Magdalenian with microlithic triangles revisited: the case of the Hranice na Moravě III – Velká Kobylanka site (Přerov district, Czech Republic)

Znovu k magdalénienu s mikrolitickými trojúhelníky: případ Hranic III – Velké Kobylanky (okres Přerov)

Martin Moník – Vít Záhorák – Jiří Drozd – Veronika Němcová

A recently acquired collection of 1332 knapped stone and 15 pebble or platy slate artefacts were analyzed to verify the dating and origin of the well-known Magdalenian site Hranice III – Velká Kobylanka in the Moravian Gate (Moravia, Czech Republic). The inhabitants of the site were processing a number of local knapped stone materials rather than long-distance imports, though (locally available) erratic flints were mostly used for tool manufacture. The most prominent as regards the typology of tools are a number of microlithic triangles, already recorded in an older assemblage from the site, indicating the Older Dryas age of the collection. The absence of raw materials from the south-west (e. g. the Olomučany chert) and typological analogies from Eastern Germany and Poland indicate that the Magdalenians from Hranice may have represented a colonization wave independent of the one that probably settled dozens of caves of the Moravian Karst. The only ^{14}C date acquired by us from the surface comes from the Atlanticum chronozone (Holocene) and dates some younger activity at the site.

Magdalenian – Moravia – lithics – geometric microliths – raw materials

Analýza nově získaného souboru 1332 ks štípané industrie a 15 valounových nebo destičkovitých břidlicových artefaktů byla provedena pro ověření datace a původu známé lokality Hranice III – Velká Kobylanka v Moravské bráně. Obyvatelé lokality využívali řadu místních, spíše než importovaných, surovin pro výrobu štípané industrie, ačkoliv k výrobě nástrojů byl využíván téměř výlučně (lokálně dostupný) eratický pazourek. Typologicky nejvýraznější jsou zde mikrolitické trojúhelníky, zaznamenané již při analýze starší kolekce a napovídající datování lokality do starého dryasu. Absence surovin z jihovýchodu (např. rohovce typu Olomučany) a typologická podobnost souboru s kolekcemi východní části Německa a Polska naznačují, že hranická lokalita možná představuje nezávislou kolonizační vlnu, lišící se od té, která osídlila desítky magdalénských lokalit Moravského krasu. Jediné radiokarbonové datum, které se nám podařilo získat z kosti ležící na povrchu, však pochází z období atlantiku (holocén) a souvisí s blíže nespecifikovanou mladší událostí v lokalitě.

magdalénien – Morava – kamenná industrie – geometrické mikrolity – suroviny

Introduction

Hranice III – Velká Kobylanka (HVK III; Přerov district, Czech Republic) is one of the few open-air Magdalenian sites in Moravia and Czech Silesia (Czech Republic) alongside Loštice, Přerov, Mokrá – quarries I and V, Brno-Maloměřice – Borky I, and Záblatí (*Neruda – Nerudová 2008*; *Neruda et al. 2009*; *Škrdla – Schenk – Zapletal 2008*; *Škrdla 1997*; *2002*; *Škrdla – Kos – Přichystal 1999*; *Valoch 1963*; *Svoboda – Wodecki 1981*). The site is the largest regarding the amount of acquired lithic artefacts. Several collections of lithic artefacts acquired through field-walking survey originate from the surroundings of the town of Hranice na Moravě and the Velká Kobylanka site. However, the majority are a result of non-professional research by amateur archaeologists and remain unpublished in private collections. Only small-scale excavations occurred at Velká Kobylanka site in the 1950s and the 1960s, but researchers were unable to identify an intact archaeological layer (*Klíma 1951*, 110; *Dvořák – Valoch 1961*).

Despite the vast collections (we use this term alternately with "assemblage" although the old and new assemblages from HVK III probably both represent palimpsests of several occupations of the site; cf. *Maier 2015*, 37) of artefacts, there are only five published works about the Velká Kobylanka site. The first two described the discovery of the site (*Klíma 1947*; *1951*). The third study was a high-school work by *P. Neruda* (*1988*). *Neruda* and *Kostrhun* (*2002*) revised the assemblages acquired at Velká Kobylanka and made a compilation of local Paleolithic sites. The last effort was a bachelor thesis by *V. Záhorák* (*2017*) and has provided the basis for this paper. The assemblage analyzed here, numbering 1332 artefacts + 15 pieces of pebble and slate plate industry, comes from a systematic field-walking survey undertaken by one of the authors (J.D.) over the last two decades. In this way, the origin and location of the artefacts are easier to estimate than, e.g., in the case of the assemblages studied by *Neruda* and *Kostrhun* (*2002*). Through our analysis, we try to verify (mostly on the basis of tool typology and analogy) the age of the Velká Kobylanka site, tentatively established as being Lower to Middle Magdalenian (*Neruda – Kostrhun 2002*, 152), and to reconstruct its raw material economy and core-reducing technology. We also compare our results with the assemblage from the same site studied by Neruda and Kostrhun and with similarly dated sites from Moravia and the neighbouring areas of the Central European Magdalenian to see if they fit well into the recently formulated regional Polish-Moravian Magdalenian group (*Maier 2015*, 98).

Geography and geology

Velká Kobylanka is a hill southeast of the town Hranice na Moravě, situated on the right bank of the Bečva River at WGS 84 coordinates 49.5435914N and 17.7560422E. Its altitude is 362 m. As a result, it overlooks a significant part of the elongated corridor of the Moravian Gate. Together with the nearby hills of Malá Kobylanka, Hůrka and Skalka it belongs to the easternmost part of the Maleník (*Demek 1987*, 337), an outcrop of Devonian and Carboniferous rocks of the Bohemian Massif rising from under the nappes of the Western Carpathian Flysch sediments. The natural borders of this (i.e., Maleník) geological feature are the Bečva River and the Račí and Hluzovský streams. The Palaeozoic rocks are frequently covered with Miocene (clays) and Pleistocene (eluvial and colluvial deposits, loess, loess loams) sediments at the site (*Pálenský red. 1987*). Today, the hilltop is covered with deciduous forest and has the status of a nature reserve. Intensely cultivated fields lie to the south towards the villages Černotín and Hluzov. To the north begin the orchards and outskirts of Hranice.

The site itself is situated in a saddle between the Velká and Malá Kobylanka hills (*fig. 1*). Other near sites with a variable number of lithic finds were described by *B. Klíma* (*1947*; *1951*), *P. Neruda* and *P. Kostrhun* (*2002*), and some unpublished collections of lithic industry were acquired in their vicinity, but HVK III seems to be the largest site in the area.

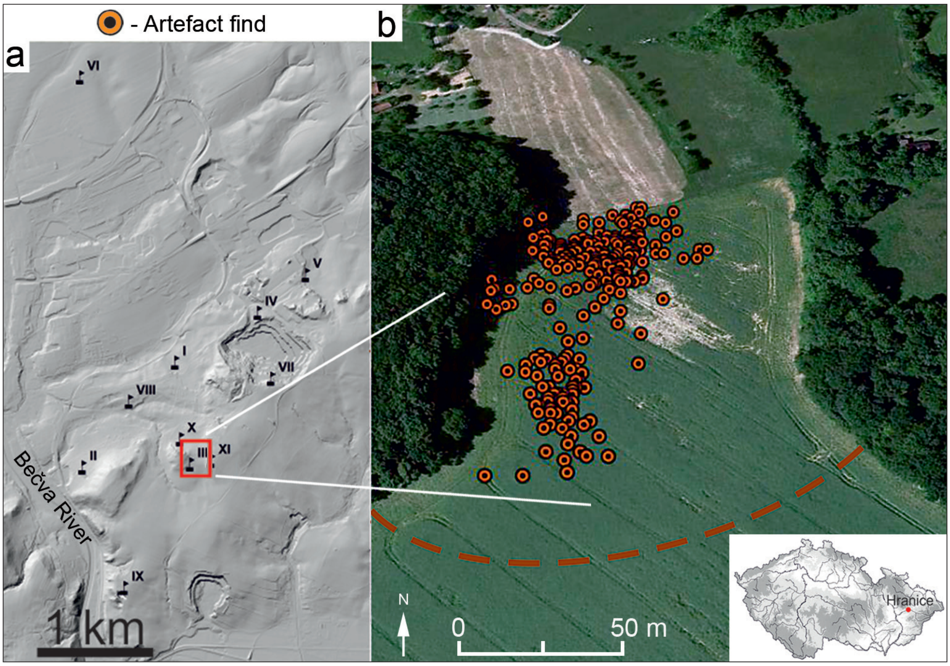


Fig. 1. Map of the Hranice na Moravě area (a) with different Palaeolithic sites known to date (I–XI). On the right (b), dots mark GPS-recorded artefacts on the Hranice III – Velká Kobylanka site in the saddle between the Velká and Malá Kobylanka hills. The dashed line shows the probable extent of the site on the basis of older finds (not GPS-located). The town of Hranice lies in the valley below (image on the right downloaded from Google Earth Pro).
Obr. 1. Mapa oblasti kolem Hranic na Moravě (a) s několika dosud známými lokalitami paleolitu (I–XI). Napravo (b) značí tečky nálezy artefaktů zaměřené pomocí GPS přímo v lokalitě Hranice III – Velká Kobylanka. Čárkovaně vyznačen přibližný rozsah lokality na základě starších nálezů (nezaměřených pomocí GPS). Město Hranice leží v údolí pod lokalitou (obrázek vpravo získán z Google Earth Pro).

Method

Over the last four or five years of a field-walking survey, the GPS coordinates of collected artefacts were recorded to estimate the area of the settlement at HVK III. These were then plotted in the Google Earth interface. With regard to raw material estimation, in all cases we used a stereomicroscope. Following older works about knapped stone materials (*Přichystal 2013*), we used water immersion to observe better the characteristic features of each raw material. Selected materials were also photographed macroscopically (*fig. 2*) at variable magnifications (*figs. 3* and *4*).

