

Paleolithic bifacial artefacts from Eastern Bohemia

Paleolitické bifaciální artefakty z východních Čech

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KEYWORDS

Eastern Bohemia – Paleolithic – bifacial artefacts – traceology – APSS analysis

ABSTRACT

Four Paleolithic lithic artefacts that were produced using the bifacial technique are currently known from the territory of Eastern Bohemia. Three of them, namely a knife from Bolehošť and leafpoints from Jaroslav and Černčice, were subjected to traceology analysis and 3D models of these artefacts were created. These models served as a basis for enhanced visualisation of their surface features using APSS surface analysis. Although in the case of the knife from Bolehošť and the point from Jaroslav no traces could be detected by tracer analysis, the point from Černčice can probably be interpreted as a knife on the basis of this method. One of the fractures on the artefact is also interesting, which seems to be the result of its re-shaping during the Paleolithic. The APSS analysis, in turn, has been proved to be a very promising tool for the documentation of lithic artefacts whose surface is also heavily weathered.

1. Introduction

Tools made by the bifacial technique represent an interesting group of Paleolithic artefacts. Their frequency varies with different Paleolithic cultures and geographical areas. In this respect, the area of Eastern Bohemia (Czech Republic) is a region with low number of known artefacts so far. Only four bifacial artefacts are currently known from the entire territory of Eastern Bohemia, and in all cases they are solitary finds without any accompanying chipped lithic artefacts. Although this state of affairs can certainly be linked to a certain extent to the state of knowledge of the region, it does not seem that Eastern Bohemia was one of the places with a large number of these tools in the Paleolithic.

At the same time, the low number of Paleolithic bifacial artefacts clearly motivates the most detailed examination possible of what has been found. With the entire region represented by only four finds, it was possible to subject the vast majority of them (namely three artefacts; one was unfortunately inaccessible for analysis at the time) to a traceology analysis. It was also possible to create detailed 3D models of them. As each of the artefacts is unique in type, context, lithic raw material, and degree of weathering, the three bifacial tools analysed provided a varied, but still limited in number, set for testing different methods of analysis and documentation.

2. Regional context

Eastern Bohemia represents an area where the Paleolithic period is still poorly known in many respects. This is mainly due to the uneven attention that this stage of prehistory has been given by various local researchers over the last 150 years (see more on this topic in Čechák 2019, 16–20). Moreover, the stage to which the East Bohemian bifacial artefacts belong / may belong, i.e. the Lower, Middle, and Early phases of the Upper Paleolithic, is currently represented by only a small number of sites and artefacts in the region (Fig. 1). Due to the fact that there are only two possible Lower Paleolithic sites in the region (see Čechák 2020) and no known bifacial artefacts, we do not discuss this period here.

Archaeologically confirmed in Eastern Bohemia is the presence of the Middle Paleolithic. At the moment there are about 15 known sites, which together contain more than 180 lithic artefacts. The beginning of the Upper Paleolithic, which is also associated with the occurrence of bifacial artefacts, is now known from only 10 sites in Eastern Bohemia, which together have yielded over 60 artefacts. The reason for such a low occurrence of finds falling within the IUP and EUP has not yet been explained. However, it can be reasonably assumed that the current data are biased by the state of archaeological research. Indeed, over 50 sites and 100 artefacts are also known from

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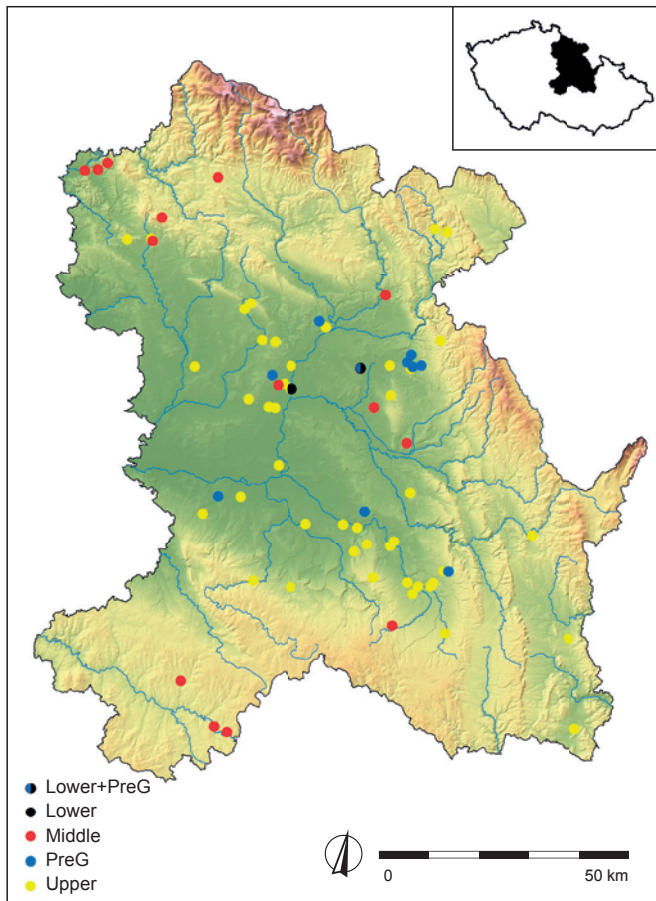


Fig. 1. Eastern Bohemia. Known Paleolithic sites dated into the Lower, Middle, Pre-Gravettian Upper and Upper (without closer determination) Paleolithic. Base map: © ČÚZK.

Obr. 1. Východní Čechy. Známé lokality spadající do starého, středního, na počátek mladého a obecně do mladého (bez bližšího určení) paleolitu. Podkladová mapa: © ČÚZK.

