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GILBERT B. TOSTEVIN, PETR ŠKRDLA

NEW EXCAVATIONS AT BOHUNICE AND THE QUESTION OF THE UNIQUENESS OF THE TYPE-SITE FOR THE BOHUNICIAN INDUSTRIAL TYPE

ABSTRACT: Recent research has documented discontinuities in the technological behaviour of hominids during the Middle to Upper Paleolithic transition in the Middle Danube region. Attribute analysis studies (Tostevin 2000 a, b, c, 2003 a, b) have shown little to no antecedents for the flintknapping behaviours of the Bohunician in those of the Central European Micoquian. Further, these attribute analyses have shown close connections in the behaviours which produced the Bohunician in Moravia with the behaviours which produced the lower two levels of Boker Tachtit in the Levant. These analyses have been corroborated by detailed refitting studies (Škrdla 1996, 2003). While these discontinuities point to the Middle Danube's role within a larger, inter-regional diffusion event, the question of how many of the flintknapping behaviours characteristic of the Micoquian survived into the Early Upper Paleolithic in the form of the Szeletian, remains to be answered. To date, this question has been problematic given our lack of understanding of the relationship between the phenomena known as the Bohunician and Szeletian Industrial Types. All of these questions rest upon an understanding of the apparent uniqueness of the type-site for the Bohunician, Brno-Bohunice. Until the 2002 re-excavation of Brno-Bohunice by the Institute of Archaeology, Brno (Škrdla), and the University of Minnesota (Tostevin), it has been difficult to address quantitatively the variability within the Bohunician Industrial Type due to the lack of proveniencing and collection protocols of the original type collection. With the new collection, however, we endeavour in this paper to evaluate the similarity/dissimilarity among the Bohunician assemblages of Stránská skála IIIa level 4, Stránská skála III, Stránská skála IIIc, and the Brno-Bohunice 2002 collection. The resulting comparisons demonstrate the close clustering of the Stránská skála assemblages in terms of technological similarities, with a Szeletian assemblage, Vedrovice V, falling significantly away from the Bohunician assemblages. The 2002 Bohunice collection is more distinct from any other Bohunician assemblage than they are to themselves, but not as distinct as the Vedrovice V collection. The ramifications of these data are explored through a discussion of the meaning of paleosol palimpsests, refits, and activity patterning on the Pleistocene landscape of Moravia.

KEY WORDS: Early Upper Paleolithic – Central Europe – Bohunician – Szeletian – Lithic technology

THE MIDDLE DANUBE REGION AND THE BOHUNICIAN IN THE MIDDLE TO UPPER PALEOLITHIC TRANSITION

Paleolithic archaeologists are turning more and more towards the study of the spatial and temporal distribution of specific tool-making behaviours within and between regions of Eurasia in order to reconstruct the processes by which modern humans dispersed from Africa into Eurasia. While most of the regional studies and inter-regional syntheses have focused on western Europe, southeastern Europe, or the Levant (Mellars 1996, Bar-Yosef 2002, Conard, Bolus 2003), other regions such as southern Europe and eastern Europe are now receiving more attention. The

Middle Danube region of central Europe has likewise recently proven productive for increasing our understanding of the end of the Middle Paleolithic and the beginning of the Upper Paleolithic (Svoboda, Škrdla 1995, Svoboda, Bar-Yosef 2003). Inter-regional comparisons, however, using data from the Middle Danube, are only beginning to impact our view of what role this region played in the colonization of Europe by modern humans (Škrdla 1996, 2003 a, b, Tostevin 2000 a, b, c, 2003 a, b). It is hoped that the present volume of *Anthropologie Brno* will further the goal of broadening the regional scope of studies of the Middle to Upper Paleolithic transition.

The archaeological record of the Middle Danube region, which comprises primarily assemblages from Hungary, Austria, and the Czech Republic, contains a larger diversity of industrial types for the Middle to Upper Paleolithic transition than western Europe or the Levant (Svoboda, Simán 1989, Svoboda *et al.* 1996). The most recent excavations of Middle to Upper Paleolithic sites have taken place in the archaeologically-rich territory of Moravia in the Czech Republic, where Neanderthals are known to have lived at least as recently as 50,000 years ago, leaving central European Micoquian toolkits and remains at sites such as Kůlna Cave (Rink *et al.* 1996, Valoch 1967, 1988). The next industry found chronologically in the Middle Danube is the Bohunician, an industry with Levallois-like core technology with a significant blade component and Upper Paleolithic tool types (Oliva 1984). Although Valoch (1976) originally labelled the industry from the type-site of Brno-Bohunice the *Szélétien de faciès levallois*, the Bohunician is currently acknowledged as a distinct entity from the Szeletian (Svoboda 1983, 1984, 1987a), the latter appearing only after 39 kya (Valoch 1984, 1993) but possibly lasting until at least 26 kya (Adams, Ringer 2004). The Bohunician is present in the region between 41 and at least 33 kya (Svoboda, Bar-Yosef 2003), being found in both the Lower Pleniglacial soil and the superimposed Lower soil of the Last Interpleniglacial soil complex of Moravia (Damblon *et al.* 1996). This results in contemporaneity with the Szeletian for at least 6 ky. The claim for contemporaneity is derived from 1) overlapping radiocarbon dates (see *Table 1*), and, more importantly 2) the occurrence of both Bohunician and Szeletian industries in the same Lower soil of the Last Interpleniglacial complex. The only excavated Aurignacian assemblages in the northern part of the Middle Danube are relatively late, dating between 32 and 29 kya and always found in the Upper soil of the Interpleniglacial soil complex, stratigraphically above the Bohunician and Szeletian. The dates on charcoal from ashy lenses in Layer 3 at Willendorf II in Lower Austria have been attributed to the Aurignacian (Damblon *et al.* 1996, Haesaerts *et al.* 1996, Haesaerts, Teyssandier 2003) and are earlier than any in Moravia. This may represent an earlier occupation by the Aurignacian in the southern half of the Middle Danube basin, although Zilhão and d'Errico's reservations (1999: 39, 2003: 338) concerning the strength of the Aurignacian attribution should be kept in mind. The original attribution of an even older assemblage at Willendorf to the Aurignacian (Broglio, Laplace 1966), the sparse assemblage from Layer 2, is even more doubtful and has been re-ascribed alternatively to the Bachokirian (Kozłowski, Otte 2000), possibly the Bohunician (Svoboda 2003), and an undifferentiated Early Upper Paleolithic (Haesaerts, Teyssandier 2003). Further downstream from Willendorf II, however, Adams and Ringer's (2004) new AMS dates from sites in the Bükk Mountains of northern Hungary give late and overlapping ages for both the Aurignacian and the Szeletian in this portion of the Middle Danube basin, complicating the contemporaneity issue further.

While Valoch (1990 a, b) and Neruda (2000) have argued that the Szeletian is derived from the local Micoquian (see Adams, Ringer 2004 for another view), it has been harder to explain the appearance of the Bohunician in the Middle Danube. Valoch (1986, 1990 a) first noticed the typological and technological similarity between the industry of Brno-Bohunice (Valoch 1976, 1982) and the transitional industry of Boker Tachtit Level 1 (Marks 1983, Marks, Kaufman 1983) in the southern Levant, although he made no attempt at a systematic comparison. Subsequently, scholars such as Demidenko, Usik, Kozłowski, and Škrdla presented syntheses which argued that these similar industries represent one entity, a particular evolutionary stage in the development of the Middle to Upper Paleolithic transition across the regions (Demidenko, Usik 1993, Ginter *et al.* 1996, Škrdla 1996, Kozłowski 2000). As these studies were based only on qualitative evaluations of refitting sequences, a new methodology was developed by Tostevin (2000 a, b, c, 2003 a, b) in an effort to reconstruct a technological signature for each assemblage, regardless of refits, for systematic comparison within and between regions. The debitage, core, and tool attributes of 15 assemblages in the Levant, central Europe, and eastern Europe dating between 60 and 30 kya were analysed according to this method. Each regional sequence of change in flintknapping behaviours was then contrasted with adjacent regions in order to evaluate model predictions derived from archaeological and social anthropological theory designed to identify changes due to *in-situ* innovation *versus* those due to diffusion or population movements. The systematic comparison of assemblages within and across these three regions isolated a suite of flintknapping behaviours, from initial core preparation to directional core reduction strategy to retouch type, which was labelled the "Bohunician Behavioural Package." The Bohunician Behavioural Package seems to appear first in the Levant at 47/46 kya at Boker Tachtit level 1, possibly next in the Balkans if the preliminary results from Temnata Cave layer VI, sector TD-II (Ginter *et. al.* 1996, Drobniewicz *et al.* 2000) are confirmed, next in central Europe at Stránská skála IIIa at 41 kya, and finally in eastern Europe at Korolevo II Complex II by 38 kya. The "Bohunician Behavioural Package" had no precedent in any of these three regions and represents an intrusive diffusion of ideas and/or people.

