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LEVALLOIS POINT OR BLADE: WHICH BLANK WAS THE TARGET ARTEFACT OF THE BOHUNICIAN TECHNOLOGY?

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Abstract

The Bohunician represents a techno-complex on a local scale known almost exclusively from the Brno basin, Moravia. However, on a broader scale, the Bohunician fits into the complex of evolved Levalloisian industries known from the Near East (Boker Tachtit), through the Balkan peninsula (Temnata), Ukraine (Kulichivka) and even further to the east (e.g., Kara Bom). The Bohunician occupation in Moravia was present between 50-40 ka BP during the time of the Middle to Upper Palaeolithic transitional period – the period of first contacts between the remaining Neanderthals and the arriving anatomically modern humans in this area. Because Moravia represents a junction of routes connecting the south and the north as well as the east and the west of Europe, it represents a zone of contact between both types of humans. Therefore the technological affinity with the Near Eastern industries in the time of contact and in the zone of contact suggests the possibility that the Bohunician is one of the potential candidates for the first techno-complex with anatomically modern humans in this area.

The Bohunician technology was originally defined as a mixture of Levallois technology and Upper Palaeolithic blade core reduction. Based on the analysis of refitted cores from Stránská skála, where both techniques were used on the same core, the definition was subsequently refined as a contextual fusion of Levallois and Upper Palaeolithic technologies. All reconstructed cores display a tendency towards the production of a Levallois point (or a series of points) being the target artefact. In this concept, blades were removed in order to shape the frontal face of the score and represent (technologically) a secondary product. Both flake and blade blanks were utilized for retouched tools.

Keywords

Moravia, Bohunician, Middle to Upper Palaeolithic transition, Levallois

Introduction

Moravia, with its specific geography – highlands separated by river valleys that present ideal routes between lowlands – is a connection route between the Danube basin and the north European plains (Fig. 1). This important geographic position played a significant role in glacial conditions during the last glaciation, when both the animal herds and human groups migrated from the more temperate south to northern latitudes and back. In later prehistory that route was known as the Amber Route. During the Palaeolithic period it was used for the transport of high-quality erratic flint from northern to southern regions. The route in the periglacial zone between the Fennoscandinavian and alpine ice sheets represented one of the routes connecting Western and Eastern Europe during the glacial period (cf. Schwabedissen 1943).

During the Middle to Upper Palaeolithic transitional period, i.e., 50-40 ka BP, two main techno-complexes are documented in Moravia: The Bohunician and the Szeletian (Svoboda et al. 1996). While the fully Upper Palaeolithic techno-complex – the early Aurignacian – is known from nearby Austria (Willendorf – AH 3; Nigst et al. 2008), in Moravia the Aurignacian is documented only in its middle phase (the middle or evolved Aurignacian) dated between 40-34 ka BP (Svoboda et al. 1996).

The Bohunician was dated by 14C, thermoluminescence (TL), infrared stimulated luminescence (IRSL) and optically stimulated luminescence (OSL) methods (Richter et al. 2009; Nejman et al. 2011). While the radiocarbon dates (calibrated using CalPal-2007, Weninger et al. 2007) have a relatively wide spread (between 40-48 ka BP), a TL weighted average of eleven artefacts from the Bohunice 2002 excavation yielded a result of 48.2 ± 1.9 ka BP. Based on the radiocarbon record and comparing the Bohunician radiocarbon dates with Szeletian dates (Vedrovice V, Moravský Krumlov IV and Želešice III) and early Aurignacian (Willendorf II - AH 3) sites, the Bohunician may have