The typology and technology of the analyzed assemblage were estimated on the basis of well-known lithic industry manuals (*Sonneville-Bordes – Perrot 1956*; *Sklenář 1989*; *Demars – Laurent 1989*; *Inizan et al. 1999*). Apart from specific tool types, we also classified every artefact to one of six categories, namely blades, flakes, tools, cores, unworked raw material, and fragments. The category of blades covers artefacts whose length reaches at least the double their width and which had not been subsequently retouched (these fall within the "tool" category together with retouched flakes). Flakes do not meet the condition

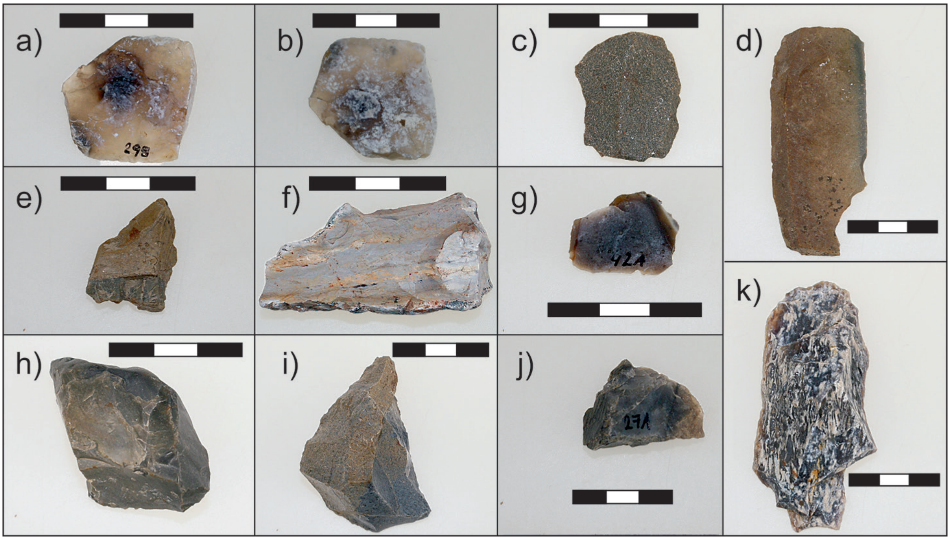


Fig. 2. Macroscopic character of knapped stone raw materials from Hranice III – Velká Kobylanka. a, b: chalcedony; c: glauconitic quartz arenite; d: silicified siltstone; e: plasma on contact with quartz sandstone/arenite; f, k: menilite chert; g: probable Baltic (erratic) flint; h: radiolarite; i: Baška chert; j: blueish chert.
Obr. 2. Makroskopický vzhled surovin štípaných v Hranicích III – Velké Kobylance. a, b: chalcedon; c: glaukonitický křemenný pískovec; d: silicifikovaný prachovec; e: plazma na kontaktu s křemenným pískovcem; f, k: menilitový rohovec; g: pravděpodobně baltský (glacigenní) pazourek; h: radiolarit; i: bašský rohovec; j: namodralý rohovec.

of this size ratio. Tools were only estimated on the basis of their retouch (or burin blow), i.e., no traseological observations were carried out. Cores, raw material and fragments are artefacts related to the *chaîne opératoire* and do not need more explanation.

Lastly, one charred bone collected from the surface in the north-west part of the site was used for AMS radiocarbon (^{14}C) dating. This was conducted at the Center for Applied Isotope Studies of the University of Georgia in spring 2019.

Results

Distribution of finds within the site

As indicated in *fig. 1: b*, most finds between the Velká Kobylanka and Malá Kobylanka hills concentrate on the northern margin of the site area just over the NW slope falling to the valley. The artefacts, however, were also collected more to the south on a gentle slope. Two clusters of lithic artefacts thus seem to have formed here, possibly reflecting two different settlement or flint-knapping areas. It is hard to estimate, however, how significant here has been the redeposition of sediments with artefacts by slope movement. Earlier finds were also encountered on the same field closer to the Malá Kobylanka hill, SE of the GPS-delimited area. Further finds will be probably situated directly on the summit of Velká Kobylanka hill which, however, is nowadays covered with forest and not suitable for field-walking prospection.

Raw materials

Knapped stone

The most numerous (929 out of 1332 pieces; *tab. 1* – amounts by *Neruda* and *Kostrhun /2002/* are also given; for some reason their sum is 2881) are erratic flints transported to Moravia and Silesia by continental glacier in the Elsterian and Saalian glacial periods (*Šibrava 1986*; *Gába – Pek 1999*). These tend to be variable in color, granularity, and homogeneity but still are usually easy to flint-knap, and frequently predominate at Moravian Upper Palaeolithic sites (*Přichystal 2013*, 53–54). The southernmost intrusion of the continental glacier is supposed to have reached what is now Polom and Hustopeče n. B. (*Tyráček 2011*, 39), about 7 to 8.5 km ENE and E of HVK III, the minimum distance to acquire flints from their occurrences. In this way, erratic flints practically represent local material here. Flint artefacts on the site are always covered with at least a shade of white patina so that, theoretically, they could be in exceptional cases mistaken for other fine-grained chert/flint material. However, they frequently contain characteristic fossil microfauna like sponge spicules, bryozoans (*fig. 3: a*), foraminifers, and others.

Similarly to the sample studied by *Neruda* and *Kostrhun* (*2002*), where erratic flints were also predominant, the studied collection contained a significant number of artefacts (282 pieces) made of another siliceous material, characterized by different authors as chalcedony matter (*Neruda – Kostrhun 2002*, 110) or chalcedony-chert (*Klíma 1951*, 103). The idea of *Neruda* and *Kostrhun* (*2002*, 110) was that this material had originated during volcanic activity at Hončova hůrka near Příbor, a well-known outcrop of Lower Cretaceous effusive rocks. This material is usually well-silicified, with frequent red pigment in its matrix. There are pores with opaline rims (*fig. 3: d*) filled with chalcedony in the siliceous matrix. The material is frequently partially covered with a white patina (*fig. 2: a, b*) which is, unlike that of erratic flints, irregular, forming white angular patches. The fracture is not always conchoidal so that core and blank surfaces are sometimes as well rather angular.

New assemblage		
Raw material	**Amount**	**%**
Erratic flints	929	69.74
Chalcedony	282	21.17
Burned	22	1.65
Radiolarite	19	1.43
Glauconitic sandstone	16	1.20
Flysch cherts	12	0.90
Quartz	11	0.83
Baška chert	9	0.68
Cracow chert	7	0.53
Quartz sandstone	7	0.53
Menilite chert	5	0.38
Fe-rich sandstone	5	0.38
Silicified siltstone	5	0.38
Fe-ore	1	0.08
Plasma	1	0.08
Blue chert	1	0.08
Total	**1332**	**100.00**

Neruda – Kostrhun 2002		
Amount	**%**	
Erratic flints	2468	85.72
Chalcedony	360	12.50
Not estimated	14	0.49
Radiolarite	12	0.42
Silicified shale	2	0.07
Quartzite ("sun boulder")	2	0.07
Quartz	2	0.07
Baška chert	3	0.10
Silicified sandstone	11	0.38
Menilite chert	5	0.17
	2879	**100.00**

Tab. 1. Raw materials of knapped stone artefacts from the Hranice III – Velká Kobylanka site. Left – recently analyzed assemblage, right – assemblage analyzed by *Neruda* and *Kostrhun* (*2002*).
Tab. 1. Suroviny štípaných artefaktů z Hranic III – Velké Kobylanky. Vlevo nově analyzovaný soubor, vpravo soubor analyzovaný *Nerudou* a *Kostrhunem* (*2002*).

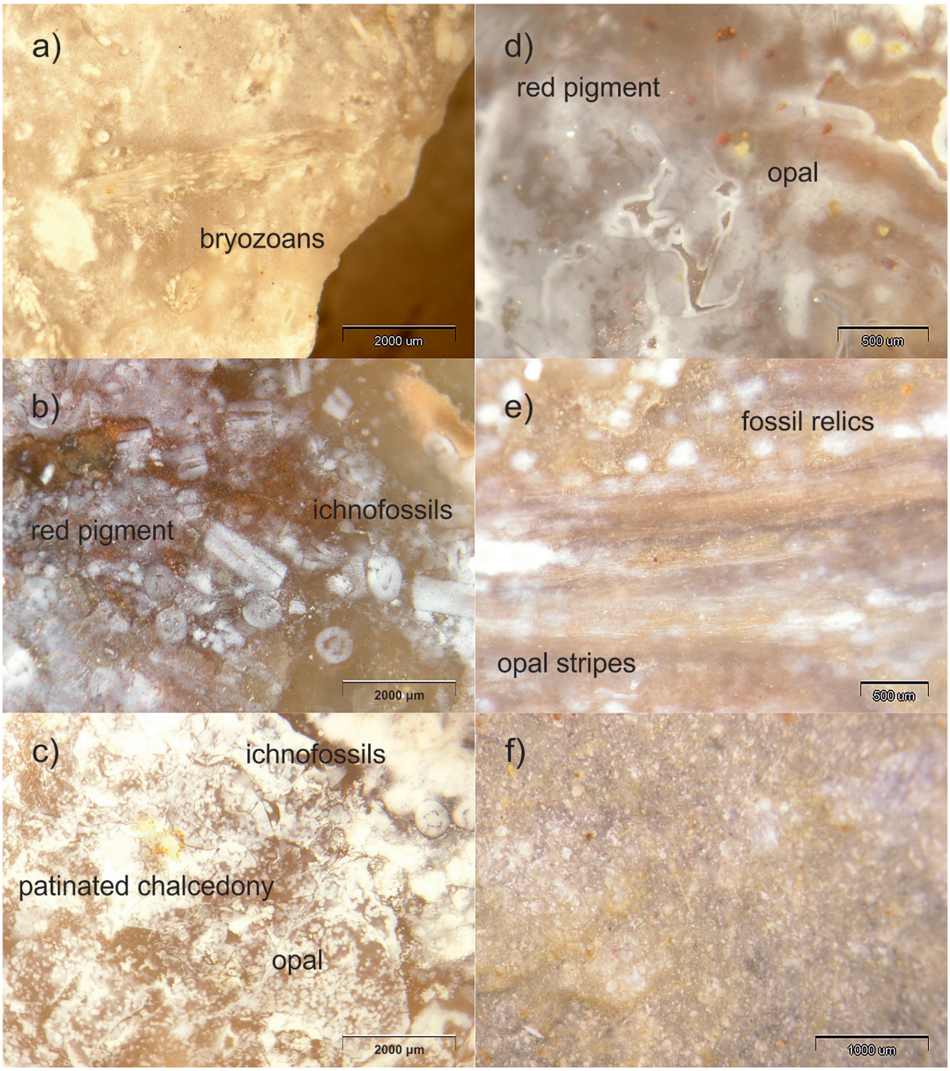


Fig. 3. Knapped stone materials under a stereomicroscope (measures in µm). a: Baltic (erratic) flint; b–d: chalcedony; e: menilite chert; f: Western Carpathian Flysch chert.
Obr. 3. Suroviny štípané industrie pod stereomikroskopem (měřítka v µm). a: baltský (eratický) pazourek, b–d: chalcedon, e: menilitový rohovec, f: rohovec flyšového pásma Západních Karpat.

