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USE-WEAR ANALYSIS OF MORAVIAN PALEOLITHIC CHIPPED INDUSTRY

ABSTRACT: The use-wear analysis of reviewed implements from the archaeological excavations in Pavlov, Dolní Věstonice and Stránská Skála was made to complete the complex information about these internationally important sites from the period of early settlement of Moravia and also to evaluate the possibilities of High power approach (HPA) for Moravian Paleolithic chipped industry versus Low power approach (LPA). The total number of analysed artefacts was 263 (flint, radiolarite and chert). Based on both LPA and HPA, about 60% of the analysed artefacts displayed interpretable traces of wear. The most frequently interpreted material was hide, which comprised about 50% of found traces. The application of HPA appeared not only possible but also necessary for the most accurate use-wear traces interpretation.

KEYWORDS: Use-wear analysis – Moravia – Upper Paleolithic – Postdepositional modification – Chipped industry

INTRODUCTION

Moravia played a very important role in Paleolithic migration of the ancient *Homo sapiens* as it made a natural corridor between south and north of central Europe, which allowed shifting both humans and animals in times of glaciations. This fact is amply evidenced by a dense net of Paleolithic settlements. In order to obtain the best information about the life during the Paleolithic period on the territory of Moravia, extensive researches have been performed since the beginning of last century. However, the method of use-wear analysis has recently been adapted in Czech research.

The Paleolithic material is often supposed to be unsuitable for use-wear analysis due to loss of preservation or high postdepositional modification (Keeley 1980). Nevertheless, other studies have shown that micro-wear traces caused by use are present on even the most ancient archaeological (Keeley, Toth 1981) or Middle Paleolithic tools (Roebroeks *et al.* 1997). According to these results, use-wear analysis has been attempted on the Moravian Paleolithic chipped artefacts to prove or disprove this possible source of scientific knowledge.

Three different excavations were selected for the analysis: Stránská Skála, Pavlov and Dolní Věstonice. Each site represents a slightly different type of settlement.

The Upper Paleolithic settlement at Stránská Skála covers two main occupation stages, the Bohunician (about 35,000–40,000 BP), and the Aurignacian (33,000–30,000 BP). The sites are situated near the top of Stránská Skála hill and have been excavated from 1982 to 1999. The final monograph is in preparation (Svoboda, Bar-Yosef in preparation).

The very extensive settlement in Pavlov is dated from 26,700 to 25,000 BP. This site was systematically excavated in years 1952-65 and 1971–72 by Bohuslav Klíma from the Institute of Archaeology, AV ČR Brno. Over a period of twenty years, Klíma (1957) and his collaborators excavated an area of about 2,100 m^2. The density of artefacts is incredible: based on weight and numbers, the total number of stone artefacts alone is estimated at more than 600,000 objects larger than 5 mm and a total weight of over 400 kg (Verpoorte in preparation). Currently, the site is being processed and published in a series of monographic volumes.

Though the sites of Dolní Věstonice (I, II) are well known for a very extended settlement between 28,000–

25,000 BP, the more peripheral Dolní Věstonice locality IIa represented probably only short term, but repeated occupations. This site has been excavated in 1999, and further fieldwork is foreseen.

All analysed artefacts come from excavations made by the Institute of Archaeology AV ČR Brno, where the artefacts are also deposited. Every excavation is published in detailed report of a wider international project or in series of institutional monographs.

MATERIAL AND METHOD

Use-wear analysis of chipped artefacts was aimed to identify the method of tool use and the worked material. All tools were analysed both by the high power approach (HPA) using the incident light microscope with a high magnification and the low power approach (LPA) using a binocular microscope, even though the postdepositional modification, mainly white patina and the shine, had influenced most of the analysed artefacts.

The total amount of analysed implements from Stránská Skála was 42 pieces. Two Bohunician samples were selected: 14 pieces from Stránská Skála III (1982) and 27 pieces from Stránská Skála IIIa (1984). Furthermore, one massive Aurignacian endscraper from the upper layer of site IIIa (1984) has been analysed for comparative purposes. Raw materials varied from Stránská Skála chert, which showed the majority (83%) to less frequent Krumlovský Les chert (10%) and radiolarite (7%).

The total amount of analysed implements from Pavlov was 180 pieces. Samples were taken from excavation of Pavlov I 1954 A (squares 7/I, 7/I, 7/III + all radiolarites) and Pavlov I 1970. The raw materials of analysed tools consisted approximately of 60% of flint, 39% of radiolarite and 1% of unknown material.