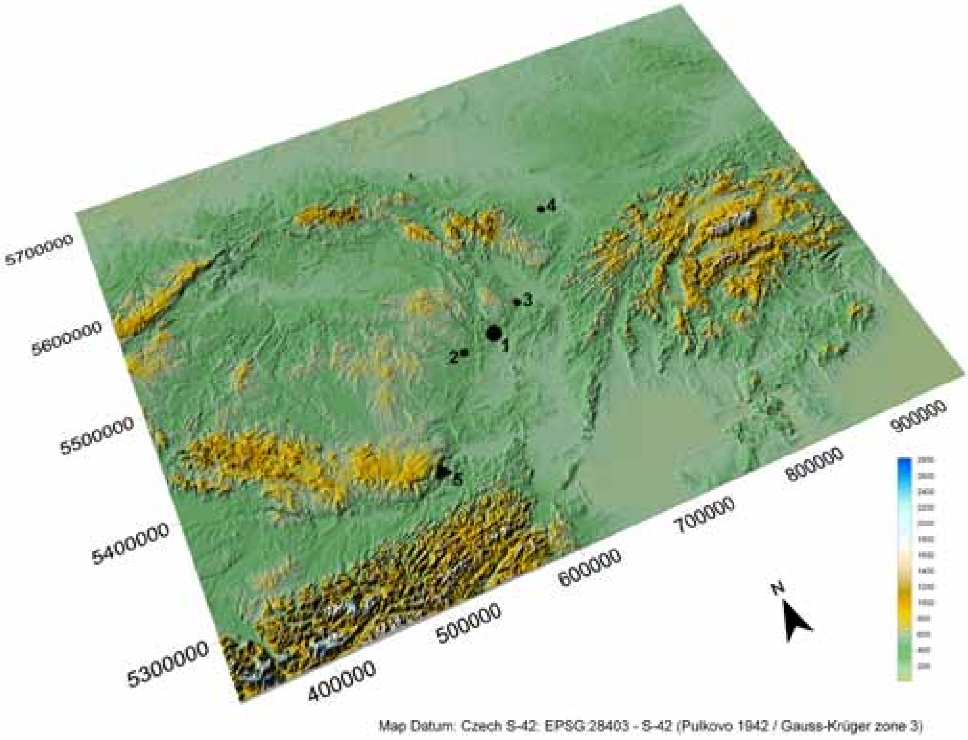

Fig. 1 Geographical setting of Moravia with sites mentioned in the text. 1 – Brno basin (Bohunice, Stránská skála, Líšeň and Tvarožná), 2 – Mohelno, 3 – Ondratice, 4 – Dzierzyslaw, 5 – Willendorf. II.

been contemporaneous with both of the latter mentioned techno-complexes (Fig. 2).

Based on the current radiocarbon record, both transitional techno-complexes – the Bohunician and the Szeletian – were replaced by middle Aurignacian after the Heinrich Event 4.

In the region of the middle Danube, the very beginning of the Upper Palaeolithic was characterized by several behavioural shifts. People tended to avoid protected sites in caves and rock shelters located in the highlands, which still attracted human occupation during the Middle Palaeolithic, and instead they settled in the open landscape (Škrdla 2003, 148). Most early Upper Palaeolithic sites are located strategically at elevated locations flanking big river valleys and basins, in the transitional zone separating lowlands and highlands.

Recently, under the auspices of an early Upper Palaeolithic project in collaboration with the University of Minnesota (Tostevin) and the Institute of Archaeology in Brno (Škrdla), all three techno-complexes have been the subject of new investigations in Moravia. This research included lithic analyses as well as field research. New intensive field surveys were conducted at already known sites and at locations near known sites. This research resulted in new excavations of recently discovered sites with unaffected sediments, which increased the number of stratified and absolutely dated collections and yielded new data used in debates about the Middle to Upper Palaeolithic transitional period in the region of the middle Danube.

Brno basin and Bohunician occupation

The main Bohunician site-cluster is represented by a significant concentration in the area of the Stránská skála cliff (the outcrop of Stránská skála-type chert) in the Brno basin (Fig. 3). On the eastern margin of the Brno basin, several artefact clusters were excavated directly on the Stránská skála hillside (cf. Svoboda & Bar Yosef 2003), one artefact cluster in Líšeň (2 km east from Stránská skála; Škrdla et al. in press), and an artefact cluster in Tvarožná (7 km east from Stránská skála; Škrdla et al. 2009). On the western margin of the Brno basin, several artefact clusters were excavated at Bohunice (cf. Valoch 1976; Škrdla & Tostevin 2003), which is located on Red Hill 7 km west of Stránská skála. Another important excavated site is located at Ondratice/Želeč, 34 km northeast of Stránská skála (Svoboda 1980; Škrdla & Mlejnek 2010). An additional important site cluster is located in the southwestern margin of the Brno basin in the Bobrava river area (with the sites Želešice II, Ořechov I, II, IV 10-20 km southwest from Stránská skála; Valoch 1956; Nerudová 1999). Although these sites were originally described by Valoch (1956) as being located in the Bobrava river valley, they flank the Svratka river valley rather than following the Bobrava river. The westernmost presence of the Bohunician settlement was documented in the Mohelno area, 34 km west of Stránská skála (Mohelno-Boleniska; Škrdla 1999). The most distant sites from the Brno basin with Levalloisian technology are located at Hradsko in Bohemia (Neruda & Nerudová 2000) and Dzierzyslaw in southern Poland (Foltyn & Kozłowski 2003). Isolated implements that show the use of evolved Levallois technology (elongated Levallois blanks or characteristic opposed-directional cores) are known from many other sites; however, their relationship to the Bohunician is not clear. Only the sites Bohunice, Stránská skála, Tvarožná, Líšeň and Želeč were excavated and yielded stratified and absolutely dated lithic assemblages. The remaining sites held surface collections lacking a stratified context.

Bohunician in the Brno basin is surrounded by rich Szeletian occupation in the surrounding highlands (which, based on the current dating record, chronologically belongs to the same time span – GI 10-11). If Szeletian is accepted as a continuation of the central European Micoquian – whose creators were most probably still Neanderthals (e.g., Neruda 2010, 126) – it actually represents a wedge with specific and intrusive techno-typological features introduced into the region (evolved Levallois technology which differs significantly from local Middle Palaeolithic Levallois technology - cf. Oliva 1986). The middle Aurignacian occupation after 39 ka BP covered the whole area settled previously by the Bohunician and Szeletian entities.

