SUPPLEMENTUM 2

ŠTUDIJNÉ ZVESTI

ARCHEOLOGICKÉHO ÚSTAVU SLOVENSKEJ AKADÉMIE VIED

FOSSILE DIRECTEUR

MULTIPLE PERSPECTIVES OF LITHIC STUDIES IN CENTRAL AND EASTERN EUROPE

ŠTUDIJNÉ ZVESTI

ARCHEOLOGICKÉHO ÚSTAVU
SLOVENSKEJ AKADÉMIE VIED

SUPPLEMENTUM 2

ŠTUDIJNÉ ZVESTI

ARCHEOLOGICKÉHO ÚSTAVU
SLOVENSKEJ AKADÉMIE VIED

SUPPLEMENTUM 2

FOSSILE DIRECTEUR

Multiple perspectives on lithic studies in Central and Eastern Europe

Adrián Nemergut – Ivan Cheben – Katarzyna Pyżewicz
(editors)

The publication was supported by projects
of the Slovak Research and Development Agency (No. APVV-20-0521)
and the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic
and the Slovak Academy of Sciences (No. VEGA 2/0101/19 and 2/0075/21).

NITRA 2021

Adrián Nemergut – Ivan Cheben – Katarzyna Pyżewicz (editors)

Fossile directeur. Multiple perspectives on lithic studies in Central and Eastern Europe

Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021

Recenzovaný časopis / Peer-reviewed journal

Hlavné redaktorky / Editors-in-chief
Gertrúda Březinová, Alena Bistáková

Redakčná rada / Editorial board
Lucia Benediková, Jozef Bujna, Jana Čižmářová, Eva Fottová, Joachim Henning, Ivan Cheben, Alexandra Krenn-Leeb, Ján Rajtár, Peter C. Ramsl, Jozef Zábojník

Technické redaktorky / Technical editors
Daniela Fábiková, Miriama Nemergutová

Počítačové spracovanie / Layout
Beáta Jančíková

Grafický návrh a počítačové spracovanie obálky / Graphic layout and computer elaboration of the cover
Beáta Jančíková, Adrián Nemergut

Príspevky sú indexované a evidované v databázach WoS, Scopus a CEJSH.
Bez predbežného písomného súhlasu vlastníka vydavateľských práv nesmie byť žiadna časť tejto publikácie reprodukovaná alebo rozširovaná v žiadnej forme – elektronicky či mechanicky vrátane fotokópií, nahrávania, prípadne iným použitím informačného systému vrátane webových stránok.

Articles are indexed and covered in WoS, Scopus, and CEJSH databases.
No part of this publication may be reproduced or transmitted in any form – electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, including web pages, without the prior written permission from the copyright owner.

Za znenie a obsah príspevkov zodpovedajú autori. / Authors are responsible for their contributions.

http://archeol.sav.sk/index.php/sk/publikacie-2/studijne-zvesti/
http://archeol.sav.sk/index.php/en/publications/the-studijne-zvesti-au-sav-journal/

Rozširuje / Distribution
Archeologický ústav SAV, Akademická 2, SK – 949 21 Nitra
e-mail: nraukniz@savba.sk

Tlač / Printed by
VEDA, vydavateľstvo SAV, Bratislava

© Archeologický ústav SAV, Nitra 2021

ISSN 0560-2793

Dátum vydania október 2021 Evidenčné číslo MK SR 3403/09 IČO 00 166 723

OBSAH

Magda Cieśla

Keep it or discard it?
Why the Neanderthals made tools from some rocks 7

Zachować czy wyrzucić?
Dlaczego neandertalczycy wykorzystywali niektóre typy skał w produkcji narzędzi 18

Małgorzata Kot – Natalia Gryczewska

Found in a box.
Unknown bifacial leaf point from the Koziarnia Cave 19

Znalezione w pudełku.
Nieznane bifacjalne ostrze liściowate z jaskini Koziarni 29

Krisztián Zandler – András Markó – Attila Péntek

Szeletian or not Szeletian.
Bifacial industries from three open-air Middle Palaeolithic sites from the Cserhát Mountains
(Northern Hungary) 31

Szeletien alebo nie szeletien.
Bifaciálna industria z troch otvorených stredopaleolitických lokalít v pohorí Cserhát (severné Maďarsko) 46

Zsolt Mester

What about the Szeletian leaf point as *fossile directeur*? 49

Szeletiensky listovitý hrot ako *fossile directeur*? 61

Katarzyna Pyżewicz – Adrián Nemergut

First results of use-wear analysis of the leaf points from Moravany nad Váhom-Dlhá 63

Prvé výsledky trasologickej analýzy listovitých hrotov z lokality Moravany nad Váhom-Dlhá 80

Marián Soják – Maciej Wawrczak

Spišské Podhradie-Dreveník, an important Palaeolithic site of the Lower Spiš 83

Spišské Podhradie-Dreveník, dôležitá paleolitická lokalita dolného Spiša 92

Yuri E. Demidenko – Petr Škrdla – Joseba Rios-Garaizar – Jaroslav Bartík – Tereza Rychtaříková

Epiaurignacian industry with Sagaidak-Muralovka-type microliths industry
in the south of Eastern Europe and Eastern Central Europe and its lithic artefact fossil types 93

Epiaurignacká industrie s mikrolity typu Sagaidak-Muralovka v období posledního glaciálního maxima
na jihu východní Evropy a ve východní části střední Evropy a její vůdčí artefakty 109

Michaela Polanská

Est-il possible d'identifier des groupes pavloviens sur le territoire d'actuelle Slovaquie ? 111

Osídľovali pavlovienske skupiny územie dnešného Slovenska? 126

Sandra Sázelová – Bibiána Hromadová – Angela Perri – Michaela Polanská

Aspects of hard tissue modifications.
Three objects from the Gravettian at Dolní Věstonice II (Czech Republic) 129

Možnosti modifikace tvrdých tkání.
Tři gravettské předměty z Dolních Věstonic II (Česká republika) 143

Michaela Polanská – Martin Novák – Laurent Klaric

Fossiles directeurs variability in Late and Final stages of the Gravettian of Central Europe 145

Variabilita *fossiles directeurs* v mladom a finálnom gravettiene strednej Európy 161

Zdeňka Nerudová

Can we identify any *fossile directeur* in the Epigravettian? 163

Je možné nalézt *fossile directeur* pro epigravettien? 173

Ivan Cheben – Michal Cheben

Analysis of chipped industry from the setllement of the Želiezovce group in Bajč 175

Analýza štiepanej kamennej industrie z lokality želiezovskej skupiny v Bajči 197

Roman I. Muravev – Evgenia S. Tkach – Dmitriy V. Gerasimov

Sinkers and composite fishing hooks in the Neolithic of Eastern Baltic.
Slate artefacts from Berezovo 2 (Karelian Isthmus, North-West Russia) 199

Závažia a zložené rybárske háčiky z neolitu vo východnom Pobaltí.
Bridlicové artefakty z lokality Berezovo 2 (Karelská šija, severozápadné Rusko) 210

Jaroslav Bartík – Petr Škrdla

Raw material as *fossile directeur*?
A case study of the use of Stránská skála-type chert 213

Surovina jako *fossile directeur*?
Případová studie využívání rohovce typu Stránská skála 229

Ľubomíra Kaminská

Use of obsidian in Slovak prehistory 231

Využitie obsidiánu v praveku Slovenska 250

Magdalena Sudoł-Procyk

Chocolate flint outcrops in the Kraków-Częstochowa upland.
State of knowledge on mining, use and distribution of the raw material
and further research perspectives 251

Wychodnie krzemienia czekoladowego na Wyżynie Krakowsko-Częstochowskiej.
Stan wiedzy nad wydobywaniem, użytkowaniem i dystrybucją surowca
oraz perspektywy badawcze 262

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 7–18

KEEP IT OR DISCARD IT?

Why the Neanderthals made tools from some rocks

Magda Cieśla

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.1

Keywords: Middle Palaeolithic, Carpathians, Obłazowa Cave, stone raw materials

Abstract: The adjustability of stone processing techniques to the kind and quality of accessible stone raw materials is an important factor of Middle Palaeolithic stone tool production. Middle Palaeolithic people mostly exploited local rocks, preferably of good quality, and yet in some sites, even located in flint-rich areas (like the Obłazowa Cave site discussed in the text), Neanderthals used rocks they found elsewhere, alongside locally sourced but quite unusual raw materials. These are rocks that are likely to crack or that are very soft, unsuitable for knapping and for later use as tools. The question that arises is, to what end were these rocks even processed? In the paper, the typological character of those artefacts, prepared from a variety of raw material (high-quality foreign rocks and low-quality local ones), and their place in the *chaîne opératoire* will be discussed.

Studying the subject of Neanderthal raw materials use has brought us a better and fuller understanding of the past land-use patterns, foundations of raw material economics and in some cases, a better understanding of the connection between the land-use and seasonal change of the subsistence strategy. Analysing the strategies for the procurement of knappable rocks, together with the techno-typological research, provides an insight into the logic of Neanderthal economy.

The above holds true as long as the rock type is relevant in some way to the form and technique implemented in the production process. It is widely acknowledged that in most cases, Neanderthal communities based their raw material economy on local rocks. Local extraction of raw materials, or hauling good-quality fine-grained raw material into sites located in areas with poor supply of rocks is understandable. Similarly comprehensible is the local use of low-quality rocks in the face of no other raw material sources in close proximity of the archaeological site.

However, in archaeological records, there are exceptions to this seemingly logical behavior. Examples include the processing of low-quality stones alongside (or instead of) local fine-grained rocks (e.g. *Márquez et al. 2013*); long-distance transport of low-quality rocks; transport of unprocessed or seemingly unprocessable (i.e. too small or extensively cracked) pieces of raw material to the site. Transporting rocks across distances that in some cases exceed 100 km, although not unique (*Cieśla 2018*; *Féblot-Augustins 1993*; *1999*; *Turq et al. 2017*; *Valde-Nowak/Cieśla 2020*, etc.), must therefore be considered at least unusual. This article aims to present those unusual situations on an example of the Obłazowa Cave archaeological site. It is a case study of the site inventories. In the cave located in a flint-rich area, Neanderthals exploited some poor-quality rocks. Also, some stones from a very distant transport (like obsidian) can be found, in the form of microlithic artefacts, among them tools.

When attempting an explanation of these phenomena, raw material provisioning options should be taken into account. This concerns both local raw material available for exploitation by Neanderthals and transport possibilities on a regional scale.

Additionally, as shown by several studies, we should take into account the possibilities and necessity for stone artefacts recycling (*Vaquero et al. 2015*), or instances of ramification (branched production or cores-on-flakes as a pre-planned element of production process; *Mathias/Bourguignon 2020*; *Romagnoli et al. 2018*); these phenomena can also factor in the pre- and postdepositional character of an archaeological deposit.

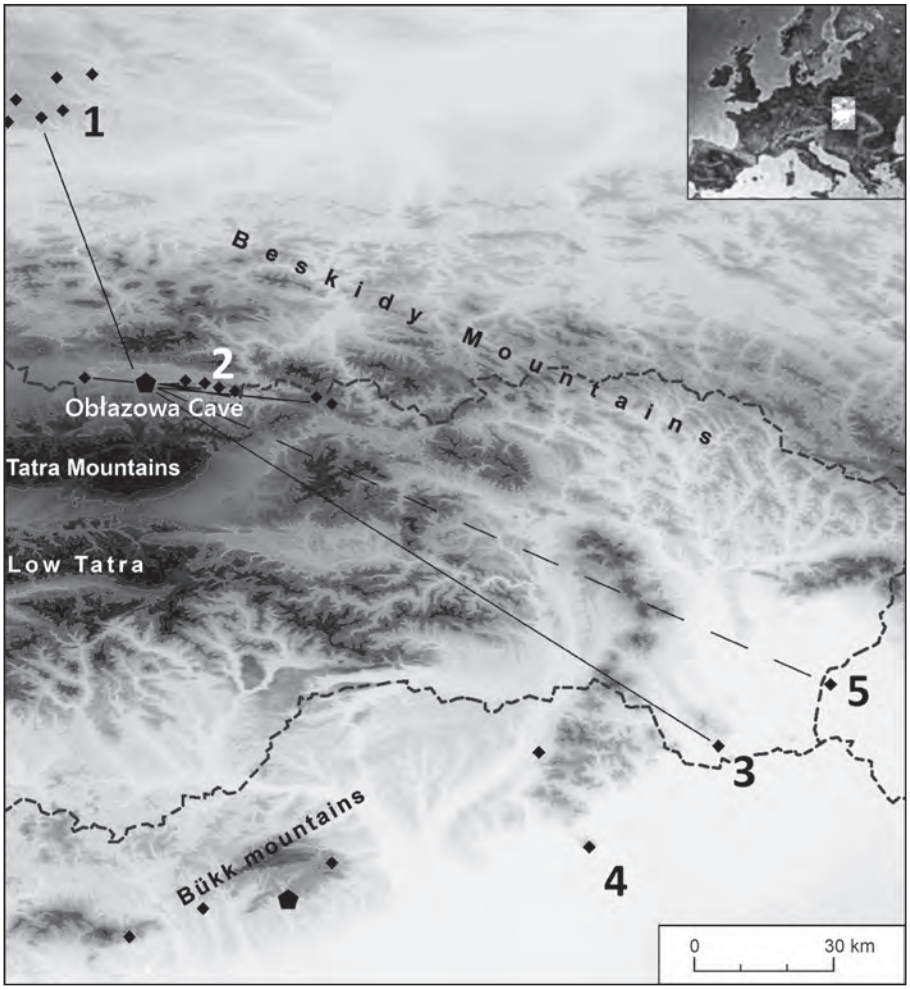


Fig. 1. Carpathian stone raw materials. Materials exploited at the site of Obłazowa Cave. 1 – Kraków Jurassic flint; 2 – Pieniny radiolarite; 3, 4 – Slovak obsidian; 5 – possible location of the sources of silicified sandstone from layer XIII (drawing by M. Cieśla).

OBŁAZOWA CAVE SITE, RAW MATERIAL BASE AND MIDDLE PALAEOLITHIC ARCHAEOLOGICAL RECORD

The archaeological site of Obłazowa Cave, located in Southern Poland, in the highland plateau of Eastern Podhale (or, more precisely, on the border of this plateau and the Pieniny mountain range), has yielded numerous finds connected with Middle, Upper and Late Palaeolithic. The richest series of artefacts come from the Neanderthal layers. In the latest excavations, the overall number of Middle Palaeolithic artefacts from the site has reached several thousand pieces.

The site is located in a zone with outcrops of local silica rock, a fine-quality Carpathian radiolarite. The outcrops of this raw material are known primarily from limestone geological formations of the Pieniny Klippen Belt and also from Tatra Mountains (*Sujkowski 1932*) but that fact alone does not answer the question of the radiolarite provenience in the Obłazowa Cave. Nowadays, good-quality radiolarites can be found at a distance of 7 km from the site, in the riverbed of a small stream called Branisko. Some lower-quality radiolarites can be found closer to the site, but their use was not extensive, or at least, it is not documented at the site.

In close vicinity of the site (ca. 100 m), the Białka River flows. Its bed is made of pebbles, cobbles and boulders of various rock types, mostly granites. Some water-formed sedimentary rocks, such as sandstones, brought by the watercourse from the flysch zone of the Magura Spiska range can be found

there. Initially, the river flowed through the cave itself, leaving inside a thick deposit of sands, gravels and river cobbles (*Valde-Nowak/Nadachowski/Madeyska 2003*). With the developing erosion of the riverbed, at the time of the Neanderthals' first settlement at the site the river had already changed its course and flowed beside the cave.

As can be seen, good-quality raw material was relatively easily accessible from the site, and low-quality rocks could be found in direct proximity of the cave (Fig. 1).

The local raw material used at the site constitutes a large majority of all the Neanderthal occupation levels in the cave (Table 1), which coincides with the standard of Neanderthal sites from central Europe. Although this holds true for all of the MP inventories, in a number of them some rather exotic rocks were also found. As already discussed in previous articles (*Cieśla 2018*; *Valde-Nowak/Cieśla 2020*), the presence of such raw materials probably reflects the range of Neanderthal mobility or at least the range of their familiarity with neighbouring lands. The currently known trails of raw material transportation show that the Obłazowa Cave Neanderthals knew and used rocks from the borders of the Hungarian Plain as well as those from the Kraków-Częstochowa Upland. Although it seems clear that the site witnessed an increased mobility of Neanderthal groups towards the end of Middle Palaeolithic, and the archaeological records could likely support a hypothesis of a Carpathians crossing in late Middle Palaeolithic (in some of the archaeological levels, raw material from both south and north of the mountain range can be found; *Cieśla 2018*), the majority of preserved raw material is nevertheless of local provenience.

MATERIALS AND METHODS

The material studied for this paper was the Middle Palaeolithic inventory of stone artefacts discovered at the site of the Obłazowa Cave. The artefacts discussed include specimens found *in situ*, in a clearly defined stratigraphic position. They belong to various archaeological units connected with the Obłazowa Cave Middle Palaeolithic series: layers XXb, XIX, XVIIIb, XVII, XVI, XVb or XIII (listed here in chronological order, starting with the oldest; see *Alex et al. 2017*; *Valde-Nowak/Nadachowski/Madeyska 2003*).

The radiocarbon dates obtained for the site suggest a late chronology of its Middle Palaeolithic inventories – they can be positioned at the beginning of MIS 3 (*Alex et al. 2017*).

The current analysis only includes material excavated before the year 2018, and therefore the statistics presented in this article (see Table 1–3) may change in the years to come, when new material will have been excavated and analysed.

The use-wear analysis of the Middle Palaeolithic artefacts from the site has proved inconclusive in distinguishing between intentional and unintentional changes to the artefacts surface (*Valde-Nowak/Nadachowski/Madeyska 2003*). As a result, the distinction between intentional and unintentional modifications of stone implements was based on their macroscopic overview, in some cases aided by use of an optical microscope.

Additionally, the subject of manuports was approached with special care. Since sandstone pebbles could have occurred at the site naturally as a water sediment, only pieces with evident traces of processing were considered in this work. Several limestone flakes that were documented during the excavations were also ignored in this compilation, as the intentional character of their presence inside a limestone cave cannot be confirmed beyond reasonable doubt.

ANALYSIS

In all of the archaeological units in this time frame, local raw material dominates. Some 98% of all of the artefacts from the Neanderthal layers were made of radiolarite (Table 1).

Although their number is relatively low, the artefacts made of different rock types form an interesting collection.

Obsidian artefacts can be found in the older set of layers from Obłazowa (layers XIX, XVIIIb and XVII), in the form of small flakes and chips (in most cases less than 1 cm in diameter). In comparison with the overall number of artefacts, they are fairly insignificant (see Table 1; 2).

Table 1. Obłazowa Cave. Raw materials in MP layers. Legend: R – radiolarite; Q – quartz; QZ – quartzite; G – granite; F – flint; O – obsidian; C – conglomerate; S – sandstone; HS – hornstone; L – limestone; UR – undetermined rock; SSA – undetermined silicified sandstone.

Layer		R	Q	QZ	G	F	O	C	S	HS	L	UR	SSA
XXb	Tools	39	–	1	–	–	–	–	–	–	–	–	–
	Unretouched forms	124	1	1	–	–	–	–	–	–	–	–	–
	Cores	5	–	–	–	–	–	–	–	–	–	–	–
XIX	Tools	314	–	–	–	–	4	–	–	–	–	–	–
	Unretouched forms	1957	1	7	–	1	19	–	–	2	–	3	–
	Cores	34	–	–	–	–	–	–	–	–	–	–	–
	Other	1	–	–	1	–	–	1	4	–	2	–	–
XVIIIb	Tools	34	–	–	–	–	–	–	–	–	–	–	–
	Unretouched forms	109	–	–	–	–	1	–	–	–	–	1	–
	Cores	6	–	–	–	–	–	–	–	–	–	–	–
XVII	Tools	53	–	–	–	–	–	–	–	–	–	–	–
	Unretouched forms	173	–	3	–	–	2	–	–	–	1	–	–
	Cores	3	–	1	–	–	–	–	–	–	–	–	–
	Other	–	–	1	–	–	–	–	–	–	–	–	–
XVI	Tools	4	–	–	–	–	–	–	–	–	–	–	–
	Unretouched forms	53	–	1	–	–	–	–	2	–	–	–	–
	Cores	3	–	–	–	–	–	–	1	–	–	–	–
XVb	Tools	35	–	1	–	1	–	–	–	–	–	–	–
	Unretouched forms	98	–	1	–	4	–	–	–	–	1	–	–
	Cores	4	–	–	–	–	–	–	–	–	–	–	–
XIII	Tools	16	–	1	–	3	–	–	–	–	–	–	1
	Unretouched forms	139	–	–	–	2	–	–	–	–	1	–	2
	Cores	2	–	–	–	–	–	–	–	–	–	–	–
	Other	–	–	–	–	–	–	–	4	–	–	–	–

Table 2. Obsidian in Obłazowa Cave. Number of artefacts and their weight per layer.

Number of layer	XIX	XIX: Obsidian	XVIIIB	XVIIIB: Obsidian	XVII	XVII: Obsidian
Number of pieces	2352	23	151	1	237	2
Weight (g)	14845.5	32	1574	0.2	1299.6	10.2

The largest collection so far comes from the layer XIX (Fig. 2), which is the level that supposedly can be interpreted as a palimpsest of several Neanderthal visits to the site[1].

The character of most obsidian artefacts, as described below, is similar in the inventories from all of the archaeological layers: they are small and in many cases visibly damaged. Although the postdepositional abrasion of pieces has to be considered as an important factor, it also needs to be emphasised that the abrasive processes did not seriously alter the form and size of artefacts. The intentional character of the average of 70% of outer surfaces is clearly visible in their form – they show all the traits of intentionally prepared negatives. What is more, in the cases where the dorsal side of a flake is well preserved, the width of earlier flake negatives varies between 0.6 cm to 1 cm. All this suggests that the artefact size does not result only from destructive postdepositional processes, but mostly from intentional actions of their makers.

[1] In case of the discussed site the sedimentation rate in the beginning of MIS 3, when most of the inventories were formed was rather high. The thickness of MP-connected sediment reaches approx. 1.5 m, while the radiocarbon dates for most of the inventories are similar (see ex. *Alex et al. 2017*; *Valde-Nowak/Nadachowski/Madeyska 2003*). Also, in layer XIX there are visible dissimilarities in the state of preservation of different artefacts, there are no (or close to none) refittings, and the saturation of artefacts in layer XIX is unusually high: sometimes the number of artefacts is larger than the amount of sediment. All this points at the probability of the layer being a palimpsest of different occupation episodes.

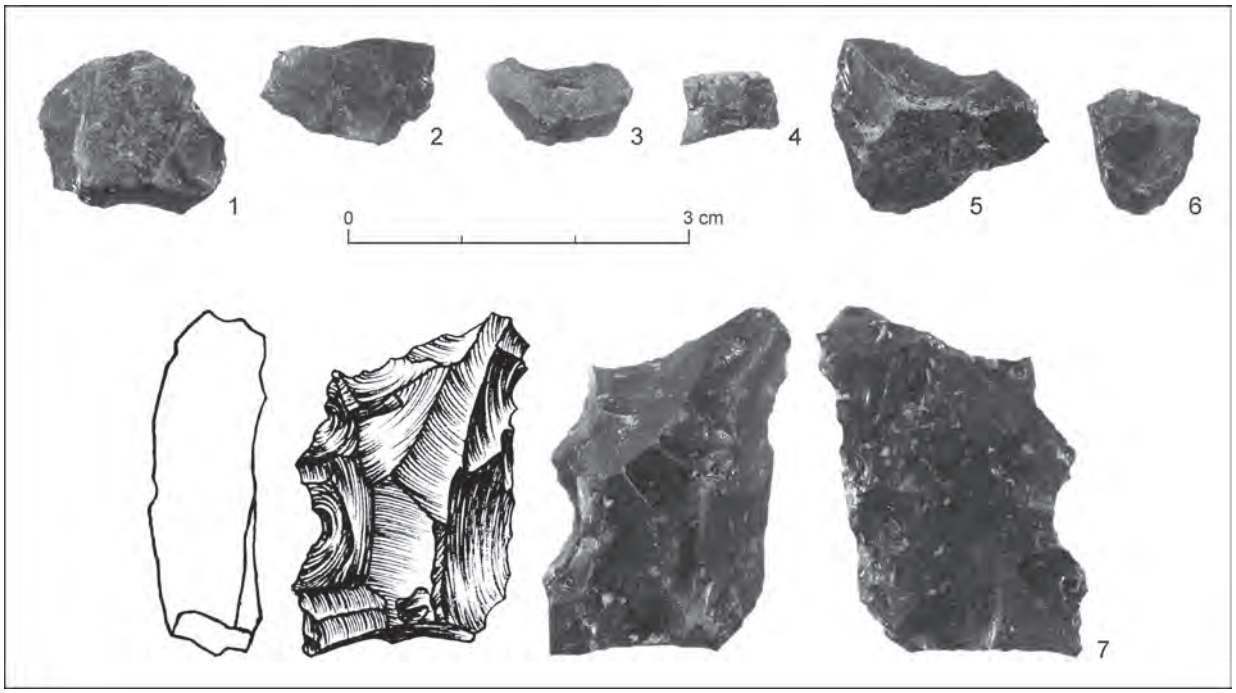


Fig. 2. Obłazowa Cave, layer XIX. Selection of Middle Palaeolithic obsidian artefacts (photo by M. Cieśla).

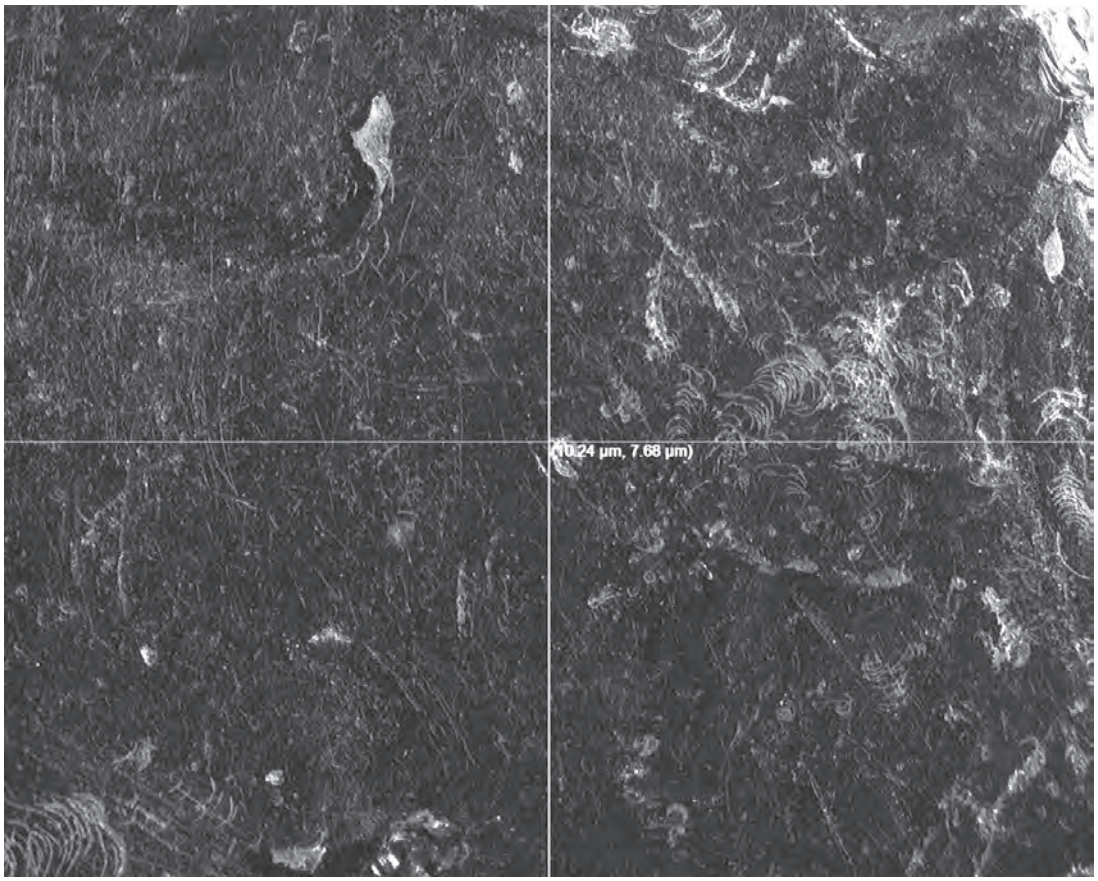


Fig. 3. Obłazowa Cave, layer XIX. View of obsidian artefact surface abrasion (photo by M. Cieśla).