At least two similar materials were used during the Moravian Palaeolithic. One is the plasma (or chalcedony-contact quartzite; *Matýsek 1988*) frequently encountered at Hončova hůrka, Žilina at Nový Jičín and other sources of submarine extrusions and pillow lavas in the Silesian Unit of the Flysch Zone of the Western Carpathians. This originated in connection with effusive ultrabasic submarine rocks, namely picrites, at contact zones with surrounding sedimentary rock (i.e., siltstones and claystones). It is composed of chalcedony with some carbonates, pyrite, illite and chlorite as accessories (ibid.) which give it its predominantly green and green-blue color. A blueish variety of plasma or hornfels was evidenced at the probably Epiaurignacian site at Šenov-Salaš 1, about 18 km NE of HVK III. Another analogy is the "plasma"

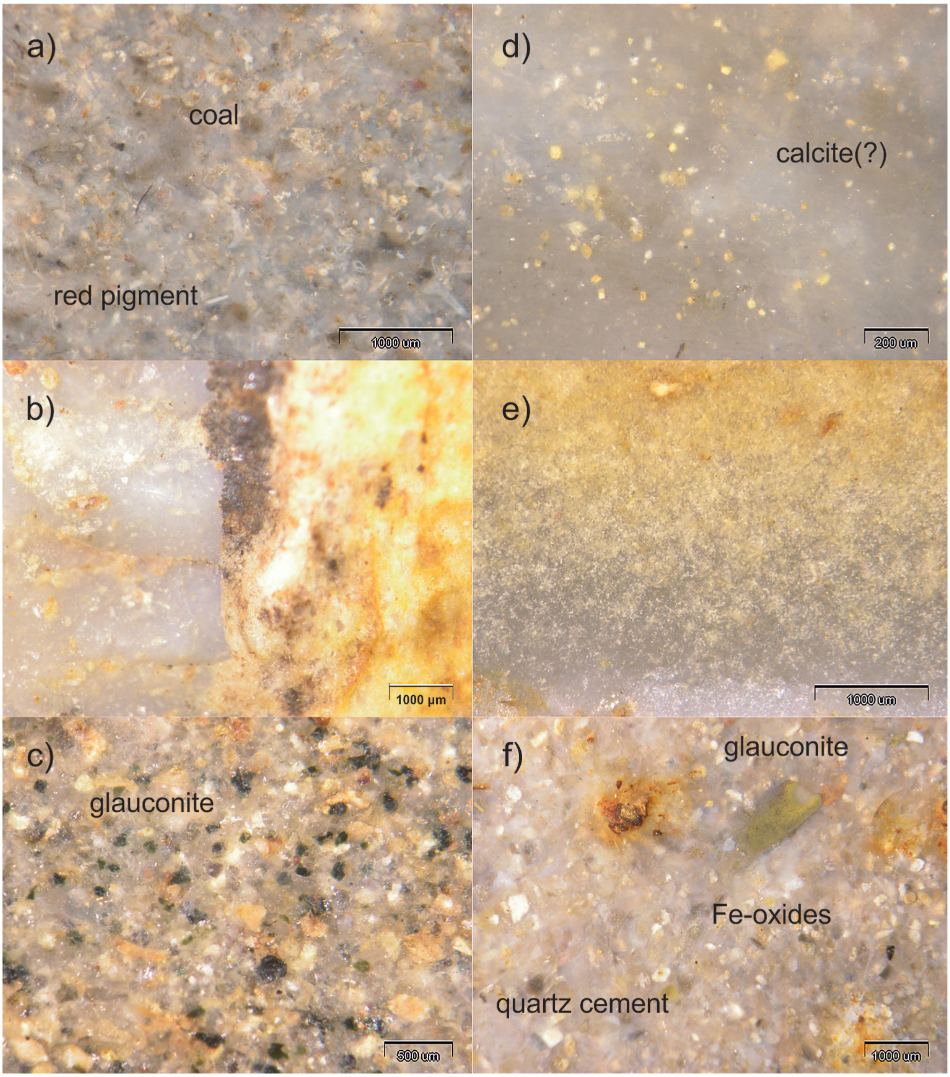


Fig. 4. Knapped stone materials under a stereomicroscope (measures in µm). a: Baška chert; b: plasma on contact with quartz arenite; c: glauconitic quartz arenite; d: blueish chert; e: silicified siltstone; f: quartz arenite.
Obr. 4. Suroviny štípané industrie pod stereomikroskopem (měřítka v µm). a: bašský rohovec; b: plazma na kontaktu s křemencem; c: glaukonitický křemenný pískovec; d: namodralý rohovec; e: silicifikovaný prachovec; f: křemenný pískovec.

of south-western Moravia which, although macroscopically similar to the previous, originated through the weathering of metabasic and basic rocks in the hot and wet Tertiary climate (*Koníčková et al. 2015*). This material is composed of length-fast chalcedony, quarzine, moganite, A-opal, α-tridymite, and accessories of chlorite, fuchsite, dolomite, Cr-spinellide, amphibole, pyroxene, ilmenite, titanite, zircon, and clay minerals. It was evidenced as knapped-stone raw material, e.g., in the south-Moravian Late Palaeolithic and Mesolithic (*Eigner et al. 2015*, 78–79; *Moník 2012*, 510) and then frequently in the Neolithic.

Chalcedony from Velká Kobylanka, though not analyzed in thin section, is different from the two mentioned types of chalcedony in at least two aspects: its color is rather bright greyish brown rather than greenish or blueish, and it contains ichnofossils (*fig. 3: b, c*). There was no calcite or pyrite observable either, but the latter may have been replaced by the frequent iron oxides (*fig. 3: d*). The microfossils are quite exceptional (we evidenced them in one blank only) but still indicate that this material did not originate as hydrothermal dyke infill but rather through replacement of older sedimentary rock, possibly siltstone or claystone (also the hornfels described by *Matýsek /1988/* may have originated this way). The evidenced ichnofossils are coprolites and belong to an unidentified group of crustaceans which expelled fecal pellets from their burrows or packed them in some of their dead-end side tunnels to form biogenic mud (see *Shinn 1968*; we also owe our thanks to Andrew K. Rinsberg and Paul Enos for their estimation). The pellets are about 0.5 mm in diameter and up to 2 mm long (*fig. 3: b, c*) and are indeed clustered close to each other. We may thus suppose the chalcedony is indeed of the Lower Cretaceous age, a period of intense submarine volcanism in the area (*Grabowski et al. 2003*) which led to silica migration, enclosure and replacement of older sedimentary rock. The exact outcrop of the chalcedony is unknown but due to its abundance at Velká Kobylanka, may be situated close to the site.

The remaining materials are far less numerous. 22 pieces were burned beyond recognition. A further 19 artefacts are made of radiolarites, i.e. chert varieties with some admixture of clay minerals and frequent radiolarians. The colours and pebble form of some of the exemplars (*fig. 2: h*) indicate that the origin of these radiolarites is not necessarily the Klippen Belt of the Western Carpathians but possibly also Flysch Belt sediments or river gravels where they are also known (*Mišík 1999*; *Přichystal 2013*). The gravels of the Váh River cannot be excluded either, with approximate distances of 70 km as the crow flies from the site. Radiolarites form a stable component of Middle Paleolithic to Bronze Age assemblages from both Slovakia and Moravia. A further 12 pieces are made of undistinguished Flysch Belt cherts, where at least six of these are probably Mikuszowice chert, a Lower Cretaceous layered chert-spongolite evidenced at a number of Silesian and even Lesser Polish Palaeolithic sites (*Foltyn – Jochemczyk 2013*). This was in use from the Upper Palaeolithic to Lower Bronze Age. One of the authors of this article (M. M.) collected this material on the outcrops of Mikuszowice layers, 5 km north of Valašské Meziříčí. The material was not blueish or blueish-grey as most varieties described by Foltyn and Jochemczyk but rather green to greenish-grey, similar to the artefacts from Velká Kobylanka. Its matrix is filled with yellow clasts, probably fragments of calcite (*fig. 3: f*). It is thus possible that the variability of Mikuszowice cherts is even greater than that observed by the two Polish researchers.

Sixteen pieces are made of glauconitic sandstone or quartz arenite of Flysch Belt origin. The amount of glauconite in its quartz matrix is about 5 % (*figs. 2: c*; *4: c*); occasional iron (hydr)oxides are also visible under stereomicroscope. This material was also evidenced by *Neruda* and *Kostrhun* (*2002*, 110) and by two of the authors (J. D. and M. M.) at the probably Epiaurignacian site Šenov-Salaš 1. Glauconitic sandstones were also evidenced in the South-Eastern Moravian Aurignacian site Boršice/Buchlovice (*Škrdla 2010*). These, however, probably originated from other sources than those from Velká Kobylanka, whose origin lies at the contact zone of local Lower Cretaceous volcanics (*Matýsek 1988*).

Eleven artefacts are made of quartz which may originate in both glacial and glacifluvial sediments, in Holocene river gravels, or in older (Culmian) sediments at the site. Nine pieces are made of greyish-blue to dark grey Cretaceous chert with inclusions of coal fragments (*figs. 2: i*; *4: a*). This has been denominated as Baška chert by *Přichystal* (*2013*) and its occurrences are more than 25 km to the North-East, around Štramberk and Hukvaldy.

It was used mainly on a local basis, above all on sites at the break of the Pleistocene and the Holocene.

Seven pieces are made of Jurassic Cracow flint. This is typically brown with a reddish hue, and red pigment visible under stereomicroscope (*Přichystal 2013*). The artefacts from HVK III, contrary to those on erratic flints, are not patinated and may theoretically indicate a younger (Neolithic) intrusion. In the experience of the authors, however, this material doesn't patinate so readily as erratic flints and may indeed represent Magdalenian imports from outcrops in southern Poland, 170km distant.

Equally numerous was a quartz arenite well cemented with quartz (*fig. 4: f*) and with much fewer glauconite clasts than in the above-mentioned quartz sandstone. Its origin is unknown, but we may again suppose its relation to silica precipitation around Lower Cretaceous volcanic rocks of the picrite-teschenite association of NE Moravia. Following this are five pieces of menilite chert, an Oligocene, frequently layered opaline material with fossil remnants. Its color varies from white to black (*figs. 2: f, k*; *3: e*). It has been evidenced at both Neolithic (*Hovorka – Iliášová 2002*, 72) and Palaeolithic (*Neruda – Kostrhun 2002*, 110; *Klíma 1969*, 41) sites in Moravia and Slovakia.

A further five pieces are made of Fe-rich quartz arenite which originated, again, due to thermal metamorphism during the Lower Cretaceous. This is evidenced in one of the artefacts where this contact between quartz arenite and magmatic vein infill (plasma) is visible (*figs. 2: e*; *4: b*). We may suppose that five pieces of silicified siltstone/shale originated in a similar way (*figs. 2: d*; *4: e*), or were at least influenced by silica migration linked to Mesozoic volcanism. One piece of iron oxide also appeared, probably red ochre (haematite) of uncertain origin, and one piece of plasma of greenish colour. Also linked to volcanic activity and related silica precipitation is probably one blueish chert with fragments of calcite in its matrix (*figs. 2: j*; *4: d*). The distinction between plasma and such cherts of probably volcanic or sub-volcanic origin is, of course, difficult and would require further petrographic research.

One fine-grained flint was noticed with parallel stripes under its cortex (*fig. 2: g*), as in the cherts from the Ortenburg region (*Elburg – van Kroft 2002*), 350 km distant. Given it is one piece only, and the variability of local erratic flints, this import cannot be taken for granted. The overall character of Velká Kobylanka Magdalenian lithics rather points to local material use and the absence of imports from the south or the west. Finally, there were evidenced five pieces of probably modern-age flintstones (not included in our analyses).

Other

Apart from knapped lithics, 13 pebbles and 2 plates made of tougher materials were evidenced in our assemblage (*fig. 11*). The used materials were Culm greywacke (8 pieces) and shale (1 piece), a Devonian limestone from the Hranice karstic area and five artefacts made on materials from the Carpathian Flysch Belt: two yellowish siltstones with glauconite, one glauconitic quartz arenite (also evidenced among knapped artefacts), one bright-brown sandstone also with glauconite, and one burned sandstone. All the used materials probably come from the close vicinity of the site, but the pebbles must have been collected in river gravels (the floodplain of the Bečva River lies 100 vertical metres below the site). Some of the pebbles carry grooves similar to those evidenced at other Moravian sites (especially Ochoz, Pekárna and the Býčí skála Caves; *Valoch 2001*, 151; *Oliva 2015*, 145–152). The grooves from Velká Kobylanka are not so unambiguously intentional as

Category	Amount	%
Blades	242	18.2
Flakes	489	36.7
Tools	134	10.1
Cores	44	3.3
Raw materials	32	2.4
Fragments	391	29.4
Total	**1332**	**100**

Tab. 2. Technological composition of the assemblage from Hranice III – Velká Kobylanka.
Tab. 2. Technologické složení souboru z Hranic III – Velké Kobylanky.