Bohunician and early Upper Palaeolithic settlement strategies

The early Upper Palaeolithic sites are generally located on significant elevations that allowed control of the Brno basin or surrounding valleys jutting from the Brno basin to the south (Svratka river valley) and east (Vyškov gate). The characteristic position is on a hilltop or the crest of a hill, at an altitude of ca. 270-330 m asl (relative altitude ranges between 70-130 m above the river). The position of early Upper Palaeolithic sites on top of hillocks, which are currently (and probably also during the MIS 3) not covered by loess, resulted in the erosion of many sites that are surface sites only nowadays, with just a few sites that permit stratigraphic observations. Generally,

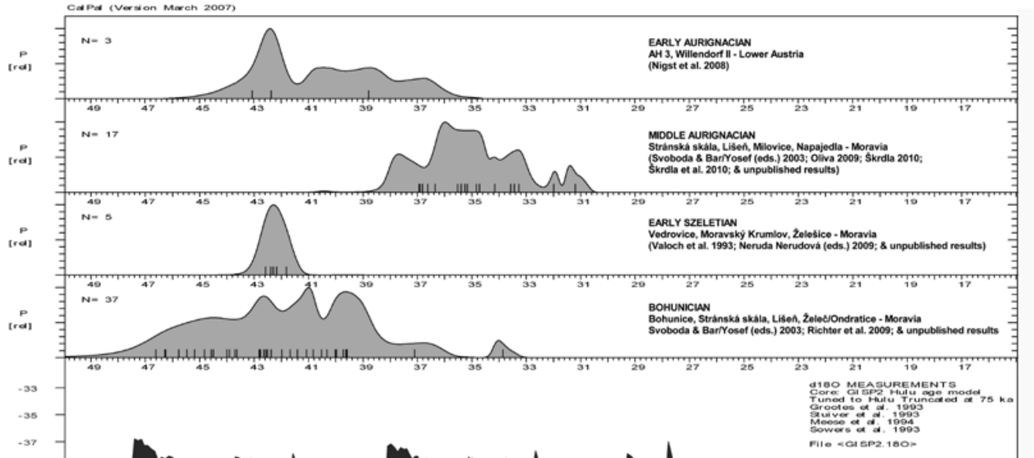

Fig. 2 Calibrated (with CalPal-2007$_{Hulu}$) radiocarbon ages for Moravian early Upper Palaeolithic techno-complexes.

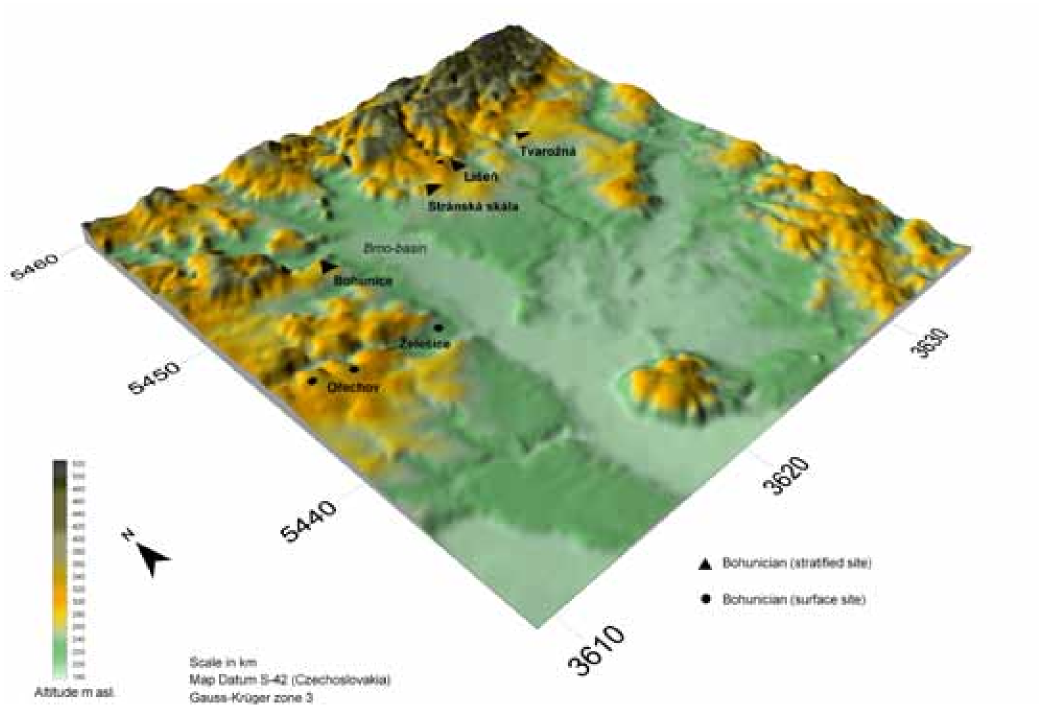

Fig. 3. Map of the Brno basin with locations of Bohunician sites.