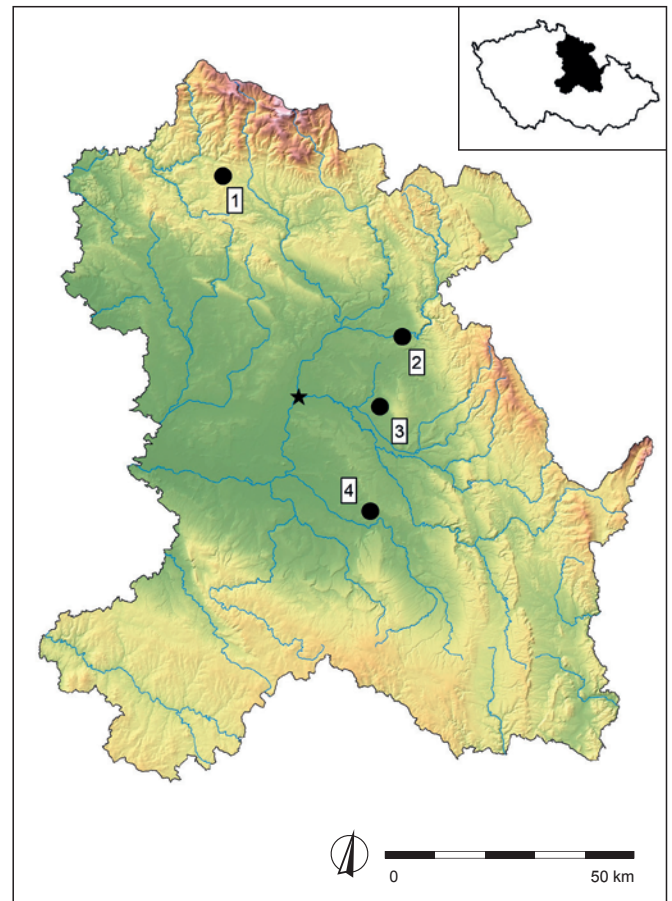


Fig. 2. Paleolithic sites with bifacial artefacts in Eastern Bohemia. 1 – Javorek; 2 – Černčice; 3 – Bolehošť; 4 – Jaroslav; star – modern city of Hradec Králové. Base map: © ČÚZK.

Obr. 2. Východočeské paleolitické lokality s bifaciálním artefakty. 1 – Javorek; 2 – Černčice; 3 – Bolehošť; 4 – Jaroslav; hvězdička – centrum současného Hradce Králové. Podkladová mapa: © ČÚZK.

Eastern Bohemia at this time, which cannot yet be described as anything other than Upper or Upper/Late Paleolithic (Čechák 2019, 169–170). This group might include situations that actually fall at the beginning of the Upper Paleolithic.

There are a total of four Paleolithic bifacial artefacts from all these sites (Fig. 2). Two of them – the finds from Javorek and Bolehošť – belong to the Middle Paleolithic (specifically, probably to the Micoquian), while the other pair discovered in Jaroslav and Černčice are from the Upper Paleolithic (for the reasons of their cultural determination, see Nerudová, Přichystal 2001; Čechák 2019; Šída, Pokorný eds. 2020, 48). Although all four finds are united by the bifacial technique used, they differ chronologically, typologically, in the raw material used as well as geographically.

3. Sites and artefacts

3.1 Bolehošť

The find from Bolehošť was discovered in 2008 at coordinates WGS84 50.2066738 °N; 16.069466 °E (S-JTSK: 624282; 1044635) at an altitude of about 260 m a.s.l. (Fig. 3). The artefact was discovered accidentally during the construction of the cellar of a house by its owner. Shortly afterwards (Levínský 2011) it was published as a leafpoint. Later (Čechák, Pacák 2018, 21–22) it was identified as a knife. However, due to the large weathering of the surface of the artefact, it is not possible to answer this question unequivocally.

The artefact from Bolehošť was made of local quartzite, the surface of which, as already mentioned, is now heavily weathered. At the same time, the object has suffered recent damage (perhaps during the construction of the cellar during which it was discovered), as it is probably broken in its middle. The other part of the artefact has not survived or has not been discovered. The dimensions of the surviving part (Fig. 4) are 7.5 × 6.2 × 1.8 cm, the weight is 84 g. With the exception of the bifacial artefact, no other Paleolithic chipped lithic artefacts have been discovered, either within the above-mentioned cellar construction or elsewhere on the village cadastre.

3.2 Černčice

A bifacial artefact from the cadastre of Černčice was discovered in 1986 by the East Bohemian amateur archaeologist Jan Boček. The coordinates of the find are WGS84 50.3411250 °N; 16.1107602 °E (S-JTSK: 619645; 1030114), the elevation of the site is around 304 m a.s.l. (Fig. 5: 1). Since its discovery, the artefact has been stored at the Museum of Eastern Bohemia in Hradec Králové, but until its recent publication (Čechák, Pacák 2018) it was forgotten.

In terms of typology, it is a leafpoint (Fig. 6), specifically of the Jerzmanowice type. In the descriptive system that has been developed for pointed bifacial artefacts (Nerudová et al. 2011, 24) it is a plano-convex point in transverse cross-section, concave in longitudinal cross-section and lateral in shape (type D). The dimensions of the artefact are 8 × 4 × 1.1 cm, and the weight is 34 g.