A total of 41 artefacts (flint 91%, radiolarite 7%, unknown 2%) were chosen from Dolní Věstonice, excavation 1999 from the intact drills A and B.

For further analysis, tools were divided into more general groups (*Table 1*). Analyses were made in co-operation with the Lithic Laboratory of the Leiden University. Interpretation of the contact material was based on the structure of polishes, striations (HPA) and edge damages (LPA) and compared with the use-wear traces on experimental tools.

Tools were cleaned before the analysis by using only weak cleaning solution (soapy water) to avoid alteration in a structure of stones (Plisson, Mauger 1988). Artefacts with a secondary calcic crust were saturated by water for 15 minutes before cleaning by a weak solution (5%) of HCl to lower penetration of acid into stone surface (Gijn 1990) that could have a negative influence. Before and during microscopic analysis, the tools were cleaned by ethanol to remove fingerprints and by acetone to remove lacquer which covered the inventory number.

The level of postdepositional modification has been slightly different. The most affected artefacts were the older chert tools from Stránská Skála. For this reason, only small sample of the best preserved tools were chosen to find whether the application of use-wear analysis would be suitable for these artefacts. However, it seems that the high intensity of patina does not simply correlate with the age of artefacts, as in the recent research of Early Paleolithic settlement excavated from Stránská Skála I. The surface of most artefacts was much better preserved than that of the analysed artefacts from the Upper Paleolithic sites Stránská Skála II and III, as the heavy white patina has not been present (Šajnerová in preparation).

RESULTS

Use-wear analysis was carried out on samples of implements mainly for showing possibilities of use-wear analysis at these sites. No obvious differences between flint and radiolarite artefacts have been found in either typology or function (Šajnerová *et al.* 2001).

Trace interpretation was based on both LPA and HPA analysis. From 263 analysed implements 94 pieces showed no use-wear traces which represent about 35%, 78 pieces (30%) had none or unsure traces by HPA method but an approximate determination of hardness by LPA method, and 91 pieces (35%) showed clear traces of use interpretable by HPA method.

Detailed description for every site is provided in *Tables 2* and *3*. However, it is necessary to be aware that the sample of Stránská Skála was specifically pointed mostly to distinctive types of tools and in a complex view it is not representative of the whole collection. The prevalent worked material was hide (*Table 3*), which makes in total about 50% of all interpreted traces (Stránská Skála 50%, Pavlov I 52%, Dolní Věstonice 1999 14% of the interpreted traces).

Examined artefacts could have had more than one used area or could have been retooled and the rest of originally used areas could be still visible. However, these cases, where more than one used area was found, were rather rare (Stránská Skála 7%, Pavlov I 17%, Dolní Věstonice 1999 only 2% of analysed artefacts) and mostly connected to blades with two edges used, burins or tools with unsure traces that may have originated from hafting (scrapers).

Analysis showed clear connection between end-scrapers and hide processing that was not so apparent for side-scrapers. Also, end-scrapers had the most significant interpretation of use in general, well developed degree of traces and clearly interpreted worked material by HPA. On the contrary, side-scrapers were more often interpreted as used for working hard or unsure materials. The points and microlites categories showed a very high percentage of (probably) unused tools (73% of microlites and 70% of points had no traces of use).

Direction of motion during the usage was interpreted by a directionality of microretouches/scars and/or polish plus striations. The direction was related to the used edge

TABLE 1. Typological structure of analysed artefacts.

Typology Groups	Stránská Skála III, IIIa	Pavlov I	Dolní Věstonice IIa
blades	5%	32%	56%
flakes	0%	12%	34%
points	24%	3%	0%
scrapers	47%	10%	0%
burins	0%	13%	2%
microlites	0%	20%	7%
others	24%	10%	0%

TABLE 2. Hardness categories of interpreted materials based on LPA method.

Contact materials	Stránská Skála III, IIIa	Pavlov I	Dolní Věstonice IIa
hard material	11%	11%	10%
medium material	18%	11%	0%
soft material	27%	18%	5%
unsure	16%	25%	26%
no traces	29%	35%	60%

TABLE 3. Categories of interpreted materials based on HPA method.

Contact materials	Stránská Skála III, IIIa	Pavlov I	Dolní Věstonice IIa
unspecific hard	2%	3%	5%
hide	33%	32%	5%
soft animal	7%	3%	12%
wood	0%	3%	2%
soil/minerals	2%	1%	0%
polish 10	0%	1%	0%
unsure	22%	21%	12%
no traces	33%	38%	64%

TABLE 4. Direction of interpreted motion based on both LPA and HPA methods.