Table 3. Jurassic flint in Obłazowa Cave. Number of artefacts and their weight per layer.

Number of layer	XIX	XIX: Jurassic flint	XVB	XVB: Jurassic flint	XIII	XIII: Jurassic flint
Number of pieces	2352	1	145	5	171	5
Weight (g)	14845	18	772	34.2	657.6	4.2

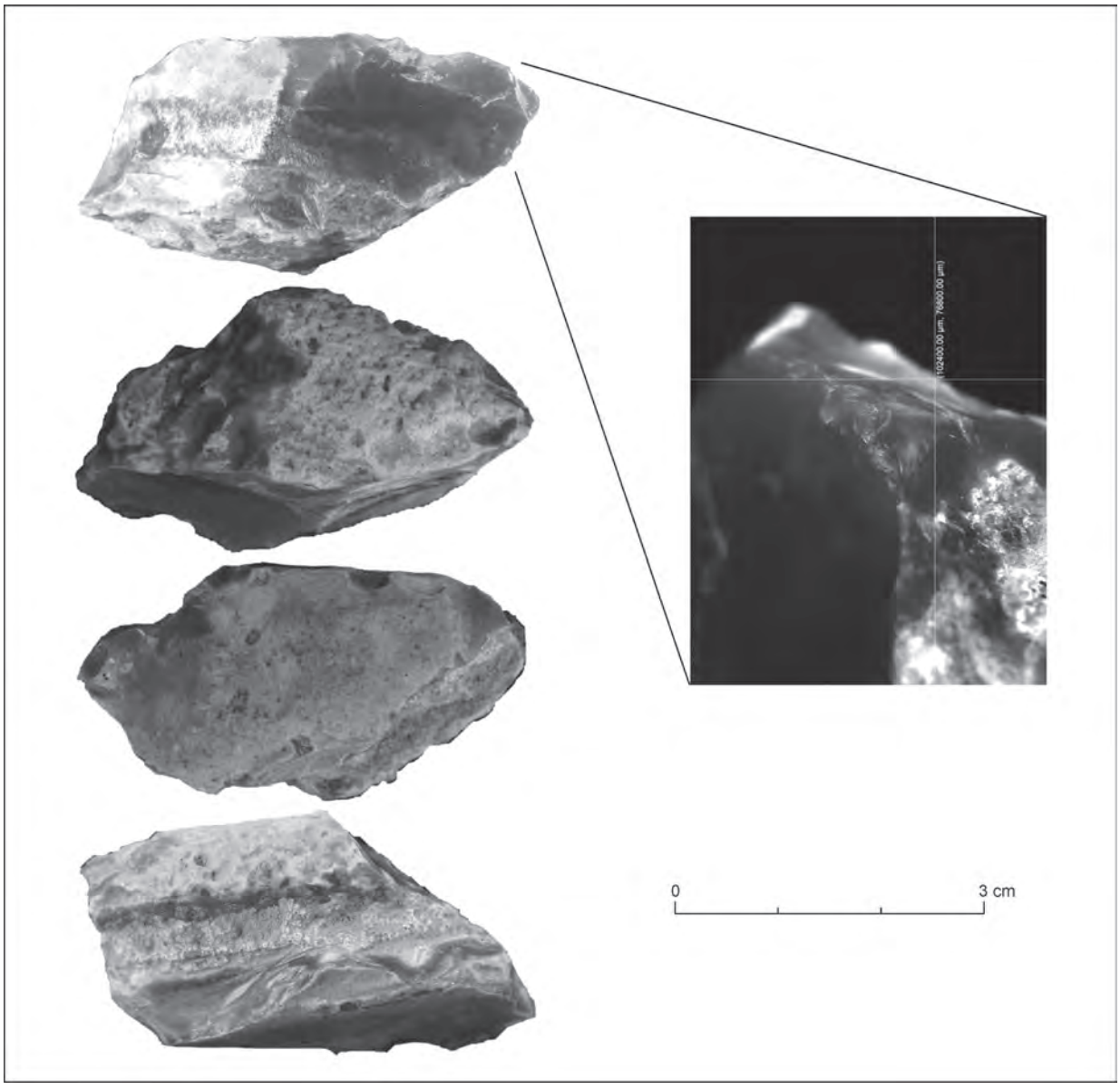


Fig. 4. Obłazowa Cave, layer XIX. Artefact made of Kraków Jurassic flint (photo by M. Cieśla).

The outer surface of the specimens is visibly abraded (Fig. 3), unlike the surface of the radiolarite or flint artefacts. On average, obsidian in archaeological contexts is considered as more brittle and prone to damage than other knappable rocks (*Dobosi 2011*). It reaches only 5 to 5.5 points on Mohs scale of hardness, as compared with good-quality silicites and quartz reaching 7 points (*Brandl 2014; 2016*).

The majority of flint artefacts can be found in the context of the youngest Middle Palaeolithic layers at the site: XVb and XIII (Table 1; 3). The only exception to this chronological rule is a chunk of a Kraków Jurassic type flint found as an element of a layer XIX (Fig. 4).

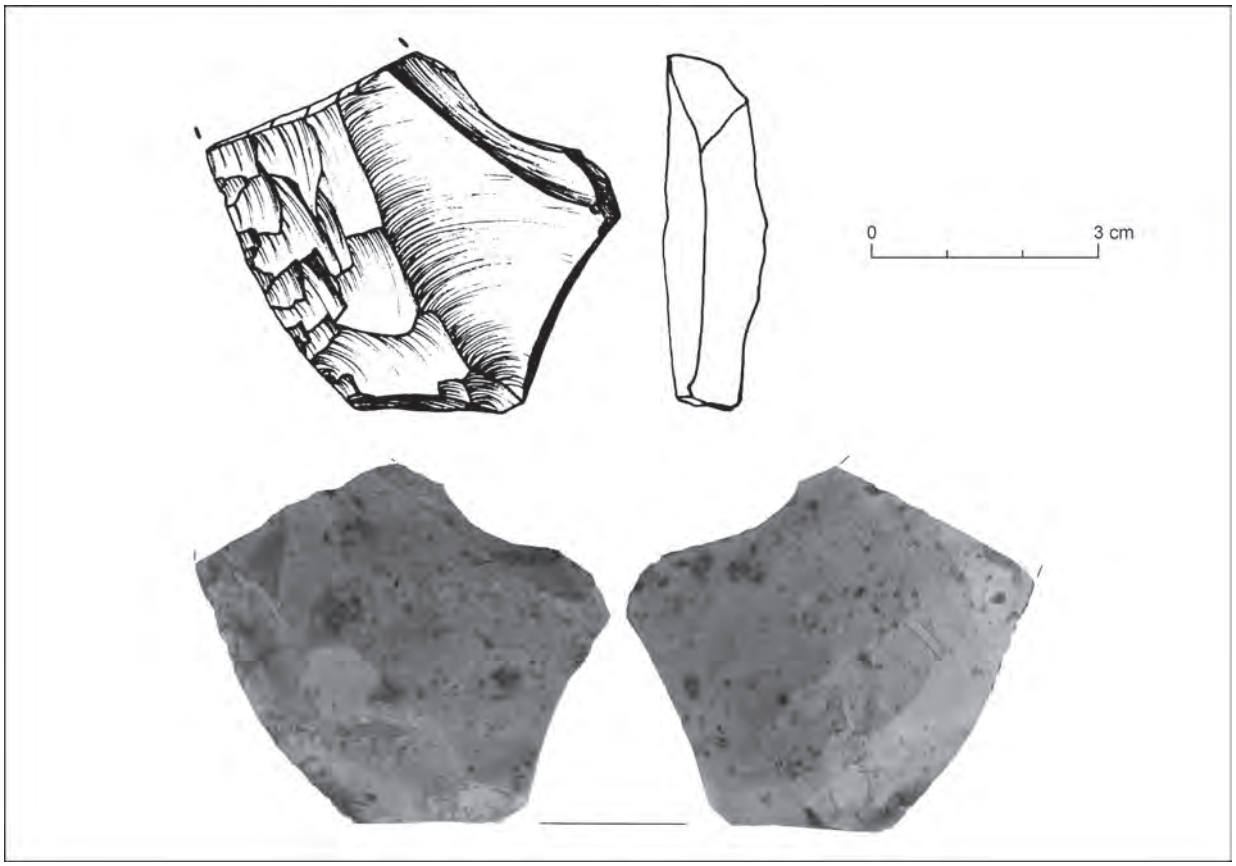


Fig. 5. Obłazowa Cave, layer XVb. Artefact made of Kraków Jurassic flint (drawing and photo by M. Cieśla).

Mostly, flint artefacts are small flakes or chips and chunks. The exception to this rule are a middle sized (4.7 x 2.3 cm) chunk of flint from layer XIX and a broken sidescraper from layer XVb (Fig. 5).

In most cases, no macroscopically visible damage could be observed on the surface of the artefacts and all intentional negatives are completely preserved. The breakage of the sidescraper from layer XVb could be pre-depositional in character (so far, no other part of this specimen was discovered).

The analysis of the flint artefact from layer XIX (Fig. 4) is more challenging. The outer surfaces of the specimen are intensively polished. The macroscopically visible polishing can also be spotted on the surface of the negatives on the edge of the artefact (where it is less intensive). Both types of polishing (more and less intensive) could be resulting from the rubbing of the sediment on the surface of a deposited artefact, which was already mentioned for the discussed site (use-wear analysis, as described by *Valde-Nowak/Nadachowski/Madeyska 2003*, 73). However, it has to be emphasised that the typical polish of flints from the site is less intensive; it usually fits what can be seen in the negatives of described specimen, therefore the polishing of all its other surfaces most probably originates from the phase before its deposition.

Sandstone use at the site is limited to one layer only, XVb. In some other layers, natural sandstone pebbles occur, but as they do not show any traces of intentional processing, they will not be discussed here.

The two sandstone specimens with visible intentional negatives on their surface are middle-sized sandstone plate and pebble (Fig. 6). The plate (Fig. 6: 2) has only one negative and its intentional character is questionable. The other artefact, however, was processed with several uni-directional strokes, forming a clear flaking platform on one side (Fig. 6: 1).

A double sidescraper (*limace*) of undetermined rock type (Fig. 7) was found in the youngest Middle Palaeolithic layer of the site (layer XIII). The raw material is most probably not a local one; however, there is no consensus as to the geographic attribution of its outcrops. It is most likely some kind of highly silicified sandstone, similar to that which can be found in Transcarpathian Ukraine

(*Rácz 2013*, 133, 134, 144), in the distance of approximately 180 km as the crow flies from the Obłazowa Cave. Although there can be no certainty as to the location of its sources, the character of the artefact suggests that it might have been brought in from a considerable distance. The intensively retouched edges and slightly rounded arrises between some of the negatives on the dorsal side point to a prolonged use and probably to the transport of the specimen. Additionally, despite its fine quality, this kind of rock does not appear in any other assemblage at the site. In layer XIII, where it was found, it is accompanied by three small chips made of the same material (which do not refit with this specimen). Finally, the form of the artefact should be considered of vital importance – *limace* scrapers are not a common feature in Eastern Central European Middle Palaeolithic inventories.

DISCUSSION

The examples listed above seem disjointed but they are all parts of a group of non-typical artefacts among Middle Palaeolithic materials of the Obłazowa Cave.

In the case of obsidian, its use in Middle Palaeolithic is well described, at least in Hungarian archaeological sites (e.g. *Biró 1984*; *Biró/Dobosi 1991*; *Biró/Dobosi/Schléder 2000*). The exotic character of this rock in the context of Obłazowa (minimal transport distance: 140 km as the crow flies; Fig. 1) is combined with its relative popularity at this site (expressed in its repeated occurrence in subsequent chronological units rather than the quantity of artefacts). There are several possible explanations for the presence of this raw material at the site.

The physical characteristics of this stone type (i.e. lack of fissures or internal cracks, homogeneity) suggest that it could have been treated as a supply of fine-quality raw material for long distance journeys. Some smaller chips can supposedly be interpreted as remains of "missing artefacts" – larger tools retouched on-site and than transported off-site (as proposed by *Neruda/Kaminská 2015*). This

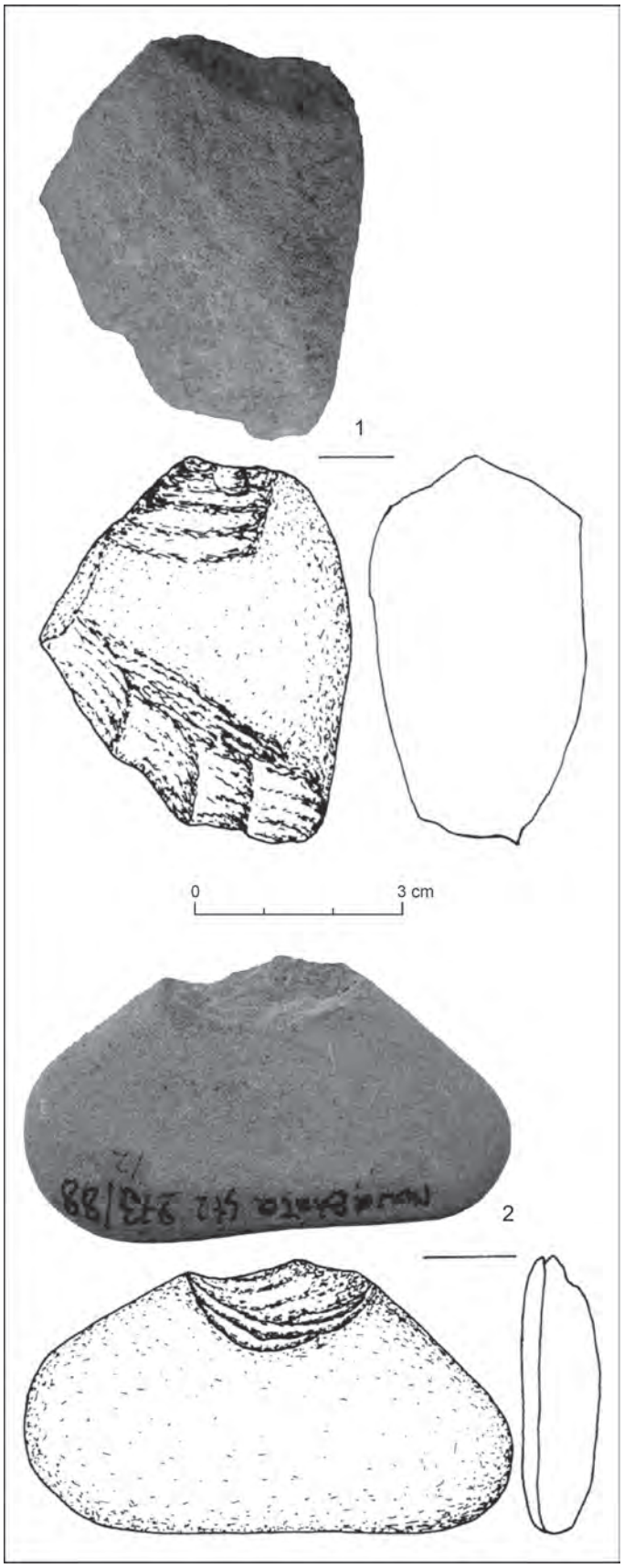


Fig. 6. Obłazowa Cave, layer XVb. Artefact made of local sandstone (drawing by E. Osipowa, photo by M. Cieśla).

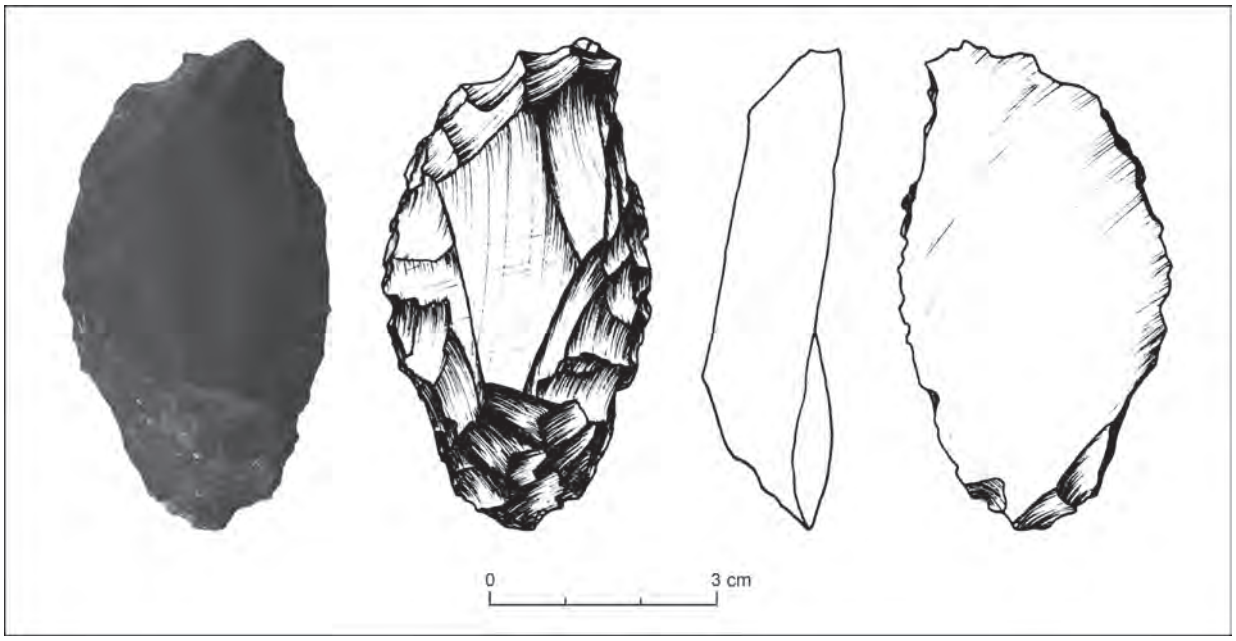


Fig. 7. Obłazowa Cave, layer XIII. Artefact made of undetermined rock (silicified sandstone?; drawing and photo by M. Cieśla).

however, does not explain the presence of microlithic tools made of obsidian (e.g. Fig. 2) at the site. Also, the small size of tools might be interpreted as an adaptation to the conditions of transport – for example, the use of microlithic flakes in hafts could allow transport of smaller amounts of raw material.

Ramification (e.g. *Mathias/Bourguignon 2020*), defined as the branching of the production strategy, here expressed in pre-planned use of cores-on-flakes as a part of raw material transport strategy, can be taken into account in the case of this raw material. However, no direct evidence of this strategy being used for obsidian has been found so far. No core-on-flake of obsidian has been discovered, nor any obsidian artefacts are found among the modest representation of flakes with double ventral sides from the Obłazowa Cave. The procurement of small flakes from bifacial pieces can probably be ruled out for this material among the obsidian flakes – none of them meets the formal requirements for such pieces. In the diachronic perspective, the occurrence of this rock in the older set of layers suggests the southern origins of settlement in this mountainous region in the first stages of MIS3.

The concept of branched production can be observed in the case of two artefacts described above. The first one is the flint scraper, with visible Quina retouch (layer XVb; Fig. 5). The other is the silicified sandstone double scraper (*limace*, layer XIII; Fig. 7), prepared for use both as a tool and a source of small, sharp flakes.

In this context, the Jurassic flint from layer XIX (Fig. 4) appears to be out of place. Even so, in the context of this layer, which can possibly be interpreted as a palimpsest of occupation episodes formed in relatively favorable climatic conditions (see *Valde-Nowak/Nadachowski 2014*), arrivals from south and north or contacts with populations living on both sides of the Carpathians happening in the same climatic phase cannot be excluded. The fact that among so many artefacts (see Table 1), only one specimen demonstrates links with the north suggests a relatively low recognition (typical for the initial phase of migration and settlement) of septentrional raw material resources.

The explanation of the origins of this specimens typological classification (it can be described as an unretouched chunk of raw material, with some dubious retouch negatives) is more complicated. As demonstrated for most of the exotic raw materials at the site (save for obsidian, as discussed above) and generally in Middle Palaeolithic contexts (see e.g. *Delagnes/Rendu 2011*), good-quality rocks were processed in a way that allowed them to be easily reworkable tools, or to be used as tools and cores at the same time. In this case, the obviously non-local rock was transported, probably kept for a long time – hence the intensive polish of the surfaces – and finally discarded in an almost unchanged form. Of course, it is possible that for some reason, the specimen was kept as a curiosity; it is also possible that

it had some practical use. It has been suggested that it could have been used as a fire striker[2] – but so far, this hypothesis has remained an unsubstantiated speculation, and the question still stands. Examples of fire strikers this old admittedly feature in archaeological records but their typological form is quite different (*Sorensen/Claud/Soressi 2018*).

The original purpose of the sandstone artefacts is probably the most obscure. It has to be stressed that the sandstone in question was not silicified and was therefore soft and prone to cracking; in short, completely unsuitable for the production of cutting or scraping tools. The use of sandstone in archaeological contexts is well documented in many archaeological sites but it concerns unprocessed pieces (see e.g. *Pacheco et al. 2012*). The situations where despite abundance of raw material of better quality (as we would understand it), sandstone is still used are rare but they do exist (see e.g. *Márquez et al. 2013*). Mostly, however, sandstone nodules are interpreted *a priori* as hammerstones. It is possible in this case that we are dealing with a specific hammerstone prepared for some knapping action, or with a core for flakes that could have served as such hammerstones (retouchers). Due to intensive surface abrasion, which precludes a study of this artefact for traces of such use, this hypothesis will have to remain in the realm of speculation.

CONCLUSIONS

The subject of seemingly incomprehensible use of various raw materials and their place in the *chaîne opératoire* of Neanderthal tool production definitely requires more room in the scientific literature. Extensively described use of local raw materials that are characteristic for a particular site and their techno-typological characteristics, together with a wide-range analysis of the site context is a basis of any archaeological analysis. Even so, when studying the Middle Palaeolithic, research into less usual types of artefacts, or simply those that are in some way surprising in their context, can yield otherwise unobtainable findings.

Translated by author

BIBLIOGRAPHY

Alex et al. 2017 — B. Alex/P. Valde-Nowak/L. Regev/E. Boaretto: Late Middle Paleolithic of Southern Poland: Radiocarbon Dates from Ciemna and Obłazowa Caves. *Journal of Archaeological Science: Reports* 11, 2017, 370–380. DOI: https://doi.org/10.1016/j.jasrep.2016.12.012

Biró 1984 — K. Biró: Distribution of obsidian from the Carpathian Sources on Central European Palaeolithic and Mesolithic sites. *Acta Archaeologica Carpathica* 23, 1984, 5–42.

Biró/Dobosi 1991 — K. Biró/V. Dobosi: *Litotheca – Comparative Raw Material Collection of the Hungarian National Museum*. Budapest 1991.

Biró/Dobosi/Schléder 2000 — K. Biró/V. Dobosi/Zs. Schléder: *Litotheca II – Comparative Raw Material Collection of the Hungarian National Museum*. Budapest 2000.

Brandl 2014 — M. Brandl: Genesis, Provenance and Classification of Rocks within the Chert Group in Central Europe. *Archaeologia Austriaca* 97/98 (2013/2014), 2014, 33–58. DOI: https://doi.org/10.1553/ARCHAEOLOGIA97-98S33

Brandl 2016 — M. Brandl: The multi layered chert sourcing approach (MLA) analytical provenance studies of silicite raw materials. *Archeometriai Műhely* 13/3, 2016, 145–156.

Cieśla 2018 — M. Cieśla: How far did they go? Exotic stone raw materials occurrence at the Middle Palaeolithic sites. Case studies of sites from Western Carpathian Mts. *Acta Archaeologica Carpathica* 53, 2018, 7–28.

Delagnes/Rendu 2011 — A. Delagnes/W. Rendu: Shifts in Neandertal mobility, technology and subsistence strategies in Western France. *Journal of Archaeological Science* 38, 2011, 1771–1783.

Dobosi 2011 — V. Dobosi: Obsidian use in the Palaeolithic in Hungary and adjoining areas. *Natural Resource Environment and Humans* 1, March 2011, 83–95.

Féblot-Augustins 1993 — J. Féblot-Augustins: Mobility strategies in the Late Middle Palaeolithic of Central Europe and Western Europe: elements of stability and variability. *Journal of Anthropological Archaeology* 12/3, 1993, 211–265.

[2] I would like to thank Małgorzata Kot, PhD., from the Institute of Archaeology of the University of Warsaw for suggesting this hypothesis to me.

Féblot-Augustins 1999 J. Féblot-Augustins: La mobilité des groupes paléolithiques. *Bulletins et Mémoires de la Société d'anthropologie de Paris* 11/3–4, 1999, 219–260.

Mathias/Bourguignon 2020 C. Mathias/L. Bourguignon: Cores-on-flakes and ramification during the middle palaeolithic in Southern France: A gradual process from the early to late middle palaeolithic? *Journal of Archaeological Science: Reports* 31, 2020, 1–23. DOI: https://doi.org/10.1016/j.jasrep.2020.102336

Márquez et al. 2013 B. Márquez/M. Mosquera/E. Baquedano/A. Pérez-González/J. Panera/J. A. Espinosa/J. L. Arsuaga/J. Gómez: Evidence of a Neanderthal-made quartz-based technology at Navalmaíllo Rockshelter (Pinilla Del Valle, Madrid Region, Spain). *Journal of Anthropological Research* 69, 2013, 373–395. DOI: https://doi.org/10.3998/jar.0521004.0069.306

Neruda/Kaminská 2015 P. Neruda/Ľ. Kaminská: Neanderthals at the Open-Air Site of Bojnice III: The Issue of "Missing" Artifacts. In: N. J. Conard/A. Delagnes (eds.): *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*, Vol. IV. Tübingen 2015, 205–226.

Pacheco et al. 2012 F. G. Pacheco/F. J. G. Guzmán/J. M. Gutiérrez López/A. Santiago Pérez/C. Finlayson/J. Rodríguez Vidal/G. Finlayson/D. A. Fa: The tools of the last Neanderthals: Morphotechnical characterisation of the lithic industry at level IV of Gorham's Cave, Gibraltar. *Quaternary International* 247, 2012, 151–161. DOI: https://doi.org/10.1016/j.quaint.2011.02.026

Rácz 2013 B. Rácz: Main raw materials of the palaeolithic in transcarpathian Ukraine: geological and petrographical overview. In: Z. Mester (ed.): *The lithic raw material sources and interregional human contacts in the Northern Carpathian regions*. Kraków – Budapest 2013, 131–147.