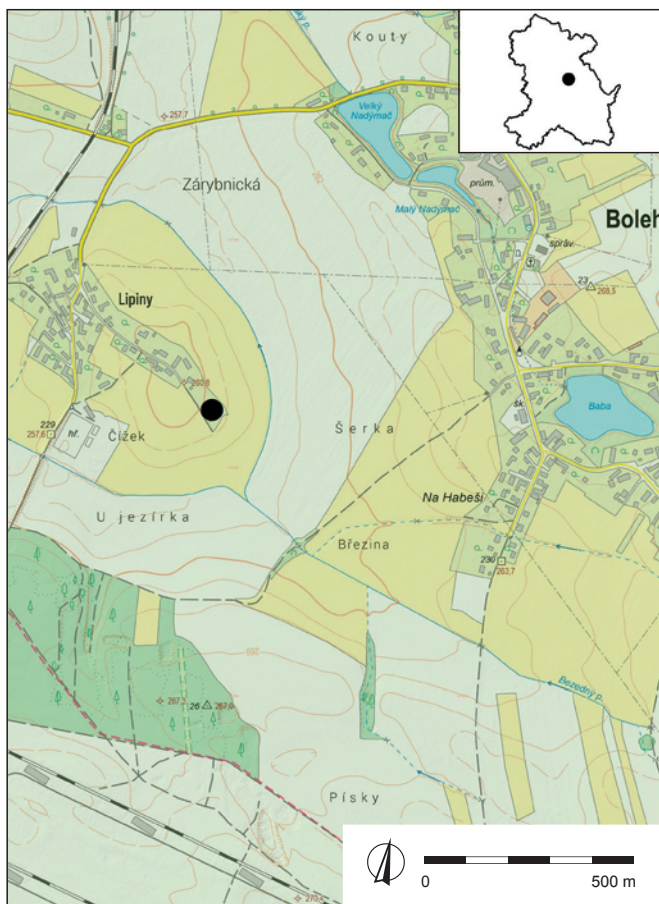


Fig. 3. Bolehošť site on the ZTM10 map combined with the DMR 5G. Base map and DMR 5G source: © ČÚZK.

Obr. 3. Lokalita Bolehošť na mapě ZTM10 kombinované s DMR 5G. Podkladová mapa a zdroj DMR 5G: © ČÚZK.



Fig. 5. Černčice sites on the ZTM25 map combined with the DMR 5G. 1 – Leafpoint site; 2 – Gravettian site. Base map and DMR 5G source: © ČÚZK.

Obr. 5. Polohy v Černčicích na mapě ZTM25 kombinované s DMR 5G. 1 – Místo nálezu listovitého hrotu; 2 – gravetttská lokalita. Podkladová mapa a zdroj DMR 5G: © ČÚZK.

The low degree of surface weathering and the overall good preservation of the whole object should be noted in comparison with others cases. The tool was made of silicite of glacial sediments, and its entire surface is covered of a thick, rich white patina. This is another interesting feature, as already macroscopically a double patina can be discerned on the surface of the point. On the right side of the tool there is a large fracture,

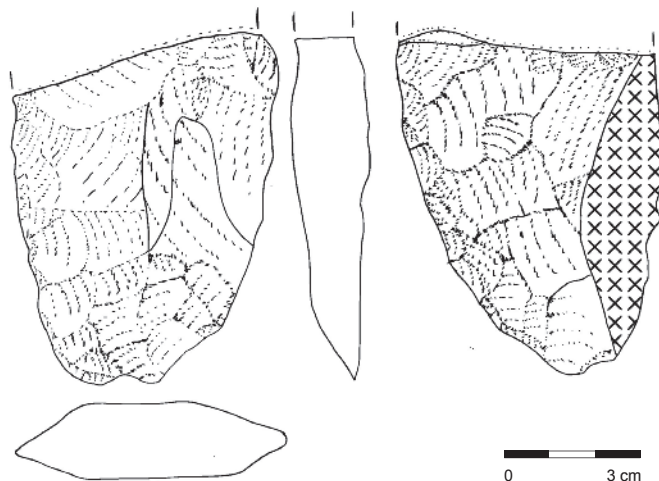


Fig. 4. Knives from Bolehošť. After Čechák 2019, 46, obr. 19.

Obr. 4. Nůž z Bolehošti. Podle Čechák 2019, 46, obr. 19.

which is covered with a weaker white patina. At the time of its initial publication (Čechák, Pacák 2018, 20–21), a theory was put forward according to which this phenomenon could have been caused by reutilisation of the point during the Paleolithic, but only after a longer period of time.

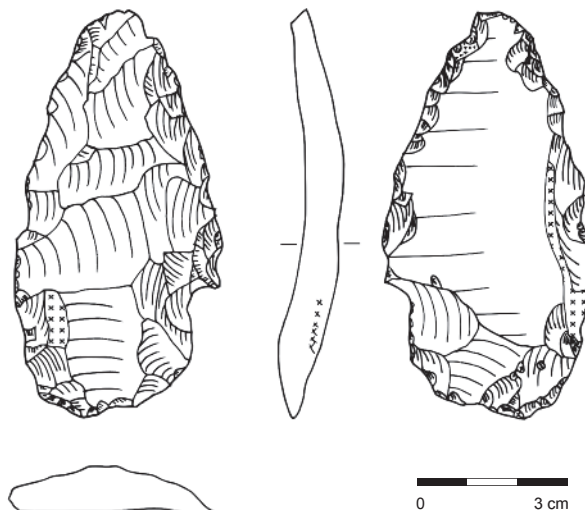


Fig. 6. Leafpoint from Černčice. After Čechák 2019, 50, obr. 25.

Obr. 6. Listovitý hrot z Černčic. Podle Čechák 2019, 50, obr. 25.