the sites were often located in places with gravel or stony bedrock rather than loess or soil sediment surfaces, which may be related to the permafrost conditions or topsoil humidity during the period. On the other hand, while the sites mentioned above on gravel or weathered bedrock allow surface surveys, the sites covered by sediments are buried and not that easy to detect (cf. with similar east European records; Hoffecker 2011, 24). Currently, the only documented multi-layered site is at Stránská skála, and in all cases, the Bohunician was below the middle Aurignacian occupation (Svoboda & Bar Yosef 2003). Because the settlement strategies of all early Upper Palaeolithic techno-complexes are similar (e.g., Bohunician, Szeletian and Aurignacian preferred similar positions in the landscape for placing their sites) many other sites probably represent palimpsests of repeated occupations by different early Upper Palaeolithic techno-complexes. Therefore the method of using surface collections to create developmental schemes for individual techno-complexes as well as for general developmental schemes is unacceptable (e.g., Svoboda 1984; Svoboda et al. 1996; Allsworth-Jones 1990; Škrdla 2006). Some authors (e.g., Valoch 1996; Oliva 1987; Valoch & Karásek 2010, 52) continue to argue for one-time occupations allowing the creation of regional developmental schemes.

The earlier phase of MIS 3 is stratigraphically characterised by a complex of palaeosoils, which are often damaged by gelifluction and cryoturbation or redeposition (Škrdla et al. 2009), which makes microstratigraphic research difficult. For example, the attempt to separate possible occupational episodes in Bohunice 2002 was not successful (Škrdla & Tostevin 2005).

BOHUNICIAN *CHAÎNE OPÉRATOIRE*: THE REFITTING APPROACH

Škrdla began systematically refitting the Bohunician assemblages in 1993 and, with numerous interruptions, had refitted the Stránská skála III, IIIa, IIIc and IIId assemblages by 2001 with a total of more than 10,000 artefacts (Svoboda & Škrdla 1995; Škrdla 1996, 2003). Refitting is a time consuming process and the Stránská skála material consumed ca. 1 year of absolute working time. This attempt resulted in 14 almost completely reconstructed cores from the decortification stage, through the production stage to the abandonment of the exhausted core, supplemented by dozens of other, less complete production sequences. Subsequently this was followed by refitting attempts by

Neruda and Nerudová at the Stránská skála III-1 assemblage (Valoch et al. 2000, 2009), who reconstructed several cores, even though not as completely as the 14 items mentioned above; this attempt resulted in the identification of alternative modes within the Bohunician technology. Attempts to refit Bohunician collections from sites other than Stránská skála workshop sites did not result in complete sequences. In Bohunice, Krásná refitted the collection from Kejbaly II (Nerudová & Krásná 2002) and Škrdla refitted material from the Bohunice 2002 excavation (Škrdla & Tostevin 2005). In the latter collection, only one production sequence, which consists of two blades, documents a characteristic Levallois bidirectional reduction sequence and a refit of a side scraper with a curved flake represents evidence of bifacial thinning. The most recent attempt is the refitting of the Tvarožná assemblage (Škrdla et al. 2009), which did not result in technologically significant sequences.

The following simplified scheme of the Bohunician operational sequence was defined with the almost completely reconstructed assemblages from Stránská skála III-1, IIIa, and IIIc (cf. Škrdla 2003).

The Levallois point has been originally defined as a characteristic product of Levallois technology (Bordes 1980). According to Boëda (1995), only an artefact produced by Levallois technology can be classified as a Levallois point. However, the Bohunician technology differs from Levallois techniques as described by Boëda. The term Levallois in the frame of the Bohunician industry was introduced by previous scholars (e.g., Valoch 1976) on the basis of artefact morphology. To distinguish whether a point was produced by Levallois or a different technique is difficult when it does not come from a refitted sequence. But for the sake of historical continuity we continue to use the term Levallois.

Raw material procurement

In contrast to the settlement strategies described above, the raw material procurement typical for early Upper Palaeolithic techno-complexes is similar to the Middle Palaeolithic procurement strategies based on exploitation of local raw materials - however, the proportion of the imported lithic material increases slowly. The Bohunician lithic economy (alongside with all other known early Upper Palaeolithic techno-complexes) is characterized by the utilization of local chert supplemented by infrequent imports (up to 15 %; with the exception of Ondratice/Želeč). Chert of the Stránská skála-type was utilized in the Brno basin and nearby. Local orthoquartzite and chert were used in Ondratice/Želeč. In the Krumlovský Les area, the local Krumlovský Les-type chert was dominant. Radiolarite was imported from the White Carpathians (the distance to the nearest sources: 100 km) and erratic flint from northern Moravia and lower Silesia (the distance to the nearest deposits: ca. 120 km). Limnic siliceous rocks (documented only in Tvarožná) were imported from northern Hungary or southern Slovakia, a region that was probably occupied by the Szeletians.