Romagnoli et al. 2018 F. Romagnoli/B. Gómez de Soler/A. Bargalló/M. G. Chacón/M. Vaquero: Here and now or a previously planned strategy? Rethinking the concept of ramification for micro-production in expedient contexts: Implications for Neanderthal socio-economic behaviour. *Quaternary International* 474 B, 2018, 168–181. DOI: https://doi.org/10.1016/j.quaint.2017.12.036

Sorensen/Claud/Soressi 2018 A. C. Sorensen/E. Claud/M. Soressi: Neandertal fire-making technology inferred from microwear analysis. *Scientific Reports* 8/1, 2018, 1–16. DOI: https://doi.org/10.1038/s41598-018-28342-9

Sujkowski 1932 Z. Sujkowski: Radiolarites des Karpates Polonaises Orientales et sur leur comparaison avec les radiolarites de la Tatra. *Sprawozdania Państwowego Instytutu Geologicznego* 7, 1932, 97–168.

Turq et al. 2017 A. Turq/J. P. Faivre/B. Gravina/L. Bourguignon: Building models of Neanderthal territories from raw material transports in the Aquitaine Basin (Southwestern France). *Quaternary International* 433, 2017, 88–101. DOI: https://doi.org/10.1016/j.quaint.2016.02.062

Valde-Nowak/Cieśla 2020 P. Valde-Nowak/M. Cieśla: Models of raw materials exploitation as an indicator of Middle Palaeolithic mobility. Case studies from uplands of northern Central Europe. In: J. Cascalheira/A. Picin (eds.): *Short-term occupations in Paleolithic archaeology: interdisciplinary contributions to archaeology*. Interdisciplinary Contributions to Archaeology 2020, 105–120.

Valde-Nowak/Nadachowski 2014 P. Valde-Nowak/A. Nadachowski: Micoquian assemblage and environmental conditions for the Neanderthals in Obłazowa Cave, Western Carpathians, Poland. *Quaternary International* 326/327, 2014, 146–156. DOI: https://doi.org/10.1016/j.quaint.2013.08.057

Valde-Nowak/Nadachowski/Madeyska 2003 P. Valde-Nowak/A. Nadachowski/T. Madeyska (eds.): *Obłazowa Cave. Human activity, stratigraphy and paleoenvironment*. Polska Akademia Nauk. Kraków 2003.

Vaquero et al. 2015 M. Vaquero/A. Bargalló/M. G. Chacón/F. Romagnoli/P. Sañudo: Lithic recycling in a Middle Paleolithic expedient context: Evidence from the Abric Romani (Capellades, Spain). *Quaternary International* 361, 2015, 212–228. DOI: https://doi.org/10.1016/j.quaint.2014.05.055

Dr. Magda Cieśla
Instytut Archeologii
Uniwersytet Jagielloński
Ul. Gołębia 11
PL – 31-007 Kraków
magda.ciesla@uj.edu.pl

Zachować czy wyrzucić?

Dlaczego neandertalczycy wykorzystywali niektóre typy skał w produkcji narzędzi

Magda Cieśla

Streszczenie

W badaniach nad paleolitem środkowym zagadnienie wykorzystania różnorodnych skał przez neandertalczyków podsumowywane jest zazwyczaj stwierdzeniem o dominującym znaczeniu surowców lokalnych. Badania z ostatnich lat potwierdzają wprawdzie użytkowanie w paleolicie środkowym Europy surowców transportowanych nawet z relatywnie dużych odległości, jednak ich znaczenie dla podstaw gospodarki surowcowej można uznać za marginalne.

Zadokumentowane są jednak też sytuacje, gdy w inwentarzach pojawiają się skały nietypowe, lub też niektóre skały są nietypowe dla zastosowanego celu. Są to sytuacje gdy obok dobrej jakości łatwo dostępnych skał lokalnych opracowywane były również skały złej jakości; gdy transport z większych odległości obejmował skały nie nadające się do obróbki – zbyt małe lub zbyt spękane, lub nieodpowiednie do opracowania. Wreszcie, do sytuacji nietypowych należy zaliczyć transport skał z dużych odległości, np. przekraczających odległość 100 km w linii prostej.

Analiza tych sytuacji wymaga uwzględnienia całej gamy zjawisk: dostępności surowca w różnych warunkach środowiska, możliwego wielokrotnego przerabiania narzędzi kamiennych, rozgałęziania procesu produkcji a także charakteru i stanu zachowania artefaktów w danym inwentarzu.

Wymienione powyżej zagadnienia zostały omówione w oparciu o analizę materiałów z sekwencji środkowo paleolitycznej z Jaskini w Obłazowej (gm. Nowy Targ, Polska) odkrytych przed rokiem 2018. Dostępne w relatywnie niewielkiej odległości od stanowiska były wychodnie dobrej jakości surowca: radiolarytu. Bezpośrednio przy stanowisku, w dolinie rzeki dostępne były w dużych ilościach skały gorszej jakości.

Wśród przedmiotów ze skał importowanych warto wymienić pojedyncze, niewielkie artefakty obsydianowe. Ich obecność na stanowisku dokumentuje transport surowca z południowych obrzeży Karpat Zachodnich. Inny typ skały importowanej na stanowisko to pojawiający się przeważnie w młodszych poziomach osadniczych krzemień jurajski. Występuje on w formie odłupków i łusek, odkryto jednak również zgrzebło wykonane z niego i silnie wyświecony, być może naturalny fragment krzemienia. Do importów zaliczyć należy prawdopodobnie również *limace* z najmłodszego poziomu środkowo paleolitycznego. Nie udało się nadal ustalić z jakim rodzajem surowca mamy do czynienia, co utrudnia interpretację.

Jednocześnie na stanowisku zadokumentowana jest obróbka lokalnych piaskowców, skał pozbawionych cech odpowiednich dla produkcji narzędzi kamiennych.

Określenie roli takich artefaktów w *chaîne opératoire* danego stanowiska jest zadaniem utrudnionym m. in. ze względu na wpływ czynników podepozycyjnych. Dodatkowo, zrozumienie ich roli wymagałoby dostępu do licznego materiału porównawczego, co w kontekście małej ilości takich opracowań bywa utrudnione. Można rozważać wykorzystanie poszczególnych opisanych elementów w specjalistycznych zadaniach typu krzesanie ognia lub wykorzystanie jako specjalnie przygotowane tłuczki. Szczególnie w przypadku zabytków z importowanych surowców, można rozważać ich wykorzystanie w ramach tzw. rozgałęzionej produkcji (ramifikacji). Wszelkie tego typu sugestie wymagają jednak dalszych badań.

Ryc. 1. Karpackie surowce kamienne. Typy skał wykorzystywane na stanowisku w Jaskini w Obłazowej. 1 – krzemień jurajski podkrakowski; 2 – radiolaryt pieniński; 3, 4 – obsydian słowacki; 5 – prawdopodobna lokalizacja złóż skrzemienionego piaskowca znalezionego w warstwie XIII (rysunek M. Cieśla).
Ryc. 2. Jaskinia w Obłazowej, warstwa XIX. Wybrane artefakty z obsydianu z inwentarzy środkowopaleolitycznych (foto M. Cieśla).
Ryc. 3. Jaskinia w Obłazowej, warstwa XIX. Widok przetartej powierzchni artefaktu z obsydianu (foto M. Cieśla).
Ryc. 4. Jaskinia w Obłazowej, warstwa XIX. Artefakt wykonany z krzemienia jurajskiego podkrakowskiego (foto M. Cieśla).
Ryc. 5. Jaskinia w Obłazowej, warstwa XVb. Artefakt wykonany z krzemienia jurajskiego podkrakowskiego (rysunek i foto M. Cieśla).
Ryc. 6. Jaskinia w Obłazowej, warstwa XVb. Artefakt wykonany z lokalnego piaskowca (rysunek E. Osipowa, foto M. Cieśla).
Ryc. 7. Jaskinia w Obłazowej, warstwa XIII. Artefakt wykonany z nieokreślonego surowca (skrzemieniony piaskowiec?; rysunek i foto M. Cieśla).

Tabela 1. Jaskinia w Obłazowej. Surowce kamienne w inwentarzach środkowopaleolitycznych. Legenda: R – radiolaryt; Q – kwarc; QZ – kwarcyt; G – granit; F – krzemień; O – obsydian; C – zlepieniec; S – piaskowiec; HS – rogowiec; L – wapień; UR – surowiec nieokreślony; SSA – nieokreślony skrzemieniony piaskowiec.
Tabela 2. Obsydian w Jaskini w Obłazowej. Liczba artefaktów i ich waga w poszczególnych warstwach.
Tabela 3. Krzemień jurajski z Jaskini w Obłazowej. Liczba artefaktów i ich waga w poszczególnych warstwach.

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 19–30

FOUND IN A BOX

Unknown bifacial leaf point from the Koziarnia Cave

Małgorzata Kot – Natalia Gryczewska

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.2

Keywords: Polish Jura, leaf point industries, cave mining, archive collection, Ferdinand Römer

Abstract: Throughout the 19th century, caves of the Polish Jura have become of interest to both businessmen and amateur archaeologist. The landlord of Ojców, Jan Zawisza, explored the caves in search of traces of ancient man and conducted his excavations which were subsequently published. At the same time, neighbouring landowners started cooperation with the Prussian Mining Office and exploited caves for their soils, rich in organic matter, including phosphoric acid. Sediments removed from the caves were later sold as a natural field fertiliser. Industrial mining of the caves brought to the light numerous artefacts and bones of extinct animals, which were entrusted to the palaeontologist Ferdinand Römer, director of Mineralogical Museum at Breslau University. The assemblage from Nietoperzowa Cave, the first cave around Ojców to be mined for soil, became the starting point of Römer's collection and his fieldworks in the area. Koziarnia Cave was one of the caves exploited on request of the landowner and later excavated on Römer's behalf by Oskar Grube. Among other artefacts, a single leaf point was found and published from Koziarnia Cave. Many years later, when a new transitional industry – Jerzmanowician – was identified, based on the mentioned leaf point, the cave has been included into a group of scarce cave sites attributed to the new Middle/Upper Palaeolithic transitional entity. In the second half of the 20th century, Waldemar Chmielewski conducted extensive fieldworks at the site but failed to find other artefacts that could be linked with the leaf point published by Römer.
Meanwhile, the only bifacial leaf point from Koziarnia Cave has been lost. However, recently conducted studies of Römer's collection brought into light one more bifacial leaf point from Koziarnia Cave. This paper aims to show this previously unpublished leaf point with the use of modern analytical approach in order to present new evidence of Jerzmanowician occupation in the Koziarnia Cave.

INTRODUCTION

Polish Jura, a karstic region situated in Southern Poland (Fig. 1), has a long history of archaeological research. First amateur archaeological fieldworks in the caves were conducted by Jan Zawisza, the owner of Ojców castle, since 1871 (*Zawisza 1871*; *1873*; *1874a*; *1874b*). Since then over 210 archaeological cave sites have been discovered and studied in the region. In the second half of the 19th century, along with scientific interest, a more utilitarian one appeared. Cave sediments were exploited and used as field fertiliser (Fig. 2: a). In majority, local farmers used cave sediments for their own purposes (*Wojenka 2012*), although several caves, including Koziarnia and Nietoperzowa Caves were industrially exploited by their owners (Fig. 1: c). It was at that time, when the first bifacial leaf points, among other artefacts, were found, first in Nietoperzowa Cave and later in Koziarnia Cave. Almost a century later from the name of a village Jerzmanowice, where Nietoperzowa Cave is located, originated a name of a new Middle/Upper Palaeolithic transitional entity – called Jerzmanowician. W. Chmielewski first introduced the term in 1961 (*Chmielewski 1961*) based on his archaeological fieldworks conducted in Nietoperzowa Cave. Jerzmanowician was soon included in one of the transitional industries distinguished in Europe, called Lincombian-Ranisian-Jerzmanowician (LRJ; *Desbrosse/Kozłowski 1988*). The distinctive features of this industry include the use of double platform cores and production of leaf points on blades with minimal bifacial shaping. To this day there are only several sites in Poland that could be unequivocally linked with Jerzmanowician (*Kowalski 1967*; *1969*; *Kowalski et al. 1965*; *Krajcarz et al. 2018*; *Lorenc 2006*; *Madeyska 1992*). One of them was Koziarnia Cave, where a single bifacial leaf point was found and published by

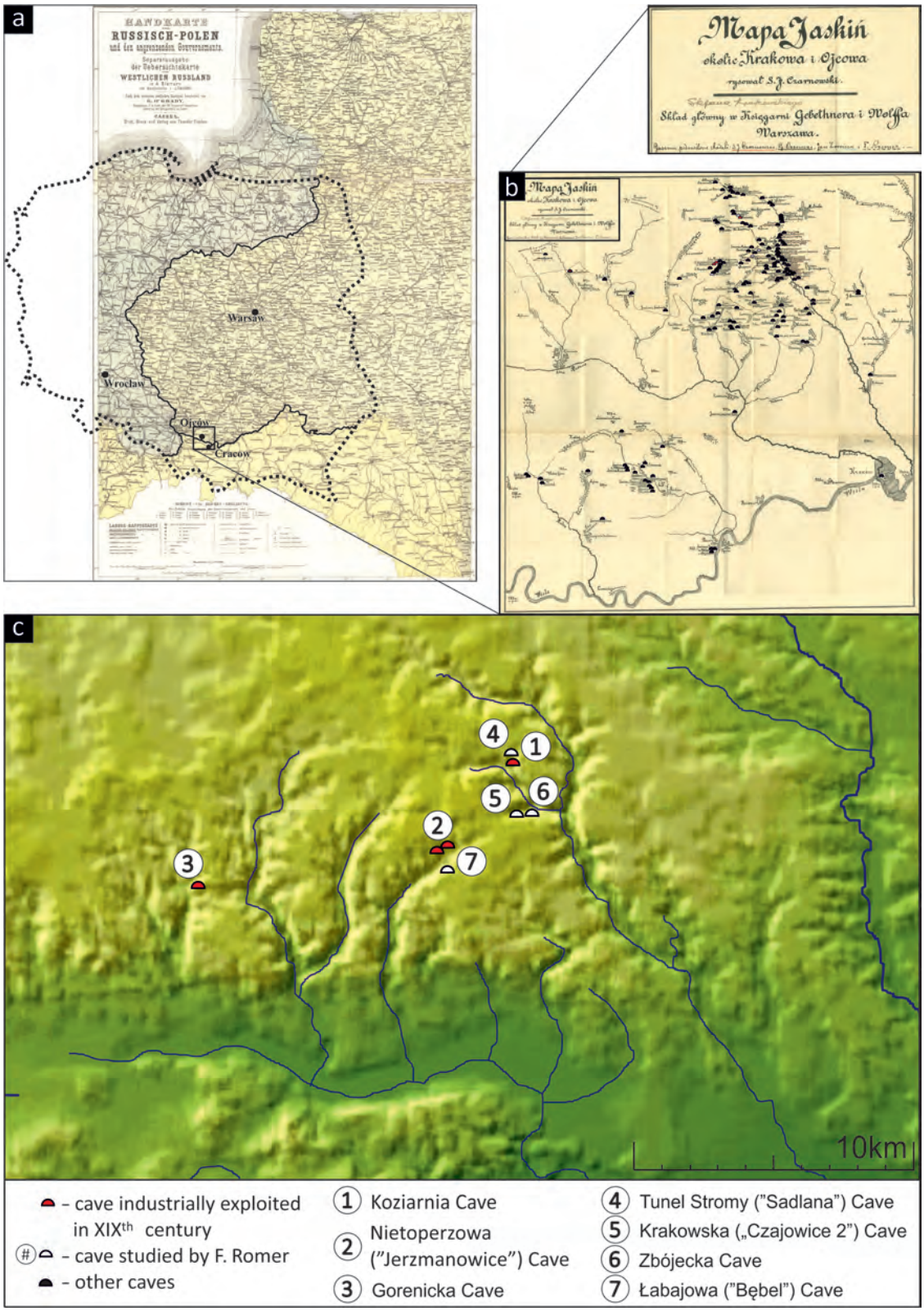


Fig. 1. The localisation of the caves mentioned in the text. a – current map of Poland plotted on the map of Western Russia and neighbouring countries from 1890. Solid lines and colours indicate partitions: blue colour – Prussian Partition, green – Russian Partition, yellow – Austrian Partition; b – scan of a personal exemplar of a "Map of caves around Cracow and Ojców" published by *S. J. Czarnowski* (*1911*) belonging to S. Krukowski. Map with S. Krukowski personal notes available from the archive of the State Archaeological Museum in Warsaw: http://193.39.71.4/atom/index.php/spuscizna-stefana-krukowskiego; isad, inventory number: PL PMA 1-1-5-1-13-1; c – map of caves studied by F. Römer.

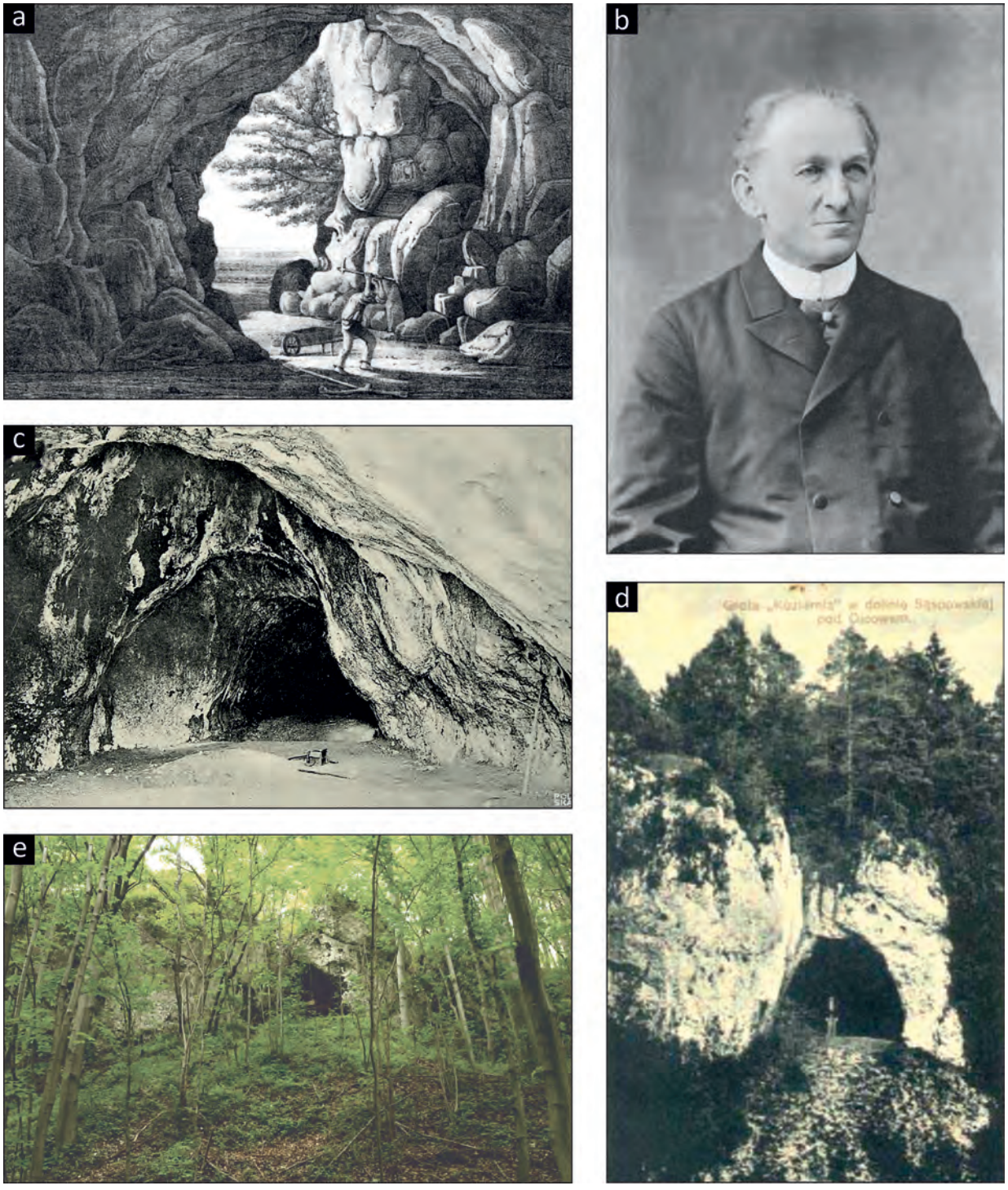


Fig. 2. a – cave sediment exploitation in the 19th century, cave in Złoty Potok drawn by J. Cegliński (after: *Wójcik 2004*, 271, fig. 2); b – Ferdynand Römer (after: *Simonds 1902*); c – Koziarnia Cave around 1910, the pit visible in the middle part may be a remnant of the F. Römer fieldworks in 1879; d – postcard dated to 1927 illustrating the entrance to the Koziarnia Cave; e – Entrance to the Koziarnia Cave in 2018, seen from the bottom of the Koziarnia Gorge (photo by M. Bogacki).

F. Römer (*1883*; *1884*). The fieldworks in Koziarnia Cave conducted by W. Chmielewski in 1958–1962 aimed at finding more traces of Jerzmanowician occupation in the cave (*Chmielewski et al. 1967*). Even though he managed to determine 22 geological layers in the cave, none of them could be attributed to Jerzmanowician. For this reason, until now, the Jerzmanowician occupation in Koziarnia Cave could be confirmed solely on the basis of a single bifacial leaf point (Fig 3: 1a, 1b).

The recently launched project focused on prehistoric settlement in Sąspów Valley (*Kot et al. 2019*), where Koziarnia Cave is located, created an opportunity to get back to the old collections and obtain new insights into transitional industries in Poland (*Kot et al. 2021*). One of the restudied collections was Römer's one. Interestingly, during the archive investigation, several unpublished artefacts have been found in the collection. Among them, another bifacial leaf point from Koziarnia Cave. The paper aims at studying this previously unpublished bifacial leaf point from Koziarnia with use of the modern analytical approach in order to present new evidence of Jerzmanowician occupation at the site.

RÖMER'S COLLECTION

Ferdinand Römer, born 1818 in Hildesheim in Lower Saxony, was a palaeontologist and geologist (Fig. 2: b). He received his doctoral degree from University in Berlin. In 1845 he travelled to America to study its geology and palaeontology. He focused mainly on the geology of Texas. Till now, he is used to be named the "Father of Geology of Texas" (*Simonds 1902*). In 1855 he was offered a position of ordinary professor at the Schlesische Friedrich-Wilhelms-Universität in Breslau (Wrocław), where he worked as head of the Department of Geology and Mineralogy till his death in 1891 (*Simonds 1902*). In 1868 he established the Mineralogical Museum of Royal University of Breslau. He always sought to improve the paleontological collection at the University. Opportunity for that presented itself when he was notified of industrial mining of cave deposits in Polish Jura (*Römer 1875).*

The region rich in caves suitable for exploitation was at that time part of the Russian Empire (Fig. 1: a), but the mining activities were conducted or coordinated by the local landlords, Prussian businessmen and Upper Silesian Mining Office. Sediments were transported from the Russian territory to Prussia and then sold as a field fertiliser. Cave soils were said to contain guano, animal bones and carcasses which made them rich in phosphoric acid. Chemical analyses of the cave sediments made by Dr. Fr. Hulwa, confirmed a high concentration of phosphonates in the exploited soil (*Römer 1879*, 47).

It is not clear how F. Römer obtained the information about archaeological and palaeontological discoveries made during the cave sediment exploitation. At that time caves around Ojców (e.g. Mamutowa Cave, Zbójecka Cave) were explored by Jan Zawisza, the owner of Ojców, who not only conducted his excavations but also published his results (*Zawisza 1871*; *1874*). In 1874 Römer visited Nietoperzowa Cave, which was at this time exploited by O. Ogrowsky, a businessman from Breslau, and the mine foreman named Tischler, who acquired the right to work in the Nietoperzowa Cave and another cave nearby (*Römer 1875*; *1879*). In order to enrich the Mineralogical Museum collection, Römer made an agreement with Ogrowsky to select the bones and artefacts during the future works (*Römer 1879*, 48, 49). In 1878 Römer started his investigations in Nietoperzowa Cave, funded by Königl. Preussische Cultusministerium (Royal Prussian Ministry of Culture). He also visited Jan Zawisza, who at that time was exploring Mamutowa Cave (*Römer 1884*, 11). Zawisza's rich findings of fossil bones, but also meticulous methods undoubtedly influenced Römer, convincing him of cave sediments potential and value in palaeontological research.

Encouraged by the obtained results, Römer sought to excavate beyond Nietoperzowa Cave. Therefore, in 1879 he acquired further funding from Königliche Akademie der Wissenschaften (Royal Academy of Sciences) in Berlin and studied several more caves (i.e. Koziarnia Cave, Zbójecka Cave, Krakowska Cave (called by him Czajowice 2 Cave), Tunel Stromy Cave (called by him Sadlana Cave), Łabajowa Cave (called by him Bębel Cave) and Gorenicka Cave (Fig. 1: c; *Römer 1884*, 17). The person entrusted with leading the excavations and collecting material at his request was Oscar Grube, as he was unable to lead and supervise the excavations himself (*Römer 1884).* According to *S. J. Czarnowski* (*1910*), Grube was a Prussian businessman involved in industrial mining of cave sediments, but according to *P. Socha* and *K. Stefaniak* (*2006*, 16), he was a director of Upper Silesian Prussian Mining Office.

After the completion of fieldwork and ensuing description and publication, all the collected materials, including artefacts and fossil bones, were deposited in the Mineralogical Museum of the University of Breslau. Currently, Römer's collection is dispersed. Animal bones are stored in the Palaeontology Department of the Institute of Zoology at the University of Wrocław. A few dozen of stone, bone, metal and pottery artefacts are stored in the Archaeological Museum in Wrocław. Some artefacts have been lost including the published bifacial leaf point from Koziarnia Cave.

KOZIARNIA CAVE

Koziarnia Cave is situated in the southern part of the Polish Jura (Fig. 1). It is located on the left slope of Koziarnia Gorge, which is part of Sąspów Valley. The entrance of the cave is 5-metre-high and heads SW. It opens up onto the main chamber, which covers an area of over 100 m^2 and then turns into a single 40-metre-long gallery narrowing toward the end of the cave (Fig. 2: c–e).

In the second half of the 19th century, Koziarnia Cave belonged to the Lordship of Pieskowa Skała named Mieroszewski, and it was on his request that cave was excavated in order to procure fertiliser in 1877 (*Römer 1884*, 9). Römer mentions that the sediments were sieved to separate soil from stones.

O. Grube conducted fieldworks in Koziarnia Cave on behalf of F. Römer in 1879. Römer described in his publication several artefacts found in the cave including:

- flint tools, among them a leaf point (Fig. 3: 1a, 1b; *Römer 1883*, pl. XXII (I): 7),
- spindle whorls (Fig. 3: 2; *Römer 1883*, pl. XXII (I): 12),
- bronze ring (Fig. 3: 3; *Römer 1883*, pl. XXVII (VI): 5),
- glass beads (Fig. 3: 4, 5; *Römer 1883*, pl. XXVI (V): 1, 2),
- stone polishers (Fig. 3: 6; *Römer 1883*, pl. XXVI (V): 8),
- bone needle (Fig. 3: 7; *Römer 1883*, pl. XXV (IV): 10),
- silver coin (Fig. 3: 8; *Römer 1883*, pl. XXVII (VI): 7a, b),
- pottery vessels (Fig. 3: 9; *Römer 1883*, pl. XXVII (VI): 2),
- bone borer (Fig. 3: 10; *Römer 1883*, pl. XXIII (II): 7),
- iron spearhead (Fig. 3: 11; *Römer 1883*, pl. XXVII (VI): 8),
- perforated tusk of *Ursus spalaeus* (Fig. 3: 12; *Römer 1883*, pl. XXV (IV): 7).

Interestingly, among the artefacts from Römer's collection, some have neither been studied nor published. In his collection one may find the following unpublished artefacts from Koziarnia Cave: two spindle whorls, two metal arrowheads, a fragment of antler with incisions, undistinguishable metal artefact, pottery piece, three bone tools with traces of processing, single bone splinter and a single flint leaf point. Recently two of the mentioned bone tools were analysed and radiocarbon dated (*Kot et al. 2021*).