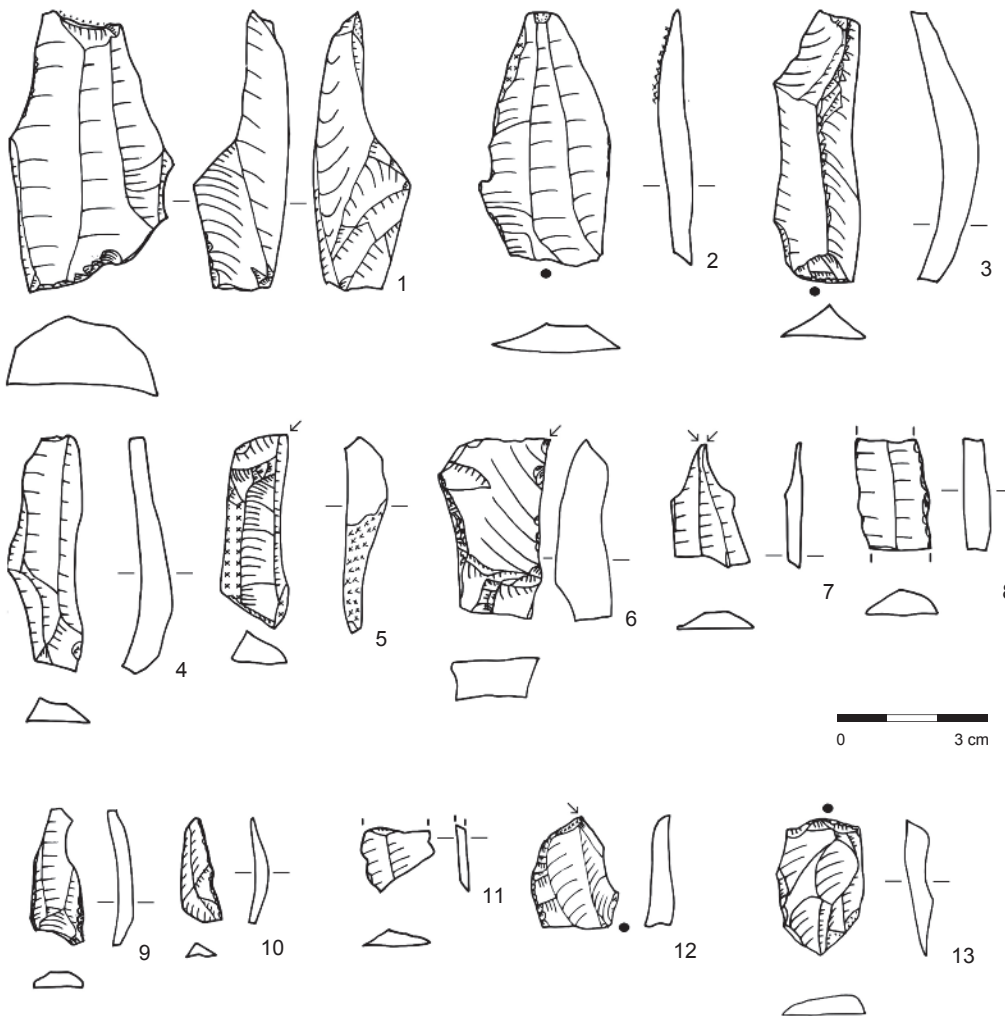


Fig. 7. Selection of Gravettian artefacts from Černčice. After Čechák 2019, 50, obr. 25.

Obr. 7. Výběr gravettských artefaktů z Černčic. Podle Čechák 2019, 50, obr. 25.

The point from Černčice is currently the only East Bohemian bifacial artefact to which other finds can theoretically be related from the cadastre. Although only a few unidentifiable fragments of chipped lithic artefacts come from the site of the actual discovery of the leafpoint, another site is situated relatively close by – less than 1.5 km by air (Fig. 5:2). Although this has so far only been investigated by field-walking, it nevertheless yields a rich collection of artefacts belonging to the Gravettian. Until a few years ago (Čechák et al. 2018; Čechák 2019, 52), the site had yielded about 70 pieces of chipped lithic artefacts (Fig. 7); today the number is close to a hundred. Although, of course, it is not possible to unambiguously culturally link the find of the point to the second location, it is not possible to reject this thesis either. While this is only an indirect indication, it is possible to state that the degree of patination on the Gravettian artefacts from Černčice is macroscopically the same as in the case of the leafpoint.

3.3 Jaroslav

The unique find was discovered in 1984 at coordinates WGS84 50.0127734 °N; 16.0765982 °E (S-JTSK: 626241; 1066119) and an altitude of approximately 274 m a.s.l. (Fig. 8). Again, this is an accidental discovery. Typologically, it is a leafpoint, as it was already identified at the time of its initial publication (Nerudová, Přichystal 2001).

The artefact (Fig. 9) was made of local cretaceous spongolite and, except for partial weathering, is not seriously damaged. Its

dimensions are 12 × 4 × 2 cm. The artefact is bifacially retouched and its shape is slender and elongated. In the context of its first publication, it was suggested that the find from Jaroslav could represent a unique intervention of a Szeletian from Moravia into Bohemia (Nerudová, Přichystal 2001, 58–59). At present, this thesis cannot be confirmed or rejected. In general, it can be summarised that the artefact falls at the beginning of the Upper Paleolithic (Čechák 2019, 80). Apart from the leafpoint, no other Paleolithic artefacts have been discovered in its immediate vicinity or elsewhere in the cadastre of Jaroslav.

3.4 Javorek

A bifacial artefact from Javorek was found during amateur field-walking in 2017 at approximately coordinates WGS84 50.5990004 °N; 15.5430001 °E (S-JTSK: 656297; 996882) at an elevation of around 492 m a.s.l. (Fig. 10). This is a hand axe, however it has so far only been published in general (Šída, Pokorný eds. 2020, 48, 556) and unfortunately was not available for the actual analyses described in this paper.

The hand axe was made from silicite of glacial sediments, and despite its dating (the find falls within the Micoquian) the surface of the artefact is not patinated (Fig. 11). On the other hand, it is very iron-stained, an effect caused by the sediments in which it was deposited. It is our intention to examine the artefact in the coming year using similar analyses to those to which the other East Bohemian bifacial artefacts have been subjected.