The most important raw material utilized in Bohunician – chert of the Stránská skála-type – was probably collected from natural outcrops on top of the weathered limestone rock or in the limestone scree covering the slopes of the cliff. However, high quality chert blocks were observed in sediments underlying the Bohunician deposits at Stránská skála IIIb (Svoboda 1993) and quarrying these blocks for procurement (also documented in the same period in north Africa; Vermeesch 2002), cannot be excluded. The chert of the Stránská skála-type was available both as nodules and prismatic blocks. The nodules were globular, semiglobular, ovoid or flat; the blocks were often prismatic (occasionally flat) or of indeterminate forms shaped by natural cracks. There are great differences in the quality of the raw material in this type of chert.

The proportion of Stránská skála-type chert in the Bohunician collections decreases rapidly in a radial pattern while moving away from the source (i.e., away from the Stránská skála rock outcrop - Fig. 4). It demonstrates that its export was limited to the nearest vicinity of Brno basin; further away from the Brno basin, its role decreases and local raw materials are used instead. The sources of other local raw materials including Krumlovslý-les-type chert, Cretaceous spongolite chert or orthoquartzite are not restricted to a single place as much as the Stránská skála-type chert, which makes

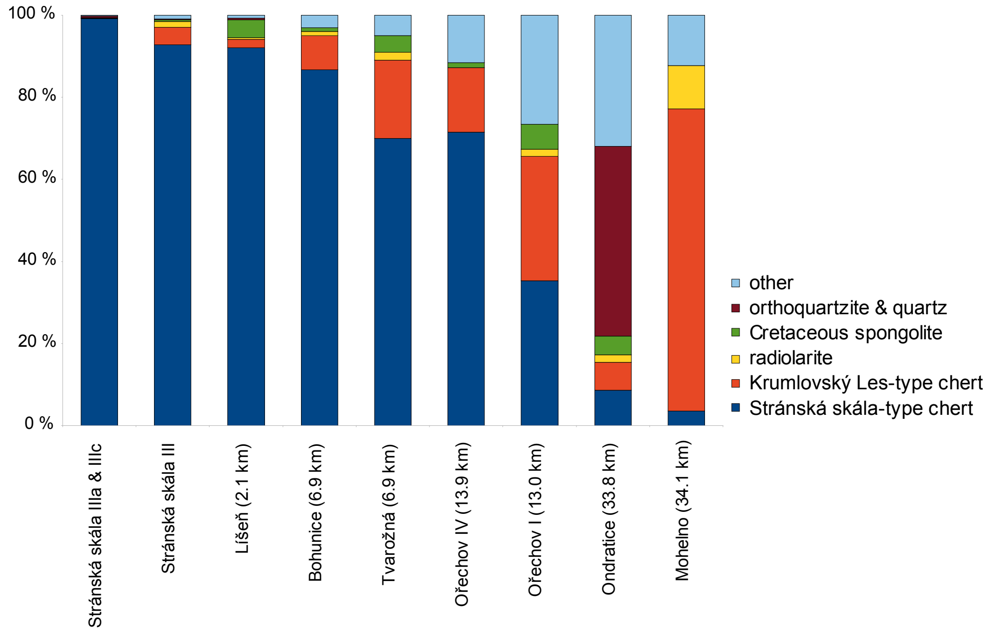

Fig. 4 Raw material procurement: Proportion of the Stránská skála-type chert for individual Bohunician sites, sorted according to the distance from the Stránská skála outcrop.

studies of their distribution models more difficult. For example, the local Krumlovský Les-type chert represents a raw material base for assemblages in the Krumlovský Les area; however, its isolated sources in gravels are known throughout the entire territory of southern Moravia. Therefore, it might be that the Krumlovský Les-type chert in the Bohunician assemblages in the Brno basin or in Ondratice/Želeč come from local gravels. The same applies for Cretaceous spongolite chert or orthoquartzite.

Although Oliva (e.g., 1986) claimed that isolated Bohunician implements such as Levallois points were produced only out of the Stránská skála-type chert in the Krumlovský Les area and represent transport of finished products rather than in situ production, Škrdla and Plch (1993) documented application of Bohunician technology of different types of raw material in Mohelno. The same author stated (Oliva 1981, 1984) that leaf points in Bohunician assemblages, frequently made on imported raw materials, represent imports from Szeletian workshops. However, Tostevin and Škrdla (2006) proved bifacial reduction in situ at Bohunice, which applied also for Stránská skála-type chert. Svoboda (1987) described a series of leaf points made from Stránská skála-type chert from Líšeň-Čtvrtě.

Preparation stage

The raw material nodules or blocks were shaped in the classic Upper Palaeolithic method, i.e., with a prepared frontal crest. The frontal crest was made by a series of cortical flake removals. In any case this preparation exploited up to one third of the nodule's volume, and in specific cases when the attempt was not successful, this stage use the whole nodule. However, particularly in the case of prismatic blocks of suitable shape that do not require any preparation, the core was initiated from a natural crest. Simultaneously or subsequently one or two opposed reduction platforms were prepared. The second platform (always opposed to the first) was sometimes even prepared during core reduction.