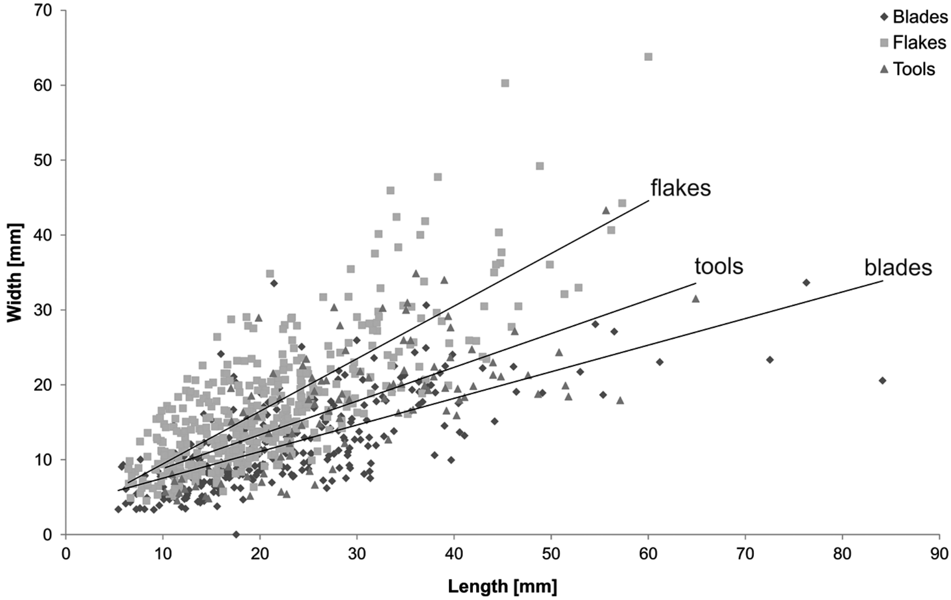
those analyzed in France by *Marschack* (*1972*, 451) but still may indicate some kind of notation. Unfortunately, we cannot altogether exclude either a younger origin of the grooves given the context of the finding (agricultural field) of the pebble artefacts.

Technology

From the analysis of the acquired cores and debitage it is apparent that blade (and bladelet; *figs. 5: 9*; *7: 13*; *9: 9*) production was the main focus at the site (242 pcs in total; *tab. 2*). Flakes, although most numerous (489 pcs), originated rather as preparation products. The majority of the cores (32 out of 44 pcs) were reduced by unipolar flaking (*figs. 7: 21, 22*; *8: 1, 3–5, 7–10*; *10: 4–6, 8–10*) although most (10 pieces) of the remaining cores show opportunistic shifts of the main axis of blank detachment (*fig. 8: 2*; *10: 7*). Less frequent are double-platform cores (two pieces; *fig. 8: 6, 11*). Most cores were intensively reduced. The biggest exemplar reaches almost 8 cm in length, but the majority of cores (73 %) are smaller than 5 cm. Average core sizes were 3.8 cm in length (min. 1.14 cm, max. 7.9 cm), 3.7 cm in width (min. 1.18 cm, max. 6.95 cm) and 2.73 cm in thickness (min. 0.6, max. 7.31 cm). The size of the studied debitage was similar: the majority of blades were also smaller than 5 cm. However, fragments of the largest blades are longer than the biggest cores, the largest reaching 8.4 cm in length. The second-longest fragment is a remnant of an even bigger blade as its mesial part is 7.6 cm long. It is clear, that the original cores, in this case, must have been significantly larger than the cores present in the studied collection.

The frequent presence of a cortex (77.5 % of artefacts) indicates that the materials were brought to the site in their natural form or just slightly preformed and processing occurred on site. This is supported by the composition of the collection dominated by flakes and smaller fragments (63 %) from the shaping and consecutive flaking stages of core reduction. Some of the flakes were utilised for the manufacture of tools; however, retouch is rare (10 %) on flakes when compared to blades (25 % are retouched). This is in concordance with the metrics of tools which also indicates that blades rather than flakes were the desired supports for tool manufacture (*graph 1*).

Evidence of core preparation is represented by 41 blades from core flanks (17 %). More specific are three primary crested blades (1.2 %) and one secondary crested blade. Looking at the used raw materials, the cores form three groups. The first group makes up one half of the cores in the collection (22 pcs) and represents artefacts made of erratic flints. The second group, represented by 12 artefacts, is made of chalcedony. This category also shows the most shifts in the main axis of blank detachment (5 times). The last category is made up of the other materials and consists of the remainder of the cores in the collection.



Graph 1. Comparison of the length (x-axis) and width (y-axis) of blades (diamond), flakes (squares) and tools (triangles) in the HVK III assemblage. The lines show the linear function characteristic for all three categories. It is apparent that the tools (middle line) are closer to blades (bottom line) than to flakes (upper line). Sizes are shown in millimetres.
Graf 1. Srovnání délky (osa x) a šířky (osa y) čepelí (kosočtverce), úštěpů (čtverečky) a nástrojů (trojúhelníky) v kolekci z Hranic – Velké Kobylanky. Přímky ukazují lineární funkci pro každou technologickou kategorii. Je zřejmé, že nástroje (prostřední přímka) leží blíže čepelím (spodní přímka) než úštěpům (horní přímka). Rozměry udány v mm.

Apart from the mentioned categories, there are also 32 unworked pieces, 391 closely unspecified fragments and 134 tools.

Typology

In the whole collection, there are 134 artefacts classified as tools, which makes 10 % of the entire assemblage (1332 pieces). The preferred semi-products were blades and bladelets (60.7 % of described tools), the focus on flakes is also pronounced (37 %), while tools on cores are rare (2.2 %).

This slightly contrasts with the pattern of preference of flakes to blades observed by *Neruda* and *Kostrhun* (*2002*, 115). With regard to raw materials, the tools are mostly (124 artefacts, 92.5 %; *tab. 3*) made on erratic flints, a further 10 pieces (7.5 %) were either burned (3 pcs; 2.2 %) or made on cherts from the Carpathian Flysch zone (2 artefacts, 1.5 %), radiolarite (2 artefacts, 1.5 %), sandstone, chalcedony or Cracowian Jurassic chert (1 artefact each, 0.7 % in each case). The low amount of chalcedony tools is noticeable in contrast to the total number of chalcedony in the collection.

Endscrapers are represented by only six artefacts (4.5 % of tools). All but one burned piece was made on erratic flints, mostly on cores (3 pcs; *fig. 8: 2, 3*), less on flakes (2 pcs; *fig. 10: 2, 3*) and blades (1 pc; *fig. 10: 1*). The low number of endscrapers was also observed by *Neruda* and *Kostrhun* (*2002*, 121) and identified as a characteristic feature of their assemblage (see *tab. 3*).

Type	Material									
	flint	burned	chalcedony	flysch chert	radiolarite	sandstone	Cracow chert	Total	%	
blade endscraper	1							1	0.7	
flake endscraper	2							2	1.5	
core endscraper	2	1						3	2.2	endscrapers total: 4.5%
burin-retouched blade	7							7	5.2	combinations total: 5.2%
borer	5							5	3.7	
small borer	20							20	14.9	
multiple borer	4							4	3.0	
hook (*Zinken*)	3							3	2.2	borers total: 23.9%
dihedral burin	20	2		1				23	17.2	
multiple dihedral burin	3			1	1			5	3.7	
multiple mixed burin	2							2	1.5	
burin on natural surface	2							2	1.5	
burin on broken blade	1							1	0.7	
transverse burin	1							1	0.7	
burin on retouch	7							7	5.2	
multiple burin on retouch	1							1	0.7	burins total: 31.3%
laterally retouched blade	10		1			1		12	9.0	
flake/blade with ventral retouch	4							4	3.0	
blade with bilateral retouch							1	1	0.7	
notched flake	1							1	0.7	retouched blanks total: 13.4%
sidescraper	2				1			3	2.2	
pièce esquillée	1							1	0.7	*heavy-duty* tools total: 3.0%
triangle	7							7	5.2	
laterally retouched bladelet	8							8	6.0	
bladelet with proximal retouch	1							1	0.7	
backed bladelet	4							4	3.0	
truncated backed bladelet	3							3	2.2	
small point	1							1	0.7	
tanged bladelet	1							1	0.7	microliths total: 18.7%
Total	**124**	**3**	**1**	**2**	**2**	**1**	**1**	**134**	**100.0**	
%	**92.5**	**2.2**	**0.7**	**1.5**	**1.5**	**0.7**	**0.7**	**100.0**		

Neruda – Kostrhun 2002	erratic flints	cherts	radiolarite	sandstone	chalcedony	Total	%
endscrapers	34				1	35	6.6
burins	245		1		9	255	47.8
retouched blades	44			1	1	46	8.6
borers	79	1			5	85	15.9
sidescrapers	33		1			34	6.4
microliths	78					78	14.6
Total	**513**	**1**	**2**	**1**	**16**	**533**	**100**

Tab. 3. Raw materials of tools in the newly acquired assemblage (top) and the assemblage published by *Neruda* and *Kostrhun 2002* (bottom). In the latter, combined tools count as two separate tools.
Tab. 3. Suroviny nástrojů v nově analyzovaném souboru a souboru publikovaném *Nerudou* a *Kostrhunem 2002* (dole). V druhém případě byly kombinované nástroje počítané jako dva různé typy nástrojů.