METHODS

The artefact under scrutiny was submitted to a detailed morpho-technological description based on the scar pattern analysis (working step analysis; *Bar-Yosef/Van Peer 2009*) which is currently a standard method for the analysis of bifacial tools production and reduction processes. The method, as proposed by German researchers over 20 years ago (*Pastoors et al. 2015*; *Pastoors/Schäfer 1999*; *Perreault et al. 2013*; *Richter 2001*), relies on the reconstruction of *chaîne opératoire* derived from evaluating the characteristics, spatial distribution and chronology of scar pattern visible on the tool. The method is successfully used for the analysis of bifacial forms such as asymmetrical knives (*Jöris 2001*; *Kot/Richter 2012*; *Urbanowski 2004*), leaf points (*Kolobova et al. 2019*; *Kot 2014*; *2017*), handaxes (*Boëda 2001*; *2013*) as well as for debitage (*Bar-Yosef/Van Peer 2009*; *Przeździecki 2019*).

LEAF POINT ANALYSIS

The analysed tool is made of the cortical blade. It is 51 mm long, 19 mm wide and 9 mm thick (Fig. 4: a, b). The artefact was made on flint. Over 50% of its dorsal surface is covered with cortex; moreover, the tool is highly patinated, which renders it almost ineligible for detailed raw material identification. The glossy surface patina covers almost the entire artefact. The edges display numerous postdepositional damage traces such as notches, blunting removals and truncations (Fig. 4: c). Only a small fragment of the retouched edge does not exhibit any postdepositional damage. The postdepositional damage areas are either not patinated or patinated to a degree which allows for observing the original dark-grey colouring of the flint mass, indicating most probably its local Jurassic origin.

The tool manufacturing process can be divided into the following stages (Fig. 4: d, e):

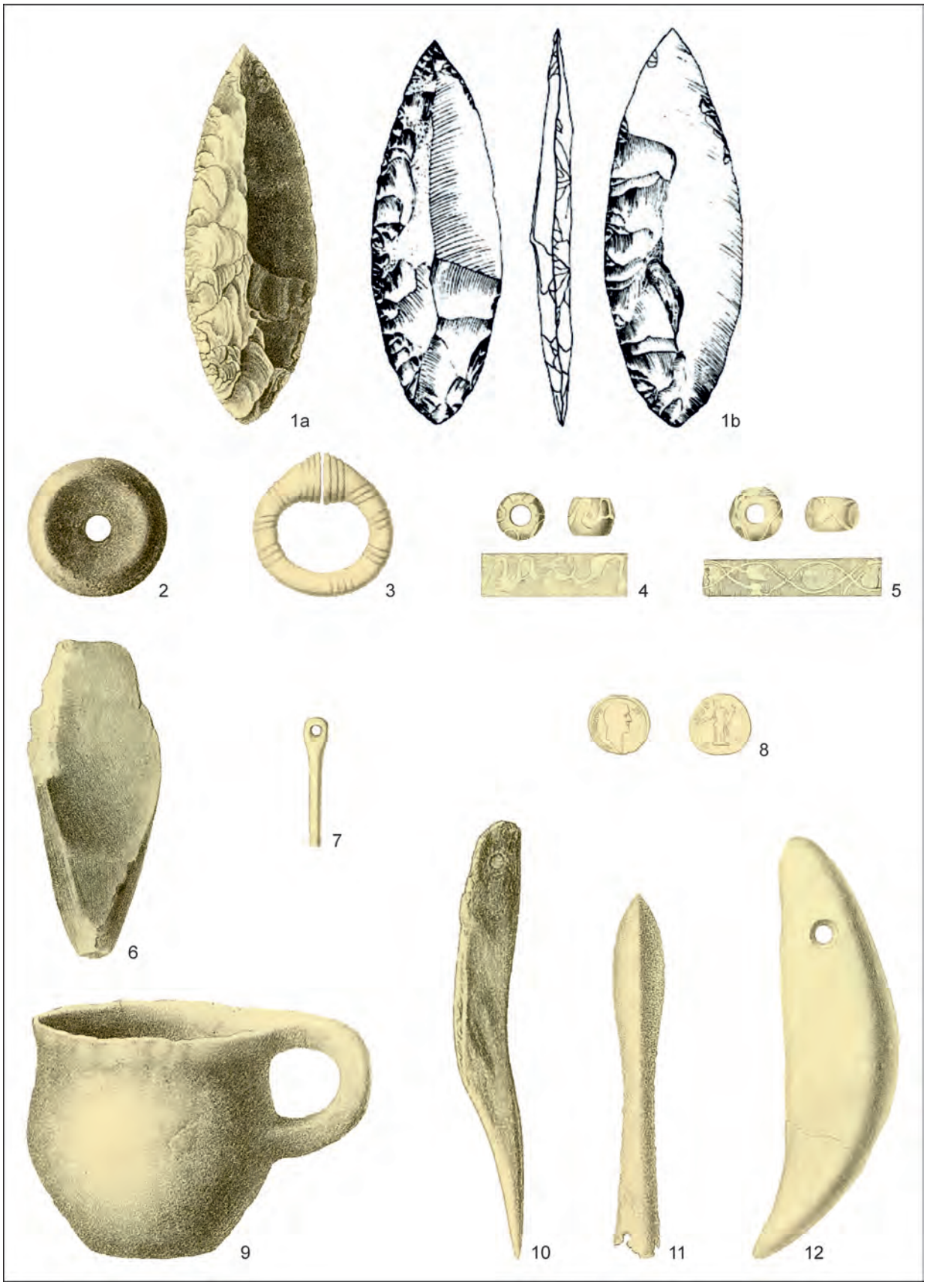


Fig. 3. 1a, 2–12 – artefacts from Koziarnia Cave published by *F. Römer* (*1883; 1884*); 1b – drawing of both sides of bifacial leaf point from Koziarnia Cave published by *W. Chmielewski et al.* (*1967*). The leaf point must not have been lost then. No scale.

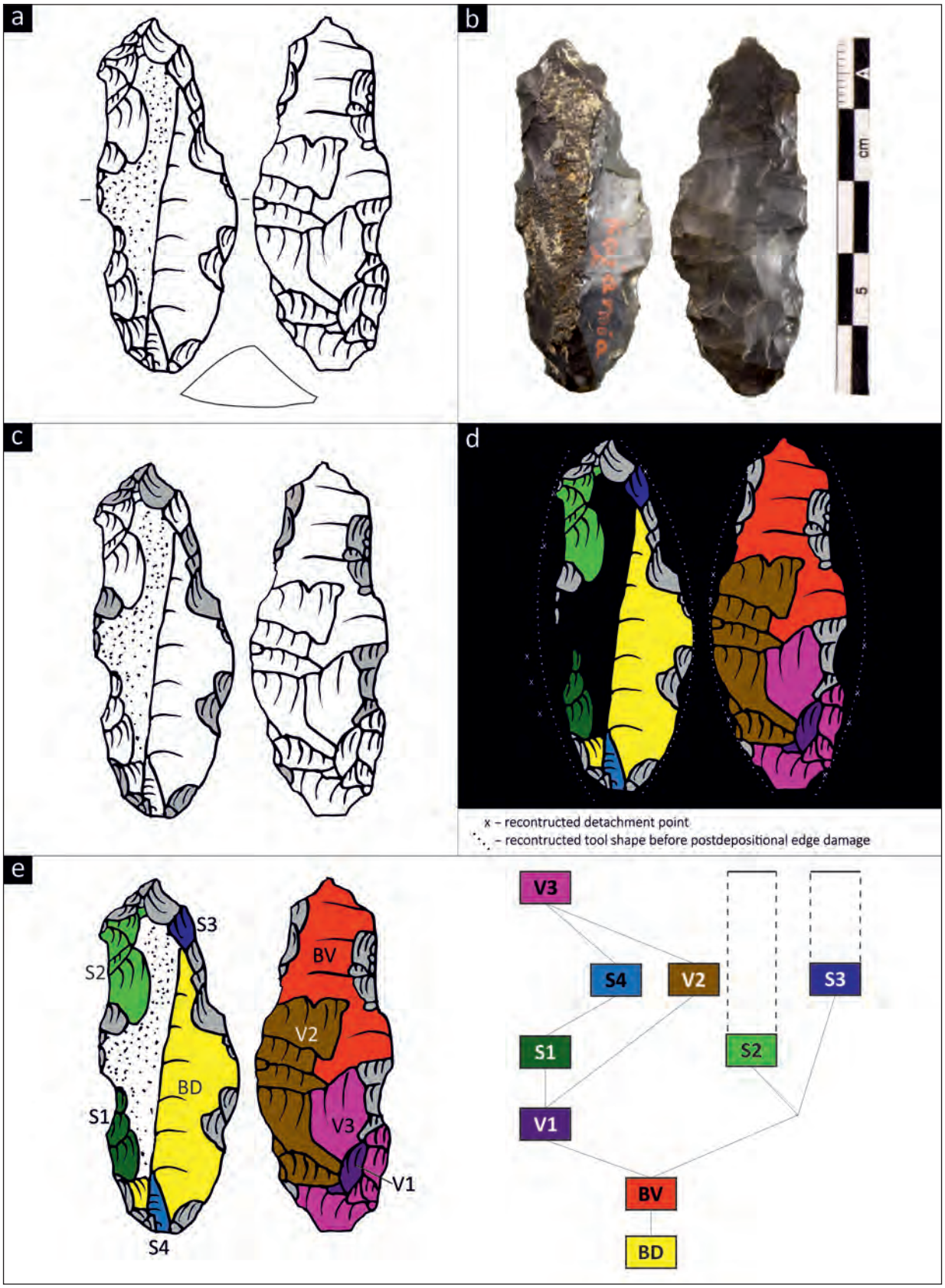


Fig. 4. Unpublished leaf point from Koziarnia Cave found recently in Römer's collection. a, b – drawing and photo of the leaf point; c – state of preservation; postdepositional retouch marked in grey; d, e – scar pattern analysis results with a diagram of chronological relation between subsequent series of removals (drawing by M. Kot).

Blank detachments (BD, BV)

The blade has on its dorsal side a negative of a previous blade detached from the same flint nodule. Both blades were detached from the same striking platform. Due to the further ventral thinning, no observations can be done on the proximal part of the original blank.

Tool thinning in its basal ventral part (V1)

One of the first stages of tool preparation was a detachment of flat removals on the ventral side of the blank in its proximal part. Its aim was thinning and flattening of the near-the-base part of the blank, as well as the reduction of the bulb.

Edge shaping (S1–S4)

This stage is only partially represented on the tool due to the significant postdepositional damages of the edges. Only several scars of semi-steep and semi-flat removals detached on a dorsal side of the tool can be attributed to this particular stage of tool production. Still, one can observe removals detached angularly along the edges, which aimed at shaping the convexity of the edges.

Additional thinning in the basal ventral part (V2, V3)

Already after the edge shaping at least near the base, the ventral side was knapped again. The last stage of the tool preparation is a series of flat removals detached near the base. The removals aimed at final thinning and flattening the near-the-bulb part of the blank. Still, due to postdepositional damages, one cannot exclude, that the near-the-tip part was shaped (S2, S3) even after the ventral thinning.

DISCUSSION

The state of preservation of the described tool is considerably different from the other leaf point found in Koziarnia, especially due to the presence of such an intensive postdepositional retouch. As long as the artefact is missing, one can base his assumptions solely on the drawings. Still, the drawn sharp tip and edges (Fig. 3: 1b) as well as lack of steep multidirectional marginal removals, seem to indicate a lack of such invasive postdepositional damage, as seen on the recently discovered artefact.

On the other hand, one should take into consideration, that the majority of the artefacts found in Koziarnia both by W. Chmielewski, and recently by M. Kot (*Kot et al.* 2*021*), show a high degree of postdepositional damages. The postdepositional edge retouches were especially abundant both in the lowermost strata (layer L) representing Middle Palaeolithic settlements as well as in the upper ones, up to layer D, which was recently connected with Jerzmanowician settlement. The Gravettian artefacts found in the uppermost part of the cross-section, i.e. layers K and K' are less postdepositionally damaged (*Kot et al.* 2*021*). Similar postdepositional damage as well a glossy patina is present, e.g. on a double platform blade found by W. Chmielewski in layer 17 of trench IX, which can be correlated with layer D from the recent fieldworks.

Regardless of the intensive postdepositional damages of the edges, the knapping scheme of the tool can be at least partially reconstructed, showing a focus on ventral thinning and surface flattening in the bulbar part of the blade. As a result of such an intensive ventral thinning, more than 50% of the ventral surface is covered with removals, whereas the dorsal edge shaping removals cover no more than 10% of the upper surface. Such an extensive treatment of the ventral surface of blade blanks is a distinctive feature of the LRJ leaf points. One can observe such intensive ventral thinning especially in the proximal part of the blades, but the artefacts with invasive flat thinning in the distal part of the tool are also present (*Bolus 2012*; *Flas 2011*; *Chmielewski 1961*; *Jacobi/Debenham/Catt 2007*; *Pope et al. 2013*). Also use of cortical blades for leaf point production is common in LRJ, e.g. in Nietoperzowa Cave (*Chmielewski 1961*).

CONCLUSION

As long as the described tool has no clear stratigraphic context, its cultural affiliation should always be treated with caution. Still, taking into consideration the state of preservation of the leaf point, distinct knapping scheme used for its production, and previously obtained data from Koziarnia Cave, we can conclude, that the artefact is a heavily posdepositionally damaged Jerzmanowician leaf point. Therefore we can confirm the presence of at least two Jerzmanowician leaf points in Koziarnia Cave, what goes well with the recent results presenting the traces of Jerzmanowician occupation connected with layer D (layer 15 by *Chmielewski et al. 1967*).

Acknowledgements

The project is financed by the National Science Centre, Poland, grant: 2016/22/E/HS3/00486. The authors would like to thank the Archaeological Museum in Wrocław and especially Krzysztof Demidziuk and Magdalena Szczecińska for their kind help and providing access to the collection.

Translated by authors

BIBLIOGRAPHY

Bar-Yosef/Van Peer 2009 — O. Bar-Yosef/P. Van Peer: The Chaîne Opératoire Approach in Middle Paleolithic Archaeology. *Current Anthropology* 50, 2009, 103–131.

Boëda 2001 — E. Boëda: Détermination des unités techno-fonctionnelles de pièces bifaciales provenant de la couche acheuléenne C'3 base du site de Barbas I. *Les industries à outils bifaciaux du Paléolithique moyen d'Europe occidentale* 98, 2001, 51–76.

Boëda 2013 — E. Boëda: *Techno-logique & Technologie: une Paléohistoire des objets lithiques tranchants.* Archéoéditions 266. Prigonrieux 2013.

Bolus 2012 — M. Bolus: Blattförmige Schaber, Limaces, Blattspitzen. In: H. Floss (ed.): *Steinartefakte Vom Altpaläolithikum bis in die Neuzeit*. Tübingen 2012, 309–326.

Chmielewski 1961 — W. Chmielewski: *Civilisation de Jerzmanowice*. Wrocław – Warszawa – Kraków 1961.

Chmielewski et al. 1967 — W. Chmielewski/K. Kowalski/T. Madeyska-Niklewska/L. Sych: Wyniki badań osadów jaskini Koziarni w Sąspowie pow. Olkusz. *Folia Quaternaria* 26, 1967, 1–69.

Czarnowski 1910 — S. J. Czarnowski: *Dolina Bętkowska i jej zabytki przeddziejowe*. Polska Przedhistoryczna. Warszawa – Kraków 1910.

Czarnowski 1911 — S. J. Czarnowski: *Jaskinie okolic Krakowa i Ojcowa i ich zabytki przeddziejowe*. Polska Przedhistoryczna. Warszawa – Kraków 1911.

Desbrosse/Kozłowski 1988 — R. Desbrosse/J. K. Kozłowski: *Hommes et climats a` l'âge du mammouth. Le Palèolithique supèrieur d'Eurasie centrale*. Paris 1988.

Flas 2011 — D. Flas: The Middle to Upper Paleolithic transition in Northern Europe: the Lincombian-Ranisian-Jerzmanowician and the issue of acculturation of the last Neanderthals. *World Archaeology* 43, 2011, 605–627.
DOI: https://doi.org/10.1080/00438243.2011.624725

Jacobi/Debenham/Catt 2007 — R. Jacobi/N. Debenham/J. Catt: A Collection of Early Upper Palaeolithic Artefacts from Beedings, near Pulborough, West Sussex, and the Context of Similar Finds from the British Isles. *Proceedings of the Prehistoric Society* 73, 2007, 229–326.

Jöris 2001 — O. Jöris: *Der spätmittelpaläolithische Fundplatz Buhlen (Grabungen 1966-69): Stratigraphie, Steinartefakte und Fauna des oberen Fundplatzes*. Bonn 2001.

Kolobova et al. 2019 — K. A. Kolobova/A. V. Shalagina/V. P. Chabai/S. V. Markin/A. I. Krivoshapkin: Signification des technologies bifaciales au Pale´olithique moyen des montagnes de l'Altaï. *L'Anthropologie* 123/2, 2019, 276–288.
DOI: https://doi.org/10.1016/j.anthro.2019.06.004

Kot 2014 — M. Kot: The earliest Palaeolithic bifacial leaf points in Central and Southern Europe: Techno-functional approach. *Quaternary International* 326–327, 2014, 381–397.
DOI: https://doi.org/10.1016/j.quaint.2013.10.030

Kot 2017 — M. Kot: Bifacial and unifacial technology: A real difference or a problem of typo–technological approach? The example of the Ehringsdorf assemblage. *Quaternary International* 428A, 2017, 66–78.
DOI: https://doi.org/10.1016/j.quaint.2015.11.106

Kot et al. 2019 — M. Kot/N. Gryczewska/C. Berto/M. Wojenka/M. Szeliga/E. Jaskulska/R. Fetner/M. Krajcarz/K. Wertz/K. Zarzecka-Szubińska/M. T. Krajcarz/M. Moskal-del Hoyo/

M. Leloch/M. Jakubczak: Thirteen cave sites: Settlement patterns in Sąspów Valley, Polish Jura. *Antiquity* 93/371, 2019.
DOI: https://doi.org/10.15184/aqy.2019.155

Kot et al. 2021 M. Kot/M. T. Krajcarz/M. Moskal-del Hoyo/N. Gryczewska/M. Wojenka/K. Pyżewicz/V. Sinet-Mathiot/M. Diakowski/St. Fedorowicz/M. Gąsiorowski/A. Marciszak /G. Lipecki/P. Maciewicz: Chronostratigraphy of Jerzmanowician. New data from Koziarnia Cave, Poland. *Journal of Archaeological Science: Reports* 38, 2021, 103014.
DOI: https://doi.org/10.1016/j.jasrep.2021.10301

Kot/Richter 2012 M. Kot/J. Richter: Leaf points or rather "leafknives"? A techno-functional analysis of bifacially shaped artifacts from Mauern. *Anthropologie* 50, 2012, 361–375.

Kowalski et al. 1965 K. Kowalski/J. K. Kozłowski/M. Krysowska/A. Wiktor: Badania osadów w Puchaczej Skale w Prądniku Czajowskim, pow. Olkusz. *Folia Quaternaria* 20, 1965, 1–44.

Kowalski 1967 S. Kowalski: Wstępne wyniki badań archeologicznych w Jaskini Mamutowej prowadzonych w latach 1957–1964. *Materiały Archeologiczne* 8, 1967, 47–54.

Kowalski 1969 S. Kowalski: Nowe dane do poznania kultury jerzmanowickiej w Polsce. *Światowit* 30, 1969, 177–188.

Krajcarz et al. 2018 M. T. Krajcarz/M. Krajcarz/B. Ginter/T. Goslar/P. Wojtal: Towards a Chronology of the Jerzmanowician a New Series of Radiocarbon Dates from Nietoperzowa Cave (Poland). *Archaeometry* 60, 2018, 383–401.
DOI: https://doi.org/10.1111/arcm.12311

Lorenc 2006 M. Lorenc: Radiocarbon dating of some Late Pleistocene faunal assemblages in caves in Poland. *Acta Zoologica Cracoviensia* – serie A, 49/1–2, 2006, 41–61.

Madeyska 1992 T. Madeyska: Stratigraphy of the sediments in the Mamutowa Cave at Wierzchowie near Cracow. *Folia Quaternaria* 63, 1992, 35–42.

Pastoors/Schäfer 1999 A. Pastoors/J. Schäfer: Analyse des états techniques de transformation, d'utilisation et états post dépositionnels. Illustrée par un outil bifacial de Salzgitter-Lebenstedt (FRG). *Préhistoire Européenne* 14, 1999, 33–47.

Pastoors/Tafelmaier/Weniger 2015 A. Pastoors/Y. Tafelmaier/G.-C. Weniger: Quantification of late Pleistocene core configurations. Application of the Working Stage Analysis as estimation method for technological behavioural efficiency. *Quartär* 62, 2015, 63–84.

Perreault et al. 2013 C. Perreault/P. J. Brantingham/S. L. Kuhn/S. Wurz/X. Gao: Measuring the complexity of lithic technology. *Current Anthropology* 54, 2013, 397–406.
DOI: https://doi.org/10.1086/673264

Pope et al. 2013 M. Pope/R. Dinnis/A. Milks/P. Toms/C. Wells: A Middle Palaeolithic to Early Upper Palaeolithic succession from an open air site at Beedings, West Sussex. *Quaternary International* 316, 2013, 14–26.
DOI: https://doi.org/10.1016/j.quaint.2013.06.027

Przeździecki 2019 M. Przeździecki: Studium technologiczne materiałów krzemiennych ze stanowiska Wołkusz 3 w północno-wschodniej Polsce. Koncepcja produkcji ostrzy preferencyjnych. *Archeologia Polski* 64, 2019, 39–71.
DOI: https://doi.org/10.23858/APOL64.2019.002

Richter 2001 J. Richter: Une analyse standardisée des chaînes opératoires sur les pièces foliacées du Paléolithique moyen tardif. In: L. Bourgignon/I. Ortega/M.-C. Frère-Sautot (eds): *Préhistoire et Approche Expérimentale*. *Préhistoires* 5. Montagnac 2001, 77–88.

Römer 1875 F. Römer: Über eine mit Knochen ausgestorbener Säugethiere erfüllte Höhle bei Olkusz im Königreich Polen; desgl. über Blitzröhren und ein neues Vorkommen gediegenen Kupfers bei Börnchen unfern Hohefriedeberg. *Jahres-Bericht der Schlesischen Gesellschaft für vaterlandische Cultur. Enthält den Generalbericht über die Arbeiten und Veränderungen der Gesselschaft im Jahre 1874*, 52, 1875, 25–28.

Römer 1879 F. Römer: Über die Anwendung des Inhalts der Knochenhöhlen zwischen Olkucz und Ojcow in Polen als Düngungsmittel und über neue Funde von fossilen Wirbelthierresten in diesen Höhlen. *Jahres-Bericht der Schlesischen Gesellschaft für vaterlandische Cultur. Enthält den Generalbericht über die Arbeiten und Veränderungen der Gesselschaft im Jahre 1878*, 56, 1879, 47–50.

Römer 1883 F. Römer: Die Knochenhöhlen von Ojcow in Polen. *Palaeontographica* 29, 1883, 193–233.

Römer 1884 F. Römer: *Bone-caves of Ojców in Poland* (Translated by J. E. Lee). London 1884.

Simonds 1902 F. Simonds: Life of Dr. Ferdinand von Roemer Simonds. VIII – A Geologist of the last Century. Dr. Ferdinand von Roemer, the Father of the Geology of Texas: His Life and Work. *Geological Magazine* 9/9, 1902, 412–417.
DOI: https://doi.org/10.1017/S0016756800181397

Socha/Stefaniak 2006 P. Socha/K. Stefaniak: Badania paleontologiczne C. F. Roemera i O. Grubego na terenie Ojcowskiego Parku Narodowego. Szczątki kostne ssaków w kolekcji Zakładu Paleozoologii Instytutu Zoologicznego Uniwersytetu Wrocławskiego. *Prądnik. Prace i Materiały Muzeum im. Prof. Władysława Szafera* 16, 2006, 215–230.

Urbanowski 2004 M. Urbanowski: *Pradnik knives as an element of Micoquian techno-stylistic specifics*. PhD. Thesis. Warsaw University. Warsaw 2014. Unpublished.

Wojenka 2012 M. Wojenka: Jaskinie Wyżyny Krakowsko-Częstochowskiej w średniowieczu. Wstęp do problematyki. *Prądnik. Prace i Materiały Muzeum im. Prof. Władysława Szafera* 22, 2012, 7–43.

Wójcik 2004 Z. Wójcik: O wycieczkach fizjograficznych po Wyżynie Krakowsko-Częstochowskiej (od 1782 r. do połowy XIX w.). In: J. Partyka (ed.): *Zróżnicowanie i przemiany środowiska przyrodniczo-kulturowego Wyżyny Krakowsko-Częstochowskiej* 2. Kultura. Ojców 2004, 267–274.

Zawisza 1871 J. Zawisza: Poszukiwania archeologiczne. 3. Ojcowska Dolina i jej okolice. *Biblioteka Warszawska* 4, 1871, 40–58.

Zawisza 1873 J. Zawisza: Niedźwiedź jaskiniowy (Ursus spelaeus) w Jaskini Łokietkowej w Ojcowie. *Wiadomości Archeologiczne* 1, 1873, 1–7.

Zawisza 1874a J. Zawisza: Jaskinia Mamuta w Dolinie Wierzchowskiej w okolicy Ojcowa i Krakowa położona. *Wiadomości Archeologiczne* 2, 1874, 5–17.

Zawisza 1874b J. Zawisza: Wierzchowska Jaskinia zwiedzana w 1871, 72 i 73 r. *Wiadomości Archeologiczne* 2, 1874, 17–23.

Znalezione w pudełku

Nieznane bifacjalne ostrze liściowate z jaskini Koziarni

Małgorzata Kot – Natalia Gryczewska

Streszczenie

Od XIX. wieku jaskinie Jury Krakowsko-Częstochowskiej były przedmiotem zainteresowania nie tylko archeologów amatorów, ale także lokalnej ludności, czy nawet biznesmenów. Osady jaskiniowe, ze względu na dużą zawartość materii organicznej, były w tym czasie uważane za nawozy naturalne wysokiej jakości i używane przez okolicznych rolników. Przynajmniej kilka jaskiń, m.in. jaskinia Koziarnia oraz Nietoperzowa, dzięki współpracy lokalnych właścicieli ziemskich oraz pruskiego urzędu górniczego, było eksploatowane na większą skalę. To w tych jaskiniach znaleziono pierwsze ostrza bifacjalne, opublikowane w 1884 r. przez F. Römera, na podstawie których pół wieku później W. Chmielewski wyodrębnił nową jednostkę kulturową z okresu przejścia miedzy środkowym i górny paleolitem tzw. jerzmanowicien. W Polsce znanych jest zaledwie kilka stanowisk jerzmanowickich, stąd zrodziła się potrzeba dokładnego przeanalizowania dawnych materiałów, mianowicie kolekcji Ferdynanda Römera.