TABLE 1. Dates for selected assemblages of the MP-UP transition in the Middle Danube arranged chronologically from the oldest to the youngest.

SITE	LAYER	DATE	SAMPLE	REFERENCE
Kůlna Cave	7a Micoquian	50/53kya ± 5/6 kya	Samples 92202A – 92233A	Moravské zemské muzeum, Brno, Czech Republic (Valoch 1967, 1988). This is an average value from ten ESR dates with Early Uptake and Linear Uptake (Rink *et al.* 1996).
Willendorf II	2 Early Upper Paleolithic	41,600 +4100 –2700 41,700 +3700 –2500 39,500 +1500 –1200	GrN 17806 GrN 11195 GrN 11190	AMS radiocarbon on charcoal (Haesaerts *et al.* 1996, Damblon *et al.* 1996, Haesaerts, Teyssandier 2003, Svoboda 2003).
Stránská skála IIIa	4 Bohunician	41,300 + 3,100 –2200	GrN 12606	Conventional radiocarbon (Svoboda 1983, 1991, Svoboda, Simán 1989).
Bohunice-Kejbaly	4a	41,000+1400–1200 40,173 ± 1200	GrN 6802 Q 1044	Conventional radiocarbon (Valoch 1976). These carbon samples are not associated with the archaeological layers in the 2002 Brno-Bohunice excavations.
Bohunice-brickyard	4a	42,900+1700–1400 36,000±1100	GrN 6165 GrN 16920	Conventional radiocarbon (Svoboda, Svobodová 1985, Svoboda *et al.* 1996). These carbon samples are not associated with the archaeological layers in the 2002 Brno-Bohunice excavations.
Stránská skála III	5 Bohunician	38,200 ± 1,100 38,500 + 1,400 – 1200	GrN 12297 GrN 12298	Conventional radiocarbon (Svoboda 1991, Svoboda, Simán 1989).
Vedrovice V	Szeletian	39,500 ± 1100 37,650 ± 550 37,600 ± 800 35,150 ± 650	GrN 12375 GrN 12374 GrN 15514 GrN 15513	Conventional radiocarbon on charcoal. GrN 17261 is not included due to noted root contamination (Valoch 1993: 78), and GrN 19105 and 19106 are not included due to low carbon levels.
Stránská skála IIIc	Bohunician	38,300±1,100 36,570±940 36,350±990 34,440±720 34,530±770	AA-32058 AA-41476 AA-41478 AA-41475 AA-41477	AMS date on charcoal (Svoboda, Bar-Yosef 2003).
Willendorf II	3 Aurignacian	38,800 + 1,530 – 1280 37,930 ± 750 34,100 + 1,200 – 1,000	GrN 17805 GrN17806 GrN11192	AMS radiocarbon on charcoal (Haesaerts *et al.* 1996, Haesaerts, Teyssandier 2003, Svoboda 2003).
Brno-Bohunice 2002 excavation	Lower Paleosol Bohunician	35,025 ±730 32,740 ±530	ANU-27214 ANU-12024	AMS dates on hearth charcoal (Ladislav Nejman, personal communication). Our thanks to L. Nejman for his generosity in running these AMS dates for us.
Willendorf II	4 Aurignacian	32,060 ± 250 31,700 ± 1800	GrN 1273 H249/1276	Conventional radiocarbon on charcoal (Haesaerts *et al.* 1996, Haesaerts, Teyssandier 2003, Svoboda 2003)
Stránská skála IIa	4 Aurignacian	32,350 ± 900	GrN 14829	Conventional radiocarbon (Svoboda, Simán 1989, Svoboda 1991).
Stránská skála IIIa	3 Aurignacian	30,980 ± 360	GrN 12605	Conventional radiocarbon (Svoboda, Svobodová 1985, Svoboda, Simán 1989).
Istállóskő	7/9 Aurignacian I	32,701 ± 316 33,101 ± 512	ISGSA-0187 ISGSA-0184	AMS radiocarbon on bone (Adams, Ringer 2004).
Milovice	Aurignacian	29,200 ± 950	GrN 14826	Conventional radiocarbon (Oliva 1989).
Szeleta	3 "Early Szeletian"	26,002 ± 182	ISGSA-0189	AMS on charcoal layer (Adams, Ringer 2004). Anomalous dates from Layer 3 hearth not given.

Škrdla's (2003a) direct comparison of the Boker Tachtit refitting sequences and his refitting sequences from the Stránská skála Bohunician assemblages corroborates Tostevin's attribute analysis. In fact, Škrdla's analyses, conducted independently using different analytical techniques, isolated level 2 as most similar of the Boker Tachtit assemblages to the Bohunician of the Stránská skála assemblages, a result which agreed remarkably with Tostevin's results (2000c). Other researchers are also pointing to similar patterns (Kuhn 2003, Kozłowski 2004, Svoboda 2003, 2004). These results make it clear that the inter-regional connections evidenced in the Middle Danube must be taken into account when revising both the Danube Corridor model for the spread of anatomically modern humans into Europe and the *Kulturpumpe* model for the origin of the Aurignacian within southwestern Germany (Conard *et al.* 1999, Bolus, Conard 2001, Conard 2002, Conard, Bolus 2003). While we are currently undertaking such a reevaluation of the role of the Middle Danube in these models, these issues are beyond the context of the present paper.

THE PROBLEM OF THE TYPE-SITE FOR THE QUESTION OF BOHUNICIAN INDUSTRIAL VARIABILITY

In order to understand the relationships between the archaeological phenomena of the Early Upper Paleolithic in the Middle Danube, it is necessary first to understand the variability within the Bohunician Industrial Type. This has been difficult to date due to the way in which the type-site collection was originally acquired. The initial type-collection from the site of Brno-Bohunice or Bohunice-Kejbaly, published by Valoch (1976, 1982), was acquired by an amateur archaeologist, Mr. Klíma, during building activities between 1962–1981. Mr. Klíma extracted the artifacts from bulldozer trenches according to stratigraphic location but was unable to use any systematic collection protocols for size of artifacts and no sieving was done. The rescue situation at the time also precluded much direct excavation once Karel Valoch was called in to view the artifacts. Thus, the context of the original Brno-Bohunice collection makes comparisons using this assemblage problematic (e.g. the otherwise admirable study by Foltyn and Kozłowski 2003). While numerous *in situ* assemblages have been excavated from other Bohunician sites, the type-site collection has always appeared different in its greater variety of raw materials as well as retouched tool typology when compared to other Bohunician assemblages. In particular, the presence of bifacial foliate points at Brno-Bohunice is unique, except for the collections from deflated surface localities such as Ondratice and Líšeň, which may or may not be mixed Szeletian and Bohunician assemblages (Svoboda 1980, 1987a). Until the re-analysis of the lower level from Dzierżysław I in southern Poland (Foltyn, Kozłowski 2003, Bluszcz *et al.* 1994), there has not been an excavated assemblage associated with both Bohunician technology and foliate points.

These differences in the original collection from Brno-Bohunice can be understood as the result of one of several possible scenarios, treated here as competing hypotheses. First, excavation bias in the original collection resulted in the mixing of otherwise geologically and vertically-discrete Szeletian and Bohunician occupations at the locality, resulting in the addition of Szeletian foliate points into an otherwise Bohunician context. This can be referred to as the "Excavation Bias" hypothesis. Second, as Oliva has hypothesized (1981, 1984), the foliates in the original collection could result from the trade of points for other products or services between Szeletian knappers and Bohunician knappers. This hypothesis, labelled here as the "Traded Point" hypothesis, was advanced to explain the incongruence of foliate points without biface thinning flakes in the original collection. Third, geological and pedogenic mixing of otherwise temporally-discrete Szeletian and Bohunician occupations produced an assemblage which, when excavated, looked to be a single occupation. This can be referred to as the "Pedogenic" hypothesis. Fourth, the stable land surface represented by the lower soil of the Last Interpleniglacial paleosol complex allowed the sequential occupation of the locality by different flintknappers of both Szeletian and Bohunician traditions to associate their respective toolkits spatially into the same sedimentary matrix which eventually buried the artifacts. This can be referred to as the "Sequential Occupation" hypothesis. Fifth, hominids who produced the typically Bohunician core reduction strategies also engaged in the production, utilization, and discard of foliate points but at other points on the landscape than the Stránská skála hillside, i.e. at Brno-Bohunice. Under this hypothesis, no geological process is required to result in the artifact associations seen in the original collection. This can be referred to as the "Landscape" hypothesis. All of these hypotheses are logical and possible but not all of them are equally falsifiable.