Fig. 8. Jaroslav site on the ZTM10 map combined with the DMR 5G. Base map and DMR 5G source: © ČÚZK.

Obr. 8. Lokalita Jaroslav na mapě ZTM10 kombinované s DMR 5G. Podkladová mapa a zdroj DMR 5G: © ČÚZK.

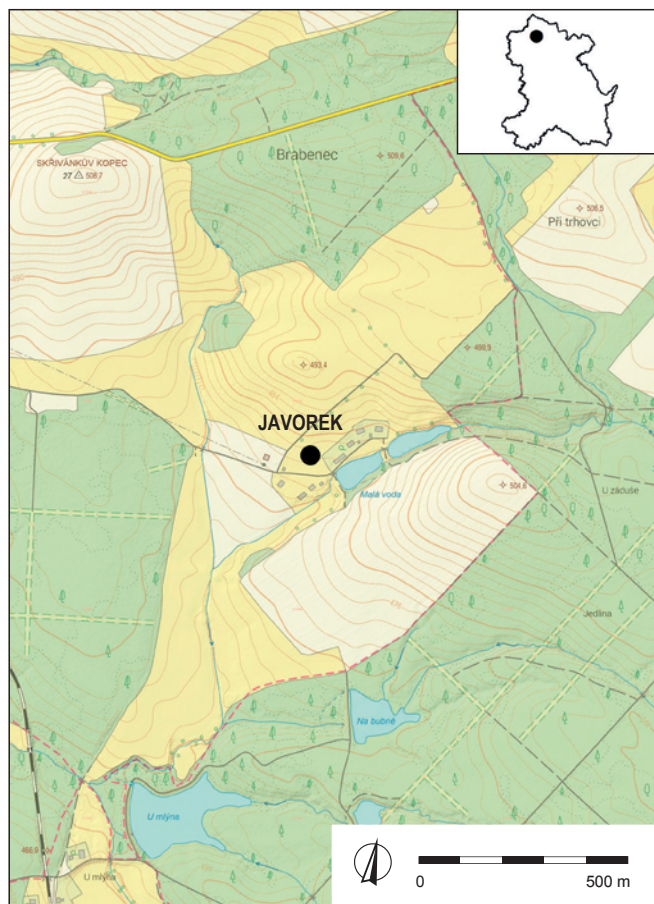


Fig. 10. Javorek site on the ZTM10 map combined with the DMR 5G. Base map and DMR 5G source: © ČÚZK.

Obr. 10. Lokalita Javorek na mapě ZTM10 kombinované s DMR 5G. Podkladová mapa a zdroj DMR 5G: © ČÚZK.

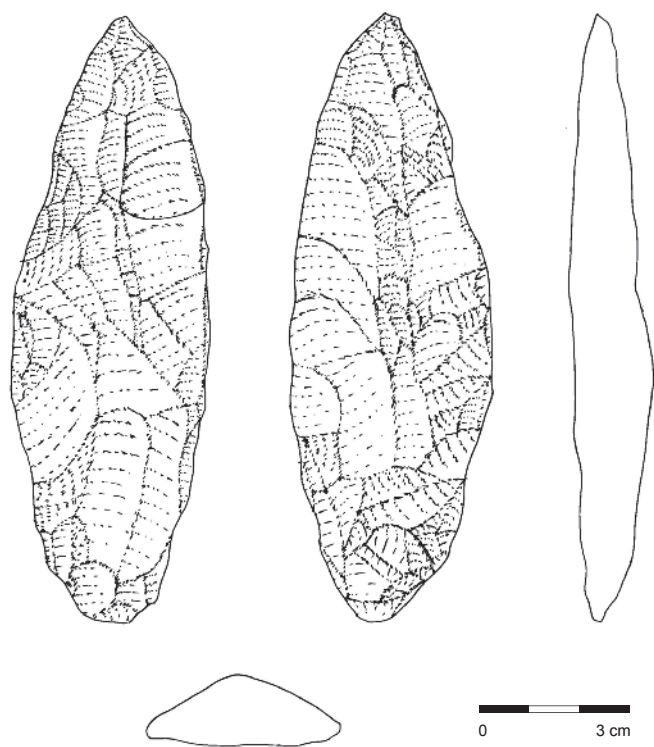


Fig. 9. Leafpoint from Jaroslav. After Čechák 2019, 80, obr. 53.

Obr. 9. Listový hrot z Jaroslavi. Podle Čechák 2019, 80, obr. 53.

4. Modelling and analyses

With the exception of the Javorek hand axe, which was not available during the analyses of the East Bohemian bifacial artefacts, all the artefacts described above were subjected to two analyses. In addition to the acquisition of detailed 3D models, traceology was used. The purpose of these modelling and analyses was both to determine the purpose for which the individual East Bohemian bifacial Paleolithic artefacts were used, and to test new approaches to the analysis of detailed 3D models and to evaluate the usefulness of the outputs of such analyses when they are focused specifically on chipped lithic artefacts.

4.1 Traceology

The tools from Bolehošť, Jaroslav and Černčice were subjected to a traceological examination carried out by Ludmila Kaňáková Hladíková from the Institute of Archaeology and Museology at Masaryk University in Brno. The intended result of these analyses was mainly to clarify the way the tools were used during the Paleolithic. In the case of the leafpoint from Černčice, the question of later reutilisation of the tool was again addressed.

Unfortunately, the results of the traceology only partially fulfilled their objectives. In the end, the condition of the artefacts made it impossible to answer most of these questions. The finds from Bolehošť and Jaroslav are unfortunately overweathered, so that all possible traces that would have been desirable to investigate with a traceological analysis have been erased by this weathering. Thus, no evaluable evidence of their use in the



Fig. 11. Hand axe from Javorek. After Šída, Pokorný eds. 2020, 49, obr. III.2.