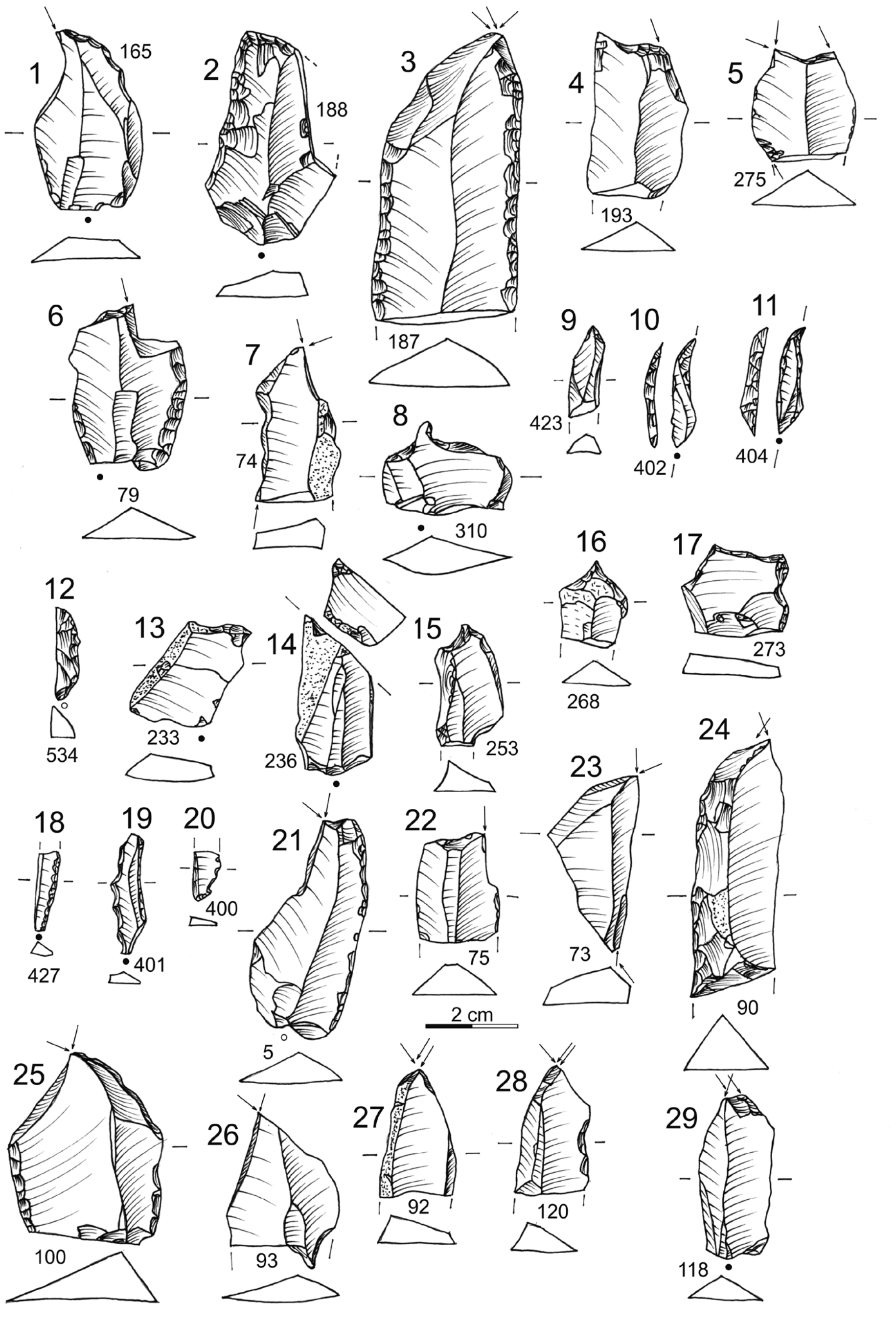


Fig. 5. Burins (1, 4, 22), burin on retouched blade/flake (3, 6), dihedral burins (21, 24–29), multiple burins (5, 7, 23), sidescraper (2), borers (8, 13, 14, 16), notched flake (15), multiple borer (17), pointed bladelet (9), triangles (10, 11), backed bladelets (12, 18), denticulated triangles (19, 20). All are erratic flint apart from one radiolarite (2), Baška chert (12) and chalcedony (24).

Obr. 5. Rydla (1, 4, 22), hranová rydla na čepeli/úštěpu (3, 6), klínová rydla (21, 24–29), několikanásobná rydla (5, 7, 23), drasadlo (2), vrtáky (8, 13, 14, 16), úštěp s vrubem (15), několikanásobný vrták (17), hrotitá čepelka (9), trojúhelníky (10, 11), čepelky s otupeným bokem (12, 18), zoubkované trojúhelníky (19, 20). Vše eratický pazourek kromě jednoho radiolaritu (2), bašského rohovce (12) a chalcedonu (24).

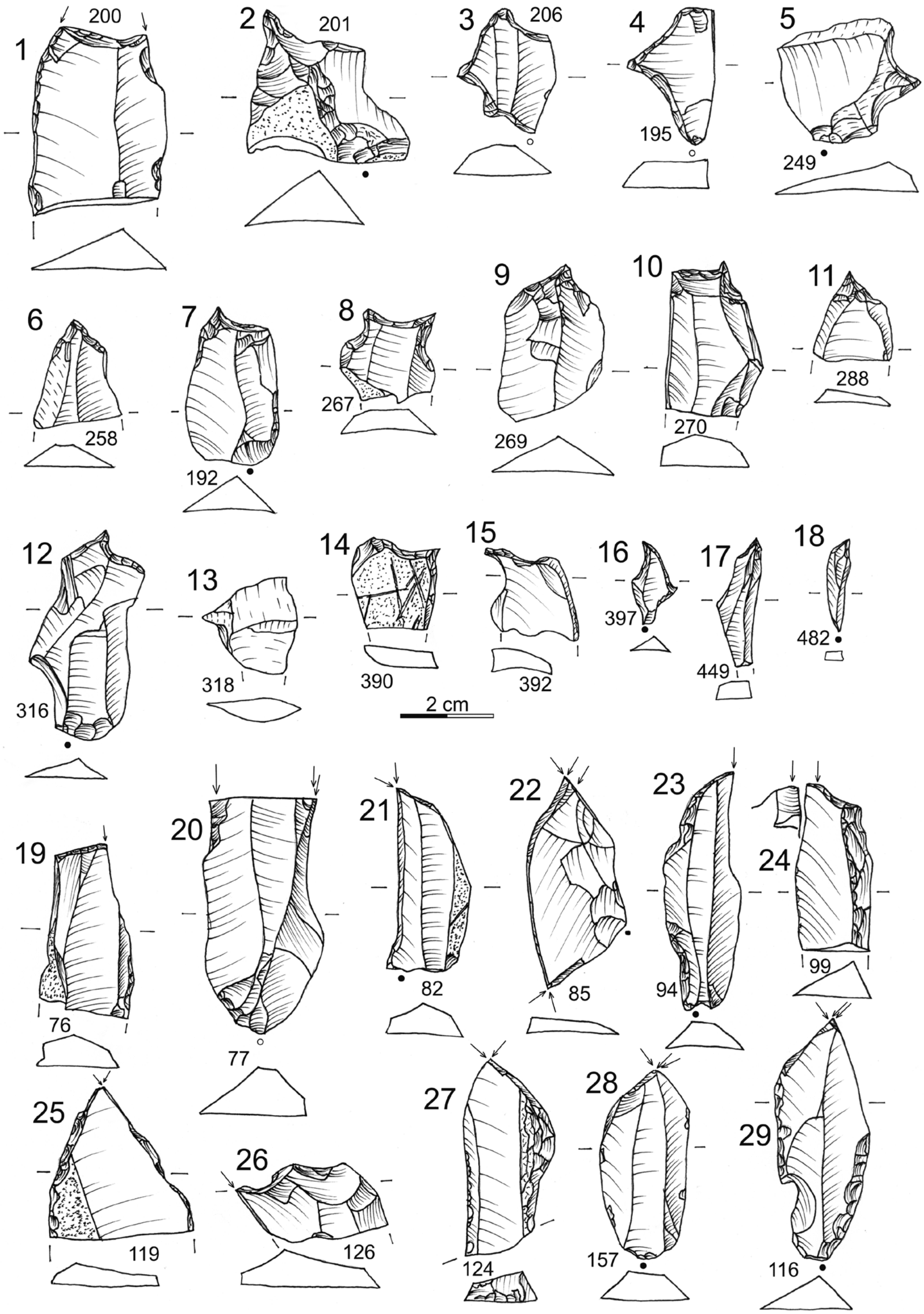


Fig. 6. Multiple burins (1, 20, 22), borers (2, 4–7, 9–15, 17–18), multiple borers (3, 8, 16), burins (19, 24, 26), dihedral burins (21, 25, 27–28), burin on retouched blade (23, 29). All are erratic flint.
Obr. 6. Několikanásobná rydla (1, 20, 22), vrtáky (2, 4–7, 9–15, 17–18), několikanásobné vrtáky (3, 8, 16), hranová rydla (19, 24, 26), klínová rydla (21, 25, 27–28), kombinace rydlo-retušovaná čepel (23, 29). Vše eratický pazourek.

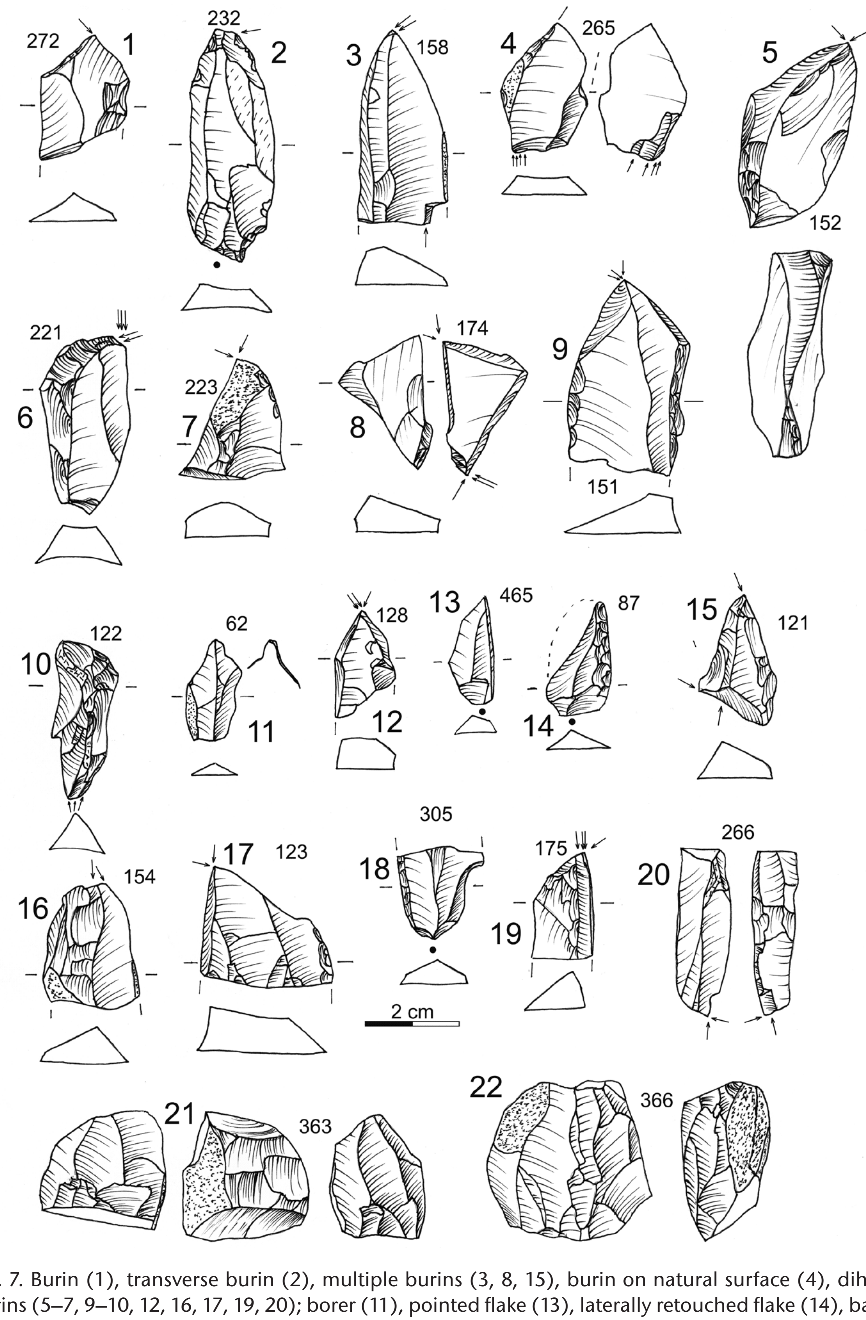


Fig. 7. Burin (1), transverse burin (2), multiple burins (3, 8, 15), burin on natural surface (4), dihedral burins (5–7, 9–10, 12, 16, 17, 19, 20); borer (11), pointed flake (13), laterally retouched flake (14), backed blade (18), cores (single-platform: 21, 22). All are erratic flint except one chalcedony (3) and one burned piece (12).
Obr. 7. Rydlo (1), příčné rydlo (2), několikanásobná rydla (3, 8, 15), rydlo na přirozené ploše (4), klínová rydla (5–7, 9–10, 12, 16, 17, 19, 20); vrták (11), hrotitý úštěp (13), úštěp s boční retuší (14), čepel s otupeným bokem (18), jádra (jednopodstavová: 21, 22). Vše eratický pazourek kromě jednoho chalcedonu (3) a přepáleného artefaktu (12).