THE LOWER PALEOSOL ASSEMBLAGE FROM THE BRNO-BOHUNICE 2002 COLLECTION

The re-excavation of the site by Škrdla and Tostevin in 2002 was designed to test the first two of these hypotheses, the "Excavation Bias" and "Traded Point" hypotheses, and to collect data toward the evaluation of the last, the "Landscape" hypothesis (Tostevin, Škrdla 2003). Specifically, the spatial proveniencing, excavation methodology, and careful collection protocols of the 2002 excavation, discussed in Škrdla and Tostevin (2003), demonstrated that only one significant artifact horizon exists at the locality, concentrated in the Lower Paleosol. As described in detail in Škrdla and Tostevin (2005), 3,360 artifacts were recovered in the Lower Paleosol compared to only 43 in the Upper Paleosol. The vertical distribution of artifacts as well as refits of breaks and production sequences

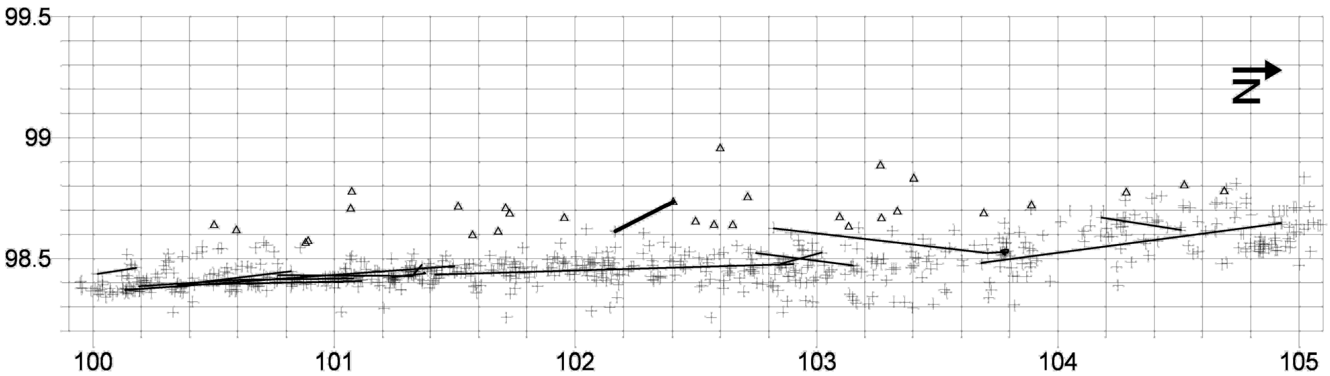


FIGURE 1. Vertical distribution of artifacts in the Area A trench of the 2002 Brno-Bohunice excavations. Triangles indicate artifacts in the Upper Paleosol, while crosses indicate artifacts in the Lower Paleosol. Lines indicate refittings. Taken from Škrdla and Tostevin (2005: fig. 3).

between artifacts confirms the homogeneity of the Lower Paleosol collection as spatially distinct from the few pieces in the Upper Paleosol. As seen in *Figure 1*, Mr. Klíma was correct in attributing his collection to one artifact horizon within the Lower Paleosol, at least as recognizable by the naked eye under field conditions. This falsifies the "Excavation Bias" hypothesis.

The collection of a new assemblage from the Lower Paleosol, containing over 1,608 provenienced lithic artifacts (>1.5 cm long) as well as 1,710 microartifacts (<1.5 cm) in the aggregated samples from the wet sieving of the excavated sediment from the 3×5 m Area A trench, has also falsified the "Traded Point" hypothesis. The assemblage recovered in 2002 contains 4 foliate points, 5 bifacially retouched tools, and 52 diagnostic biface thinning flakes, one of which refits to a bifacial tool (Fig. 2, 17, from Škrdla and Tostevin 2005: fig. 13, 9). As seen in *Figure 3*, this bifacial reduction debitage is situated immediately within the artifact horizon bearing Bohunician blades, Levalloisian points, and bidirectional cores of a classic Bohunician strategy, as defined by Škrdla (1996, 2003b). Despite their absence from the original collection, the presence of this bifacial debitage in the 2002 assemblage leaves no reason to resort to the "Traded Point" hypothesis. This finding also demonstrates the bias in the original assemblage in terms of a lack of collection protocols in regard to small finds such as biface thinning flakes. As a result, the original collection should no longer be considered representative of the archaeological record from this locality. The Lower Paleosol assemblage from the 2002 collection thus represents the most comparative collection for evaluating the uniqueness of Brno-Bohunice relative to the other assemblages belonging to the Bohunician Industrial Type.

There is currently no method and theory for directly falsifying the third and fourth hypotheses, both dealing with issues of geological site formation processes, given the sedimentological context of the Brno-Bohunice artifacts within a paleosol (see Škrdla, Tostevin 2005). Geological mixing of two vertically-distinct assemblages could be identified through micromorphology (Courty *et al.* 1989, Goldberg 1992) if the sedimentary matrix itself were not defined by the processes of vertical movement and weathering. Yet a paleosol is defined as exactly this. Pedogenesis can move randomly distributed objects into apparent layers or lenses within soil horizons (Holliday 1990, Waters 1992: 40–60, 76–77). Therefore, the compaction of the artifact horizon at Brno-Bohunice could indicate geological rather than anthropogenic association. Similarly for the fourth or "Sequential Occupation" hypothesis, the repeated discard of objects onto a non-aggrading surface could produce one find horizon from multiple occupations once buried. Even a "smoking gun" refit could not conclusively disprove the "Sequential Occupation" hypothesis, i.e. the discovery of a refit sequence showing the Bohunician reduction of a bidirectional core with the residual core being transformed into a bifacial foliate point. While intriguing, such a refit would not absolutely demonstrate the use of both knapping strategies by one population, since the not infrequent use of Lower Paleolithic artifacts by Middle Paleolithic knappers as raw material illustrates the danger of assuming a refit production sequence must have been conducted by only one individual from one population.

While both of these hypotheses are not falsifiable given the paleosol context of *all* Bohunician sites, it is possible to weigh their possibility by endeavouring to find data in support of the hypotheses. This was one of the tasks of the 2002 project. Based on the previous work at Brno-Bohunice, there was an expectation prior to the 2002 excavations for some movement of artifacts due to geological processes. For instance, Smolíková's micromorphological studies of the original Bohunice-Kejbaly profiles (1976) indicated an autochthonous origin to the Lower Paleosol, with strong evidence of influence from periglacial conditions. Svoboda (1987b) had also presented a profile from the Brno-Bohunice brickyard indicating a soliflucted lower paleosol. Our own experience from excavating at Stránská skála IIIc through IIIf also gave us this expectation. Located as they were on a different portion of the Red Hill area from the above localities, the 2002 excavations provided a different picture. From field observations during the 2002 excavation and of the stratigraphy in profile (*Figure 4*), it became clear that there was much less visible cryoturbation