Obr. 11. Pěstní klín z Javorku. Podle Šída, Pokorný eds. 2020, 49, obr. III.2.

Paleolithic could be found on the knife or the leafpoint. The only artefact for which any observations could be made is therefore the leafpoint from Černčice. In the first place, microscopic traces, probably of resin, were found on its surface, perhaps the remains of the tool's attachment to a handle. Although the actual traceological traces of the use of the point were also largely removed by weathering of the surface of the artefact, at least on the basis of the preserved ones, it seems that the tool was used to cut soft tissues in the Paleolithic, i.e. as a knife (Fig. 12). As for the differently patinated fracture on one side of the leafpoint, it can be noted on the basis of the traceology that this is indeed an intentional intervention. The nature of the fracture and its edges suggest that the fracture in question is later in time than the other interventions on the artefact, which can also be noted macroscopically (Čechák, Pacák 2018 20–21). Unfortunately, weathering has erased most of the traces even from the surface of the Černčice find, and from the point of view of traceology it is not possible to say anything else about the artefact.

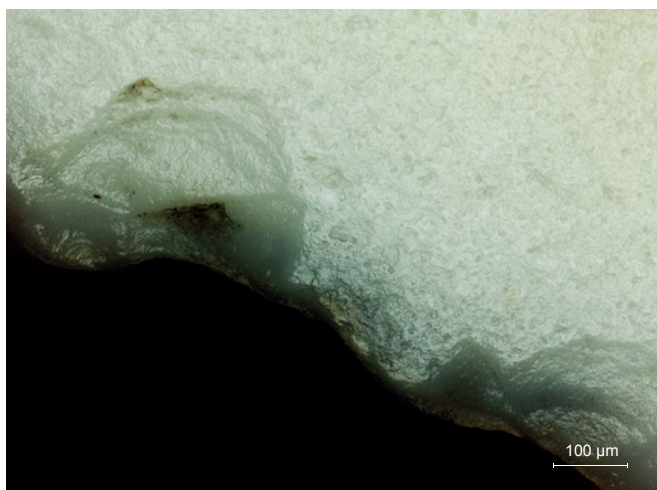


Fig. 12. Traceology of the Černčice point. Former strongly weathered surface and later ventral retouch, that was worn by a soft material. That is supported by softly rounded edges of negatives with diffusive gloss. Photo and comment by L. Kaňáková Hladíková.

Obr. 12. Trasologie na hrotu z Černčic. Ukázka silně zahlazeného povrchu a čerstvější ventrální retuše opotřebeným měkkým materiálem. To dokládá měkké zaoblení hran negativů s difúzním leskem. Foto a komentář L. Kaňáková Hladíková.

4.2 3D model analysis and enhanced visualisation

The artefacts presented in this article were modelled using SfM photogrammetry and visually enhanced for better comprehension of its surface features. Our SfM 3D models are available for download at web sites of Museum of Eastern Bohemia in Hradec Králové (MVČ HK). The enhancement method is based on the variant of the APSS surface reconstruction algorithm (Guennebaud, Gross 2007) implemented in Meshlab software (VCL), where it is used to colourise concave and convex features of a 3D model (mesh or point set) based on a set of adjustable parameters. This method seems to be well-suited for visualizing weathered chipped stone surfaces. Chipping leaves specific elongated concave shallow marks, which can be visually enhanced by this method. On the body of bifacial artefacts, sets of several of these concave surface features are usually created along with sharp edges between them. These sharp edges will erode over time, depending on environmental factors, and acquire a round convex shape. Depending on the level of abrasion, these features could be difficult to identify with the naked eye and very difficult to document using standard photography or visualisation by non-colourised 3D model (Fig. 13–15).

APSS can also be used to highlight details on non-weathered surfaces. However, as we can see on the example of the Černčice point (Fig. 16), visual enhancement in this case is somewhat redundant as details are visible even without APSS enhancement. Nevertheless, consistent colour coding of surface features can be advantageous in cases when visual comparison between two or more artefacts is needed, especially when those artefacts are made of distinct materials.

A somewhat similar effect could be also achieved in different, more archaeologically focused software GigaMesh (FCGL) and its MSII filtering (Mara, Krömker 2013). Meshlab was chosen because it is commonly known, well documented and user friendly, therefore even the users without expertise in 3D modelling can easily use it,¹ provided that a suitable 3D model is available to them.

5. Results and discussion

Unfortunately, the results of the traceology analysis can only be applied to a single artefact – the leafpoint from Černčice. Two other finds (from Bolehošť and Jaroslav) no longer bear any analysable traces and the last East Bohemian bifacial artefact (from Javorek) was not available for analysis. Based on the traceology, it seems that the find from Černčice site would fit quite clearly into the results obtained on leafpoints from Moravia (Nerudová et al. 2010) and Germany (Kot, Richter 2012). This also distinguishes it from the results from, for instance, the Polish site in Nietoperzowa Cave (cf. Wisniewski et al. 2022). In addition, its exact dating is still an open question.

Several cultures associated with the production of leafpoints were found in Central Europe during the Paleolithic period. While Jerzmanowice type points are often placed in the Lincombe-Ranis-Jerzmanowice (LRJ) complex, which is geographically associated with a broad band from Central Europe to Great Britain (Flas 2011, 607–608), they have also been found at sites of different dates. A geographically (roughly 70 km by air) and perhaps culturally close analogue is a similar find of a Jerzmanowice type leafpoint at the Henryków site in Poland (Płonka et al. 2004, 173). The discovery there was made in the context of artefacts belonging to the Gravettian. Although it would be easy to link this leafpoint to the Gravettian culture on the basis of the finds of chipped lithic artefacts from the second site at Černčice, it should be emphasised again that the two sites are approximately 1.5 km apart and no other closely datable lithic artefacts has been discovered since 1986, despite intensive field-walking efforts.