Ferdynand Römer, paleontolog i geolog, od 1855 r. był profesorem na Uniwersytecie Wrocławskim (ówczesny Breslau), późniejszym twórcą Muzeum Mineralogicznego. Gdy rozpoczęto przemysłową eksploatację sedymentów jaskiniowych, dowiedział się o znajdowanych w nich kościach zwierzęcych oraz zabytkach i w 1874 r. osobiście odwiedził jaskinię Nietoperzową. Zawiadujący pracami w jaskini, ówczesny dzierżawca O. Ogrowsky, złożył obietnicę przekazania znajdowanych sukcesywnie materiałów Römerowi. Kilka lat później, prawdopodobnie zainspirowany aktywnością właściciela Ojcowa, archeologa-amatora Jana Zawiszy, F. Römer zainicjował własne prace wykopaliskowe, początkowo w jaskini Nietoperzowej (1878 r.), a następnie okolicznych jaskiniach, m.in. Koziarni, Zbójeckiej, Krakowskiej (Czajowice), Tunelu Stromym (Sadlana), Łabajowej (Bębel) i Gorenieckiej. Prace w terenie prowadził na polecenie Römera- Oscar Grube. Kolekcja pozyskana z jaskiń jurajskich, częściowo opublikowana przez F. Römera, zdeponowana została w Muzeum Mineralogicznym. Obecnie zbiory są rozproszone, większość zabytków archeologicznych znajduje się w Muzeum Archeologicznym we Wrocławiu.

Jaskinia Koziarnia, położona w południowej części Jury, w Dolinie Sąspowskiej, w drugiej połowie XIX. wieku przynależała do majątku rodziny Mieroszewskich. Na zlecenie właścicieli, w 1877 roku jaskinię eksploatowano w celu pozyskania nawozu. W 1879 roku, z polecenia F. Römera, O. Grube przeprowadził w jaskini wykopaliska. W pracy z 1883 roku opublikowano kilkanaście znalezionych wówczas zabytków, m.in. narzędzia krzemienne, w tym krzemienne ostrze liściowate, paciorki szklane, fragmenty ceramiki czy kościane igły. Nie wszystkie zabytki

z jaskini Koziarni znajdujące się obecnie w Muzeum Archeologicznym we Wrocławiu zostały jednak opisane i opublikowane. W kolekcji znajduje się m.in. nieopublikowane ostrze liściowate, brakuje natomiast ostrza z Koziarni, które znalazło się w publikacji F. Römera.

Niepublikowane wcześniej ostrze wykonane zostało na wiórze korowym i ma wymiary 51 x 19 x 9 mm. Ponad 50% powierzchni narzędzia zajmuje kora, ponadto jest ono silnie spatynowane. Ostrze nosi ślady uszkodzeń postdepozycyjnych, szczególnie zniszczone są krawędzie, z licznymi wnękami i ukruszeniami. Niemniej, z dużym prawdopodobieństwem można stwierdzić, że formę wykonano z krzemienia jurajskiego. Proces produkcji ostrza podzielić można na 4 etapy: odbicie półsurowca, ścienienie narzędzie przy podstawie na stronie wentralnej, kształtowanie krawędzi, dodatkowe ścienianie przy podstawie na stronie wentralnej.

Stan zachowania opisywanego ostrza liściowatego diametralnie różni się od ostrza liściowatego opublikowanego i opisanego przez F. Römera, w szczególności ze względu na znaczne zniszczenia (retusze) postdepozycyjne krawędzi. Niemniej, zabytki pozyskane w trakcie prac wykopaliskowych w Koziarni, zarówno w latach 60. przez W. Chmielewskiego, jak i przez M. Kot w 2017 r., a w szczególności w warstwach związanych ze środkowym paleolitem (warstwa H'/I'H'I' i L) jak i w warstwie powiązanej z jerzmanowicienem (warstwa D–E–F), również noszą liczne ślady silnych uszkodzeń postdepozycyjnych. Pod względem technologicznym ostrze wykazuje typowe cechy dla ostrzy jerzmanowickich. Dużo uwagi poświęcono przede wszystkim ścienianiu przy podstawie po stronie wentralnej, a więc usuwaniu sęczka. Mniej zaś kształtowaniu krawędzi poprzez retusz strony dorsalnej. Również użycie półsurowca ze znaczną ilością kory, jest powszechne w przemyśle jerzmanowickim i występuje np. w przypadku ostrzy znalezionych w jaskini Nietoperzowej.

Opisywane ostrze liściowate nie posiada kontekstu stratygraficznego, zatem z ostrożnością należy traktować wszelkie atrybucje kulturowe czy chronologiczne. Niemniej, uwzględniając stan zachowania, charakterystyczny schemat produkcji oraz dotychczas uzyskane dane z jaskini Koziarni, uznać należy, że mamy do czynienia z silnie postdepozycyjnie zniekształconym jerzmanowickim ostrzem liściowatym. Odkrycie przynajmniej dwóch ostrzy liściowatych w jaskini Koziarni, potwierdza jeszcze dobitniej obecność na stanowisku śladów osadnictwa jerzmanowickiego.

Ryc. 1. Lokalizacja stanowisk wzmiankowanych w tekście. a – obecny zarys granic Polski oznaczony na mapie zachodniej części Cesarstwa Rosyjskiego i krajów ościennych z 1890 roku. Linie ciągłe i kolory oznaczają podział na zabory: kolor niebieski- zabór pruski, zielony- zabór rosyjski, żółty- zabór austriacki; b – skan prywatnego egzemplarza „Mapy jaskiń okolic Krakowa i Ojcowa" opublikowanej przez *J. Czarnowskiego* (*1911*), a należącego do S. Krukowskiego. Mapa z notatkami odręcznymi S. Krukowskiego przechowywana jest w archiwum Państwowego Muzeum Archeologicznego w Warszawie pod numerem inwentarzowym: PL PMA 1-1-5-1-13-1, wersja online: http://193.39.71.4/atom/index.php/spuscizna-stefana-krukowskiego; isad; c – mapa jaskiń badanych przez F. Römera.

Ryc. 2. a – Rycina prezentująca eksploatację sedymentów jaskiniowych w 19. wieku; jaskinia w Złotym Potoku; rysunek autorstwa J. Ceglińskiego (za: *Wójcik 2004*, 271, Fig. 2); b – Ferdynand Römer (za: *Simonds 1902*); c – jaskinia Koziarnia około 1910 roku; zaklęśnięcie osadów widoczne w środkowej części ilustracji może stanowić pozostałości po pracach wykopaliskowych z 1879 r. kierowanych przez F. Römera; d – pocztówka z 1927 przedstawiająca wejście do jaskini Koziarni; e – widok z dna wąwozu Koziarnia na otwór wejściowy do jaskini Koziarni, stan na 2018r. (foto M. Bogacki).

Ryc. 3. 1a, 2–12 – zabytki znalezione w jaskini Koziarni opublikowane przez *F. Römera* (*1883; 1884*); 1b – rysunek obu stron bifacjalnego ostrza liściowatego z jaskini Koziarni opublikowany przez *W. Chmielewskiego et al.* (*1967*). W tamtym okresie ostrze to musiało być dostępne do analiz. Brak skali.

Ryc. 4. Niepublikowane ostrze liściowate z jaskini Koziarni znalezione obecnie w kolekcji Römera. a, b – rysunek i zdjęcie ostrza liściowatego; c – stan zachowania powierzchni i krawędzi; retusz postdepozycyjny oznaczono kolorem szarym; d, e – analiza scar pattern z diagramem prezentującym chronologię sekwencji odbić prowadzących do powstania ostrza (rysunek M. Kot).

Małgorzata Kot, PhD.
Faculty of Archeology
University of Warsaw
Krakowskie Przedmieście 26/28
PL – 00-927 Warsaw
m.kot@uw.edu.pl

Natalia Gryczewska, MA.
Faculty of Archeology
University of Warsaw
Krakowskie Przedmieście 26/28
PL – 00-927 Warsaw
n.gryczewska@uw.edu.pl

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 31–47

SZELETIAN OR NOT SZELETIAN

Bifacial industries from three open-air Middle Palaeolithic sites from the Cserhát Mountains (Northern Hungary)

Krisztián Zandler – András Markó – Attila Péntek

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.3

Keywords: Late Middle Palaeolithic, Szeletian, open-air site, leaf point industry (*Blattspitzenindustrie*), leaf-shaped points, metarhyolite

Abstract: During the last 15 years, three Middle Palaeolithic open-air sites were excavated in the Cserhát Mountains (Northern Hungary), lying at the northern periphery of the Great Hungarian Plain. The context was similar at each locality: the lithics were excavated from loess-like reddish or yellowish sediment from a depth of 50–100 cm beneath of the recent surface level. Bifacially worked leaf-shaped points and knives associated with sidescrapers and endscrapers made on flakes were found at all sites but in different ratio. For the time being, the chronology of the assemblages is not clear enough, but the typological and technological attributes of the assemblages show few if any Upper Palaeolithic traits.
In the present paper, the characteristics of the bifacially manufactured and leaf-shaped implements from the sites will be compared with an emphasis on their raw material types.

INTRODUCTION

The Szeleta Cave, the first excavated Palaeolithic site in Hungary is located in the Bükk Mountains (Fig. 1: 1), North-Eastern Hungary, at 345 m a.s.l. and 100 m relative height. The first field works were carried out by the geologist O. Kadić and the anthropologist J. Hillebrand between 1906 and 1913 (*Kadić 1915*). The cave became famous very quickly because of the presence of the finely elaborated leaf-shaped points made of metarhyolite (earlier: glassy quartz porphyry, felsitic porphyry, metaquartzite or simply: Szeleta raw material), radiolarite and limnic silicite. The excavated industries were originally classified as belonging to the Solutrean (*Hillebrand 1935*; *Kadić 1915*; *1934*). Later F. Prošek defined the assemblages of the open-air and cave sites characterized by bifacially worked leaf-shaped points from Slovakia as Szeletian (*Prošek 1953*). Since then, a series of small-scale excavations have been carried out in the cave by J. Nemeskéri, A. Saád, L. Vértes, Á. Ringer and T. Hauck (*Hauck et al. 2016*; *Ringer 2002*; *Saád/Nemeskéri 1955*; *Vértes 1968*). During the analysis of the artefacts excavated at the beginning of the 20th century typical pieces of the Aurignacian, Taubachian, Jankovichian and two different Mousterian industries were also recognised (*Ringer/Mester 2000*; *2001*). Furthermore, the results of the so-called technological studies restricted exclusively to (some) leaf-shaped artefacts suggested that the Early Szeletian and Jankovichian industries belong to the same entity (*Mester 2018*).

However, in a recent study (*Markó 2016*), published on the centenary of the monograph on the Szeleta excavations, it was not possible to define any assemblage typical for an Early Upper Palaeolithic or transitional Szeletian entity from the discrete levels called as hearths or culture layers of the eponymous site. Moreover, it became clear that the majority of the rolled artefacts of the Early Szeletian (or Jankovichian) industry (*Gábori-Csánk 1993*) are not suitable for typological and technological analysis. On the other hand, some of the well-known leaf points, classified recently (*Mester 2018*) as belonging both to the Early Szeletian/Jankovichian and the Evolved Szeletian entities were associated with Gravettian backed tools in layer 5 (*Markó 2016*). As during the recent sampling project (*Hauck et al. 2016*) no diagnostic artefacts were found in the rear of the main corridor of the cave, the character of the lithic industries from the underlying layer 4 (36,430 ±330 and 36,640 ±330 uncal BP dates from the lower level of this stratigraphic unit)

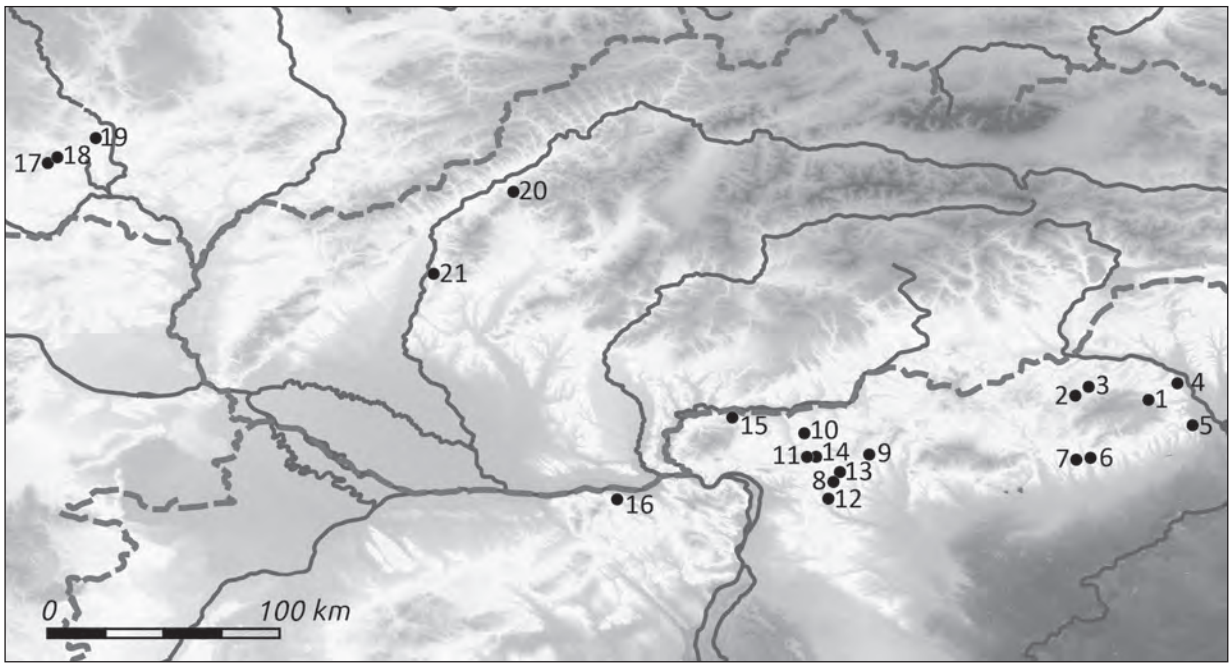


Fig. 1. Locations of the discussed sites. 1 – Szeleta Cave; 2 – Bükkmogyorósd-Hosszú-bérc; 3 – Csokvaomány/Nekézseny-Határ-tető; 4 – Sajóbábony-Méhész-tető; 5 – Mályi-Öreg-hegy; 6 – Eger-Kőporos-tető; 7 – Egerszalók-Kővágó-dűlő; 8 – Acsa-Rovnya; 9 – Buják-Szente 2; 10 – Debercsény-Mogyorós; 11 – Legénd-Káldy-tanya 5; 12 – Galgagyörk-Csonkás-hegy; 13 – Vanyarc-Szlovácka dolina 5; 14 – Szécsénke-Kis-Ferenc-hegy; 15 – Hont-Csitár (Malom-hegy); 16 – Jankovich Cave; 17 – Vedrovice V; 18 – Moravský Krumlov IV; 19 – Želešice-Hoynerhügel; 20 – Trenčianske Teplice-Pliešky; 21 – Moravany nad Váhom-Dlhá.

and 3 (dated to 36,850 ±200 and 40,850 ±810 BP) is not known. Anyway, both the "early" and "developed" points from layer 5 pieces could belong to a more recent period, which questions the proposed classification of the leaf points.

Moreover, inter-layer refits of a maximum 3.5 m in vertical direction were recognised, proving important stratigraphic disturbances along the sequence.

As a total, bearing in our mind the incomplete layer sequence in the Szeleta Cave, the more than 900 m^3 of excavated sediments and the less than 1500 artefacts excavated in six lithostratigraphic units and stored in collections of five museums in four countries, we raised the question if there is any assemblage from the eponymous site relevant in the discussion of the Szeletian industry (*Simán 1990*)? Or, put it another way: is the use of the term "Szeletian" justified?

ARCHAEOLOGICAL RESEARCH IN THE CSERHÁT MOUNTAINS

Leaf point industries from Hungarian open-air sites (Fig. 1) were known for a long time only from non-stratified or non-evaluated stratigraphic contexts (*Adams 2000*; *2007*; *Dobosi 1987–1988*; *1995*; *2011*; *Kozłowski et al. 2009*; *2012*; *Ringer 1983*; *Rozsnyói 1963*; *Simán 1985*; *Vértes 1951*; *1965*; *Zandler 2012*). Since 2003 rich assemblages with bifacial artefacts have been excavated in the previously not investigated part in Northern Hungary.

The Cserhát region, lying between the northern margin of the Great Hungarian Plain and the Ipoly/Ipeľ River valley and built by volcanic and fluviatile rocks (*Hámor 1985*; *Láng 1967*; *Noszky 1940*) belongs to the Northern Mid-Mountains range in Hungary (Fig. 1). The first data concerning the possible Palaeolithic artefacts from the Cserhát region is dated to 1913 when three "Aurignacian type" tools were found with a polished stone axe at Alsópetény. In 1952 three obsidian blades from Galgagyörk, 38 years later further chipped stone assemblages from 18 open-air sites got into museum collections (*Markó 2012*). The first excavations were conducted in the 1980s on the Upper Palaeolithic localities at Püspökhatvan and Verseg by V. T. Dobosi and É. Cs. Balogh (*Balogh/Dobosi 1991*; *1995*; *Dobosi 1991*). After the millenary,

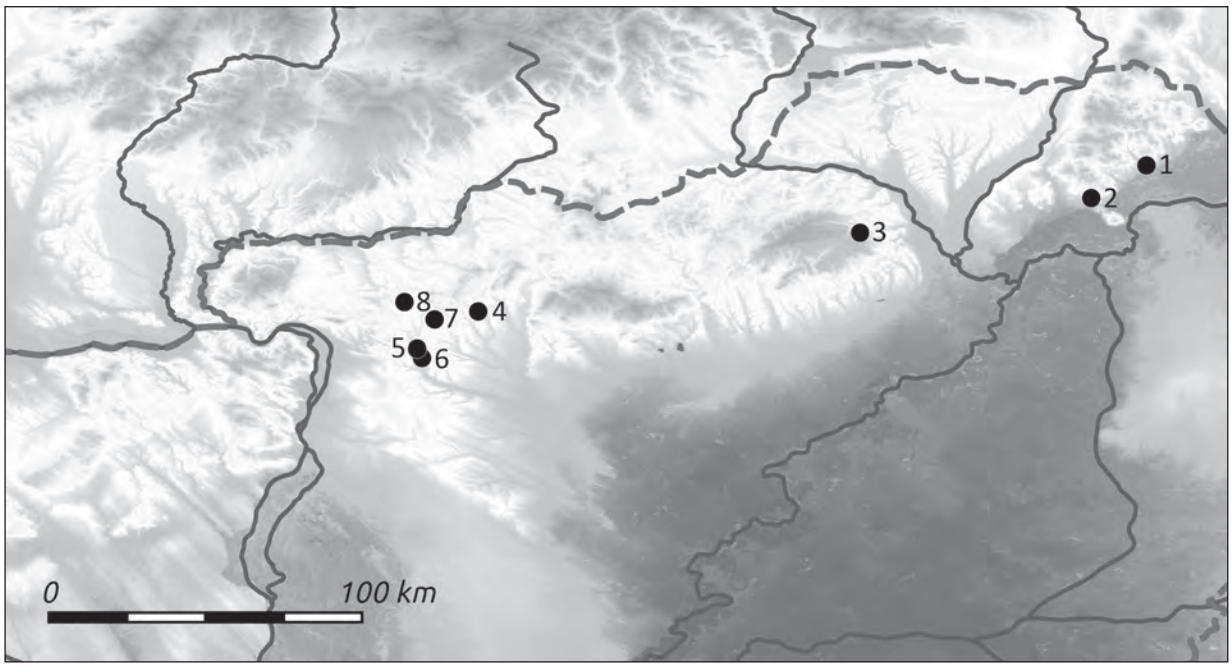


Fig. 2. Raw material procurement of the studied sites. 1 – Carpathian 2T obsidian (Tolcsva); 2 – Carpathian 2E obsidian (Mád); 3 – Metarhyolite (Bükkszentlászló); 4 – Limnic silicite (Buják); 5 – Limnic silicite (Püspökhatvan); 6 – Andesite and Siliceous, Radiolarite and Quartzite pebbles at Galgagyörk; 7 – Siliceous, Radiolarite and Quartzite pebbles at Vanyarc; 8 – Siliceous, Radiolarite and Quartzite pebbles at Szécsénke.

the Early Upper Palaeolithic site was excavated at Acsa (*Dobosi 2008*; *2013*). Further open-air sites were located by A. Péntek in the southern slopes of the Cserhát (*Markó 2012*; *Markó/Péntek/Béres 2002*; *Simán 1993*), many of them could have been connected to the Middle (*Markó 2009b*; *Péntek 2014–2015*; *2015*; *Péntek/Gábriel 2018*; *Péntek/Zandler 2013a*; *2013b*; *2014*; *2017*; *2018*) and Upper Palaeolithic (*Dobosi 2010*; *2011–2013*; *Markó/Péntek/Béres 2002*; *Péntek 2016*; *2018*; *Péntek/Zandler 2016*; *Zandler 2008*) period.

An important number of Late Middle Palaeolithic localities, lying along dead-end valleys with asymmetrical cross-sections, 50–70 m above the valley-bottom (*Markó 2012*; *Péntek 2014–2015*; *Péntek/Zandler 2016*) yielded leaf-shaped tools (*Markó 2009b*; *Péntek 2014–2015*; *2015*; *Péntek/Gábriel 2018*; *Péntek/Zandler 2013a*; *2013b*; *2014*; *2017*; *2018*). Three of them, Vanyarc – Szlovácka dolina, Galgagyörk – Csonkás hegy and Szécsénke – Kis Ferenc hegy were successfully excavated (Fig. 1: 12–14). In the following the leaf shaped implements from these sites will be discussed.

The assemblages are characterised by:

- the presence or even the elevated ratio of the extralocal metarhyolite raw material, transported from a distance of about 100 km to the sites (Fig. 2: 3);
- the presence of leaf-shaped points, bifacial sidescrapers and knives (in typological point of view);
- the flake blanks selected for tool manufacturing;
- the absence of blades among the blanks and blade cores, as well as;
- the lack of typical Upper Palaeolithic tool types.

The studied localities

The results of the excavations at Vanyarc (Fig. 1: 13) were published in several papers (*Markó 2007*; *2011*; *2012*). The site is located north-west of the village, on a plateau lying between the Nógrád/Vanyarc streamlet and an asymmetrical dead-end valley (Cesz dolina), at 265–275 m a.s.l. and a 60–70 m relative height.

The Galgagyörk locality (Fig. 1: 12) is lying south of the village, in the tectonically preformed wide and highly asymmetric valley of the Galga River, on the uppermost terrace level (220–230 m a.s.l.), at 70–80 m relative height. From this site, only the surface collected artefacts are published until now (*Markó/Péntek/Béres 2002*) as belonging to the Micoquian (or *Keilmessergruppe*: *Jöris 2004*). During the later systematic

Table 1. The studied lithic assemblages.

	Vanyarc	Galgagyörk	Szécsénke
Year of the field works	2003–2007	2008, 2018	2015–2018
Excavated trench	52 m²	31 m²	18 m²
Number of excavated lithics	1950	437	1077
Number of tools	42	33	37

surveys, the authors used a handheld GPS unit to document the archaeologically relevant artefacts. In 2004 an exceptionally finely elaborated leaf-shaped point found here was compared to the artefacts of the Upper or Evolved Szeletian following the terminology of that time (*Markó 2004*). Four years later the first sounds were started in the hope of documenting the stratigraphic position of the Szeletian and Micoquian industries. During the excavations, however, a single artefact bearing layer was documented and neither bifacial backed knives nor small circular scrapers (*groszak*s) were found. The relatively rich lithic assemblage is classified as belonging to the leaf point industry (*Markó et al., in press a*).

The site of Szécsénke (Fig. 1: 14) is situated to the south-east from the village, on the hilltop between the Halyagos and Szécsénke streamlets, at an altitude of at 270–280 m a.s.l. At this locality the coordinates of the archaeologically significant surface finds were also documented by a handheld GPS (*Péntek/Zandler 2013a*). A test excavation was carried out in 2015 (*Chu et al. 2018*) lead by K. Zandler and continued by the authors of this paper between 2016–2018 (*Zandler et al., in press*) exposing 30 m²; the intact artefact-bearing layer was excavated 18 m² in total (Table 1).

STRATIGRAPHIC AND CHRONOLOGICAL DATA OF THE LOCALITIES

During the excavations, complex geo-pedological investigations were undertaken at each site; the results of the fieldwork at Vanyarc have already been published (*Horváth/Mindszenty 2007*). Generally, the artefact bearing layers were documented in a basically *in situ* position, without any traces of recent (agricultural) disturbances. During the excavations, however, evidences of wedge formation, periodic shrinking and swelling of clay minerals and clay migration were recognised. Due to the plateau position of the localities, the artefacts were excavated in a reduced layer sequence, in decalcified loam directly underlaying the present-day humic soil level. Except for a single tooth fragment from Galgagyörk classified as *Bison sp.* by the palaeontologist István Vörös (p. c.), no faunal remains were preserved.

Among the artefacts, numerous charcoal grains were observed, classified by A. Grynaeus as remains of deciduous trees (oak, beech and willow: *Markó 2007*). In our view these pieces were found in a secondary position, fallen in the wide and deep desiccation cracks observed during the dry summers of the excavations also. We had the possibility to date two samples (Table 2), which, however, reflect only the minimum age of the artefacts, due to the small amount of carbon (*Markó 2012*).

Table 2. Radiocarbon dates from Vanyarc.

Laboratory code	$\delta^{13}C$‰	^{14}C age (BP)
Hv-25892	-25.1	32,330 ±2260
Hv-25893	-24.3	27,430 ±1310

During the excavations at Galgagyörk and Szécsénke OSL samples proved around 50,000–40,000 years old occupation. The results will be published together with the age of a burned silex artefact excavated at Vanyarc and the complex stratigraphic evaluation of the localities (*Markó et al., in press b*).

RAW MATERIAL PROCUREMENT

The studied assemblages are dominated by locally available hydrothermal raw material types (Table 3). The geological sources of the medium to low quality rocks are known partly from the Galga valley

Table 3. The excavated raw material procurement of the studied assemblages.

Raw material types	Vanyarc		Galgagyörk		Szécsénke	
Limnic silicite	1211	62.10%	264	60.41%	1024	95.17%
Jasper/Lydite	18	0.92%	–	–	1	0.09%
Siliceous pebble	3	0.15%	4	0.92%	3	0.28%
Radiolarian pebble	1	0.05%	1	0.23%	4	0.37%
Quartzite pebble	12	0.62%	6	1.37%	26	2.41%
Andesite	–	–	96	21.97%	–	–
Metarhyolite	650	33.33%	56	12.81%	19	1.67%
Obsidian	–	–	4	0.92%	–	–
Burned	55	2.82%	6	1.37%	–	–
Total	1950	100.00%	437	100.00%	1077	100.00%

near the village of Püspökhatvan (Fig. 2: 5), and from fluvial sediments dated to the Middle Miocene Sarmatian period, covering a large area lying east of Vanyarc (Fig. 2: 4). Finally, a very low-quality variant was used at the Galgagyörk site (*Markó 2005*), where the andesite from the nearby outcrops was also extensively manufactured: 22% of the assemblage was made of this rock (Fig. 2: 6).

Although in the surface collected assemblage from Szécsénke numerous artefacts were made of various pebbles (e.g. *Péntek 2015*; *2019*), the secondary raw material sources played a subordinate role in the raw material procurement of the excavated assemblages: the quartzite, radiolarite and siliceous pebbles (Fig. 2: 6–8) are represented by single pieces only (Table 3).

One of the points observed during the surface collections on the Cserhát Middle Palaeolithic sites was the high number of the extralocal raw material (*Markó 2009a*; *2011*), transported from the south-eastern part of the Bükk Mountains over a distance of at least 100 km (Fig. 2: 3). The ratio of metarhyolite reached one-third of the lithic assemblage and 40% of the tools in the Vanyarc assemblage (Table 3). Among the surface collected artefacts of Szécsénke the comparably high ratio of metarhyolite 38.01% was recognised, (*Péntek/Zandler 2013a*), however, only 1.67% of the 1077 excavated pieces were made of this raw material (Table 3). Finally, at Galgagyörk, 12.81% of the studied assemblage was made of this raw material. Importantly, artefacts of the Hungarian obsidian (Tolcsva and Mád-type or Carpathian 2E and 2T) variants (Fig. 2: 1, 2) are also represented by single pieces (Table 3), which is a unique phenomenon in the discussed leaf point assemblages of the Cserhát area.