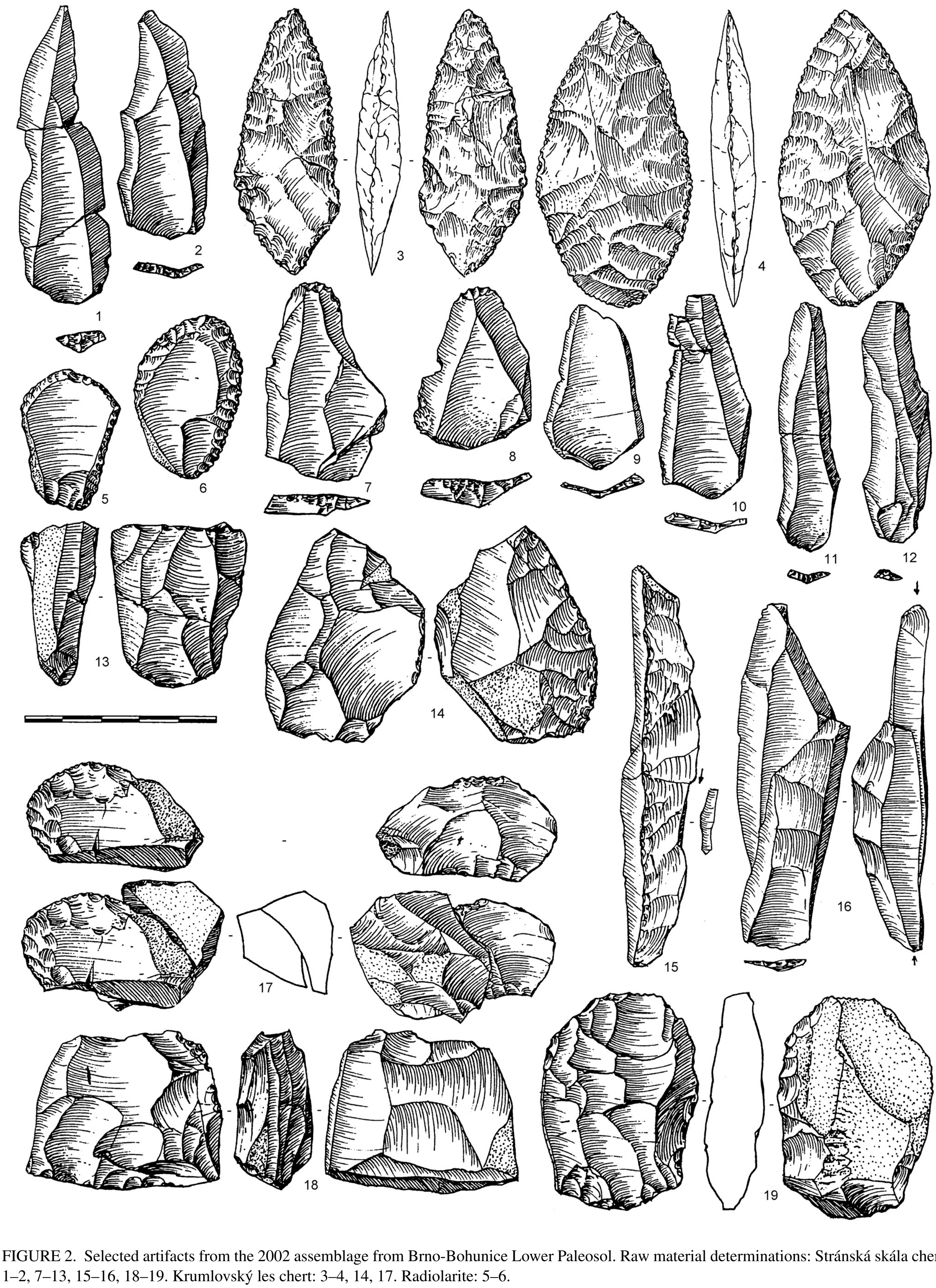


FIGURE 2. Selected artifacts from the 2002 assemblage from Brno-Bohunice Lower Paleosol. Raw material determinations: Stránská skála chert: 1–2, 7–13, 15–16, 18–19. Krumlovský les chert: 3–4, 14, 17. Radiolarite: 5–6.

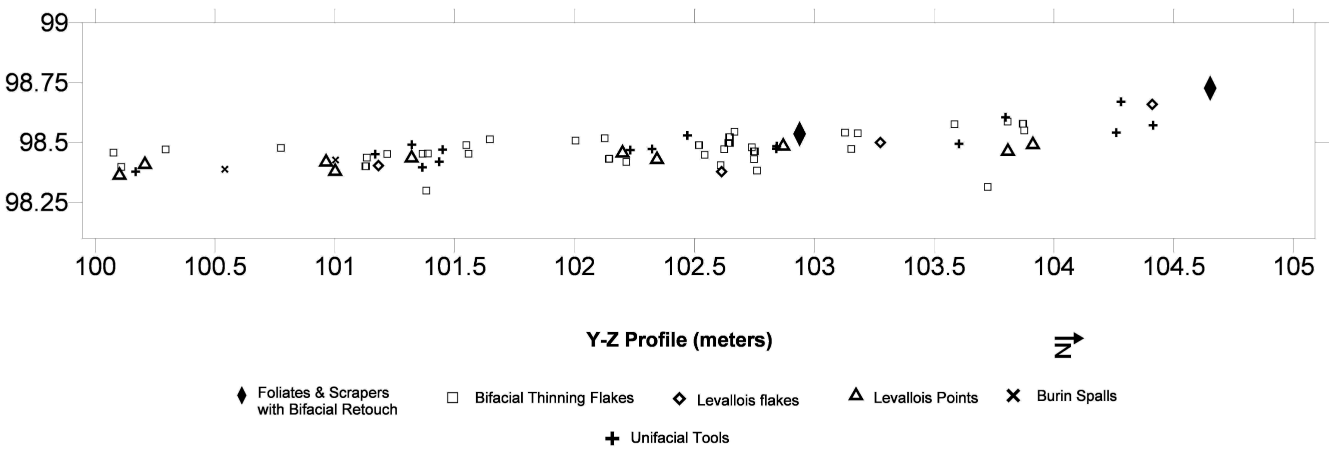


FIGURE 3. Vertical distribution of technologically diagnostic artifacts in the Area A trench of the 2002 Brno-Bohunice excavations. Taken from Škrdla and Tostevin (2005: fig. 6).

and solifluction at Brno-Bohunice than at the Stránská skála localities where Bohunician assemblages had been found. Compare *Figure 4* with Havlíček and Svoboda (2003: figs. B.8, B.13) and Czudek (2003: figs. D.2-D.4). In particular, the Brno-Bohunice paleosols were not affected by visible vertical cryoturbation seen as "mushrooming" of underlying sediment into the superimposed paleosols as at these Stránská skála localities (Czudek 2003: fig. D.4, Smolíková 2003). There does appear to be slight gelifluction associated with the solifluction of seasonally or perennially frozen ground at Brno-Bohunice (*Figure 4*) but this is evident between the Upper Loess and the Upper Paleosol, not between the paleosols or the lower Loess. These indications make it less likely for pedogenesis alone to be responsible for the tight vertical compaction of the find horizon, particularly in Area A of the excavation. More importantly, the contemporaneity of artifacts within the find horizon is demonstrated by the refits found by Škrdla. This makes the "Pedogenic" hypothesis even less likely. Škrdla and Tostevin's (2005) investigation of the spatial distributions of artifacts by raw material, technology, dorsal scar direction, and typology also failed to demonstrate any horizontal associations which could corroborate the "Sequential Occupation" hypothesis.

The present paper is designed to investigate the variability within the Bohunician Industrial Type under the assumption that the last or "Landscape" hypothesis is a strong possibility. As this hypothesis posits that hominids who produced the typically Bohunician core reduction strategies also engaged in the production, utilization, and discard of foliate points at selective localities on the landscape, for functional or mobility purposes, the final resolution of the hypothesis will likely involve the excavation of new Early Upper Paleolithic assemblages from localities other than Stránská skála and Brno-Bohunice. In the meantime, however, the new data from the 2002 Brno-Bohunice assemblage can be used to investigate the possibility of this hypothesis. To pursue this goal, each Early Upper Paleolithic assemblage discussed here will be defined as the material evidence of the portion of knapping behaviours captured and incorporated into the archaeological record at this particular locality during the length of the open palimpsest. This is the only epistemologically valid conception of Pleistocene assemblages of this type, particularly given the geoarchaeological issues implied by paleosol palimpsests. This definition in essence negates the "Sequential Occupation" hypothesis, since whichever hominids walked over the Brno-Bohunice locality and deposited artifacts into the record constitute the "hominids of Brno-Bohunice", even if these individuals elsewhere produced assemblages typed as "Szeletian" or "Bohunician".

ANALYSING VARIABILITY WITHIN AN INDUSTRIAL TYPE

The defining of an industrial type label is recognition by archaeologists of meaningful similarities between assemblages. While the causes behind these similarities are often not explicitly discussed, even if the details of the similarities are demonstrated, the separation of inter-assemblage variability into more abstract units called industrial types for communication and subsequent analysis does have a role in Paleolithic archaeology. While this is not the proper venue to elucidate the benefits and limits of the industrial type concept, a discussion of the reasons and assumptions behind an investigation into the variability within this analytical construct is warranted.

The epistemological practice of breaking variability into defined, categorical units for heuristic manipulation is the basis of most archaeological low-level theory building (Thomas 1998), if not most human cognitive practice (Adams, Adams 1991). It should not be the end goal of analyses, however; it is only one of the first steps in understanding the causes behind variability in prehistoric hominid behaviour. Thus, we wish to make clear that a discussion of the variability within the Bohunician Industrial Type is not designed to reify the reality of this label. Straus (2003) and Clark and Riel-Salvatore (2003) are quite correct when they point out that the problem