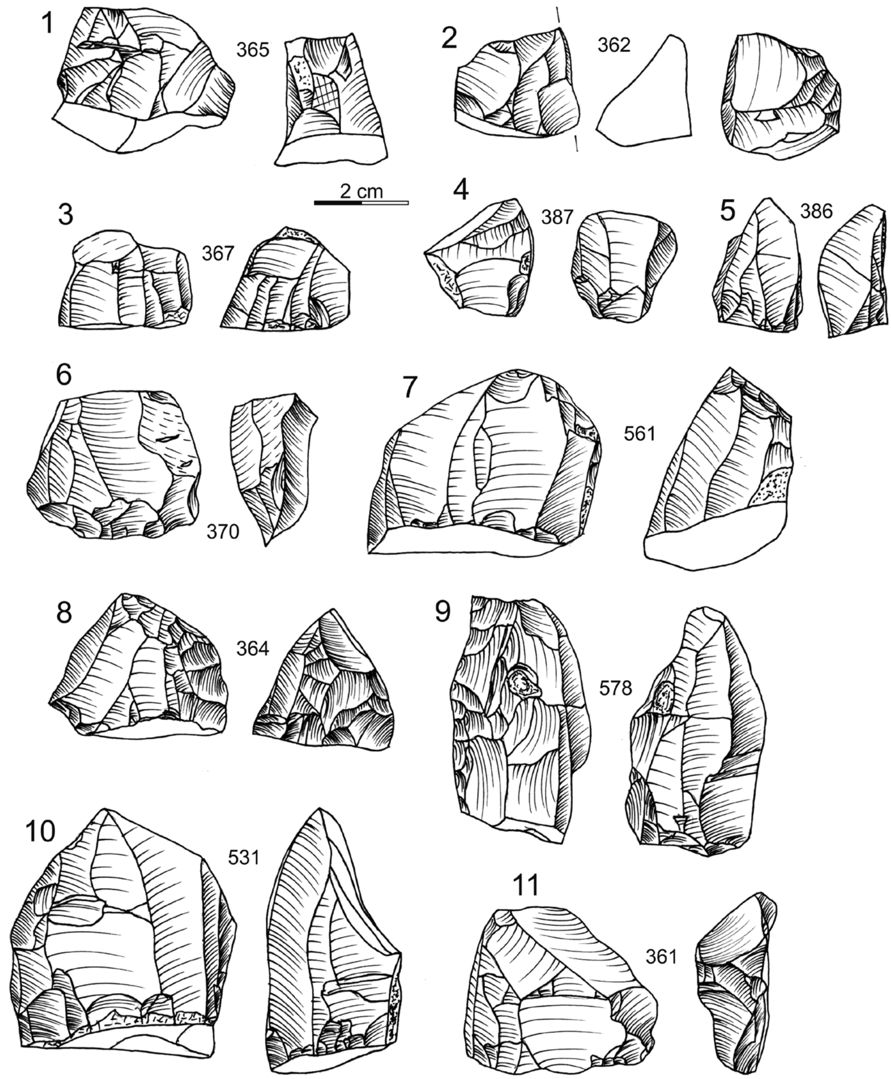


Fig. 8. Cores (single-platform: 1, 3–5, 7–10; re-oriented: 2; double-platform: 6, 11). All are erratic flint except two radiolarite (1, 10) and three chalcedony (7–9) pieces.
Fig. 8. Jádra (jednopodstavová: 1, 3–5, 7–10; se změněnou orientací: 2; dvoupodstavová: 6, 11). Vše eratický pazourek kromě dvou kusů z radiolaritu (1, 10) a tří z chalcedonu (7–9).

Burins represent a substantial category of artefacts in the collection. With 42 pieces (31.3 %; or 49 / 36.6 % if combinations are included) they constitute the most numerous group among tools, similarly to the older assemblage (47.8 %; *Neruda – Kostrhun 2002*, tab. 10; *Dvořák – Valoch 1961*, 156). There are dihedral burins (23 pcs; *figs. 5: 21, 24–29*; *6: 21, 24, 28*; *7: 5–7, 9, 10, 12, 16, 17, 19, 20*), burins on retouch (7 pcs; *figs. 5: 1, 4, 22*; *6: 26; 7: 1*), multiple burins (8 pcs; *figs. 5: 5, 7, 23*; *6: 1, 22*; *7: 3, 8, 15*; *9: 30*), multiple burin on broken blade (*fig. 6: 20*) or natural surfaces (3 pcs; *fig. 7: 4*), and one transverse burin (*fig. 7: 2*). Seven pieces are burins on prominently retouched blades (the retouch not linked with a burin blow) which were classified as **combinations** of burins and retouched blades (5.2 %; *figs. 5: 3, 6*; *6: 19,*

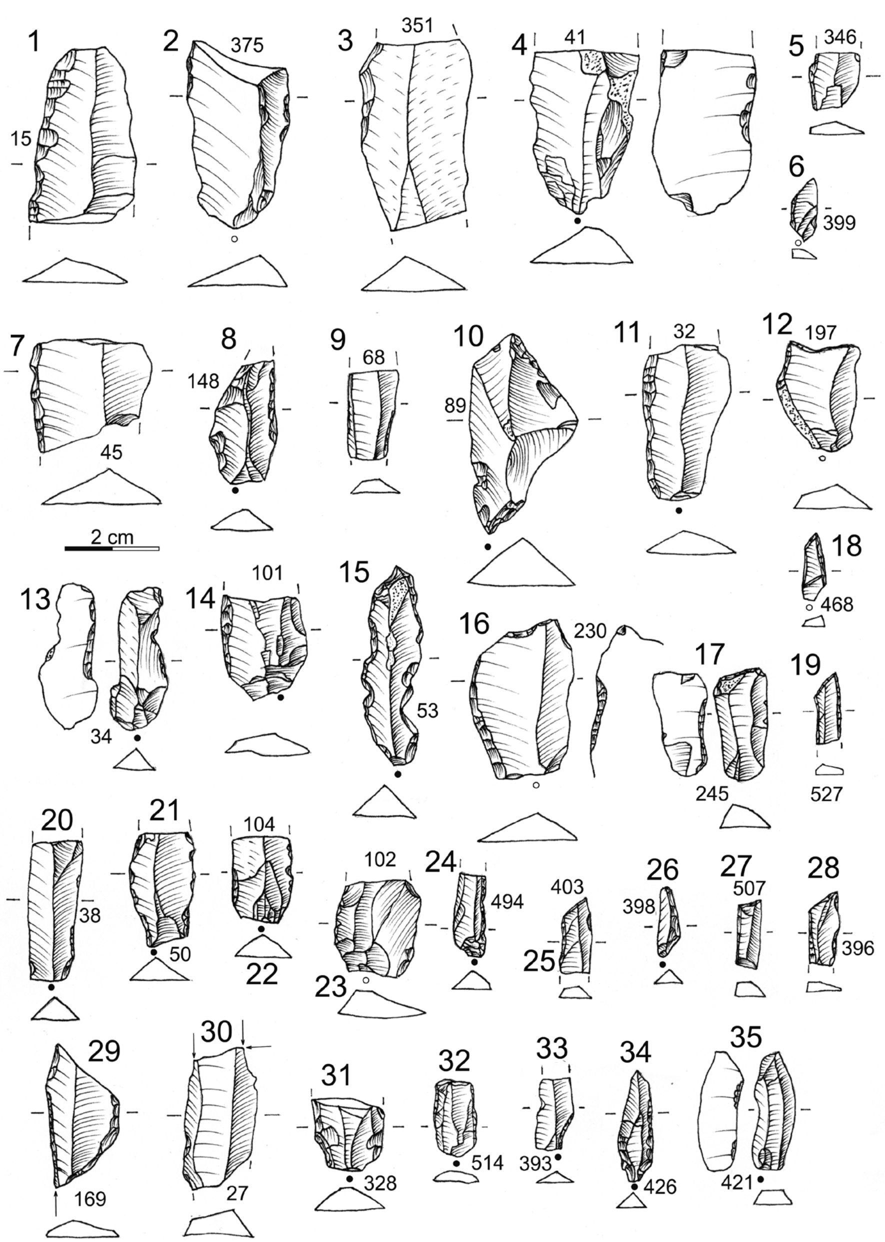


Fig. 9. Blades with lateral retouch (1, 3, 7, 11, 14, 20, 23, 31), hooks (*Zinken*; 2, 16), blades with ventral retouch (4, 13, 35), bladelets with lateral retouch (5, 17, 21, 22, 32), triangles (6, 26, 29), blade with bilateral retouch (8), bladelet (9), borers and tiny borers (10, 12, 15), truncated backed bladelets (18, 19, 25), backed bladelets (24, 27), small point (28), multiple dihedral burin (30), bladelet with proximal retouch (33), tanged bladelet (34). All are erratic flint except one glauconitic quartz arenite (3), chalcedony (7), chert of Cracowian Jurassic (8), and radiolarite (30).

Obr. 9. Čepele s boční retuší (1, 3, 7, 11, 14, 20, 23, 31), nevýrazné vrtáky (zobce; 2, 16), čepele s ventrální retuší (4, 13, 35), čepelky s boční retuší (5, 17, 21, 22, 32), trojúhelníky (6, 26, 29), čepele s oboustrannou retuší (8), čepelka (9), vrtáky a vrtáčky (10, 12, 15), čepelky s otupeným bokem a retušovaným koncem (18, 19, 25), čepelky s otupeným bokem (24, 27), hrůtek (28), několikanásobné klínové rydlo (30), čepelka s proximální retuší (33), čepelka s řapem (34). Vše eratický pazourek kromě jednoho glaukonitického pískovce (3), chalcedonu (7) rohovce krakovsko-čenstochovské jury (8) a radiolaritu (30).