Production stage

The result of the preparation phase was a core with a frontal crest (both prepared and natural) and one or two prepared reduction platforms. The core reduction started with the crest blade removal. It was followed by a series of blade removals, often reduced from both opposed platforms. The aim of these removals, called *débordant* blades, was the attainment of an elongated triangular shape of the frontal face of the core. The striking platforms of these blades were faceted, allowing better control of the strike. In that time, the core often had two prepared platforms and its frontal face was ready for Levallois point production. The prevailing dorsal scar pattern was bi-directional or opposed directional (Škrdla 2003, Tab. 7,1). Before the Levallois point production, the striking platform was carefully prepared (faceted) to reach a slightly prolonged shape (not in the style of *chapeau de gendarme*, however) to allow accurate targeting of the strike. Now, the first Levallois point or in many cases, a series of two Levallois points, was produced (from the same direction). The striking platform was often reshaped before each point removal. The outcome was a wide frontal face of the core, not pointed, and the loss of its distal convexity - the necessary shape for a further production of a Levallois point. Therefore, it was necessary to narrow the wide frontal face of the core with several blade removals to pre-prepare it for the production of another Levallois point. This process, defined by these two steps - 1) shaping and narrowing, and 2) Levallois points' production - continued until the raw material was exhausted.

Core abandonment

In the core's final stage, the striking platforms for all removals were further prepared, and the frontal face was intensively shaped (narrowed) by a series of blade and flake removals from both opposed platforms. However, the tendency towards a unidirectional dorsal scar pattern is visible (cf. Tostevin 2003, 91). The artefacts produced at that stage were short and not suitable for further utilization. The core residual was significantly modified during that stage and its final shape does not reflect the technology used in production phase – which necessarily has to be taken into account in the study of artefact morphology.

Formal tool production

The Bohunician typological spectrum represents a mixture of Middle and Upper Palaeolithic tool-types. Among the Middle Palaeolithic tool-types, side scrapers of different forms are frequent followed by different types of points, notched and denticulated artefacts. The points are Levallois, convergently retouched (Mousterian), leaf points, Jerzmanowice-type points and Quinson-type points. The Upper Palaeolithic tool kit is represented mainly by end scrapers and rare burins.

Blanks selected for the retouched tool production were utilized for both blades and flakes; however, the flake blanks prevail significantly. Flake blanks were also preferred in the case of characteristic Upper Palaeolithic tool-types, e.g., end scrapers. The Upper Palaeolithic tool-types were made of such Levallois points.

Typologically speaking, in contrast to the late Middle Palaeolithic, in the Bohunician there is a proportional increase not only of Upper Palaeolithic tool-types, but also of the number of projectiles. Similar to the proportion of Stránská skála-type chert in the raw material spectrum, the proportion of Levallois points also decreases in a radial pattern, while on the other hand, the presence of leaf points in Bohunician collections grows with an increasing distance from the Stránská skála site. Since the Bohunician technology has been used with other raw materials (both local and imported, not only with imported chert of the Stránská skála-type) outside of the Brno basin, the isolated Levallois points in the assemblages from outside the Brno basin cannot be interpreted as imports from the Brno basin but as in situ production.

Discussion

The analysis of refitted sequences enables us to define the Bohunician knapping behaviour in detail. General rules for describing the Bohunician technology have been described already (Škrdla 2003). The following paragraphs list a refined version of the six basic characteristics:

1. The Bohunician technology was originally defined as a mixture of Levallois technology and Upper Palaeolithic blade core reduction (Valoch 1976). Later, the use of several different reduction techniques used in order to achieve Levallois points

was described, and the first refittings proved that they were used on the same core (Svoboda & Škrdla 1995; Škrdla 1996). However, more recently the definition was refined - the reconstructed, almost complete sequences together with the shorter (not so complete) sequences represent a specific technology, which was described as a conceptual fusion of Levallois and Upper Palaeolithic reduction strategies (Škrdla 2003). Raw material was prepared and initiated as an Upper Palaeolithic crested core (with a frontal crest, with a prepared platform or two opposed platforms, reduced from a narrow edge, prismatic at the initial stage). The serial production of Levallois points together with blades from opposed platforms continued. The shape of an abandoned core residual (e.g., a discoidal core) differs depending on the techniques used during its reduction. The analysis shows that all reconstructed cores show a tendency towards the production of a Levallois point (or a series of points) as the target artefact (Škrdla 2003). Prismatic or pyramidal cores were documented. However, the reduction suggested the same aim in all those cases – to produce a Levallois blank. Since Bohunician reduction is a relatively difficult method that needs a successful sequential removal of a series of blanks before a Levallois point is produced, the reduction of many cores led to a dead end and those cores were abandoned. While Škrdla (2003) excluded these unsuccessfully (in his opinion) reduced sequences and described the Bohunician technology based on the almost completely refitted sequences, other authors (e.g., Valoch et al. 2000) included short and undiagnostic sequences into the scheme, which allowed them to recognize other knapping methods – subprismatic and Upper Palaeolithic blade core technology – which they believed was applied independently. They also rejected the term conceptual fusion between the Levallois and the Upper Palaeolithic core method and replaced it with the term coexistence of Levallois and non-Levallois methods. However, none of the completely refitted cores shows evidence for an exclusive use of the subprismatic or Upper Palaeolithic blade reduction method. In other words, while cores showing the application of all methods (i.e., fusion) on a single core were described by Škrdla, Valoch et al. (2000) on the other hand, advocate the existence of several independent core reduction strategies (which, we assume, is the meaning of their term coexistence), which were applied on differently shaped raw materials. The academic debate about the characteristics of Bohunician technology continues (e.g., Sitlivy & Zięba 2006; Valoch et al. 2010) and, in our opinion, more assemblages including more refitted complete cores are needed.