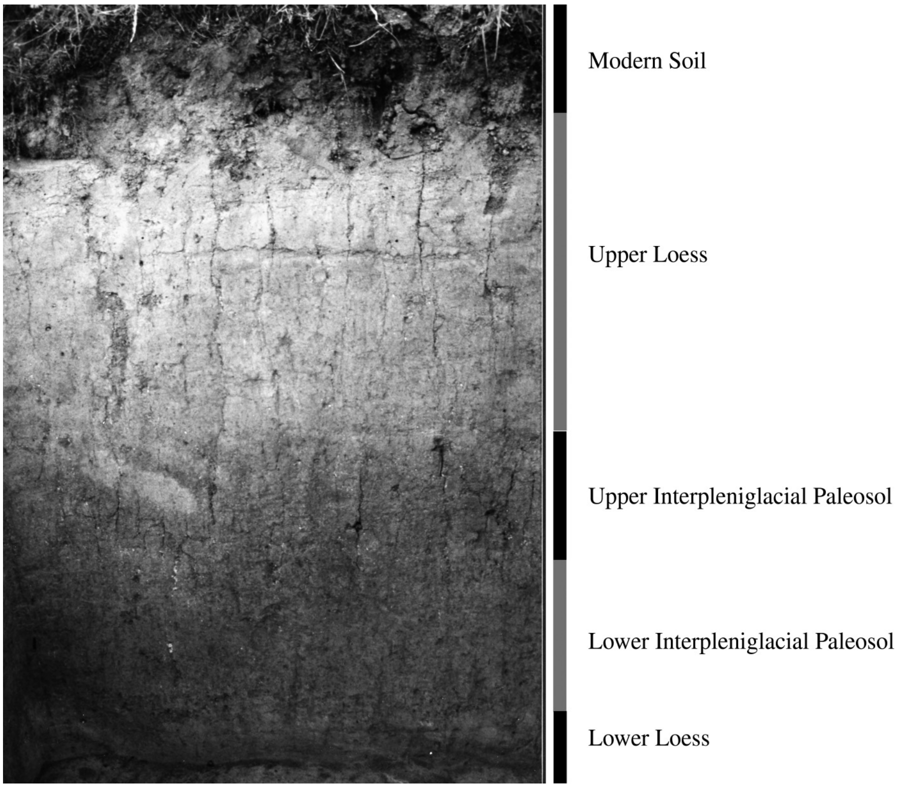


FIGURE 4. Section, western profile of Test Trench 1, 2.5 m south of Area A of the 2002 excavations. Photo by P. Škrdla.

of the reality of industrial types (in their argument, the Aurignacian) is limiting our ability to understand variability through time and space. Tostevin (2000a, 2003a) has also argued that patterns in material culture evolution are best analysed not as generalized industrial types but on the basis of changes in our smallest units of analysis. These units are in fact individual assemblages, the smallest unit of association between artifacts as defined archaeologically or geologically at the finest chronological resolution possible. Note that McPherron *et al.* (2005) point to ways to increase the resolution of artifact association through better proveniencing methods, to separate further the concept of archaeological assemblage from geological layer. The present discussion, therefore, is using the industrial type label as a way to select a certain portion of the Early Upper Paleolithic archaeological record for a systematic comparison of individual assemblages within this sample of the record. In the present case, the investigation of the variability among assemblages bearing the Bohunician label serves as the starting point for evaluating our understanding of the patterning of flintknapping behaviours across the landscape in one region during the transition from the Middle to the Upper Paleolithic.

The present reason for investigating the variability among assemblages labelled Bohunician is to determine how different resources, limitations, and opportunities specific to different portions of the Pleistocene landscape of the Middle Danube affected the behavioural pattern of flintknapping among hominids occupying the area during this period. Specifically, one of the hypotheses for the observed differences between the original collection from Brno-Bohunice and the Bohunician assemblages of the Stránská skála hillside is the unique situation of Brno-Bohunice on the landscape relative to the raw material sources available in the region. Compared to other excavated Bohunician and Szeletian sites in Moravia, Brno-Bohunice is not situated on or close to a source of raw material. Thus, variation between these sites due to differential landscape use and differential core and tool reduction intensity is a prime target of investigation for understanding the adaptation of the particular hominids whose behaviours were sampled by the sedimentological processes at these sites (samples subsequently labelled "Bohunician" or "Szeletian"). Understanding the differences between these assemblages is consequently part of a larger processual investigation into the organization of technology (*sensu* Nelson 1991) in this period. As a result, the evaluation of whether or not specific assemblages should bear the label "Bohunician" given the new assemblage from the type-site, *per* the paleontological type-fossil approach, is not the task at hand.

HOW DOES ONE EVALUATE VARIABILITY WITHIN AN INDUSTRY?

While the few refitted production sequences within the Lower Paleosol in the Brno-Bohunice 2002 collection are similar to those from the Stránská skála assemblages (Škrdla, Tostevin 2005), the sequences are not extensive enough to form the sole basis for a comparison of Bohunician assemblages to evaluate the uniqueness of the type-site relative to the variability within the rest of the industrial type. Therefore, attribute analysis of the debitage, cores, and tools is required to evaluate how Brno-Bohunice differs from other EUP assemblages, in this case a sample of Bohunician assemblages from the Stránská skála hillside as well as the Szeletian assemblage from Vedrovice V.

But how to go about this? This question has almost as many answers as there are archaeologists interested in the question. Frequently, retouched tool type-lists are compared (e.g. Odell 1996, 2004, Stutz, Estabrook 2004). Alternatively, archaeologists illustrate a technological sequence for each assemblage (by either core reduction or *chaîne opératoire* methods), producing abstractions of an order of procedures for reducing a nodule down into exhausted tools (e.g. Andrefsky 1987, Boëda 1993, 1994, Van Peer 1992). The retouched type-list approach has the advantage of the comparison of quantitative observations, while the reduction sequence approach has the advantage of an inclusive view of the behaviours which produced the whole assemblage. On the other hand, the former has the disadvantage of frequently confounding population-specific learned behaviour with environmentally-specific processes designed to optimize function or to manage raw material constraints, i.e. the degree of resharpening. The latter has the disadvantage that abstract descriptions of a process are difficult to compare quantitatively. Given the limitations of the alternative approaches, a different course is taken here, in which variables are examined which are both quantitatively observable on debitage and tools as well as encapsulate the knapping choices known through flake fracture mechanics studies to be controlled by artisans during the flintknapping process (Dibble, Whittaker 1981, Dibble, Pelcin 1995, Pelcin 1997a, b, c, Dibble 1997, Shott *et al.* 2000).

The methodology applied to these analyses has already been presented in detail elsewhere (Tostevin 2000c, 2003b, and in press 1). It should be stressed, however, that almost all of the variables used are designed to measure the central tendencies and dispersion of the morphologies selected by the knapper across the entirety of the blank production process, at least as represented by the palimpsest of the assemblage. For instance, with each blow delivered by the knapper to the core, s/he unconsciously or consciously chooses to strike a platform with a particular exterior platform angle, at a particular depth from that edge (the platform thickness), and opposite particular dorsal morphologies to produce a removal. The only variables designed to characterize particular parts of the blank production phase of the operational sequence are the characterisations of the direction of early vs. late core exploitation, evidenced through the cross-tabulation of the debitage dorsal scar pattern vs. blank length. Therefore, this analysis of the blank production behaviours is not a sequence study, as with so many core reduction sequence and *chaîne opératoire* analyses. The analytical structure does, however, contrast how assemblages compare between the blank production behaviours and the morphologies of the retouched toolkits. This is an informative contrast because the artifacts of the retouched toolkit represent the morphologies desired for use and reuse on the landscape, selected from the pool of produced blanks. As such, due to the equifinality of blank production behaviours, the toolkit morphologies more closely map functional needs than do the blank production behaviours. Also, the toolkit is more socially visible than the blank production behaviours, and so represents technological solutions accessible to less socially intimate individuals (Carr 1995, Tostevin in press 2). The remainder of this paper will focus on detailing the data and results relevant to the present research question.

COMPARISON OF BEHAVIOURAL SIGNATURES FOR EACH ASSEMBLAGE

The variables known to be subject to the direct control of the flintknapper engaged in blank production are compared for the assemblages in question in *Table 2*. Each variable is tested for similarity between the Brno-Bohunice 2002 assemblage in the far left column with each assemblage to the right of Brno-Bohunice's column (for example, Brno-Bohunice vs. Stránská skála III, Brno-Bohunice vs. Stránská skála IIIa, etc.). Significant differences ($p<0.05$ for two-tailed t-tests and G^2 likelihood tests) between the central tendencies for each variable in the two assemblages are given in bold. As the choice of certain variable states can affect the form of other variable states within related aspects of the flintknapping process, the number of differences noted between assemblages for each variable are summed within each domain but divided by the number of variables within that domain before being added to the values of other domains to provide the cumulative measure of difference. As there are four domains for this comparison, the maximum level of difference is 4.0 while a value of 0.0 would indicate total similarity between two assemblages. This procedure controls for interdependence between variables within domains as much as possible. For the tool morphology variables in *Table 3*, these variables are judged as falling within the same domain and so are summed and divided by 7, the number of variables, for a maximum measure of difference of 1.0. See Tostevin (in press 1) for a more detailed discussion of these variables and the analysis of the assemblages other than Brno-Bohunice.[1]

[1] The present data analysis differs from Tostevin's previous studies in focusing on the inter-assemblage comparison of knappers' choices for blank production, as calculated for all complete flakes and tools (domains 1–4, *sensu* Tostevin 2000a, 2003b) versus a comparison of the morphological variables of the retouched toolkits most relevant to their effective use, as calculated for complete tools – unretouched Levallois and backed items included (Tostevin in press 1). Direct statistical comparison of the toolkits better serves this purpose than comparison of blank selection criteria for retouching (domain 5, *sensu* Tostevin 2000a).