Direction of motion	Stránská Skála III, IIIa	Pavlov I	Dolní Věstonice IIa
boring	2%	1%	2%
diagonal	2%	4%	5%
longitudinal	20%	31%	14%
transversal	40%	19%	5%
dynamic activities	2%	1%	0%
unsure	7%	16%	12%
no traces	27%	28%	62%

(*Table 4*). The older artefacts from Stránská Skála displayed transversal direction as the most often motion (55% of interpreted traces), but this significant prevalence was caused probably due to a predominance of scrapers (38% of analysed artefacts) in the Stránská Skála sample. The second most frequent motion was longitudinal (30% of interpreted traces). On the contrary, both Gravettian sites Pavlov I and Dolní Věstonice IIa showed as most frequent the longitudinal motion, probably in accordance with the predominance of blades. In the analysed sample from Pavlov I, the longitudinal motion took about 56% of interpreted traces and transversal motion (26% of interpreted traces) was the second most frequent. Similarly, Dolní Věstonice IIa had the longitudinal motion as most frequent (55% of interpreted traces) but other motions (transversal, diagonal, hafting and boring) had almost equal frequency, of about 13% (Šajnerová 2001).

Generally, most artefacts showed middle or heavy white patination and postdepositional shine, which together lowered the possibility of interpretation by incident light microscope

FIGURE 1. Use-wear traces interpretation based exclusively on LPA method.

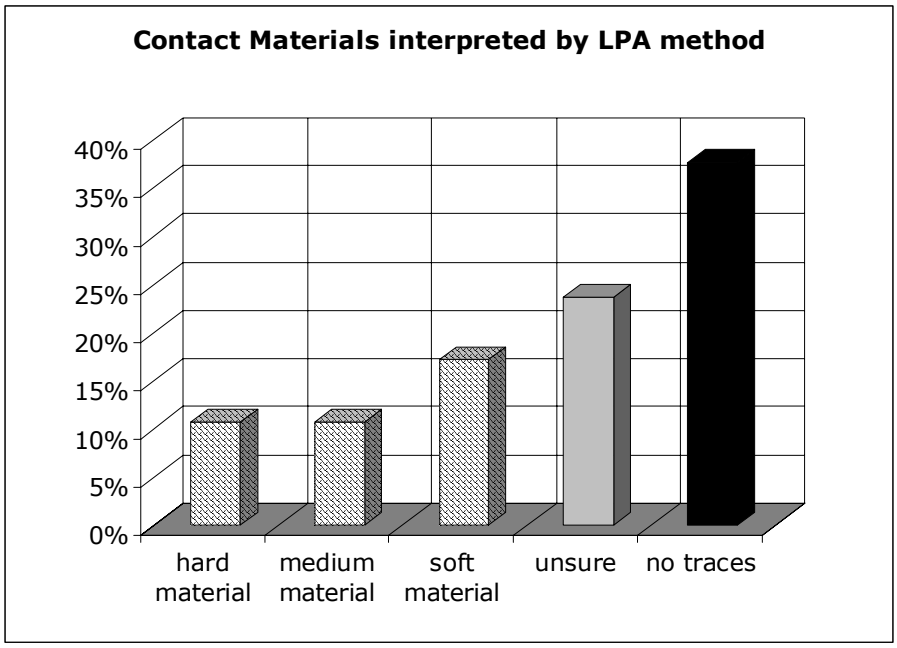
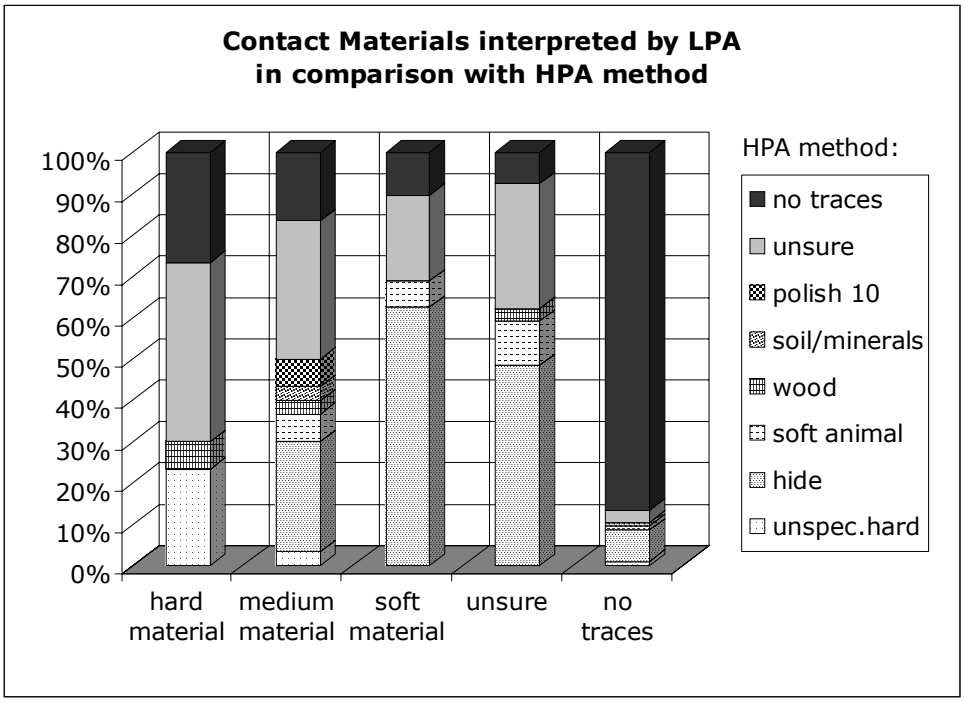