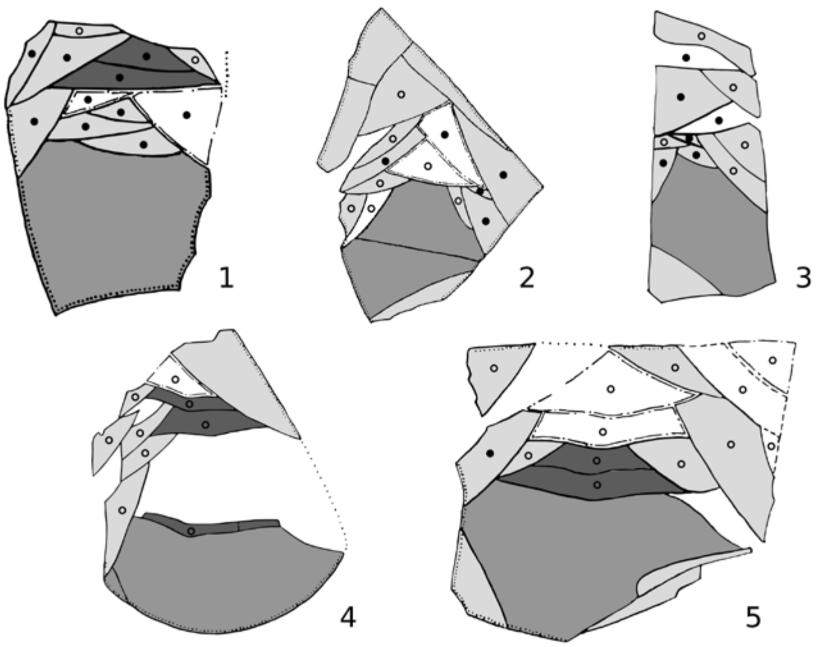

Fig. 5 Cross sections of selected almost completely reconstructed cores.

2. The spatial distribution of the refitted pieces of the individual refitted cores is predominantly limited to several nearby square meters, which documents an in situ reduction. However, an isolated connection of ca. 10 m (between Stránská skála IIIa and Stránská skála IIIc trenches) was also documented. The inner parts of the restored cores are not present and the core shapes are reconstructed mainly from cortical flakes and blades (cf. Fig. 5). Levallois points are often small, irregular, broken, or they have not been found. As the largest Levallois points are missing from the almost completely reconstructed cores, we suppose the Levallois points represent the target artefacts of Bohunician technology and were taken from the production site. However, the shape and dimensions (generally larger compared to finds from the site and from the negatives at core residuals) of these artefacts can be reconstructed from their negatives at the cores. The workshop character of the Stránská skála localities is well documented by high scores of indices of conjoinability and an average number of artefacts within refitted sequences (Tab. 1), as well as by the high score for the production sequences/breaks relation (cf. Škrdla & Tostevin 2005, 47). The same numbers evaluated for the sites located at a distance of ca. 7 km from the Stránská skála outcrop (Bohunice and Tvarožná) differ significantly and document a more economical use of raw material, including more intense utilisation of removed blanks for tools and a high degree of transport away from the sites.
3. The role of blades within the Bohunician reduction scheme is not clear. The blades represent an indispensable portion of the industry (the blade index ranges from 20 % to 45 % at the different sites; Svoboda & Škrdla 1995, 432). The reconstructed cores were exploited in order to create Levallois points, while blades were struck in order to change the frontal face of the core into a narrow and triangular shape allowing a Levallois point production. Within this concept, they represent a secondary product or a by-product. The majority of reconstructed sequences show a trend towards Levallois points and the production of other pointed artefacts. Both flake and blade blanks were utilized for retouched tools and flake tools prevail significantly.
4. The end scrapers and other formal tools (often made from imported raw materials) could not be refitted with the rest of the assemblage, particularly at Stránská skála III and Bohunice 2002. They were probably produced in a location other than the excavated workshops and then brought to the site as finished products. Conversely, the specific large Levallois points were exported from the Stránská skála workshop site. At Stránská skála IIIa and Stránská skála IIIc the scrapers were made also of cortical flakes of local chert (expedient tools?).
5. In contrast to the Middle Palaeolithic Levallois based technologies (cf. Oliva 2006), the Bohunician technique was more volumetric. In this technology flat nodules or flat blocks of raw material were processed from the wide edge. Additionally, the flat core residuals were rotated by 90 degrees around their axes and exploitation continued from the narrow edge. As was stated in a preliminary study (Škrdla 1996), the operational schemes were partly a function of the raw material shape. Three basic groups were identified: Nodules (often semiglobular), plaques and undetermined blocks of raw material. Although there are slight differences (e.g., the preparation of frontal crest of nodules or initiation from the natural crest in the case of prismatic blocks), the Bohunician reduction strategy was applied to all of these shapes and raw materials.
6. It is obvious that it is difficult to study the technologies from the beginning of the Upper Palaeolithic based on the products' morphology (Bar-Yosef & Van Peer 2009; Škrdla 2003). In the Bohunician, and probably more generally, the core residuals cannot reflect the technology used during its reduction. Morphologically Levallois points cannot be produced by Levallois technology (cf. Marks & Volkmann 1983; Boëda 1995). Refitting represents the one and only method for studying and understanding technologies. However, attribute analysis may be successfully used for an inter-assemblages comparison (cf. Tostevin 2000, 2003). The matching of Bohunician technology with other technologies of the beginning