TABLE 2. Comparison of the behavioural signature of blank production at Brno-Bohunice with other Bohunician assemblages and one Szeletian.

Brno-Bohunice Lower Level	**Stránská skála IIIa-4**	**Stránská skála IIIc**	**Stránská skála III**	**Vedrovice V**
Domain 1: Core modification				
Core orientation: Use of one longitudinal surface	Use of one longitudinal surface	Use of one longitudinal surface	Use of one longitudinal surface	Use of one longitudinal surface
Core management: Débordants and side blade removals	Débordants and side blade removals	Débordants and side blade removals	Débordants and side blade removals	**Lateral core tablets, changes of orientation**
Number of differences/2 steps	0/2=0	0/2=0	0/2=0	1/2=0.5
Domain 2: Platform maintenance				
Platform treatment: Unprepared: 53% Prepared: 47% n=534	Unprepared: 58% Prepared: 42% n=448, p=0.12, Fisher's Exact	Unprepared: 58% Prepared: 42% n=767 p=0.09, Fisher's Exact	Unprepared: 55% Prepared: 45% n=367 p=0.68, Fisher's Exact	Unprepared: 61% Prepared: 39% n=379 **p=0.02**, Fisher's Exact
External platform angle (degrees) mean: 88.4 s.d.: 13.8 n=481	mean: 85.2 s.d.: 15.3 n=425 **p=0.00,** t=3.24 df=861.3	mean: 84.9 s.d.: 15.0 n=664, **p=.00,** t=3.93 df=1143	mean: 86.4 s.d.: 14.0 n=340 **p=0.04,** t=2.03 df=819	mean: 89.0, s.d.: 17.4 n=342 p=0.55**,** t=–0.60 df=626.4
Platform thickness: mean: 3.63 s.d.: 2.08 n=509	mean: 4.82 s.d.: 2.45 n=433 **p=0.00** t=–7.97, df=852.2	mean: 4.55, s.d.: 2.52 n=741, **p=0.00** t=–7.05, df=1205	mean: 4.42 s.d.: 2.16 n=344 **p=0.00** t=–5.34, df=851	mean: 5.01 s.d.: 3.64 n=359 **p=0.00** t=–6.48, df=523.5
Number of differences/3 steps	2/3=0.67	2/3=0.67	2/3=0.67	2/3=0.67
Domain 3: Direction of core exploitation				
Early exploitation: Bidirectional and sub/centripetal	**Bidirectional**	**Bidirectional**	**Bidirectional**	**Bidirectional and unidirectional**
Late exploitation: unidirectional	Unidirectional	Unidirectional	Unidirectional	Unidirectional
Number of differences/2 steps	1/2=0.5	1/2=0.5	1/2=0.5	1/2=0.5
Domain 4: Dorsal surface convexity system				
Length/Width ratio: mean: 1.74 s.d.: 0.80 n=395	mean: 1.71 s.d.: 0.67 n=502 p=0.58 t=0.56, df=769.2	mean: 1.82 s.d.: 0.80 n=731 p=0.13 t=–1.52, df=1124	mean: 1.83, s.d.: 0.74 n=397, p=0.09 t=–1.71, df=790	mean: 1.50, s.d.: 0.59 n=473, **p=0.00** t=5.07, df=707.7
Lateral edges: Parallel: 41% Convergent: 13% Expanding: 20% Ovoid: 26% n=373	Parallel: 49% Convergent: 23% Expanding: 17% Ovoid: 11% n=489, **p=0.00** G^2=45.0, df=3	Parallel: 41% Convergent: 16% Expanding: 18% Ovoid: 25% n=706, p=0.44 G^2=2.73, df=3	Parallel: 59% Convergent: 17% Expanding: 10% Ovoid: 14% n=395, **p=0.00** G^2=41.9, df=3	Parallel: 39% Convergent: 16% Expanding: 31% Ovoid: 14% n=410, **p=.00** G^2=22.36, df=3
Profile: Straight: 60% Curved: 22% Twisted: 18% n=388	Straight: 54% Curved: 29% Twisted: 17% n=496, p=0.07 G^2=5.43, df=2	Straight: 56% Curved: 25% Twisted: 19% n=731, p=0.45 G^2=1.60, df=2	Straight: 47% Curved: 30% Twisted: 23% n=396, **p=0.00** G^2=13.5, df=2	Straight: 64% Curved: 16% Twisted: 20% n=419, p=0.052 G^2=5.92, df=2
Cross-section: Triangular: 40% Trapezoidal: 54% Other: 6% n=384	Triangular: 45% Trapezoidal: 50% Other: 5% n=495, p=0.29 G^2=2.50, df=2	Triangular: 41% Trapezoidal: 47% Other: 12% n=724, **p=0.00** G^2=12.46, df=2	Triangular: 40% Trapezoidal: 55% Other: 5% n=397, p=0.66 G^2=0.82, df=2	Triangular: 50% Trapezoidal: 29% Other: 21% n=431, **p=0.00** G^2=70.1, df=2
Width/Thickness ratio: mean: 4.77 s.d.: 2.37 n=395	mean: 4.03 s.d.: 1.83 n=502 **p=0.00,** t=5.06, df=727.1	mean: 4.15 s.d.: 1.84 n=731 **p=0.00,** t=4.49 df=655.5	mean: 3.99 s.d.: 1.73 n=397 **p=0.00,** t=5.28 df=722.1	mean: 4.26 s.d.: 1.84 n=473 **p=0.00,** t=3.48 df=734.9
Number of changes/5 steps	2/5=0.4	2/5=0.4	3/5=0.6	4/5=0.8
Total measure of difference in blank production	1.57	1.57	1.77	2.47

TABLE 3. Comparison of the behavioural signature of the toolkit from Brno-Bohunice with other Bohunician assemblages and one Szeletian.

Brno-Bohunice lower level	**Stránská skála IIIa-4**	**Stránská skála IIIc**	**Stránská skála III**	**Vedrovice V**
Length/Width ratio: *mean: 1.95* *s.d.: 0.90* *n=80*	mean: 1.58 s.d.: 0.50 n=67, **p=0.00** t=3.18, df=127.0	mean: 1.78 s.d.: 0.70 n=93, p=0.17 t=1.39, df=171	mean: 2.02, s.d.: 0.91 n=30, p=0.71 t=–0.37, df=108	mean: 1.51, s.d.: 0.52 n=115, **p=0.00** t=3.90, df=115.0
Width/Thickness ratio: *mean: 4.80* *s.d.: 2.53* *n=80*	mean: 4.28, s.d.: 2.14, n=67, p=0.19 t=1.32, df=145	mean: 4.24, s.d.: 1.67, n=93, p=0.10 t=1.68, df=133.5	mean: 4.29, s.d.: 1.57 n=30, p=0.21 t=1.25, df=83.9	mean: 3.59, s.d.: 1.56 n=115, **p=0.00** t=3.79, df=120.7
Lateral edges: *Parallel: 41%* *Convergent: 22%* *Expanding: 17%* *Ovoid: 20%* *n=59*	Parallel: 39% Convergent: 31% Expanding: 16% Ovoid: 14% n=57, p=0.63 G^2=1.72, df=3	Parallel: 41% Convergent: 18% Expanding: 14% Ovoid: 27% n=88, p=0.75 G^2=1.23, df=3	Parallel: 29% Convergent: 54% Expanding: 11% Ovoid: 7% n=28, (2 low cells) **p=0.03,** G^2=9.12, df=3	Parallel: 31% Convergent: 12% Expanding: 46% Ovoid: 11% n=61, **p=0.01** G^2=12.59, df=3
Distal terminus: *Blunt: 50%* *Pointed: 50%* *n=48*	Blunt: 50% Pointed: 50% n=36 p=1.0, Fisher's Exact	Blunt: 59% Pointed: 41% n=69 p=0.35, Fisher's Exact	Blunt: 21% Pointed: 79% n=24 **p=0.02**, Fisher's Exact	Blunt: 81% Pointed: 19% n=36 **p=0.01**, Fisher's Exact
Profile: *Straight: 57%* *Curved: 33%* *Twisted: 10%* *n=72*	Straight: 45% Curved: 32% Twisted: 23% n=62, p=0.11 G^2=4.46, df=2	Straight: 53% Curved: 29% Twisted: 18% n=93, p=0.29 G^2=2.51, df=2	Straight: 50% Curved: 27% Twisted: 23% n=30, p=0.21 G^2=3.10, df=2	Straight: 64% Curved: 13% Twisted: 23% n=75, **p=0.01** G^2=10.70, df=2
Unique types of retouch: *Flat bifacial retouch*	**Normal retouch**	**Normal retouch**	**Normal retouch**	Flat bifacial retouch
Tool types: *UP tools dominate*	UP tools dominate	UP tools dominate	UP tools dominate	**MP tools dominate**
Number of differences/7 steps	2/7	1/7	3/7=0.6	6/7
Total measure of difference in toolkit morphology	0.29	0.14	0.43	0.86