TYPOLOGICAL TRAITS OF THE ASSEMBLAGES

The Vanyarc, Szécsénke and Galgagyörk assemblages show different typological composition: at Vanyarc the bifacially worked and leaf-shaped tools, at Galgagyörk the sidescrapers, at Szécsénke the endscrapers are the dominating tool classes (Table 4). Generally, the endscrapers are made on short and thick flakes with non-lamellar retouches are by no means of Upper Palaeolithic character. Moreover, neither blade cores, nor blade and bladelet tools or typical burins are known from the studied assemblages, emphasising the clear Middle Palaeolithic character of the sites.

One of the common points is the presence of bifacially worked and leaf-shaped points (Table 5). The terms refer to typological and not technological categories defined by *M. Kot* (*2016*).

Among the backed knives made on raw material fragments, the presence of *Klausennische*-type and a characteristic form typical for the Vanyarc assemblages (Vanyarc-type bifacial knife) is emphasized (Pl. I: 2; II: 2). The leaf points are generally fragmented (Pl. I: 4, 5; II: 3) which prevents their technological analysis (Table 6). This way, it is not clear if the knives would represent the beginning of the leaf points (*Neruda/Nerudová 2010*). Importantly, one of the pieces from Vanyarc (Pl. I: 2) is made of non-local raw material transported from a distance of 95 km to the site, which makes problematic to use the same terminology as for the sites of workshop character based on the locally available raw material types.

Table 4. Main tool types of the studied assemblages.

Tool types	Vanyarc	Galgagyörk	Szécsénke
Leaf-Shaped point	9	3	3
Other bifacial tools	7	1	2
Sidescraper	10	14	6
Endscraper	3	5	22
Retouched flake	3	2	1
Typical tool total	32	25	34
Worked edge fragment	9	7	3
Bifacially worked fragment	1	1	–

The use of the *"wechselseitig-gleichgerichtete Kantenbearbeitung"* (*Bosinski 1967*) was documented in three cases (Pl. II: 1). Only one symmetrical leaf-shaped point with a plano-convex cross-section (Pl. I: 1) came to light during the excavations. One of the reviewers of the present paper suggested that this piece is a semi product of a leaf point. In our view, this piece, made of the extralocal metarhyolite is a rejuvenated point; the laminated structure with quartz veins of the rock made impossible to complete the next stage of the manufacture of the piece.

The most important result of the excavations at Vanyarc was the documentation of a small workshop with numerous small flakes and chips including refitted pieces (Fig. 2: 3; *Markó 2011*, 72) for manufacturing this raw material (Table 5). A rough preform of a bifacial tool (Pl. I: 3) was found in this part of the trench, however, in this case no refit was observed. Importantly, the above-mentioned bifacial knife and the rejuvenated leaf point were found more than 9 and 5 m from the unique metarhyolite flake concentration (*Markó 2012*, fig. 3: 46), questioning the on-site manufacture of these pieces.

On the other hand, the first steps of the manufacture of a thick bifacial tool ("a piece with wide edge" in Table 5, a post-genetically fragmented preform with refitted flakes) of very low quality local limnic silicite with numerous mineral veins and inclusions, as well as cleavage plans was proved by direct refits (*Markó 2007*, 11, fig. 6).

The bifacial tools from Galgagyörk were made on elongated flakes with plano-convex cross-section (Pl. II: 5, 6). A symmetrical, biconvex fragment was made of metarhyolite (Pl. II: 4), another tool of the same raw material was rejuvenated after fragmentation (Pl. II: 5). Finally, a piece, made on very poor quality limnic silicite is heavily fragmented too (Pl. II: 6).

Table 5. Distribution of bifacial tools in the studied assemblages.

Typological classification	Vanyarc	Galgagyörk	Szécsénke
Leaf point	7	2	3
Bifacial knife	4	_	1
Leaf-shaped scraper	_	1	1
"Stück mit breiter schneide"	1	–	–
Half made bifacial tool	2	–	–
Fragmented tool	1	1	–
Total	15	4	5
Raw material			
Limnic silicite	5	2	5
Metarhyolite	10	2	_
Total	15	4	5

Table 6. Details of the leaf-shaped tools from Vanyarc, Galgagyörk and Szécsénke.

Details	Vanyarc	Galgagyörk	Szécsénke
Fragmentation			
Intact	1	2	1
Proximal	3	–	2
Distal	2	1	–
Heavily fragmented	–	1	–
Symmetry			
Symmetrical	2	1	2
Asymmetrical	4	3	1
Cross-section			
Biconvex	1	1	1
Plano-convex	5	3	2
Total	6	4	3

The leaf-shaped points from the Szécsénke assemblages were also made on elongated flakes, in two cases with plano-convex (Pl. III: 1, 3) and one case with a biconvex cross-section (Pl. III: 2). Symmetrical (Pl. III: 1, 3) and asymmetrical forms (Pl. III: 2) are also represented (Table 6). The one bifacially worked knife could be a broken leaf-shaped point which was rejuvenated later as a knife (Pl. III: 4). The one fragmented bifacially retouched sidescraper is asymmetrical with a plano-convex cross-section (Pl. III: 5). Each leaf-shaped point and bifacially worked tool was made of limnic silicite (Table 5; Pl. III: 1–5).

Without microscopic analysis it is not clear if the fragmentation of the tools had been caused by impacts. However, use-wear analyses of bifacial tools in the Micoquian assemblage of the Kůlna Cave show us cutting, slicing, chopping, scraping of leather, bone and antler (*Neruda/Nerudová/Šajnerová-Dušková 2010*).

DISCUSSION

The methods of excavations and documentation of the Szeleta and Jankovich Caves were very coarse-grained for answering the archaeological questions of the 21st century. At the same time, leaf points are known various open-air sites from Hungary, as the "Aurignacian" locality of Acsa-Rovnya (Fig. 1: 8) in the Cserhát Mountains (*Dobosi 2008*; *2013*), the Middle Palaeolithic site of Hont (Fig. 1: 15) in the Ipoly/Ipeľ valley (*Zandler 2010*) and the numerous localities on the piedmont of the Bükk Mountains (Bükkmogyorósd-Hosszú-bérc, Csokvaomány/Nekézseny-Határ-tető, Eger-Kőporos-tető and Egerszalók-Kővágó-dűlő: Fig. 1: 2, 3, 6, 7; *Dobosi 1995*; *2011*; *Rozsnyói 1963*; *Vértes 1951*; *1965*; *Zandler/Béres 2014*).

Regrettably, on the sites lying in the well-known wine region around Eger the complete layer-sequence was disturbed by intensive deep ploughing (*Kozlowski et al. 2009*; *2012*; *Markó 2012*). At Acsa the artefacts were found both in the Holocene humic soil and the Pleistocene loam without forming a discrete artefact bearing layer (*Dobosi 2008*; *2013*) and in the case of the Hont locality the excavated artefacts were mixed with the pieces collected on the surface probably at several localities and field documentation is absent (*Markó 2019*). At this later site nearly 800 artefacts were recently collected from the surface. In this collection beside the local limnic silicite (76%) and the siliceous, quartzite and radiolarite pebbles (18%), the metarhyolite is represented by a few pieces (4%), similarly to the Szécsénke assemblage. Among the retouched tools, however, sidescrapers and endscrapers are nearly equally represented (27% and 26%), and leaf shaped tools (18%) and retouched blades (16%, possibly intrusion from a later prehistoric period, classified earlier as "Mesolithic": *Gábori 1964*, 70–72) are also common types.

The definition of the Bábonyian industry is based on the not stratified finds of the eastern part of the Bükk (*Ringer 1983*) and the Cserhát Mountains (Fig. 1: 11; *Markó/Péntek 2005*). The eponymous site of Sajóbábony-Méhész-tető (Fig. 1: 4) has been known since 1927 (collection by Z. Schréter). L. Tóth identified the site during the 1960s and published a total of 120 surface finds including 60 tools kept in the collection of the Ottó Herman Museum at Miskolc (*Tóth 1973*). A test excavation carried out in 1974 by Viola T. Dobosi exposing 60 m^2 yielded 180 artefacts including further 31 tools. (*Dobosi 1987–1988*). The charcoal sample collected from a well-defined fireplace yielded an anomalously young age (BLn – 2063: 185 ±50 BP).

No information is available from Ringer's fieldworks (1986, 1991, 2005 and 2014), of which only 32 selected surface-collected tools have been published until now (*Ringer 1983*). In 1997, another excavation was carried out with the participation of B. Adams exposing 26 m^2 and yielding 2,758 artefacts including the total of 75 tools (Middle and Upper Palaeolithic tool types also; *Adams 2000*; *Ringer/Adams 2000*). The radiocarbon dating efforts of two charcoal samples were not successful again (ISGS A-0007: 2542 ±55 BP and ISGS A-0008B: 2515 ±53 BP; *Adams 2000*).

Finally, in 2019 a new test excavation was carried out at the site exposed almost 2000 artefacts without further details (*Lamotte/Mester 2019–2020*).

The Mályi-Öreg-hegy locality (Fig. 1: 5) has been known since 1973 after the surface collections by M. Hellebrandt, A. Saád and Á. Ringer. The results of these activities as well as the test excavations in 1990, 1991 and 2004 have not been published except for five selected tools (*Ringer 1983*). A few artefacts were known from the 1998 excavation season, exposing 14 m^2 and yielding 206 chipped stone implements (*Adams 2000*).

Beside the Galgagyörk locality the surface collected assemblage from Legénd-Káldy-tanya (*Markó/Péntek 2005*) was classified as belonging to the Bábony-type industry in the Cserhát region. In these assemblages the leaf shaped implements are absent but typical bifacial knives and small circular scrapers are well represented. The presence of metarhyolite and obsidian among the raw material types makes these assemblages similar to the excavated industry from Galgagyörk. Further field works on this site may clear the differences between the surface collected "Micoquian" and excavated "leaf point" assemblages sharing numerous common points.

As a total, until now well-defined layers yielding rich artefactual material with leaf points have been excavated and documented only at Vanyarc, Szécsénke and Galgagyörk in Hungary. In our view the recovered assemblages belong to a single cultural tradition, dated to the Late Middle Palaeolithic period and characterised by the presence of leaf-shaped points. The lack of Upper Palaeolithic technological and typological traits (blade cores, blades and blade tools, burins, etc.) excludes an Upper Palaeolithic or "transitional" classification of these industries. Instead of "Szeletian", we suggest using the neutral term "Leaf point industry" or "*Blattspitzenindustrie*" (*Bohmers 1951*; *Bolus 2004*; *Bolus/Rück 2000*), for the archaeological assemblages from various localities in the Cserhát Mountains, and probably from Slovakia and Moravia too.

The stratigraphic position of the artefact bearing layers of the three discussed localities is seemingly identical, but the raw material spectra and the typological composition of the assemblages are different. The elevated ratio of the metarhyolite in the Vanyarc assemblage with clear evidences of on-site tool maintenance and blank production, together with numerous but fragmented leaf-shaped tools among the secondarily modified pieces may document a regular (seasonal?) moving of hunter-gatherer groups along the mid-mountain range over a distance of 100 km (Vanyarc-type industry: *Markó 2007*).

Leaf shaped tools were dominant in the assemblage of the specialised workshop site of layer 0 at Moravský Krumlov IV (Fig. 1: 18) in Moravia (*Nerudová 2011a*; *2011b*; *Nerudová/Neruda 2017*). However, as it was discussed above, the large distance from the single raw material outcrop of the metarhyolite, the bifacial tools made of this rock of the Vanyarc assemblage probably does not represent the production phase but rather the use and the rejuvenation of these pieces.

Until now the main goal of the excavations of this site was to document, if possible, a not disturbed part of the artefact bearing layer, the unusual raw material management of the locality and to collect samples for scientific dating projects. Although the number of the excavated lithics is higher than the pieces known from the Szeleta and especially, the Jankovich Caves (Fig. 1: 1, 16), further large surface excavations would be necessary to collect artefacts to perform systematic technological studies. A possible goal of these investigations is to compare the tools and the waste material of both the local and the extralocal raw material types. At the same time, however, specialized studies would be necessary to clear the nature of the tool and blank fragmentation (due to manufacture, rejuvenation, use or taphonomical agents), until now prevented by the laminar structure and the inhomogeneity of the utilised rocks.

The presence of low-quality limnic silicite and andesite excavated at Galgagyörk suggest that humans might have had no previous information about the sources of the siliceous rocks in the Cserhát region (*Richter 2001*) and exploited the nearest raw material sources without an emphasise of the quality of the rock. The presence of obsidian artefacts in the same assemblage prove that the Zemplén Mountains area was also visited by this "pioneering" human group (*Markó et al., in press a*). The stratigraphy of this locality is more favourable than it was documented at Vanyarc and the excavations are not finished yet.

Finally, the assemblage recovered at Szécsénke characterised by the dominance of endscrapers and local limnic silicite compared to the surface collected material from Buják-Szente 2 (Fig. 1: 9; *Péntek/Zandler 2014*) and Debercsény-Mogyorós (Fig. 1: 10; *Markó 2009b*) from the Cserhát area and to the Slovakian open-air stratified sites Trenčianske Teplice-Pliešky (Fig. 1: 20; *Kaminská zost. 2014*) and Moravany nad Váhom-Dlhá (Fig. 1: 21; *Nemergut 2010*; *Nemergut/Cheben/Gregor 2012*).

The raw material procurement of this locality is compared to the Moravian Szeletian sites like Vedrovice V (Fig. 1: 17; *Valoch 1993*; *2000*), Moravský Krumlov IV (*Neruda/Nerudová eds. 2009*; *Neruda/Nerudová 2010*) and Želešice-Hoynerhügel (Fig. 1: 19; *Škrdla et al. 2014*), where basically local and regional chert variants were used. At Moravany in the Váh valley (Western Slovakia) the local radiolarites were the most frequent types, the regional limnic silicites had a subordinate role. The extralocal metarhyolite and obsidian represented in a low quantity (*Nemergut 2010*; *Nemergut/Cheben/Gregor 2012*).

CONCLUSIONS

The territory of the Cserhát Mountains was one of the white spots in respect of the Palaeolithic research in Hungary. Thanks to field surveys, a great number of Middle and Upper Palaeolithic sites were discovered (*Péntek 2014–2015*; *Péntek/Zandler 2016*). Three of the Late Middle Palaeolithic open-air sites were successfully authenticated by excavations between 2003 and 2018 (Vanyarc: *Markó 2007*; *2012*). Each site is lying at the same geographical situation, along or at the heads of "dead-end valleys", at an altitude of 220–280 m a.s.l. and a 60–80 m relative height, at a distance of 15–20 km from each other, as the crow flies. The geo-pedological analysis proved relatively undisturbed layer sequences, with no traces of intense frost action and clay migration. Each of the layer sequences is non-calcareous and unfortunately does not contain faunal remains (*Markó et al., in press b*; *Zandler et al., in press*).

The non-Levallois flake industries yielded mostly exhausted single platform cores and each yielded leaf-shaped points made both on flake and raw material chunks, with a symmetrical or slightly asymmetrical shape and plano-convex or biconvex cross-section.

At each site, the local limnic silicite is the dominant raw material type. At Vanyarc (*Markó 2009a*; *2011*) and Galgagyörk the extralocal metarhyolite played the secondary role (*Markó et al., in press a*), at Szécsénke this rock was represented by single pieces (*Zandler et al., in press*). The long-distance raw material obsidian was documented only in a small quantity at Galgagyörk.

The differences observed at the distribution of the major tool classes and in the intensity of these of the local and extralocal raw materials in our view indicate different human behaviour rather than the different "cultural" background: the humans of the Galgagyörk were seemingly certain pioneers in the Cserhát region (*Markó et al., in press a*), while the "Vanyarc-type" assemblages document regular long-distance movement along the mid-mountain range (*Markó 2012*). Regrettably, the organic remains have perished during the geological processes, so we can only suppose that these assemblages are linked to (probably) hunting groups. The industry from Szécsénke site reflects the general traits known from the "Szeletian" in Moravia and Slovakia with the intense exploitation of locally available rocks (*Kaminská zost. 2014*; *Nemergut 2010*; *Neruda/Nerudová eds. 2009*; *Valoch 1993*).

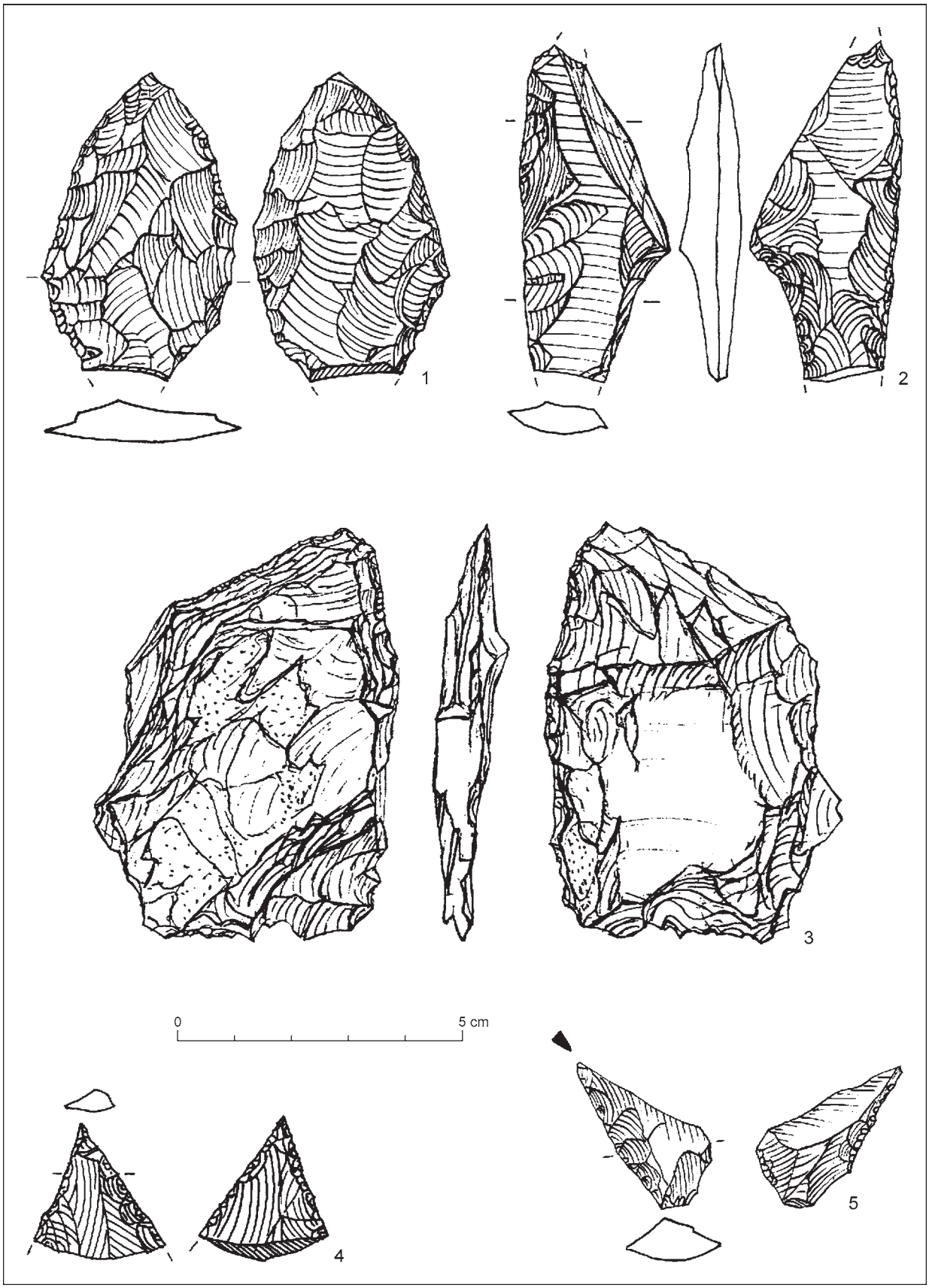
The occurrence of the asymmetrical leaf–shaped tools seems to be independent of the chronological or cultural classification of the seemingly similar pieces of the Jankovich Cave and the "Early Szeletian" of the Szeleta Cave or the discussed open–air sites in the Cserhát region. From our part, we suggest to the use the term "leaf–point industry" (*Blattspitzenindustrie*; *Bohmers 1951*; *Bolus 2004*; *Bolus/Rück 2000*) for the diverse lithic assemblages with dominant Middle Palaeolithic elements from the cave sites in the Transdanubia and in the Bükk Mountains, as well as for the recently excavated and adequately documented assemblages in the Cserhát Mountains (*Markó 2013*; *2015–2016*; *2019*).

This later area and the Ipoly/Ipeľ valley lying north of it are promising for further studies oriented towards the Late Middle Palaeolithic human occupation and behaviour.

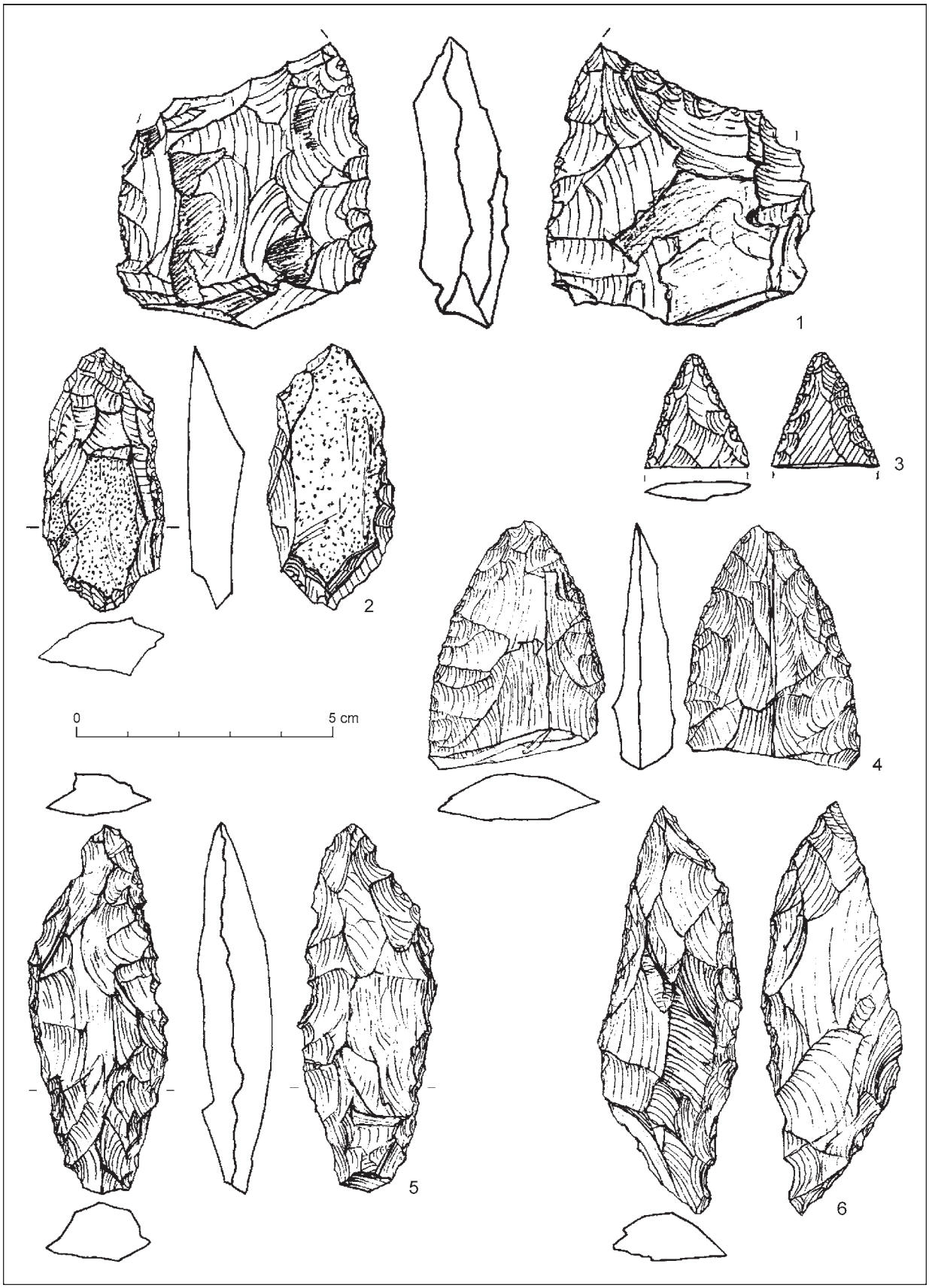
Acknowledgements

The fieldworks were supported by CR806 Our way to Europe of the University of Cologne in the case of the first season of Szécsénke. Further excavation seasons were founded by the National Cultural Fund of Hungary at Galgagyörk (COFOG 082070 NKA 207134/00333) and Szécsénke (COFOG 082070 NKA 207134/00294, COFOG 082070 NKA 207134/00300, COFOG 082070 NKA 207134/00335). The authors also thank for the support of the Hungarian National Museum and Béla Dornyay Museum. We would like to express our gratitude to Katalin Nagy for artefact drawings and to Péter Szőcs for editing the maps. We thank for Yuri Demidenko and an anonymous reviewer for their useful comments on the manuscript. We would also like to thank all the university students, volunteers and colleagues for assistance during the excavation seasons and landowners for allowing the excavations. And last we are also very thankful for the support of the members of the Eötvös Loránd University Faculty of Science: Ágnes Novothny, Gabriella Barta, Diána Csonka and Tamás Végh.

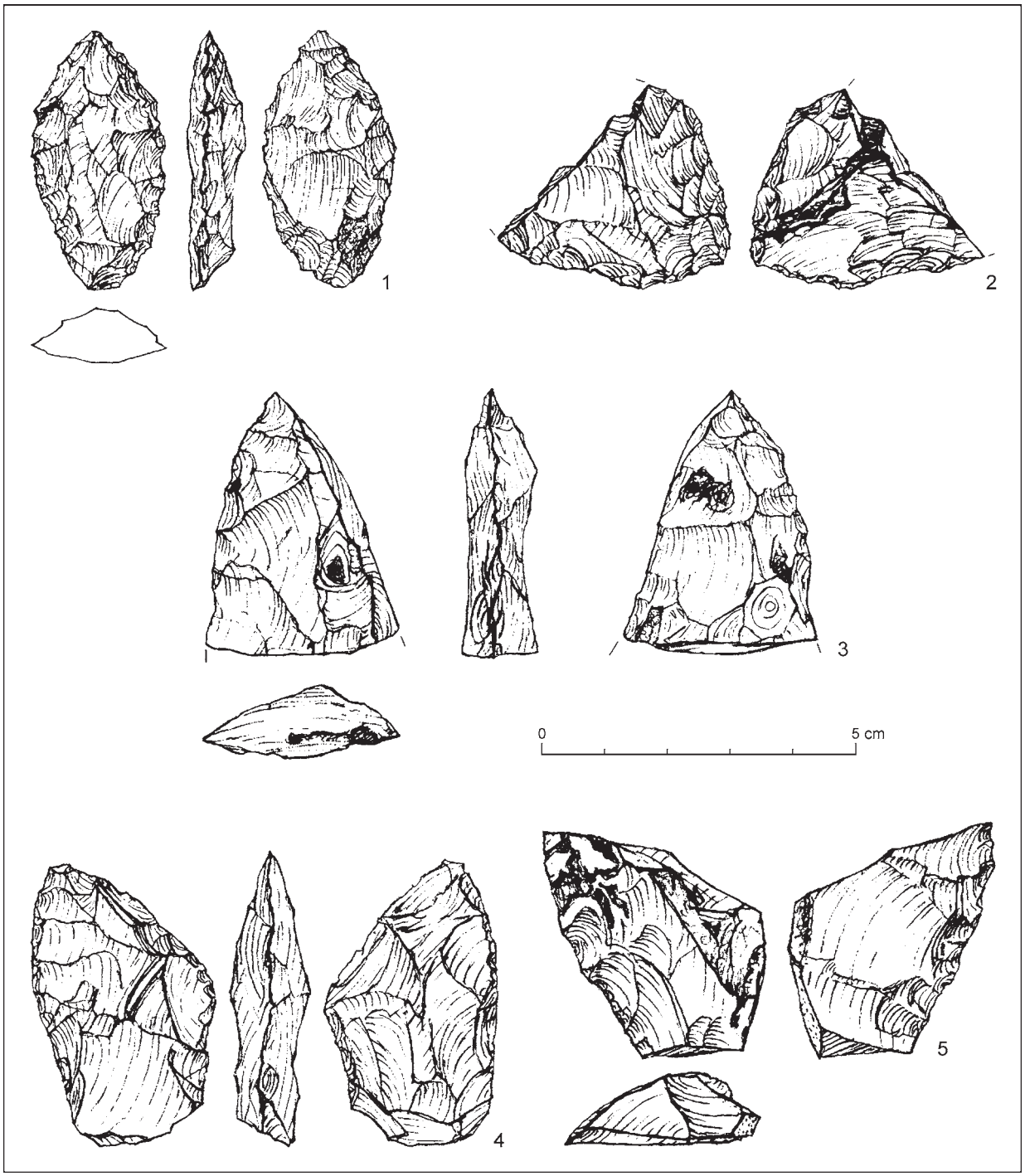
Translated by authors



Pl. I. Leaf-shaped and bifacially worked tools from Vanyarc.