FIGURE 2. Structure of interpreted use-wear traces based on both LPA and HPA methods.



(HPA method). As a result of this, about 50% of the interpreted traces by incident light microscope may be uncertain. Frequently one side is more patinated than the opposite. In few cases, a ventral side looked almost fresh. However, there was no significant difference in patination between the dorsal and ventral sides. The other frequent postdepositional modification was a friction gloss and also black residual spots of unknown origin appeared quite often on artefacts from Pavlov and Dolní Věstonice. Comparison of the postdepositional influences on the material from Pavlov I excavation 1954 A and another Gravettian site – Dolní Věstonice II (excavations in 1999) did not show any difference, which proved that the postdepositional modifications were not caused by a long storage of material from Pavlov, since 1954 (Šajnerová 2001).

Nevertheless, HPA method has been found very useful even though its results had a lower degree of certainty. In comparison of results received from LPA and from HPA methods, the LPA interpreted only about 40% of analysed artefacts as used. The remainder of about 60% would be interpreted as unsure or not used (*Figure 1*).

However, after application of HPA method, it was possible to further interpret 60% of the unsure traces and about 10% of artefacts originally interpreted by LPA method as unused (*Figure 2*). Altogether, that brings about 20% of artefacts, which would not be interpreted by LPA. Thus LPA together with HPA method were able to interpret about 60% of analysed artefacts as used that provided significantly better results that the exclusive use of LPA.

CONCLUSION AND DISCUSSION

The research proves that HPA is worth performing for Paleolithic material even with the lower degree of certainty. In this case, HPA was able to interpret mainly hide-working traces on artefacts which did not have traces interpretable by LPA method (about 50% of artefacts interpreted as used for hide working). Such a result corresponds with experimental results of Annelou van Gijn (1990), where about 25% of experimental tools used for hide-working did not display any traces interpretable by LPA. Higher percentage is caused by postdepositional rounding of all edges, which could disguise a slight rounding from use.

Hide was the predominant interpreted worked material according to other studies of Paleolithic collections, probably as it has the longest endurance against the postdepositional impacts. The hard or medium-hard worked materials were more likely interpreted by LPA than HPA method, and therefore its identification was only approximate.

The length of settlement significantly correlates with the percentage of used artefacts and also with specific activities, mainly hide-processing. Long-term occupations in Pavlov I and Stránská Skála III had a similar percentage of unused artefacts, about 30%. Conversely, Dolní Věstonice IIa, which represented only short-term occupation, had over 60% of unused implements. This correlation contributes to the complete picture of excavated sites, based on percentage of found implements and typology composition. Similar results were obtained by analysis of Late Paleolithic and Mesolithic settlements of the Czech and Moravian Karst. These probably only temporary settlements had together about 80% of probably unused implements (Horáček *at al.* 2002).

The high percentage of unused artefacts in categories of microlites and points could be explained by their purpose. Points had not been intended for extensive use and they are the category with shorter service life as well. Also, regarding the shape of tip, many of the points in Stránská Skála sample could have been waste products or just prepared for further work. A similar reason could be for microlites – the number of pieces found at Pavlov is incredible. Although they could have been used for composed tools, the use-wear analysis has not sustained this hypothesis. The second theory supposes that microlites could have been used as tips for harpoons or arrows (even though we do not have any concrete evidence for it) and then the situation would be similar to points; the used pieces were probably destroyed.

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