RESULTS

Given the attribute analysis data, what is the overall technological similarity between the type-site and the Stránská skála assemblages? As presented in *Table 2*, there is no difference in the first domain (core modification) between Brno-Bohunice and any of the Stránská skála assemblages, and only one difference relating to core convexity management with the out-group, Vedrovice V. The cores at Brno-Bohunice are indistinguishable in reduction strategy from those seen in the Stránská skála assemblages (Škrdla, Tostevin 2005: fig. 10). The degree of platform treatment (whether prepared with more than one scar on the platform or not) is the same across the Bohunician assemblages although different for the Szeletian assemblage. Both external platform angle and platform thickness differ significantly, however, between Brno-Bohunice and the other assemblages. For the third domain, late core exploitation is similar across all of the EUP assemblages whereas early core exploitation differs significantly (*Figure 5*).[2] The variables within the fourth domain are not as consistent in their degree of similarity across the assemblages, save for the much larger ratio of width/thickness of the blanks at Brno-Bohunice. For the blank production variables of domains 1–4, therefore, Brno-Bohunice appears more similar to the Stránská skála assemblages (from 1.57 to 1.77 out of 4.0) than to Vedrovice V (2.47 out of 4.0). This means that the behavioural choices made by the artisans who produced the Brno-Bohunice assemblage were more similar to those choices enacted on the Stránská skála hillside than to those at Vedrovice V in the Krumlovský les area.

When compared to the level of difference across pair-wise comparisons of a sample of Early Upper Paleolithic assemblages in Moravia (*Table 4*), the patterning of blank

[2] This step is characterised differently in the present study compared to Tostevin (2000a, 2003b). Blank length in quartiles is correlated with dorsal scar pattern to identify the most numerous dorsal scar pattern (unidirectional, bidirectional, crossed, and subcentripetal together with centripetal) for early core exploitation (the first quartile and thus longest blanks) and late core exploitation (the fourth quartile and thus smallest blanks). Corticality of blanks is no longer used for this analysis, save to exclude blanks with more than 60% cortex. The identification of the most numerous scar pattern in each quartile is standardised by listing two scar patterns only if the first and second most numerous patterns fall within 10% of each other, in terms of representation of blanks within the quartile. See Tostevin (in press 1) for a further discussion.

TABLE 4. Measures of the difference in blank production between Bohunician assemblages presented as a difference matrix, with the Szeletian of Vedrovice V as an out-group.

	Stránská skála IIIa-4	Stránská skála IIIc	Stránská skála III	Brno-Bohunice	Vedrovice V
Stránská skála IIIa-4	0.00	0.60	0.73	1.57	2.33
Stránská skála IIIc		0.00	0.60	1.77	2.47
Stránská skála III			0.00	1.77	2.66
Brno-Bohunice Lower Paleosol				0.00	2.47
Vedrovice V					0.00

production variables in these assemblages is striking. The Stránská skála Bohunician assemblages are extremely similar to each other, with values ranging from 0.60 to 0.73 out of 4.0 (mean of 0.64), but are notably more different from Brno-Bohunice (with values ranging from 1.57 to 1.77, with a mean of 1.70) than they are from themselves. All of the comparisons between Bohunician assemblages vs. the Szeletian assemblage of Vedrovice V, however, fall much farther apart, from 2.33 to 2.66 (mean of 2.48). While the values of the Brno-Bohunice-vs-Vedrovice V differences are not as large as some other assemblage comparisons (e.g. Stránská skála IIIa-4 and Kůlna Cave Layer 7a with a value of 3.26 from Tostevin, 2000a, in press 1), these values indicate that Brno-Bohunice falls between the Szeletian and the other Bohunician sites in the distinctiveness of the technological choices which produced this particular palimpsest.

In terms of the morphology of the toolkit (*Table 3*), Brno-Bohunice tools are fairly similar to those of the other Bohunician assemblages but quite different from those of Vedrovice V. Brno-Bohunice tools are more bladey (length/width ratio) than those at Stránská skála IIIa-4 and Vedrovice V. The other toolkit variables do not show significant differences between Brno-Bohunice and the other assemblages except for the high frequency of convergent lateral edges and pointed distal terminations at Stránská skála III. Brno-Bohunice does differ significantly from other Bohunician assemblages in the presence and production of foliate points using flat bifacial retouch (see Škrdla, Tostevin 2005). In this, Brno-Bohunice is judged to be similar to Vedrovice V. As a whole, this produces measures of difference for the toolkits of 0.14 to 0.43 (out of a maximum of 1.0) for the comparisons between Brno-Bohunice and the other Bohunician assemblages and 0.86 for a comparison of Brno-Bohunice and Vedrovice V. In other words, Brno-Bohunice evidences a selection of tool morphologies which are significantly more similar to the other Bohunician assemblages than they are to the tool morphologies of the Szeletian assemblage.

Figure 6 illustrates the patterning that results when pair-wise comparisons of assemblages by blank production variables are graphed against toolkit morphology variables (i.e. the "total measure of difference" from *Tables 2* and *3*). Assemblage comparisons in the bottom left corner of the graph are most similar to each other in terms of both blank production and tool morphology. Points that are further up the y-axis differ more in terms of blank production, whereas those that are further along the x-axis differ more in terms of tool morphology. This graphical biplot format is preferred for this question compared to other alternatives (Hovers, Raveh 2000, Wurz *et al.* 2003), as the influence of individual variables on the resulting characterization of the variability is far more transparent than these alternatives.

The Bohunician comparisons cluster in the lower left corner of the graph, indicating little difference in blank production and toolkit, although Brno-Bohunice is always at the top of this cluster along the y-axis, indicating slightly greater differences in blank production. The Szeletian-Bohunician comparisons, however, all fall in the middle to upper right corner of the graph, indicating substantial differences in both blank production and toolkit morphology. Even though the foliate points from the Brno-Bohunice collection make it more similar to Vedrovice V, this is not sufficient to balance the differences in all of the other toolkit variables. Thus, despite the contentious foliate points in the original type-collection, the Brno-Bohunice 2002 assemblage demonstrates that the knapping options employed in creating both the blanks and the toolkit are more similar to Bohunician assemblages than to the Szeletian assemblage.

What differences do exist between Brno-Bohunice and the Stránská skála assemblages remain to be explained, however. The effect of the debitage produced by bifacial reduction of foliate points in the Brno-Bohunice collection is one possible explanation for the differences in blank production variables. Specifically, from *Table 2*, it is apparent that the difference in blank production between Brno-Bohunice and the other assemblages is largely accounted for by the difference in the direction of early core exploitation at Brno-Bohunice, which evidences a much closer proportion of subcentripetal and centripetal scar patterns, the second most numerous pattern, to bidirectional scar patterns, the most numerous pattern, than in the other Bohunician assemblages. As bifacial reduction typically produces more crossed, subcentripetal, and centripetal dorsal scar patterns (Bradbury, Carr 1999) than a classic Bohunician bidirectional core reduction, the much higher frequency of subcentripetal and centripetal dorsal scar patterns at Brno-Bohunice might be explained as the result of bifacial reduction. Given the fact that all 4 bifacial foliate points recovered at Brno-Bohunice are made on Krumlovský les chert and all but one of the 12 bifacial thinning flakes over 1.5 cm long are made on this raw material (the 40 bifacial thinning flakes noted in the

FIGURE 5. Brno-Bohunice Lower Paleosol. Percent of blanks with particular dorsal scar patterns by blank length (mm) in quartiles for complete flakes and tools over 2 cm long (excluding pieces with a crested scar pattern, an indeterminate scar pattern, greater than 60% cortex, or fewer than 3 dorsal scars).