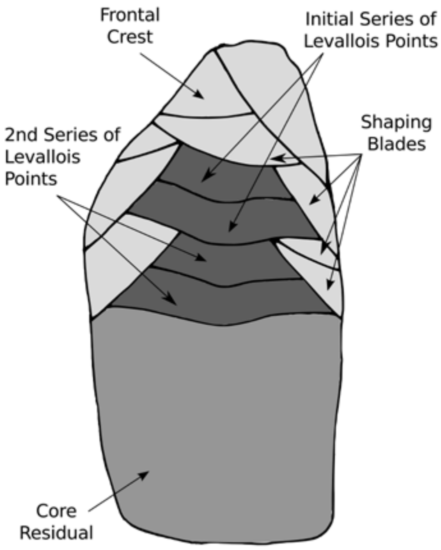

Fig. 6 Theoretical scheme of Bohunician technology.

of the Upper Palaeolithic (e.g., Szeletian), and its Middle Palaeolithic antecessors (e.g., Micoquian) and Upper Palaeolithic descendants (e.g., Aurignacian), as carried out by Tostevin (cf. Tostevin 2000, 2003) and based on attribute analysis, is the aim of future projects - we need to find and excavate new assemblages suitable for refitting. The preliminary attempt by Neruda and Nerudová (2005) suggests a significant difference in the Szeletian technology from Moravský Krumlov IV, which is based on bifacial thinning, producing massive bifaces and leaf points together with irregular subprismatic or discoidal cores producing flakes and blades. The same authors described an Aurignacian technology from Vedrovice Ia as a fully Upper Palaeolithic prismatic core method aiming for blade production. No flake cores were documented.

Conclusions

The Bohunician technology was studied on the refitted material from the key site Stránská skála, which represents a workshop site located directly at the outcrop of raw material. The workshop character of the site and the limited transport of end products from the site allowed a detailed reconstruction of the technological process based on refitting. Other Bohunician sites located off the source show a different and more economical model of raw material use – blanks were more frequently used for tool production and taken away from the sites, which makes reconstruction (refitting) of cores more complicated.

Based on the majority of the almost completely reconstructed assemblages, specifically, on cross-sections perpendicular to the long core axis (Fig. 5), as well as on shorter sequences, and with regards to Škrdla's previous definitions (2003), the Bohunician reduction strategy may be reconstructed as follows: The core was shaped as a typical Upper Palaeolithic prismatic core with a frontal crest (or initiated from a natural crest when available) and two opposed platforms were created. Consequently a series of blades was removed from both opposed platforms in order to form the frontal face of the core into a shape (triangular, elongated) which allows Levallois point production. When a Levallois point (or a series of points) was produced, the frontal face of the core lost its shape and thus its suitability for further point production. Therefore, the frontal face of the core was treated by a series of blade removals, allowing production of a second series of a Levallois point (or points). This process, shaping by blade removals and production of a Levallois point, continued until the core was exhausted (Fig. 6). The abandoned core residual cannot reflect the technology used during core reduction.

In this concept, blades were removed in order to shape the frontal surface of the core and present (technologically) a secondary product.

We would like to conclude that more excavations and analyses of Bohunician collections are needed to obtain further refittings and to test the homogeneity/heterogeneity of Bohunician assemblages. This is the aim of a current early Upper Palaeolithic project (http://www.iabrno.cz/EUP.htm).

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TABLES

site	N	ic	1/in	ps/b ratio
Stránská skála IIIc	2,398	16.47	3.74	1/0.4
Bohunice 2002	1,620	4.44	2.47	1/3
Tvarožná X	249	6.83	2.21	1/1.4

Tab. 1 Comparison of indices of conjoinability (ic), average number of artifacts in refitted sequences, and production sequences/breaks (ps/b) ratio for individual Bohunician collections.