Pl. II. Leaf-shaped and bifacially worked tools. 1–3 – Vanyarc; 4–6 – Galgagyörk.



Pl. III. Leaf-shaped and bifacially worked tools from Szécsénke.

BIBLIOGRAPHY

Adams 2000 B. Adams: Archaeological investigations at two open-air sites in the Bükk Mountain region of Northeast Hungary. In: J. Orschiedt/G.-Ch. Weniger (eds.): *Neanderthals and modern humans – discussing the transition. Central and Eastern Europe from 50.000–30.000 B.P.* Wissenschaftliche Schriften des Neanderthal Museums 2. Mettmann 2000, 169–182.

Adams 2007 B. Adams: Gulyás archaeology. The Szeletian and the Middle to Upper Palaeolithic transition in Hungary and Central Europe. In: J. Riel-Salvatore/G. A. Clark (eds.): *New approaches to the study of Early Upper palaeolithic "Transitional" industries in Western Eurasia – transitions great and small.* BAR International Series 1620. Oxford 2007, 91–110.

Balogh/Dobosi 1991 É. Cs. Balogh/V. T. Dobosi: Paleolit és neolit kőeszközök Verseg-Tatárdombon. Palaeolithic and Late Neolithic stone artefacts from Verseg-Tatárdomb. *Studia Comitatensia* 21, 1991, 97–111.

Balogh/Dobosi 1995 É. Cs. Balogh/V. T. Dobosi: Palaeolithic settlement traces near Püspökhatvan. *Folia Archaeologica* 44, 1995, 37–59.

Bohmers 1951 A. Bohmers: *Die Höhlen von Mauern I. Kulturgeschichte der Altsteinzeitlichen Besiedlung.* Paleohistoria 1. Groningen 1951.

Bolus 2004 M. Bolus: Der Übergang vom Mittel zum Jungpaläolithikum in Europa. Eine Bestandsaufnahme unter besonderer Berücksichtigung Mitteleuropas. *Germania* 82, 2004, 1–54.
DOI: https://doi.org/10.11588/ger.2004.69198

Bolus/Rück 2000 M. Bolus/O. Rück: Eine Blattspitze aus Wittislingen, Lkr. Dillingen a. d. Donau (Bayern). Zur südwestlichen Verbreitungsgrenze spätmittelpaläolithischer Blattspitzeninventare. *Archäologisches Korrespondenzblatt* 30, 2000, 165–172.

Bosinski 1967 G. Bosinski: *Die mittelpaläolitische Funde im Westlichen Mitteleuropa*. Fundamenta A4. Köln – Graz 1967.

Chu et al. 2018 W. Chu/Gy. Lengyel/C. Zeeden/A. Péntek/L. Kaminská/Zs. Mester: Early Upper Paleolithic surface collections from loess-like sediments in the Northern Carpathian Basin. *Quaternary International* 485, 2018, 167–182.
DOI: https://doi.org/10.1016/j.quaint.2017.05.017

Dobosi 1987–1988 V. T. Dobosi: Ásatás Sajóbábony-Méhésztetőn. *Archaeológiai Értesítő* 114–115, 1987–1988, 226–236.

Dobosi 1991 V. T. Dobosi: Paleolit telep Verseg-Kertekalján. Palaeolithic setlement at Verseg-Kertekalja. *Studia Comitatensia* 21, 1991, 73–77.

Dobosi 1995 V. T. Dobosi: Eger-Kőporos-tető. Revision d'une industrie a outils foliaces. In: *Actes du Colloque de Miskolc.* Paleo – Supplément 1. Miskolc 1995, 45–55.

Dobosi 2008 V. T. Dobosi: Acsa: new opena-air Aurignacien site in Hungary. In: N. Z. Slugostowska/A. J. Tomaszewszki (eds.): *Man-Millennia-Environment. Studies in honour of Romuald Schild.* Warsaw 2008, 151–159.

Dobosi 2010 V. T. Dobosi: "... akkoriban ugyanis még paleolit régésznek készültem" (Patay Pál). In: Sz. Guba/K. Tankó (eds.): *"Régről kell kezdenünk..." Studia Archaeologica in honorem Pauli Patay. Régészeti tanulmányok Nógrád megyéből Patay Pál tiszteletére.* Szécsény 2010, 11–21.

Dobosi 2011 V. T. Dobosi: Leaf Points in non-Szeletian context. *Praehistoria* 9–10, 2011, 71–80.

Dobosi 2013 V. T. Dobosi: Acsa-Rovnya: új eredmények. *Litikum* 1, 2013, 50–59.

Dobosi 2011–2013 V. T. Dobosi: Őskőkori lelőhelyek Romhány környékén. (Gyombola Gábor gyűjtése). Palaeolithic sites around Romhány (collected by Gábor Gyombola). *Folia Archaeologica* 55, 2011–2013, 9–23.

Gábori 1964 M. Gábori: *A késői paleolitikum Magyarországon.* Budapest 1964.

Gábori-Csánk 1993 V. Gábori-Csánk: *Le Jankovichien. Une civilisation paléolithique en Hongrie.* ERAUL 53. Liège 1993.

Hauck et al. 2016 T. Hauck/J. Rethemeyer/P. Rentzel/P. Schulte/S. Heinze/Á. Ringer/J. Richter/W. Chu/F. Lehmkuhl/O. Vogel: Neanderthals or Early Modern Humans? Arevised ^{14}C chronology and geoarchaeological study of the Szeletian sequence in Szeleta Cave (Kom. Boros-Abaúj-Zemplén) in Hungary. *Archäologisches Korrespondenzblatt Jahrgang* 46, 2016, 271–290.

Hámor 1985 G. Hámor: *A Nógrád-cserháti kutatási terület földtani viszonyai. The geology of the Nógrád-Cserhát area.* Geologica Hungarica. Series Geologica 22. Budapest 1985.

Hillebrand 1935 J. Hillebrand: *Magyarország őskőkora. Die ältere Steinzeit Ungarns.* Archaeologica Hungarica 17. Budapest 1935.

Horváth/Mindszenty 2007 Z. Horváth/A. Mindszenty: Geo-pedological observations at the Vanyarc site. *Communicationes Archaeologicae Hungariae* 2007, 2007, 15–18.

Jöris 2004 O. Jöris: Zur chronostratigraphischen Stellung der spätmittelpaläolitischen Keilmessergruppen. Der Versuch einer kulturgeograpischen Abgrenzung enier mittelpaläolitischen Formengruppe in ihrem europäischen Kontext. *Bericht der Römisch-Germanischen Komission* 84, 2004, 49–153.

Kadić 1915 O. Kadić: A Szeleta-barlang kutatásának eredményei. *A Magyar Királyi Földtani Intézet Évkönyve* 23, 1915, 151–278.

Kadić 1934 O. Kadić: A jégkor embere Magyarországon. Der Mensch zur Eiszeit in Ungarn. *A Magyar Királyi Földtani Intézet Évkönyve* 30, 1934, 1–147.

Kaminská zost. 2014 Ľ. Kaminská (zost.): *Staré Slovensko 2. Paleolit a mezolit*. Archaeologica Slovaca Monographiae. STASLO 2. Nitra 2014.

Kot 2016 M. Kot: Technological analysis of bifacial leafpoints from Middle/Upper Palaeolithic transitional industries. *Quartär* 63, 2016, 61–88.

Kozłowski et al. 2009 J. K. Kozłowski/Zs. Mester/K. Zandler/A. Budek/T. Kalicki/M. Moskal/Á. Ringer: Le Paléolithique moyen et supérieur de la Hongrie du nord: nouvelles investigations dans la région d'Eger. *L'Anthropologie* 113, 2009, 399–453.

Kozłowski et al. 2012 J. K. Kozłowski/Zs. Mester/A. Budek/T. Kalicki/M. Moskal-del-Hoyo/K. Zandler/S. Béres: La mise en valeur d'un ancien site éponyme: Eger-Kőporos dans le Paléolithique moyen et supérieur de la Hongrie du nord. *L'Anthropologie* 116, 2012, 405–465.
DOI: https://doi.org/10.1016/j.anthro.2012.05.004

Láng 1967 S. Láng: *A Cserhát természeti földrajza.* Akadémiai Kiadó. Budapest 1967.

Lamotte/Mester 2019–2020 À. Lamotte/Zs. Mester: New investigations on the Middle Palaeolithic of North East Hungary: French-Hungarian excavation at Sajóbábony. *Praehistoria New Series* 1–2 (11–12), 2019–2020, 341–343.

Markó 2004 A. Markó: Újabb kőeszközök a galgagyörki Csonkás-hegyről. *Ősrégészeti Levelek, prehistoric newsletters* 6, 2004, 10–12.

Markó 2005 A. Markó: Limnokvarcit a Cserhát-hegységben. *Archeometriai Műhely* 2/4, 2005, 52–55.

Markó 2007 A. Markó: Preliminary report on the excavations of the middle palaeolithic site Vanyarc-Szlovácka dolina. *Communicationes Archaeologicae Hungaricae* 2007, 2007, 5–18.

Markó 2009a A. Markó: Raw material circulation during the Middle Palaeolithic period in Northern Hungary. In: J. Ganczarski (ed.): *Surowce naturalne w Karpatach oraz ich wykorzystanie w pradziejach i wczesnym średniowieczu*. Krosno 2009, 107–119.

Markó 2009b A. Markó: Levéleszközös leletegyüttes Debercsényből. Leaf-shaped industry from Debercsény. *Archeológiai Értesítő* 134, 2009, 155–163.

Markó 2011 A. Markó: Raw material use at the Middle Palaeolithic site of Vanyarc (Northern Hungary). *Praehistoria* 9–10, 2011, 183–194.

Markó 2012 A. Markó: *Középső-paleolitikus leletegyüttesek Vanyarc környékén.* PhD. Thesis. Eötvös Loránd University Faculty of Humanities. Budapest 2012. Unpublished.

Markó 2013 A. Markó: On the Middle Palaeolithic industry of the Jankovich cave (Northeastern Transdanubia). *Archaeologiai Értesítő* 138, 2013, 7–28.

Markó 2016 A. Markó: Considerations on the lithic assemblages from the Szeleta cave. *Communicationes Archaeologicae Hungariae* 2015–2016, 2016, 5–43.

Markó 2019 A. Markó: Jankovichian, Szeletian or a leaf point industry: Analysis of three small assemblages. *Acta Archaeologica Academiae Scientiarium Hungaricae* 70, 2019, 259–282.

Markó/Péntek 2005 A. Markó/A. Péntek: Raw material procurement strategy on the Palaeolithic site of Legénd-Káldy-tanya (Cserhát Mountains, Northern Hungary). *Praehistoria* 4–5, 2005, 165–177.

Markó/Péntek/Béres 2002 A. Markó/A. Péntek/S. Béres: Chipped stone assemblages from the environs of Galgagyörk (Northern Hungary). *Praehistoria* 3, 2002, 245–257.

Markó et al., in press a A. Markó/K. Zandler/D. Csonka/T. Végh: Preliminary report on the excavations at Galgagyörk. *Communicationes Archaeologicae Hungariae*, in press.

Markó et al., in press b A. Markó/K. Zandler/Á. Novothny/D. Csonka/B. Bradák/T. Végh: Three Middle Palaeolithic open-air sites from the Cserhát Mountains (Northern Hungary). New excavations, new results, new questions. *Geoarchaeology*, in press.

Mester 2018 Zs. Mester: The problems of the Szeletian as seen from Hungary. *Recherches Archéologique. Nouvelle Serie* 9, 2018, 19–48.

Nemergut 2010 A. Nemergut: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bártu z rokov 1963 a 1990. *Slovenská archeológia* 58, 2010, 183–206.

Nemergut/Cheben/Gregor 2012 A. Nemergut/M. Cheben/M. Gregor: Lithic raw material use at the palaeolithic site of Moravany nad Váhom-Dlhá. *Anthropologie* 50, 2012, 379–390.

Neruda/Nerudová eds. 2009 P. Neruda/Z. Nerudová (eds.): *Moravský Krumlov IV. Vícevrstevná lokalita ze středního a počátku mladého paleolitu na Moravě.* Brno 2009.

Neruda/Nerudová 2010 P. Neruda/Z. Nerudová: Moravský Krumlov IV – A new multilayer palaeolithic site in Moravia. *Archäologisches Korrespondenzblatt* 40, 2010, 155–174. DOI: https://doi.org/10.11588/ak.2010.2.51818

Neruda/Nerudová/Šajnerová-Dušková 2010 P. Neruda/Z. Nerudová/A. Šajnerová-Dušková: Trasologická analýza micoquienský bifaciálních nástrojů z jeskyně Kůlny. *Acta Musei Moraviae, Scientiae sociales* 95, 2010, 3–15.

Nerudová 2011a Z. Nerudová: The technology of the Szeletian lithic industry in the context of Moravian EUP cultures. *Praehistoria* 9–10, 2011, 47–60.

Nerudová 2011b Z. Nerudová: Moravský Krumlov, site IV. The reconstruction of the Szeletian reduction strategy on the basis of refittings. Moravský Krumlov IV. *Światowit* 9, 2011, 215–222.

Nerudová/Neruda 2017 Z. Nerudová/P. Neruda: Technology of Moravian Early Szeletian leaf point shaping: A case study of refittings from Moravský Krumlov IV open-air site (Czech Republic). *Quaternary International* 428, 2017, 91–108. DOI: https://doi.org/10.1016/j.quaint.2015.09.065

Noszky 1940 J. Noszky: *A Cserhát-hegység földtani viszonyai. Magyar tájak földtani leírása III (Das Cserhát-Gebirge).* Budapest 1940.

Péntek 2015 A. Péntek: Open-air site complex with leaf-points at Szécsénke (Cserhát Mountains, Northern Hungary). *Litikum* 3, 2015, 46–49.

Péntek 2014–2015 A. Péntek: A Cserhát-hegység és az Ipoly-völgy levéleszközös lelőhelyeinek topográfiája. *A Dornyay Béla Múzeum Évkönyve* 38, 2014–2015, 213–265.

Péntek 2016 A. Péntek: Legénd-Hosszú-földek a new open-air Aurignacian site in the Cserhát Mountains. *Gesta* 15, 2016, 3–30.

Péntek 2018 A. Péntek: Legénd-Hosszú-földek, a new open-air Aurignacian site in the Cserhát Mountains (Northern Hungary). *Archeometriai Műhely* 15, 2018, 57–74.

Péntek 2019 A. Péntek: Quartz and Quartzite as lithic raw materials in the Hungarian Palaeolithic. *Archeometriai Műhely* 16, 2019, 65–84.

Péntek/Gábriel 2018 A. Péntek/S. Gábriel: Legénd-Káldy-tanya 5. nyíltszíni paleolitikus lelőhely kőipara. *A Dornyay Béla Múzeum Évkönyve* 41, 2018, 191–219.

Péntek/Zandler 2013a A. Péntek/K. Zandler: Nyíltszíni Szeletien telep Szécsénke-Kis-Ferenc-hegyen. *Litikum* 1, 2013, 36–49.

Péntek/Zandler 2013b A. Péntek/K. Zandler: Nyíltszíni levéleszközös telep Legénd-Rovnyán. *A Dornyay Béla Múzeum Évkönyve* 37, 2013, 23–45.

Péntek/Zandler 2014 A. Péntek/K. Zandler: Buják-Szente, egy nyíltszíni paleolitikus telep. *Litikum* 2, 2014, 3–16.

Péntek/Zandler 2016 A. Péntek/K. Zandler: A Cserhát-hegység és az Ipoly-völgy felső paleolitikus és epipaleolitikus lelőhelyeinek topográfiája. *A Dornyay Béla Múzeum Évkönyve* 39, 2016, 122–171.

Péntek/Zandler 2017 A. Péntek/K. Zandler: Nyíltszíni paleolitikus lelőhelyek Bér térségében (Cserhát-hegység, Nógrád megye). Előzetes eredmények. *A Dornyay Béla Múzeum Évkönyve* 40, 2017, 336–371.

Péntek/Zandler 2018 A. Péntek/K. Zandler: Evidence of middle palaeolithic south from Vanyarc (Nógrád county, Northern Hungary). *A Dornyay Béla Múzeum Évkönyve* 41, 2018, 220–235.

Prošek 1953 F. Prošek: Szeletien na Slovensku. *Slovenská archeológia* 1, 1953, 133–194.

Richter 2001 J. Richter: For lack of a wise man? Late Neanderthal land use patterns in the Altmühl River Valley, Bavaria. In: N. Conard (ed.): *Settlement dynamics of the Middle Palaeolithic and Middle Stone Age*. Tübingen 2001, 205–219.

Ringer 1983 Á. Ringer: *Bábonyien – Eine mittelpaläolitische Blattwerkzeugindustrie in Nordostungarn.* Dissertationes Archaeologicae Series 2/11. Budapest 1983.

Ringer 2002 Á. Ringer: The new image of the Szeleta and Istállós-kő caves in the Bükk Mountains: a revision project between 1999–2002. *Praehistoria* 3, 2002, 47–52.

Ringer/Adams 2000 Á. Ringer/B. Adams: Sajóbábony-Méhész-tető: eponymous site of the Middle Palaeolithic Bábonyian industry: microwear studies made on tools found at the site during the 1997 excavation. *Praehistoria* 1, 2000, 117–128.

Ringer/Mester 2000 Á. Ringer/Zs. Mester: Rèsultats de la révision de la grotte Szeleta enterprise en 1999 et 2000. *Anthropologie* 38, 2000, 261–270.

Ringer/Mester 2001 Á. Ringer/Zs. Mester: A Szeleta-barlang 1999–2000. évi régészeti revíziójának eredményei. *A Herman Ottó Múzeum Évkönyve* 40, 2001, 5–19.

Rozsnyói 1963 M. Rozsnyói: Mezolit-gyanús szórványleletek a Bükk-hegység északnyugati részén. *Az Egri Múzeum Évkönyve* 1, 1963, 69–80.

Saád/Nemeskéri 1955 A. Saád/J. Nemeskéri: A Szeleta barlang 1947. évi kutatásainak eredményei. *Folia Archaeologica* 7, 1955, 15–21.

Simán 1985 K. Simán: Paleolit leltek Sajószentpéteren. *A Miskolci Herman Ottó Múzeum Évkönyve* 22–23, 1985, 9–20.

Simán 1990 K. Simán: Considerations on the "Szeletian unity" In: J. K. Kozłowski (ed.): *Feuilles de pierre. Les industries á pointes foliacées du Paléolithique Supérieur Européenne.* Études et Recherches Archéologiques a L'Université de Liège 90. Liège 1990, 189–198.

Simán 1993 K. Simán: Őskőkori leletek Nógrád megyében. *Nógrád Megyei Múzeumok Évkönyve* 18, 1993, 247–254.

Škrdla et al. 2014 P. Škrdla/L. Nejman/T. Rychtaříková/P. Nikolajev/L. Lisá: New observations concerning the Szeletian in Moravia. *Quartär* 61, 2014, 87–101. DOI: https://doi.org/10.7485/QU61_04

Tóth 1973 L. Tóth: Mezolit telep Sajóbábonyban. *A Miskolci Herman Ottó Múzeum Közleményei* 12, 1973, 17–25.

Valoch 1993 K. Valoch: Vedrovice V. Eine Siedlung des Szeletien in Südmähren. *Quartär* 43–44, 1993, 7–93.

Valoch 2000 K. Valoch: Das Szeletien Mährens – Seine Wurzeln und Beziehungen. In: Z. Mester/Á. Ringer (eds.): *A la recherche de L"Homme préhistorique*. ERAUL 95. Liège 2000 287–294.

Vértes 1951 L. Vértes: Novie raskopki v peschtschere na Istállóskö. *Acta Archaeologica* 1, 1951, 154–190.

Vértes 1965 L. Vértes: *Az őskőkor és átmeneti kőkor emlékei Magyarországon.* Régészeti kézikönyv 1. Budapest 1965.

Vértes 1968 L. Vértes: Szeleta-Symposium in Ungarn. 4–11 September 1966. *Quartär* 19, 1968, 381–390.

Zandler 2008 K. Zandler: Nyíltszíni paleolit lelőhely Erdőtarcsa-Daróci-hegyen. *A Nógrád Megyei Múzeumok Évkönyve* 32, 2008, 46–66.

Zandler 2010 K. Zandler: Paleolit telep Hont-Csitáron. A palaeolithic site at Hont-Csitár. In: Sz. Guba/K. Tankó (eds.): *"Régről kell kezdenünk..." Studia Archaeologica in honorem Pauli Patay. Régészeti tanulmányok Nógrád megyéből Patay Pál tiszteletére.* Szécsény 2010, 23–49.

Zandler 2012 K. Zandler: A paleolitikum kőiparai Eger környékén. *Gesta* 11, 2012, 147–203.

Zandler/Béres 2014 K. Zandler/S. Béres: Revision of three open-air Palaeolithic sitesin the Bükk Mountains, NE-Hungary. In: K. T. Biró/A. Markó/K. P. Bajnok (eds.): *Aeolian Scripts. New Ideas on the Lithic World. Studies in Honour of Viola T. Dobosi.* Inventaria Praehistorica Hungariae 13. Budapest 2014, 63–76.

Zandler et al., in press K. Zandler/A. Markó/D. Csonka/T. Végh: Preliminary report on the excavations at Szécsénke. *Communicationes Archaeologicae Hungariae*, in press.

Szeletien alebo nie szeletien

Bifaciálna industria z troch otvorených stredopaleolitických lokalít v pohorí Cserhát (severné Maďarsko)

Krisztián Zandler – András Markó – Attila Péntek

Súhrn

Listovité hroty z maďarských otvorených lokalít sú dlhodobo známe len z nestratifikovaných a nevyhodnotených stratigrafických situácií. Od roku 2003 boli v predtým nepreskúmanej oblasti, v regióne Cserhát, objavené bohaté stratifikované súbory s listovitými hrotmi. Tento región leží medzi severným okrajom Veľkej dunajskej kotliny a údolím rieky Ipeľ. Identifikované boli početné lokality v slepých údoliach, kde boli nájdené listovité hroty s asymetrickým prierezom z neskorej fázy stredného paleolitu.

Súbory objavené na lokalitách Vanyarc, Galgagyörk a Szécsénke, sú charakteristické prítomnosťou listovitých hrotov, bifaciálnych driapadiel, nožov, úštepov na výrobu nástrojov bez akýchkoľvek stôp po produkcii čepelí či nástrojov z horného paleolitu. Vo všetkých prípadoch sa navyše potvrdila prítomnosť extralokálnej metaryolitickej suroviny z východnej časti Bukovských vrchov, zo vzdialenosti zhruba 100 km od predmetných lokalít. Nálezy sa vzhľadom na

polohu lokalít nachádzali v odvápnenej hline ležiacej priamo pod súčasnou humusovou pôdou, v pozícii *in situ*, bez stôp nedávneho (poľnohospodárskeho) porušenia. V skúmaných súboroch dominujú miestne suroviny (hydrokvarcit a limnosilicit). Extralokálny metaryolit má vedľajšiu úlohu len v súboroch zo Szécsénke.

Súbory vykazujú rôzne typologické zloženie. Vo Vanyarcu sú časté bifaciálne opracované a listovité nástroje, v Galgagyörku prevládajú driapadlá. Škrabadlá sú dominantnými nástrojmi v Szécsénke.

Podľa nášho názoru patria získané súbory ku kultúrnej tradícii z neskorej fázy stredného paleolitu, ktorú charakterizuje prítomnosť listovitých hrotov a nožov. Nože by mohli byť medzistupňom vo výrobe listovitých hrotov.

V Maďarsku sú vyššie opísané lokality a industrie s listovitými hrotmi nedostatočne definované. V inej štúdii (*Markó 2013*; *2019*) bolo spochybnené aj odôvodnenie industrie jankovichienu, definovanej podľa nestratifikovaných, prípadne neadekvátne zdokumentovaných kolekcií kamenných industrií (*Gábori-Csánk 1993*). Väčšina súborov bábonyienu je stále nepublikovaná. Kamenná industria z jaskyne Jankovich a súbory z lokalít jankovichienu by mohli patriť viacerým archeologickým entitám. Súbory z hornej vrstvy v jaskyni Szeleta boli čiastočne určené pred 30 rokmi ako gravettienske, zatiaľ čo artefakty z nižšej vrstvy zatiaľ neboli revidované. Po revízii artefaktov z údajných „kultúrnych vrstiev" v Szelete sa ukázalo, že použitie pojmu „szeletien" by sa malo obmedziť len na lokality v oblasti Bukových hôr v severnom Maďarsku.

Na rôznorodé súbory kamenných industrií so stredopaleolitickými prvkami z jaskynných polôh Zadunajska a Bukových hôr, ako aj na nedávno preskúmané a patričné zdokumentované súbory v pohorí Cserhát preto navrhujeme používať pojem „industria listovitých hrotov".

Obr. 1. Poloha skúmaných nálezísk. 1 – jaskyňa Szeleta; 2 – Bükkmogyorósd-Hosszú-bérc; 3 – Csokvaomány/Nekézseny-Határ-tető; 4 – Sajóbábony-Méhész-tető; 5 – Mályi-Öreg-hegy; 6 – Eger-Kőporos-tető; 7 – Egerszalók-Kővágó-dűlő; 8 – Acsa-Rovnya; 9 – Buják-Szente 2; 10 – Debercsény-Mogyorós; 11 – Legénd-Káldy-tanya 5; 12 – Galgagyörk-Csonkás-hegy; 13 – Vanyarc-Szlovácka dolina 5; 14 – Szécsénke-Kis-Ferenc-hegy; 15 – Hont-Csitár (Malom-hegy); 16 – jaskyňa Jankovich; 17 – Vedrovice V; 18 – Moravský Krumlov IV; 19 – Želešice; 20 – Trenčianske Teplice-Pliešky; 21 – Moravany nad Váhom-Dlhá.

Obr. 2. Získavanie surovín na skúmaných náleziskách. 1 – karpatský obsidián 2T (Tolcsva); 2 – karpatský obsidián 2E (Mád); 3 – metaryolit (Bükkszentlászló); 4 – limnosilicit (Buják); 5 – limnosilicit (Püspökhatvan); 6 – andezit, kremičité, rádiolaritové alebo kvarcitové okruhliaky z Galgagyörku; 7 – kremičité, rádiolaritové a kvarcitové okruhliaky z Vanyarcu; 8 – kremičité, rádiolaritové a kvarcitové okruhliaky zo Szécsénke.