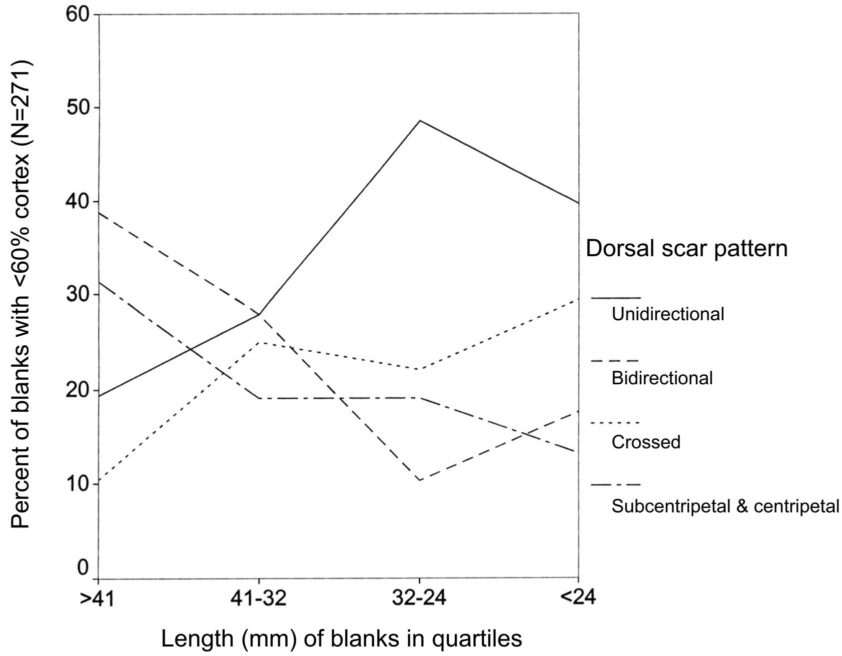
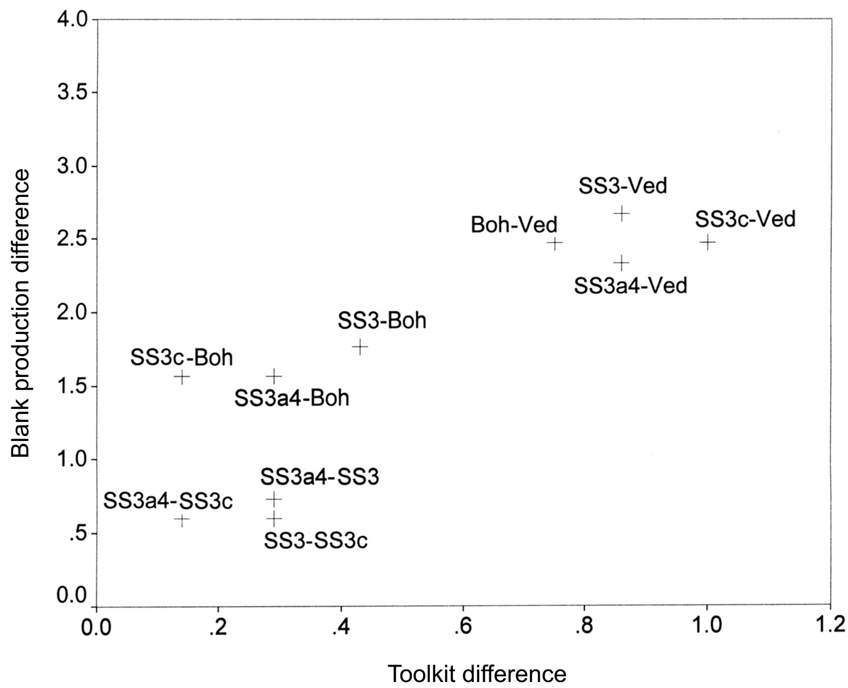


FIGURE 6. Blank production vs. Toolkit differences for pair-wise comparisons between selected Early Upper Paleolithic assemblages from the Middle Danube. Assemblage key: SS3a4: Stránská skála IIIa level 4; SS3: Stránská skála III; SS3c: Stránská skála IIIc; Boh: Brno-Bohunice Lower Paleosol; V: Vedrovice V.



0.28–1.5 cm sieved samples were too small for raw material identification), we hypothesised that bifacial reduction was conducted primarily on Krumlovský les chert while the Levallois component was conducted on Stránská skála chert (41 pieces to 2). Thus, we predicted that removing the Krumlovský les chert artifacts from the calculation of the central tendencies of the blank production variables would make Brno-Bohunice more similar to the Stránská skála assemblages, if indeed bifacial reduction is responsible for the increased difference. Interestingly, as a secondary experiment, this adjustment to the Brno-Bohunice assemblage when compared to the Bohunician from Stránská skála IIIa level 4 made the differences *greater*, as the blank profile data went from an insignificant probability value of p=0.07 to a significant value of p=0.01 with the smaller sample. The direction of early core reduction did *not* change. This resulted in a difference measure of 1.77 instead of 1.57. While it is possible that significant bifacial reduction was conducted on Stránská skála chert (there is one diagnostic bifacial thinning flake of this raw material and it is possible that foliates made of this raw material could have been curated off site), the reduction would have to have produced a good number of artifacts in the 2 cm or larger size category included in the attribute analysis to bias the result. Given the fact that all of the known foliates are only around 6 cm in length themselves and no larger bifaces are known from this time period, this is unlikely. There is thus no parsimonious argument for claiming that the bifacial reduction alone is responsible for the difference in blank production variables between Brno-Bohunice and the other sites. The chronological position of Brno-Bohunice as one of the latest Bohunician assemblages, overlapping with the youngest dates from Stránská skála IIIc (see *Table 1*), suggests a possible temporal explanation for the differences. While a chronological component to the degree of difference is possible, the refitting data discussed below suggest that behavioural issues related to site function or landscape utility may be more of a cause.

DIFFERENCES IN THE NATURE OF THE BRNO-BOHUNICE PALIMPSEST

Another explanation for the differences seen between Brno-Bohunice and the other Bohunician assemblages emerges within the context of Škrdla's refitting studies. Škrdla has shown that the ratio of refitted breaks to refitted production sequences differs markedly at Brno-Bohunice from the pattern seen at Stránská skála IIIc (Škrdla, Tostevin 2005). As 75% of the Brno-Bohunice refits are breaks (only 25% are production sequences) compared to only 27% of the refits at Stránská skála IIIc (46% if frost fractures are included), there is a clear difference in the ability to recognize production sequences at Brno-Bohunice through refitting, standardized by the ability to refit breaks. Similarly, the frequency of refits (both breaks and production sequences) at Brno-Bohunice is one-quarter that found at Stránská skála IIIc while the number of artifacts within the average refitted sequence is almost half that of the other site (Škrdla, Tostevin 2005). This indicates a difference in the frequency with which temporally contiguous flintknapping operations (i.e. refittable production sequences) were conducted and deposited into the archaeological record. The refitting of an assemblage from another location on the Červený kopec, within 50 m of the Brno-Bohunice 2002 excavation, has produced similar refit values to those of Brno-Bohunice 2002 (Nerudová, Krásná 2002). This indicates that this is a palimpsest of a different type from that of Stránská skála IIIc, and of the other Bohunician Stránská skála assemblages as well, according to extant refit studies (Svoboda, Škrdla 1995, Škrdla 1996). While the Stránská skála sites bear witness to each occupational event producing many more temporally contiguous flintknapping events (measured by production refits), Brno-Bohunice witnessed occupations with shorter flintknapping activities or activities which led to the export of artifacts from the excavated area of the site. Thus, the refit data suggests that the 2002 Lower Paleosol assemblage from Brno-Bohunice represents a different type of landscape utilization from the other excavated Bohunician assemblages in Moravia. This data thus provides a credible hypothesis for subsequent testing as an explanation for the documented differences between the type-site and the other examples of this industrial type.

CONCLUSIONS

The 2002 excavations at Brno-Bohunice have produced a new assemblage for comparison with other Early Upper Paleolithic as well as Late Middle Paleolithic assemblages in the Middle Danube region. Through the systematic consideration and rejection of competing hypotheses for the spatial association of bifacial reduction debitage and tools with Bohunician cores and points, this study argues that the 2002 Brno-Bohunice assemblage is evidence for the production, use, and discard of foliate points and Bohunician core technology by the hominids who used the locality, the only epistemologically-valid definition of the assemblage. Given this result, the study attempts to reconcile the differences between the type-site and other assemblages labelled Bohunician, using a method which quantifies lithic attributes which reflect variables controlled by flintknappers. With the addition of a quantitative comparison of refit frequencies between these assemblages, the combination of these two methods leads us to hypothesize differential landscape use as one causal factor behind the variability within this industrial type. The production of bifacial foliate points at Brno-Bohunice is unlikely to be the sole cause of the relative differences between this and other Bohunician assemblages. While the testing of this hypothesis through evaluations of core reduction intensity (Henry 1989) and the relative proportions of operational sequences present at different sites (Conard, Adler 1997, Hallos 2005) is the next task at hand, the data presented here offers a new way to examine inter-assemblage variability using quantitative and replicable observations on assemblages with and without many refits.

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Gilbert B. Tostevin
Department of Anthropology
University of Minnesota
395 H. H. Humphrey Center
301 19th Ave. South
Minneapolis, MN 55455, USA
E-mail: toste003@umn.edu

Petr Škrdla
Institute of Archaeology Brno
Královopolská 147
612 00 Brno, Czech Republic
E-mail: ps@iabrno.cz