Another very tempting theory is the actual reutilisation of the tool in the context of the Gravettian settlement of Černčice. Hypothetically, it cannot be excluded that the leafpoint itself dates to the turn of the Middle and Upper Paleolithic, when it reached its place of discovery in the Gravettian Period, but it was reutilised by the hunters from Černčice. There is, however, no direct archaeological evidence for such a theory so far. The two locations with finds of chipped lithic artefacts in Černčice will be further investigated, which will hopefully lead to finds that might suggest something in this respect.

The precision and consistency of APSS colourisation can provide a clearer picture of an artefact, especially in cases involving artefacts with large artificially modified parts on the weathered surface. This ability can best be demonstrated on the leafpoint from Jaroslav (Fig. 14). Chipped stone artefacts with weathered surfaces are notoriously hard to document. Therefore, any means of consistent visual enhancement of the surface features could be useful and potentially serve as a basis or correction for hand-drawn documentation. Many different approaches can be taken to achieve this goal. We tried APSS analysis, which yielded useful results for our intended purpose of visually enhancing three specific artefacts.

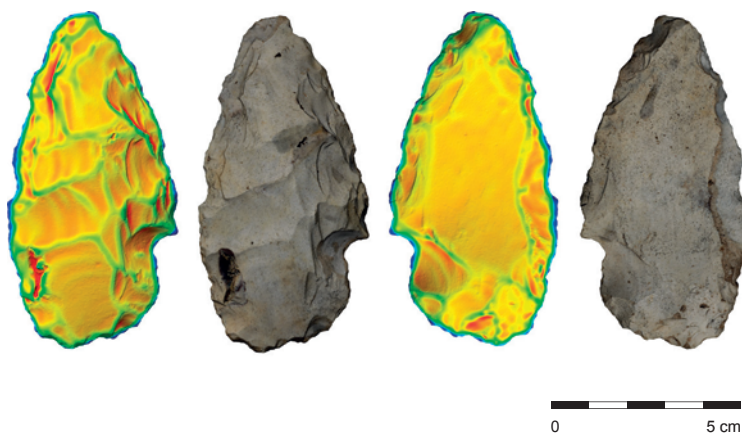


Fig. 13. APSS of the Černčice point. Author M. Pacák.
Obr. 13. APSS model hrotu z Černčic. Autor M. Pacák.

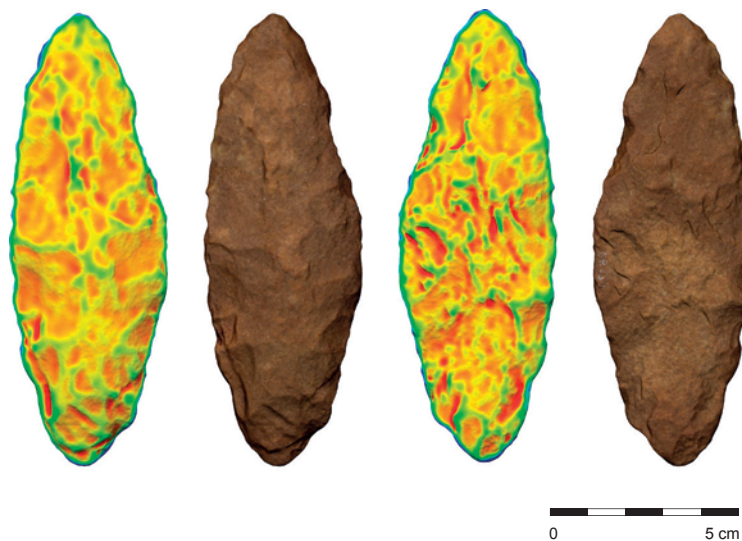


Fig. 14. APSS of the Jaroslav point. Author M. Pacák.
Obr. 14. APSS model hrotu z Jaroslavi. Autor M. Pacák.

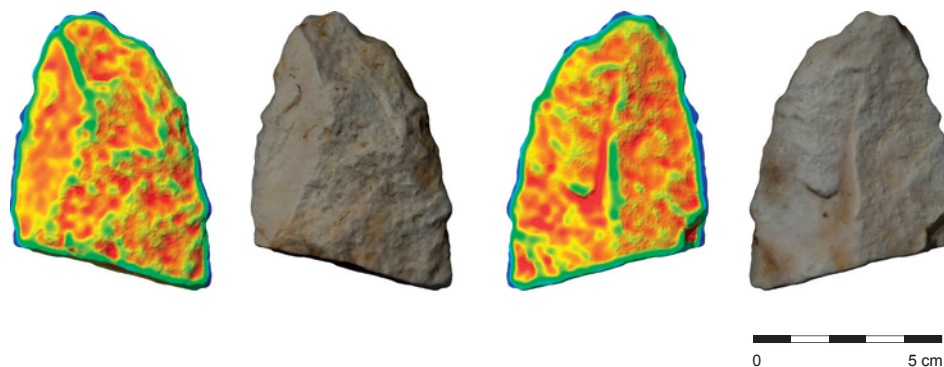


Fig. 15. APSS of the Bolehošť knife. Author M. Pacák.
Obr. 15. APSS model nože z Bolehoště. Autor M. Pacák.