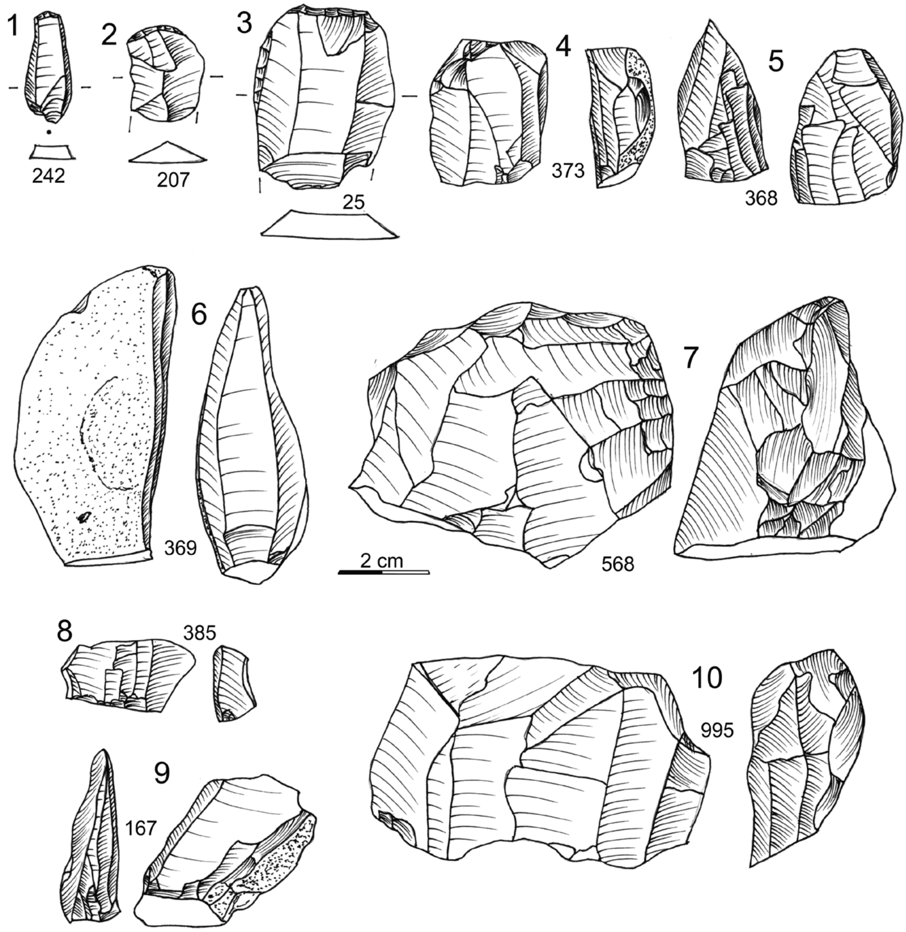


Fig. 10. Endscrapers (1–3) and cores (single-platform: 4–6, 8–10; re-oriented: 7). All are erratic flint apart from one radiolarite (8) and one chalcedony (7).
Obr. 10. Škrabadla (1–3) a jádra (jednopodstavová: 4–6, 8–10; se změněnou orientací: 7). Vše eratický pazourek kromě jednoho radiolaritu (8) a chalcedonu (7).

23, 25, 27, 29). In this way, the percentage of combined tools in our assemblage is close to that of the older collection (7 %; *Neruda – Kostrhun 2002*, tab. 10).

37 pieces (88.1 %) of burins were made of more or less patinated erratic flints. In two cases the burins are made on Carpathian Flysch chert, two artefacts are burned, and one is made on radiolarite. A focus on the production of burins is also visible in the category of production debris. There are 76 burin spalls in the collection. Apart from two artefacts made of chalcedony, they are all made of erratic flint.

We have identified 32 **borers** (23.9 %) in the whole collection. All these artefacts were made on erratic flint in different stages of patination. Most are small borers (20 pcs; *figs. 5: 8, 13, 14, 16*; *6: 6, 7, 10–15, 17, 18*; *7: 11*; *9: 12, 15*) whereas classical borers (5 pcs; *figs. 6: 2, 4, 5, 9*; *9: 10*), multiple borers (4 pcs; *figs. 5: 17*; *6: 3, 8, 16*), and hooks (*Zinken*; 3 pcs; *fig. 9: 2, 16*) are less numerous. One of the borers (*fig. 6: 18*) is made on reutilised burin spall; another bears potential linear markings on its cortex (*fig. 6: 14*). This group shows a great variability of shapes and the position of applied retouch forming the functional part of the borers is also variable.

Fig. 11. Pebbles (1–6; 9–15) and plates (7–8) from Hranice III – Velká Kobylanka. Noticeable engravings marked with white arrow. Culm greywacke (1, 2, 5–7, 10, 13, 14); glauconitic siltstone (4, 9); Culm shale (8); Devonian limestone (3); bright brown sandstone with glauconite (11); burned sandstone (12); glauconitic quartz arenite (15).
Obr. 11. Valouny (1–6; 9–15) a destičky (7–8) z Hranic III – Velké Kobylanky. Výrazné zářezy vyznačené bílou šipkou. Kulmská droba (1, 2, 5–7, 10, 13, 14); glaukonitický prachovec (4, 9); kulmská břidlice (8); devonský vápenec (3); světle hnědý pískovec s glaukonitem (11); přepálený pískovec (12); glaukonitický pískovec (15).

With regard to **retouched blades/flakes**, these are represented by 18 pieces (13.4 %), mostly by blades with lateral retouch (12 pcs; *figs. 7: 14, 18*; *9: 1, 3, 7, 11, 14, 20, 23, 31*), four blanks with ventral retouch (*fig. 9: 4, 13, 35*), one notched flake (*fig. 5: 15*) and one bilaterally retouched blade (*fig. 9: 8*). This last blade, apart from being unique, is made of Cracow chert and may represent a younger (Neolithic) intrusion (scarce LBK pottery fragments were also found at the site). Four pieces (3 %) are rather **massive** ("heavy-duty") **tools** – three of them sidescrapers (*fig. 5: 2*) and one a splitter/*pièce esquillée*. Apart from one sidescraper made on radiolarite, all are made on erratic flint.

With regard to **microlithic pieces** (25 pcs; 18.7 %), all made on erratic flints, the most prominent are seven *scalènes* triangles. These were already evidenced in the older assemblage from the site (*Neruda – Kostrhun 2002*, 126–127). Five pieces are (at least probably in the case of the broken pieces on *figs. 5: 20* and *9: 29*) retouched on all three sides (*fig. 5: 10, 11, 19*), whereas two pieces (*fig. 9: 6, 26*) are retouched on their cathetuses only. This also answers to the ratio evidenced by *Neruda* and *Kostrhun* (*2002*). The hypotenuse of the triangles is denticulated in two exemplars (*fig. 5: 19, 20*).

Furthermore, there are eight bladelets with lateral retouch (*figs. 9: 5, 17, 21, 22, 32*), and a bladelet with proximal retouch (*fig. 9: 33*). More prominent are backed bladelets (4 pcs; *figs. 5: 12, 18*; *9: 24, 27*) and truncated backed bladelets (3 pcs; *fig. 9: 18, 19, 25*). Finally, there is a small point (*fig. 9: 28*) resembling a knife of Kent type (evidenced e.g. in Žitného Cave in Moravian Karst: *Valoch 1960*, pl. VII/4), and a fine tanged bladelet (*fig. 9: 34*) somewhat resembling the Late Palaeolithic pieces of the North European Plain except for the absence of ventral basal retouch.

The amount of microlithic artefacts from HVK III is similar to that recorded in the older assemblage (15.8 % of tools in *Neruda – Kostrhun 2002*, 126; also *Klíma 1951*, 105) but much lower than in the Loštice (54 % of tools; mostly backed bladelets; *Neruda et al. 2009*, tab. 2) Magdalenian site. The acquisition of the material through fieldwalking-survey may be reflected here, whereas, in systematic excavation (Loštice I), small scale finds were collected through sieving sediment. It has been suggested (*Höck 2000*, 102, Fototafel 6; *Klíma 1951*, 106) that backed bladelets and triangles formed lateral parts of organic projectiles (e. g. harpoons) with frequent analogies in the Mesolithic.

AMS dating

The radiocarbon date acquired from the charred bone is 7230±25 BP. This answers to 8060±48 cal BP or 6110±48 cal BC, which means the Atlanticum chronozone (*Bradley 1999*). It is thus clear that the date does not correspond to the analyzed artefacts but reflects one of the later activities on the site.

Discussion

In total, we have analyzed 1332 knapped lithic artefacts (plus 15 pebbles and plates with possible engraved markings) and classified them as regards raw material, technology and, if possible, typology. Raw material procurement in the so-called Polish-Moravian Magdalenian group (*Maier 2015*, 98) is characterized by relatively larger distances covered by local Magdalenian populations when compared to their neighbours from Bohemia, SW Germany, and France. Lithics from HVK III, however, do not apparently answer this model as, apart from the Cracowian chert, practically all used materials are of local (up to about 30 km from the site) origin, similarly to the situation observed in Maier's Vltava-Saale Group (*Maier 2015*, 96). Radiolarites, used also for artefact manufacture in HVK III, have been traditionally located to the White Carpathians (Klippen Belt of Western Carpathians, about 60 km distant) for most Moravian Palaeolithic assemblages, but, in the case of HVK III, may in theory also have come from the Flysch sediments of the Western Carpathians, which would as well make them more local.

One of the reasons for the discrepancy between HVK III assemblage and the predominant procurement model in the Polish-Moravian Magdalenian is its location close to occurrences of fine-grained Baltic (erratic) flints within the Moravian Gate. Another reason may be the older age of the assemblage from HVK III (when compared, e.g. to Moravian Karst Magdalenian sites), conjectured by *Neruda* and *Kostrhun* (*2002*, 152) on the basis of typology. Finally, the HVK III site may have used different subsistence and procurement strategies than most (i.e., from the Moravian Karst area) Moravian Magdalenian sites due to cultural influence from the Vltava-Saale Magdalenian group (see above and *Maier 2015*, 95). In any case, neither the Olomučany nor Rudice Formation cherts (see the overview in *Přichystal 2013*), exploited in Magdalenian cave sites of Moravian Karst (as they outcrop there), are present at HVK III and it is possible that HVK III hunters were simply not familiar with the Moravian Karst area. The Olomučany chert especially represents a stable, though not predominant, material in South Moravian sites like Balcarka, Kůlna, Kolíbky, Pekárna, Barová, Býčí skála, Rytířská, Hadí or Žitného Caves (*Nerudová – Neruda 2010*, graph 1; *Blinková – Neruda 2015*, 288; *Svoboda et al. 1995*, tab. 2; *2000*, 68; *Seitl et al. 1986*; *Oliva et al. 2015*, 90; *Valoch 1965*, 143–148; *Klíma 1961*, 280; *Dvořák et al. 1957*) and also appears in the assemblage from the open-air site Loštice I in Central Moravia (*Neruda et al. 2009*, 47), 50 km from the outcrops.

The well-known Middle (or early Central European) Magdalenian site in Maszycka Cave in southern Poland followed the same procurement pattern as HVK III and 95 % of its lithics were of local origin (*Kozłowski et al. 2012*, 289). However, the similarity of raw material procurement between the HVK III site and Maszycka Cave is probably just superficial as it is given, in the former case, by the above-mentioned availability of fine-grained erratic flints. The exploitation of local materials thus doesn't necessarily indicate different procurement strategies in HVK III to Moravian Karst Magdalenian sites (where erratic flint also predominates among stone artefacts; *Valoch 2001*, 123). The composition of raw materials may, on the other hand, mirror the seasonality and duration of the site's occupation. During practically any season, hunters can stay weeks or months on one site (*Binford 1991*) exploiting a range of local materials at the expense of imported ones. This would also reflect the raw material economy evidenced at HVK III, but no relevant data (from faunistic or paleobotanical analyses, for example) are as yet available to work on this seasonality hypothesis.

In terms of technology, it is apparent that blade production was the main focus at HVK III, as the analysis of cores, blanks and tools suggests. There were only 49 artefacts identified as cores, mostly reduced from one striking platform. Unipolar flaking seems to be typical for the earliest Central European Magdalenian (*Kozłowski et al. 2012*, 289; *Neruda – Kostrhun 2002*, 111) of the Polish-Moravian group (*Maier 2015*, 98), contemporaneous with the middle Magdalenian of Western Europe. The fact that most of the Moravian Magdalenian assemblages usually exploited bipolar cores (*Neruda et al. 2009*, 57) may reflect their relatively younger age. The frequent presence of cortex at HVK III (77.5 % of artefacts) indicates that the materials were brought to the site in their natural form or slightly preformed and their processing took place on the site.

