovice; 3 – mikrograveta typu Dolní Věstonice; 4 – oválný element; 5 – klinové rydlo; 6 – hranové rydlo; 7 – hrot; 8 – kombinácia; 9 – škrabadlo na čepeli; 10 – škrabadlo na úštepe. Mierka: a – 1–4; b – 10–15.
Obr. 7. Pavlov I, plocha A. Celkový plán (výskum 2013–2015) a mapa hustoty priestorového rozmiestnenia 3D zaznamenaných kamenných artefaktov. Šrafované elipsovité plochy – ohniská a koncentrácie uhlíkov; sivé body – schránky kelnatiek (Dentalium). Grafika O. Herčík a M. Novák, podľa pôvodného plánu J. Svobodu.
Obr. 8. Pavlov I – juhozápad, plocha A, výskum 2013–2015. Priestorová distribúcia štiepaných kamenných artefaktov podľa surovín. 1 – eratický silicit; 2 – silicit krakovsko-čenstochovskej jury; 3 – radiolarit; 4 – bližšie neurčený silicit; 5 – rohovec; 6 – ostatné neurčené suroviny.
Obr. 9. Pavlov I – juhozápad, výskum 2013–2015. Priestorová distribúcia štiepaných kamenných artefaktov podľa hlavných technologických skupín. 1 – fragmenty a triesky; 2 – úštepy; 3 – čepele; 4 – retušované nástroje.

Tabela 1. Pavlov I, plocha A. Počty a percentuálne podiely artefaktov podľa surovín.
Tabela 2. Pavlov I, plocha A. Počty a percentuálne podiely typov úštepov.
Tabela 3. Pavlov I, plocha A. Počty a percentuálne podiely typoc čepelí.
Tabela 4. Pavlov I, plocha A. Počty a percentuálne podiely dorzálnych negatívov čepelí.
Tabela 5. Pavlov I, plocha A. Počty a percentuálne podiely pätiek čepelí.
Tabela 6. Pavlov I, plocha A. Počty a percetntuálne podiely profilov čepelí.
Tabela 7. Pavlov I, plocha A. Počty a percentuálne podiely typov bokov čepelí.
Tabela 8. Pavlov I, plocha A. Počty a percentuálne podiely typov prierezov čepelí.
Tabela 9. Pavlov I, plocha A. Počty a percentuálne podiely dorzálnych negatívov mikročepelí.
Tabela 10. Pavlov I, plocha A. Počty a percentuálne podiely bokov mikročepelí.
Tabela 11. Pavlov I, plocha A. Počty a percentuálne zastúpenie druhov použitého otĺkača na výrobu mikročepelí.
Tabela 12. Pavlov I, plocha A. Počty a percentuálne podiely retušovaných artefaktov.
Tabela 13. Pavlov I, plocha A. Počty a percentuálne podiely typov mikrolitov podľa surovín.
Tabela 14. Pavlov I, plocha A. Počty a percentuálne podiely typov rydiel podľa surovín.
Tabela 15. Pavlov I, plocha A. Všeobecné porovnanie súborov z rôznych častí lokality Pavlov I. 1954A, 1954B, 1956, 1963A, 1964 podľa *Verpoorte 2005*; 1958 podľa *Verpoorte 1997*.
Tabela 16. Pavlov I, plocha A. Typologické porovnanie súborov z rôznych častí lokality Pavlov I. 1954A, 1954B, 1956, 1963A, 1964 podľa *Verpoorte 2005*; 1958 podľa *Verpoorte 1997*.

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