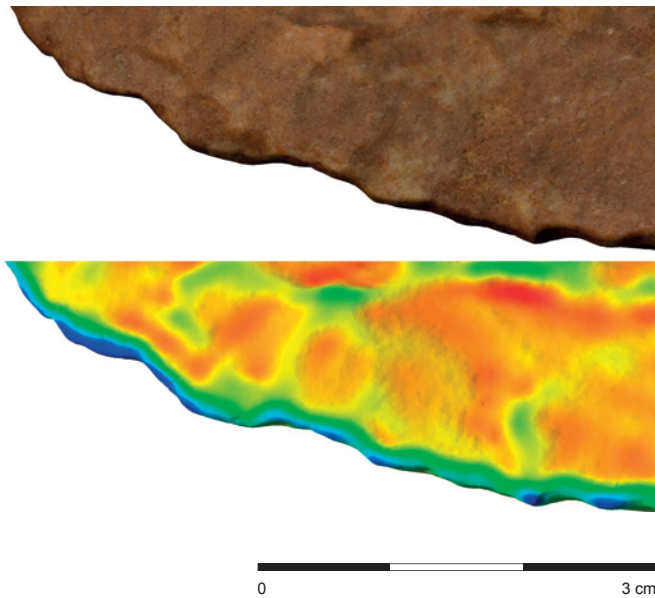


Fig. 16. Černčice leafpoint. APSS highlighted detail of the mesh surface compared to the textured mesh. Author M. Pacák.

Obr. 16. Listovitý hrot z Černčic. Porovnání modelu s texturou a metodou APSS zvýrazněným detailem povrchu modelu. Autor M. Pacák.

6. Conclusion

Paleolithic bifacial lithic artefacts represent an interesting and, from the perspective of Eastern Bohemia, so far a not very numerous group of artefacts. The Middle and the beginning of Upper Paleolithic in this region is one of the periods that are currently only very little known archaeologically. At the moment we know only four bifacial artefacts: a hand axe from Javorek, a knife from Bolehošť, a leafpoint from Jaroslav and the same type of artefact from Černčice. In all cases these are random and solitary finds, which unfortunately were not accompanied by any other lithic artefacts. Therefore, with the exception of the hand axe from Javorek, which was not available at the time, a traceological analysis and 3D modelling of these isolated finds was carried out. In the case of the Javorek hand axe, we plan to analyse it in the near future.

Unfortunately, any traces on the knife from Bolehošť and the point from Jaroslav were destroyed by the weathered surfaces of both artefacts. It was therefore impossible to make any comment on the manner of their use in the Paleolithic. The only artefact that can be at least partially analysed is the leafpoint from Černčice. Even its surface had been largely weathered, but traces of soft tissue cutting could be found. It can therefore be assumed that the point served as a knife. Importantly, it also confirms the earlier suggestion that the point had been reutilised and chipped in one place. The fracture shows a different patina and overall structure. Even with analogies from other sites, its cultural relationship with the nearby Gravettian site cannot be ruled out, but at this point it is purely a working hypothesis.

Acknowledgements

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Note

- 1 In Meshlab, the APSS analysis is located under Filters/Point Set/Colorize curvature (APSS).

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Resumé

Východní Čechy představují oblast, kde je období paleolitu prozatím stále ještě poznáno jen málo. Zároveň bifaciální artefakty z tohoto regionu jsou pro celý paleolit zatím známy pouze čtyři. Tři z nich – listovité hroty z Jaroslavi a Černčic a bifaciální nůž z Bolehoště – byly v letošním roce podrobeny několika analýzám. Poslední artefakt – pěstní klín z Javorku – nebyl pro analýzy k dispozici. Autoři jej však plánují analyzovat v příštím roce.

Trasologická analýza přinesla výsledky pouze v jednom případě. Nálezy z Jaroslavi a Bolehoště jsou příliš eolisované a nepodařilo se na nich zachytit žádné stopy, které by bylo možné následně vyhodnotit. V případě listovitého hrotu z Černčic se ukázalo, že nástroj sloužil k řezání měkkých tkání, tedy spíše coby nůž. Tím nález poměrně jasně zapadá do výsledků, které byly v tomto ohledu získány na listovitých hrotech z Moravy (Nerudová et al. 2010) a Německa (Kot, Richter 2012), a naopak se odlišuje například od artefaktů z bohaté polské lokality v Nietoperzowě jeskyni (srov. Wiśniewski et al. 2022).

Zajímavé zjištění se týkalo již dříve domnělé reutilizace artefaktu (Čechák, Pacák 2018). Trasologie se v tomto ohledu zaměřila na jeden velký, atypický lom. Potvrdila jeho odlišný charakter od zbytku retuše artefaktu i jinou patinaci. Zdá se tak, že mezi vyhotovením listovitého hrotu a jeho reutilizací uběhl značný čas. Jelikož jde (stejně jako v případech zbývajících východočeských bifaciálních artefaktů) o solitérní nález, je obtížné

jakkoli hodnotit jeho přesnou dataci a kulturní příslušnost. Z ne-daleké (asi 1,5 km) polohy Černčice 4 pocházejí doklady přítomnosti bohaté gravettské lokality, nicméně souvislost s nálezem listovitého hrotu může být i dílem náhody. Autoři tohoto textu by chtěli provést na gravettské lokalitě archeologickou sondáž, která by snad mohla být nápomocna v řešení tohoto dohadu.

S rozvojem dokumentace artefaktů tvorbou detailních 3D modelů vyvstává otázka, jak mohou být tyto modely užitečné i mimo primární dokumentaci a archivaci. Analýzy povrchu nabízejí jednu z odpovědí. V příspěvku jsou prezentovány výsledky APSS analýzy povrchu provedené na omezeném vzorku tří bifaciálně opracovaných nástrojů. Můžeme-li usuzovat z těchto kvantitativně omezených výsledků, tak se metoda zdá být použitelnou pro zvýraznění povrchové úpravy štípané kamenné industrie, především jejich eolisovaných částí.

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