There are 134 artefacts in the whole collection which can be classified as tools. These constitute about 10 % of the total number of artefacts. When looking at the raw materials, the tool collection is quite homogenous with the bulk of tools (90 %) made on erratic flints. This material was obviously preferred to the chalcedony-chert which, although the second most numerous among all artefacts, was only exceptionally (1 piece) used for tool manufacture. The older assemblage (*Neruda – Kostrhun 2002*, tab. 1) showed a similar pattern with just 3 % of the tools made on chalcedony chert indicating its application for knapping practice rather than for practical use.

Both the new assemblage and the collection analyzed by *Neruda* and *Kostrhun* (*2002*) differ from the Moravian Magdalenian sites excavated with modern methods in the relatively low amount of microliths, a fact probably caused by overlooking small artefacts during field-walking prospection. As regards other tool types, both collections are reasonably similar, with the largest category of burins (31.1 % and 47.8 % respectively) followed by borers (23.5 % and 15.9 %) and other tools. The presence of unclear forms (*Skutil 1954*, 459), the high number of borers, multiple borers and microlithic triangles in the older HVK III assemblage was used to place the site in the Lower/Middle Magdalenian (*Neruda – Kostrhun 2002*, 152), making it the oldest Magdalenian site in Moravia. Burins have also been considered typical for this stage; they also predominate in the new assemblage from HVK III and probably reflect bone (probably horse and reindeer; *Valoch 2001*, 115) and antler processing at the site.

Over time, the chronological position of HVK III has been modified on the basis of radiocarbon dates (*Valoch – Neruda 2005*) from both Moravian and other Central European sites (sadly, the only intact but numerically undated layers in Hranice area were recorded in Hranice X *abri*; see below). The site has been considered comparable in age (13 500–13 000 BP uncal.) to the earlier-mentioned sites from Poland and Germany (Dzierzyslaw 35, Cyprzanów /both Poland/ and Kniegrotte /Thuringia, Germany/; *Valoch 2001*; *Valoch – Neruda 2005*; *Połtowicz 2006*, 26; *Feustel 1979*, 878; *Höck 2000*, 92). Dzierżysław especially is very close to HVK III, in both the geographical sense and the nature of the collection. Dihedral burins predominate there, followed by geometrical microliths and borers (*Kostrhun 2004*, 100). Radiocarbon dates place Dzierżysław 35 to the Middle/Late Magdalenian (*Wiśniewski et al. 2017*, tab. 1), before the Bølling interstadial (*Kostrhun 2004*, 100; *Połtowicz-Bobak 2009*, 42) whereas Kniegrotte is undoubtedly of the Middle Magdalenian age (*Meier 2015*, tab. A.6). This fact probably places the HVK III site in the Older Dryas period (*Neruda et al. 2009*, 59), contemporaneous with the end of the Middle Magdalenian (*Bosselin – Djindjian 1988*, fig. 9) in south-western Europe. This period is, among other things, marked by the typological transition from *scalènes* bladelets to *scalènes* triangles (both elongated and denticulated) there (*Langlais et al. 2012*, fig. 7).

The chronological significance of microlithic triangles for the Central European Magdalenian was discussed by *Höck* (*2000*, 112), who discarded it as artificial and based on circular argumentation. It has been vindicated recently by *Maier* (*2015*, 59) who showed the exclusive presence of triangles in assemblages older than 16 000 cal BP (13 200 ^{14}C BP uncal). After this date, they were functionally substituted by organic barbed points (*ibid.*). This early dating of Central European sites with triangles and, at the same time, their late appearance in SW Europe leaves just a narrow time span if we suppose their common origin (unlike *Langlais 2008*, 227). The HVK III site would have to be the result of Late Middle/Early Late Magdalenian migration across Eastern Germany and the North European Plain (as the typology, used raw materials, and open-air character of the HVK III site indicate; cf. *Oliva 2017*, 126; *Vencl 1995*, 246–247). Similar in origin (migration from Central German Magdalenian?), but supposedly younger, might be the Loštice I open-air site (*Neruda et al. 2009*), for which we still lack radiocarbon dates.

There are three possibly older Moravian Magdalenian sites than HVK III, namely Balcarka, Nová Drátenická and, potentially, Žitného Caves (*Neruda 2010*, 86). Although all of them comprise geometric microliths within their lithic inventory, these are scarce and not triangles: a lunate from Balcarka Cave (*Neruda 2010*, tab. 3); three trapezes, one knife of Kent type, and a rectangle from Žitného Cave (*Valoch 1960*, pl. VII) and one rectangle from Nová Drátenická Cave (*Valoch 1960*, pl. IX). All these sites lie in southern Moravia within the Moravian Karst. Although the dating of Nová Drátenická Cave is not unambiguous, as a whole the three may represent an independent colonization wave of Moravia, having arrived along the Danube and giving origin to dozens of Late Magdalenian sites from the Moravian Karst area.

With regard to the ^{14}C date of 6110 ± 25 cal BC acquired from a charred animal bone in HVK III, this reflects either human activity or a forest fire in a relatively warm climate shortly after a steep rise of temperatures within the (Lower) Atlanticum chronozone (Holocene; *Bradley 1999*, fig. 7.13). We can only speculate whether this find is connected with the finds under a near-by *abri*/rock shelter of Hranice – Velká Kobylanka X (see *fig. 1*) where two bladelets were recorded earlier in a stratified position (between the supposedly Boreal layers 8 and 7; *Ložek – Tyráček – Fejfar 1959*, 200). If this were the case, we could at least confirm the Holocene (i.e., Mesolithic) age of the layers. It seems evident, however, that neither the ^{14}C date nor the finds from the rock shelter are related to the Magdalenian settlement of the Hranice area.

Conclusion

Recently collected and analyzed Magdalenian lithic assemblage from the Hranice III – Velká Kobylanka site is similar in raw material use, typology and technology to that published by *Neruda* and *Kostrhun* (*2002*) at the beginning of the 21st century. Knapped-stone blanks were exploited here from single-platform cores to acquire both flakes and blades, although blades were probably the desired final products. Burins predominate among tools followed by borers whereas endscrapers are rare. Geometric triangles constitute a unique phenomenon here in the Moravian Magdalenian and indicate, together with flaking technology, that the site ranks among the oldest within Moravia though probably not the oldest.

The close occurrence of erratic flints enabled the HVK III population to make use of local stone materials. Long-distance imports are rare in the analyzed assemblage. In this way, the site may seem to represent an exception in what is termed the Polish-Moravian Magdalenian group (*Maier 2015*, 98) but, in fact, the preferred material here is the same as in Moravian Karst sites (i. e. erratic flint). Whether this preference was also influenced by a prolonged settlement of the site (and several short-distance movements) is impossible to tell because of the lack of relevant organic material in the collection. On the other hand, the absence of raw materials common to more southern Moravian Magdalenian sites (e.g. Olomučany chert) indicates, along with East German and South Polish typological analogies, that the HVK III site was colonized from the northwest and may bear no relation to the mostly younger sites of the Moravian Karst. The site's dating is uncertain but is probably of the Older Dryas (Middle/Late Magdalenian) age. The only ^{14}C date acquired by us from HVK III points to younger (Mesolithic) activity on the site, possibly connected with two bladelets encountered in the 1950s under a near-by *abri*.

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Znovu k magdalénienu s mikrolitickými trojúhelníky: případ Hranic III – Velké Kobylanky (okres Přerov)

Obsahem článku je surovinová, technologická a typologická analýza souboru získaného povrchovou prospekcí za posledních 20 let v dobře známé lokalitě Hranice III – Velká Kobylanka. Analýza surovin štípané industrie ukazuje, že byly využívané především místní materiály (chalcedon) případně suroviny importované z blízkých (eratický pazourek) či ojediněle vzdálenějších zdrojů (bašský rohovec, rohovec krakovsko-čenstochovské jury) ze severovýchodu či (jiho)východu (radiolarit). Tato strategie zdánlivě neodpovídá trendu, který pro tzv. polsko-moravskou skupinu magdalénienu navrhl *A. Maier* (*2015*, 98), je to ale zřejmě dáno výskytem pazourku nedaleko lokality, nikoliv nutně např. odlišnou zásobovací strategií místních lovců-sběračů. Suroviny z jižních směrů chybí. Technologicky ve štípané industrii převažovaly úštěpy, cílovými produkty však byly spíše čepele odrážené z jednopodstavovývh jader, jak napovídá metrická podobnost čepelí a nástrojů. Mezi nástroji, vyráběnými téměř výlučně z pazourku, jasně převažují rydla nad vrtáky a retušovanými čepelemi, naopak málo je škrabadel. Typologicky výrazné jsou mikrolitické vrtáčky doprovázené čepelkami s otupeným bokem. Surovinově, typologicky i technologicky tak nový soubor víceméně odpovídá starší kolekci analyzované *Nerudou* a *Kostrhunem* (*2002*). Mikrolitické a někdy zoubkované trojúhelníky (*triangles scalènes*; *Demars – Laurent 1989*) zde zřejmě mají chronologický význam, zejména pokud jde o kulturní vliv z jihovýchodní Evropy, kde se objevují teprve na přechodu středního a mladého magdalénienu (*Langlais et al. 2012*; *fig. 7*) ve starém dryasu. I s ohledem na relativně nově získaná ^{14}C data (*Valoch – Neruda 2005*) je dnes zřejmé, že Hranice III – Velká Kobylanka není nejstarší magdalénská lokalita na Moravě (*Neruda – Kostrhun 2002*, 152), ačkoliv asi spadá mezi starší lokality v tomto regionu. Jejím specifikem je ale právě typologie nástrojů a surovinové zastoupení. Ty se liší od magdalénských lokalit Moravského krasu a naznačují možnost osídlení Moravy jak Podunajím, tak (v případě Hranic) přes dnešní Durynsko (analogie v Kniegrotte; *Feustel 1979*, 878; *Höck 2000*, 92) a Severoevropskou nížinu (analogie Dzierzyslaw 35 a Cyprzanów; *Połtowicz 2000*; *2006*, 26; cf. *Oliva 2017*, 126). Náš pokus o datování této události pomocí zvířecí kosti sebrané na povrchu ovšem v Hranicích – Velké Kobylance III ukázal časně holocenní (mezolitické) datum (8060±48 cal BP), které spíše souvisí s osídlením nedalekého abri Hranice X (*Ložek – Tyráček – Fejfar 1959*).

MARTIN MONÍK, Univerzita Palackého, Katedra geologie, 17. listopadu 12, CZ-771 46 Olomouc
martin.monik@gmail.com
VÍT ZÁHORÁK, Univerzita Palackého, Katedra historie, Na Hradě 5, CZ-779 00 Olomouc; v.zahorak@gmail.com
JIŘÍ DROZD, Střední průmyslová škola stavební, Máchova 628/10, CZ-757 00 Valašské Meziříčí
jiridro@seznam.cz
VERONIKA NĚMCOVÁ, Univerzita Palackého, Katedra historie, Na Hradě 5, CZ-779 00 Olomouc
Nemcova.Veronika@seznam.cz