Tabela 1. Skúmané kamenné súbory.
Tabela 2. Rádiokarbonové dáta z Vanyarcu.
Tabela 3. Získavanie objavených surovín v skúmaných súboroch.
Tabela 4. Hlavné typy nástrojov v skúmaných súboroch.
Tabela 5. Distribúcia bifaciálnych nástrojov v skúmaných súboroch.
Tabela 6. Detaily listovitých nástrojov z lokalít Vanyarc, Galgagyörk a Szécsénke.

Tab. I. Listovité a obojstranne opracované nástroje z Vanyarcu.
Tab. II. Listovité a obojstranne opracované nástroje. 1–3 – Vanyarcu; 4–6 – Galgagyörku.
Tab. III. Listovité a obojstranne opracované nástroje zo Szécsénke.

Preložila Viera Tejbusová

Krisztián Zandler (PhD. student)
University of Szeged
Doctoral School of History
Egyetem utca 2
HU – 6722 Szeged
krisztian.zandler@muzeumicentrum.hu

András Markó, PhD.
Hungarian National Museum
Múzeum krt. 14–16
HU – 1088 Budapest
marko.andras@hnm.hu

Attila Péntek
Késmárki utca 27
HU – 2143 Kistarcsa
attila.pentek@yahoo.com

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 49–62

WHAT ABOUT THE SZELETIAN LEAF POINT AS *FOSSILE DIRECTEUR*?

Zsolt Mester

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.4

Keywords: Solutrean, Szeletian, research history, typology, morphometry, index fossil, leaf-shaped tools

Abstract: The Szeletian is widely accepted as an industry of the Middle to Upper Palaeolithic transition in Central Europe, characterized by the production of leaf points and associated with Neanderthals. In 1953, F. Prošek has introduced the term Szeletian for describing an already existing archaeological unit in Central Europe, which had been defined relative to the Solutrean of Western Europe. He did not define the new unit but applied the fourfold model Hungarian scholars established to describe the development of the Solutrean in Hungary, based solely upon leaf point typology. Here, I argue that the "Szeletian leaf point," which is thought to characterize this unit, is a typologically undefined tool. However, the analyses of bifacial and leaf-shaped tools from Moravian and Hungarian sites, during the last decade, revealed the existence of certain basic forms which are frequent as far as they could represent types or sub-types among "Szeletian leaf points." For being considered as *fossile directeur*, these types have to have something specific by which they can be distinguished from other leaf point types, and they have to appear exclusively in the context of Szeletian assemblages. To clarify it needs further joint researches by concerned Central European scholars. Until we can not demonstrate the existence of a specific type of leaf point linked strictly to the Szeletian, it seems to be better to not use the "Szeletian leaf point" as a typological term.

INTRODUCTION

Since *F. Prošek* (*1953*) introduced the term Szeletian for an industry of the Early Upper Palaeolithic characterized by bifacial leaf-shaped tools in the Middle Danube basin, there is not a commonly accepted view of what the Szeletian is (*Mester 2014a*, 160–165). This is because the scholars from related countries based their views on the archaeological record of their own territories (*Bárta 1960*; *1990*; *Gábori 1990*; *Kaminská 2015*; *Kaminská zost. 2014*; *Kaminská/Kozłowski/Škrdla 2011*; *Kozłowski 2000*; *Neruda/Nerudová 2013*; *Oliva 1991*; *1995*; *Prošek 1953*; *Ringer 1989*; *2001*; *Simán 1990*; *Svoboda/Simán 1989*; *Valoch 1957*; *1990*; *Vértes 1956*; *1968*). After the publication of the monograph by *P. Allsworth-Jones* (*1986*), the Szeletian became widely accepted as one of the cultural units of the transition from the Middle to Upper Palaeolithic in Central Europe, associated with Neanderthals (*Bolus 2004a*; *Marks/Monigal 2000*; *Nigst 2006*; *Svoboda 2001*; *2006*). This unit is thought to be characterized by bifacial leaf points, although such tools can be found in different cultural and chronological contexts from Great Britain to Russia (*Allsworth-Jones 1990*; *Bolus 2004b*; *Kot 2014*; *2016*; *Kozłowski 1990*; *1995*).

I was faced with the problem of the bifacial leaf points following the new interpretation of the archaeological sequence of Szeleta Cave by Á. Ringer (*Ringer/Mester 2000*). According to his model, the leaf points of the Szeletian appear together with the leaf-shaped tools of the Jankovichian along almost the whole sequence (*Ringer/Mester 2000*, 268). However, the Jankovichian is considered a Late Middle Palaeolithic unit (*Gábori-Csánk 1983*; *1993*). To look for technological differences for distinguishing types of these two units, I performed analyses of the leaf-shaped tools of Szeleta and Jankovich caves (*Mester 2010*; *2014b*). Surprisingly, more similarities have been found between Early Szeletian and Jankovichian than between Early and Developed Szeletian. This result raised the question of what the meaning of the "Szeletian leaf point" is (*Mester 2018a*). The main topic of the 16th SKAM Lithic Workshop, organized by the Institute of Archaeology Slovak Academy of Sciences in Nitra (*Nemergut et al. eds. 2019*) provided an opportunity to discuss the role of these tools as index fossils of the Szeletian. However, the purpose of

this paper is not to answer the question in the title by defining the "Szeletian leaf point" as a tool type. It aims at opening a discussion about the meaning of this type in the context of the Szeletian in Central Europe.

First, I briefly review the research history to understand why a definition of the type is lacking. After that, I reconsider the typology of the leaf-shaped tools in Szeletian context in order to find elements for a future definition. Finally, I reconsider the role of *fossile directeur*.

THE UNDEFINED SZELETIAN LEAF POINT

The lack of definition for a "Szeletian leaf point" is a consequence of the complicated research history of the problem of interpretation of the industries with leaf points in Europe (*Freund 1952*). During several decades of the developing Palaeolithic archaeology in Central and Eastern Europe starting in the late 19th century, all lithic assemblages found in "diluvial" (i.e. of Pleistocene age) layers were compared to the classification elaborated in France by G. de Mortillet from the 1870s onward (*Bourdier 1967*, 45; *Brézillon 1972*, 160). This French system was laid on the concept of a linear ("Lamarckian") evolution of the human technical knowledge and society, common in the 19th century (cf. *Morgan 1877*). Mortillet's classification of the Palaeolithic was conceived as successive stages of the technological development of prehistoric humans from handaxes of the Chellean to high-quality bone industry of the Magdalenian. This classification served as a chronological scheme thought to be universal (*Julien 1992*, 165, 166). The principle and the methodology have been taken from geology and palaeontology (*Pautrat 1993*).

After the debate on the existence of a separate Aurignacian between the Mousterian and the Solutrean (*Groenen 1994*, 162–169), Mortillet's classification was refined by *H. Breuil* (*1912*). In both classifications, bifacial leaf points were attributed to the Solutrean stage only. As a result, lithic assemblages with leaf points found at the sites of Central Europe were classified – automatically – to the Solutrean (*Kozłowski J./ Kozłowski S. 1996*; *Mester 2014a*; *Valoch 1996*). At the moment of the discovery, it was evident to link the leaf point assemblages of Szeleta Cave in Hungary to the Solutrean (*Kadić 1916*). Because of the lower quality of their shaping, the more or less regular leaf points found at Hungarian sites were classified as Proto-Solutrean and Early Solutrean (*Hillebrand 1935*; *Kadić 1934*). Moreover, *J. Hillebrand* (*1935*, 34) supposed that the Solutrean has been developed in Central Europe and migrated to Southwestern Europe under the effects of the cooling climate. Based on the clear differences in the shaping between the tools of the Solutrean in Western Europe and those of the industries in Central Europe, in the 1930s, Central European scholars tried to introduce a separate stage for the industries with leaf points of the region, with Předmostí in Moravia (F. Wiegers) or Szeleta Cave in Hungary (I. L. Červinka) as eponymous site (*Freund 1952*, 211–213; *Prošek 1953*, 144, 145, 187, 188). Following *J. Andrée* (*1930*), *J. Hillebrand* (*1935*, 31) used the name of "Szeleta-Kultur" for the Proto-Solutrean of Hungary.

At the beginning of the 1950s, the leaf points of Central and Eastern Europe were demonstrated to belong to a period earlier than the Solutrean of Western Europe. Based on her European scale analysis of the evidence, *G. Freund* (*1952*) proposed to name them "Prae-Solutrean". According to stratigraphic observations made during new excavations in Western Slovakia, including Dzeravá skala Cave, *F. Prošek* (*1953*) concluded to an age of Würmian 1/2 interstadial for these assemblages in the Carpathian Basin, and described them as "Szeletian" after the first excavated site.

F. Prošek's proposition for distinguishing the Szeletian as an Early Upper Palaeolithic culture concerned an already existing unit (Solutrean) under a new name and a new chronological position. Probably, that is why he did not give a definition of the new unit but applied the fourfold model Hungarian scholars established to describe the development of the Solutrean in Hungary, although he criticized this model for being based upon solely of leaf point typology. This model was built up after a dozen excavations conducted at cave sites in Northern Hungary (*Hillebrand 1935*; *Kadić 1934*; *Mottl 1938*), it distinguished the phases of a Protosolutrean, an Early Solutrean, a Developed Solutrean and a Late Solutrean. The regular shaped bifacial leaf points in the upper layers at Szeleta Cave represented the top of this evolution, the Developed Solutrean (Fig. 1: 5, 6). The roughly elaborated specimens of the lower layers of Szeleta corresponded to the dawn of the development, the Protosolutrean (Fig. 1: 1–3). The bifacial leaf points of the Jankovich Cave fitted between the two developmental levels, the Early Solutrean (Fig. 1: 4, 7, 8). The bifacial foliate tools of the Puskaporos Rockshelter, associated with Late Glacial fauna, were less regularly shaped like the best types of the Szeleta, therefore they represented the Late Solutrean (Fig.

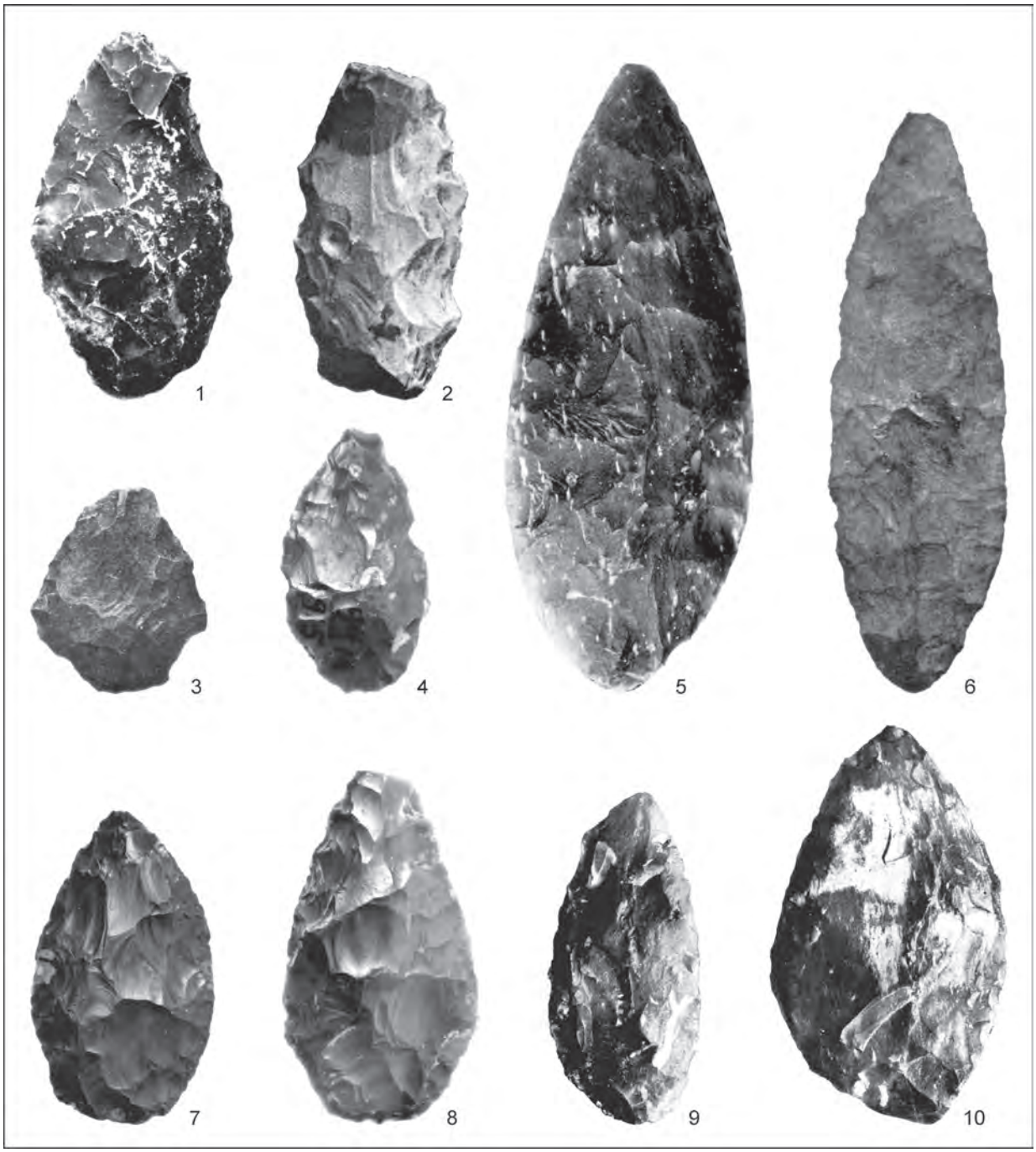


Fig. 1. Leaf points of the phases of the "Solutrean" in Hungary. 1–3 – Protosolutrean from Szeleta Cave (after *Kadić 1934*, pl. IV: 2, 5, 7, original photo by G. Toborffy); 4–6 – Early Solutrean from Jankovich Cave (after *Gábori-Csánk 1993*, pl. IIb: 5, 8, 10, original photo by A. Dabasi); 7, 8 – Developed Solutrean from Szeleta Cave (after *Kadić 1934*, pl. V: 1, 3, original photo by G. Toborffy); 9, 10 – Late Solutrean from Puskaporos Rockshelter (after *Kadić 1934*, pl. VI: 2, 7, original photo by T. Dömök). Without scale.

1: 9, 10). This typological sequence of the "laurel leaf points" was built by a biographical approach. It means that the development of a lithic tool-type follows the life of a human: childhood (the early phase after the birth) – adolescence (developmental phase) – adulthood (fully developed phase) – old age (declining phase). F. Prošek completed the characterization of these phases of the Szeletian by describing cores and other tools, too, including the archaeological record of Western Slovakia and the published data from Hungary. He did not identify the late phase of the Szeletian in Slovakia. At the same time,

M. Gábori (*1953*) revised the Hungarian record and also doubted the integrity of the late phase which he proposed to be included in the developed phase.

F. Prošek's idea intensified the research in Central Europe (*Mester 2014a*). In Hungary, the investigations aimed at specifying the archaeological meaning of the Szeletian by revising the lithic assemblages of the already excavated cave sites, as well as at demonstrating its origin in the local Middle Palaeolithic, especially in the Mousterian of the Bükk Mountains (*Vértes 1956*; *1958*; *1962–1963*; *1968*). In Czechoslovakia, intensive field works have been undertaken, focusing on the valley of the Váh River (Western Slovakia) by J. Bárta and the region of Brno and the Krumlovský les area (Moravia) by K. Valoch (*Allsworth-Jones 1986*). Due to methodological development and changing paradigm in French Palaeolithic research from the 1950s onward, lithic studies shifted from using certain types to include the whole assemblages in defining cultural identity (*Julien 1992*, 166–172). As a consequence, Central European scholars became interested in the composition of Szeletian industries using statistical approaches (*Oliva 1991*; *1995*; *Valoch 1957*; *1990*; *Valoch et al. 1993*; *Vértes 1968*). From the 1980s onward, the question of the Szeletian became part of the discussion about the Middle to Upper Palaeolithic transition (*Allsworth-Jones 1986*; *Camps/Chauhan eds. 2009*; *Conard ed. 2006*; *Farizy dir. 1990*; *Neruda/Nerudová 2013*; *Otte ed. 2014*; *Riel-Salvatore/Clark eds. 2007*; *Svoboda 2001*; *Svoboda/Simán 1989*). Scholars, were not motivated to establish a detailed typology of the "Szeletian leaf points" on a Central European scale. Only the inner variability of the type was highlighted (*Kaminská 2015*; *Oliva 1991*; *Valoch 1990*; *Valoch et al. 1993*).

ELEMENTS FOR THE TYPOLOGY OF THE SZELETIAN LEAF POINT

Now we are in a strange situation: the Szeletian is widely accepted to be a "Middle to Upper Palaeolithic transitional industry" in Central Europe characterized by the presence of the "Szeletian leaf point" which is a typologically undefined tool. Among the leaf points in Szeletian context, the only exception is the "foliate point of Moravany-Dlhá type" described by *J. Bárta* (*1960*, 302): a classic poplar leaf-shaped tip with a relatively straight base, which has the maximum width in the lower quarter of the tool and the overall shape resembles an equilateral triangle. *P.-Y. Demars* and *P. Laurent* (*1992*, 124) gave a very general definition for the "Szeletian leaf point": a foliate piece that is highly variable in form and retouched usually on the whole surface of both faces. Moreover, their fig. 48 illustrates the type by five artefacts, two of which have a different cultural context: no. 1 from Ilsenhöhle Cave and no. 4 from Nietoperzowa Cave now belong to the Lincombian-Ranisian-Jerzmanowician (LRJ) complex (*Flas 2011*; *2014*). Demars and Laurent accepted the possibility that the Jerzmanowice point can also be included in the category of "Szeletian leaf point" as a partially retouched variant. On the contrary, *P. Allsworth-Jones* (*1986*, 30, 31) argued to distinguish the "unifacial leaf point" as another tool type. In my view too, the Jerzmanowice point suggests a shaping concept completely different from bifacial leaf points, even if there are partly or totally "unifacial" examples of this latter in the archaeological assemblages (e.g. *Bárta 1960*, pl. I: 3, 4, 6; III: 2, 4; *Nemergut 2010*, pl. V: 1–12). Moreover, the Jerzmanowice point seems to be a good *fossile directeur* of the LRJ complex.

In the early 20th century, Hungarian scholars had good reasons to base their analyses of the mentioned cave sites on the "laurel leaf points" as *fossile directeur*. On the one hand, the assemblages were attributed to the Solutrean which was characterized by this tool-type in the abovementioned French system. On the other hand, these tools seemed to be of high importance in the region, because the first discoveries in the town of Miskolc (Northeast Hungary) – interpreted as traces of prehistoric humans, which incited O. Kadić to excavate at Szeleta Cave – were bifacial leaf-shaped artefacts (*Kadić 1934*, 19–23, pl. I; II; *Mester 2014a*). For a real evaluation of the typology of the leaf points in Hungary, made by Kadić and Hillebrand, we should not forget that they classified their types in comparison with the "classical" laurel leaf points of the Solutrean in France. The definition of the Solutrean laurel leaf point (*Brézillon 1968*, 216, 217; *Demars/Laurent 1992*, 132) emphasizes the often symmetrical and pointed form, the totally retouched surface on both sides with flat and parallel negatives. There is a certain variability in forms, whereby P. Smith distinguished 13 variants of the type (*Brézillon 1968*, 217, fig. 87), but almost all are elongated. From this perspective, the regular and symmetrical, elongated, bifacial foliate points from Szeleta Cave were similar enough to the "classical" type. Moreover, the two basic types recognized by *O. Kadić* (*1916*, 238) within the collection of the regular and symmetrical points

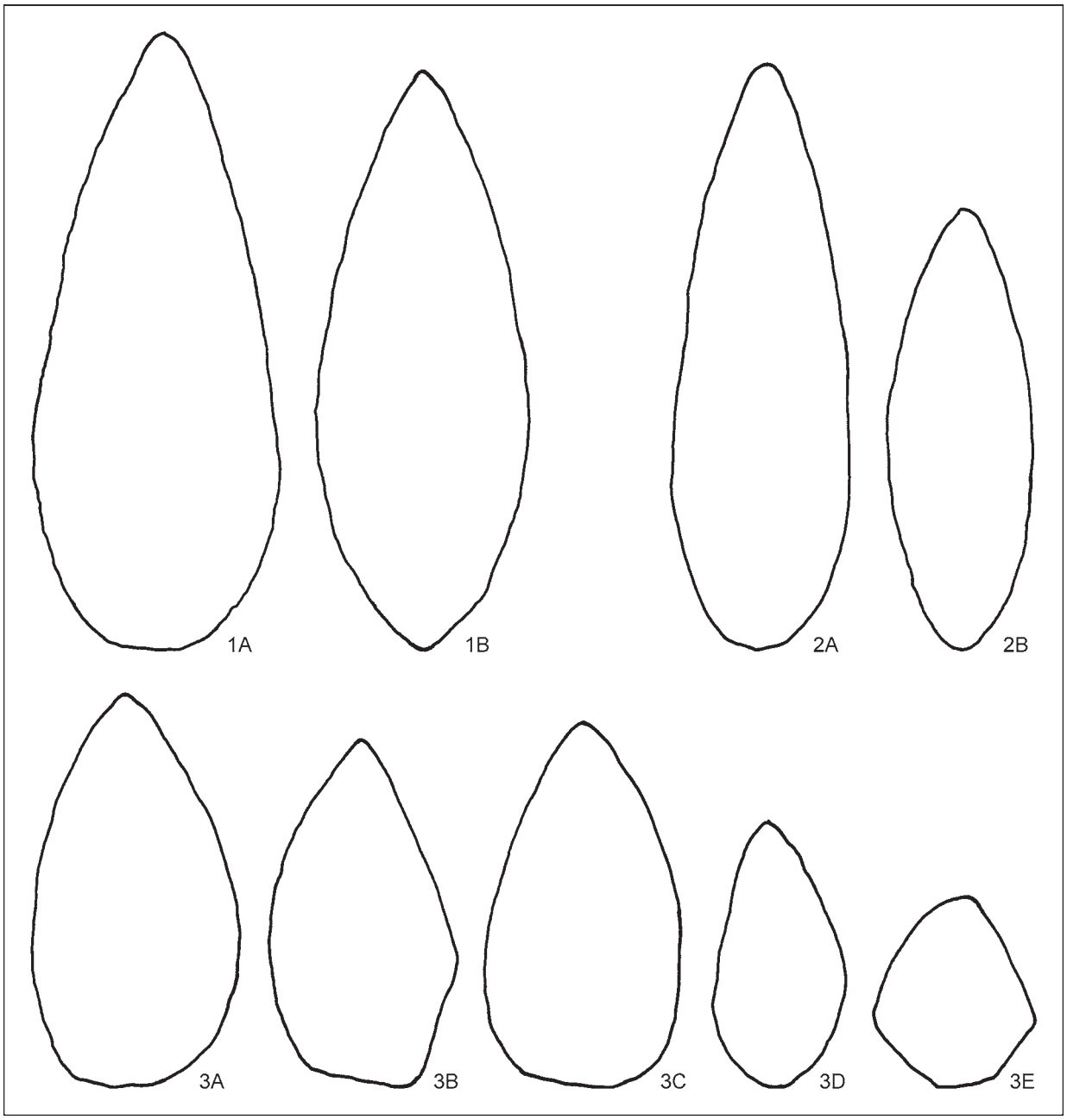


Fig. 2. Recognized modules of Szeleta bifacial foliate tools. 1 – broad, elongated and symmetrical types with rounded base (A) or pointed base (B); 2 – narrow, elongated and symmetrical types with maximum width at the proximal part (A) or at the mesial part (B); 3 – asymmetrical types with laurel leaf shape (A–C), small laurel leaf shape (D), small sub-triangular shape (E); (after *Mester 2014b*, fig. 12).

from Szeleta were known in the French Solutrean too (cf. *Brézillon 1968*, fig. 87: B, C, I): a mainly larger with rounded base (*feuille de laurier* – laurel leaf) and a mainly narrower with pointed base (*feuille de saule* – willow leaf). *K. Simán* (*1990*, 192) also distinguished only these two types in the assemblage from the upper layers of Szeleta Cave, however, the morphological analysis demonstrated the existence of both variants (with rounded and with pointed base) for both types (large or narrow symmetrical form; Fig. 2: 1A, 1B, 2A, 2B; *Mester 2014b*, fig. 12).

F. Prošek's paper (*1953*) published in *Slovenská archeológia* journal (Czechoslovakia), probably was hardly known to prehistoric archaeologists on the other side of the Iron Curtain. These colleagues could get knowledge of any new results mainly from review articles published in Western European languages

in Western European journals. The major source of information on the Szeletian appears to have been the paper of *B. Klíma* (*1957*) in *Quartär* published in Erlangen (West Germany) and, consequently, the article of *J. Combier* (*1962*) in *L'Anthropologie* journal (France). This could be the reason why these two publications are referred to for the description of the "Szeletian leaf point" as a type. Relying on a figure published by *B. Klíma* (*1957*, 102, fig. 9), *P.-Y. Demars and P. Laurent* (*1992*, 124) present three variants – willow leaf point, laurel leaf point, and poplar leaf point – from the Modřice site in Moravia. Klíma's three variants, supplemented by a fourth one – asymmetrical point – were also cited by *M. Brézillon* (*1968*, 330, fig. 199) who used *J. Combier*'s (*1962*, fig. 1: 1, 2, 4, 5) illustrations presenting the pieces from Modřice, Neslovice and Dzeravá skala Cave. The poplar leaf point as a variant was originally defined by *L. F. Zotz* (*1951*, 183–187), who introduced the name of "foliate point of Moravany type" because a very rich collection has been found at the excavation of Moravany nad Váhom-Dlhá open-air site in Western Slovakia. Zotz pointed out that this type was already found at several sites before, including a top-quality exemplar discovered at a house building at Petőfi Street in Miskolc, which was wrongly attributed to the Late Acheulean by H. Obermaier because of its regular triangular shape (cf. *Kadić 1934*, pl. II: 2). According to *O. Kadić* (*1934*, 23), this artefact from Miskolc had an uncertain stratigraphic position, but needs to belong to the Developed Solutrean by its shaping technique even though this type was unknown in the assemblage of Szeleta Cave.

One can consider the analyses of bifacial and leaf-shaped tools from Moravian and from Hungarian sites accomplished during the last decade as "an attempt to fill the void" (*Kot 2014*; *Mester 2010*; *2014b*; *2017*; *2018b*; *Neruda/Nerudová 2017*; *Nerudová 2009*; *2011*; *Nerudová/Neruda/Sadovský 2011*). These investigations applied technological and cognitive approaches, including refits, techno-functional analysis, scar-pattern (working stages) analysis, use-wear studies, GIS, 2D morphometry and statistics. The most important aspect of these studies is the attempt to understand human behaviour during tool production and use. This contributed to better estimate the role of re-sharpening and transformation in the final morphology of bifacial tools, as well as to recognize characteristic forms linked to stages of production. All these factors could be the source of variability in a lithic assemblage.

Morphometrical studies, however, revealed the existence of certain basic forms which are so frequent that they could represent types or sub-types among "Szeletian leaf points". Z. Nerudová described 13 basic shape variants, applied for the analyses of bifacial tools from Moravian sites (Fig. 3; *Nerudová 2009*, 165–167; *2011*, 63; *Nerudová/Neruda/Sadovský 2011*, 24). In these publications, she analysed 183, 31 and 415 pieces from Szeletian contexts respectively. It is very thought-provoking that the most frequent variants were the B (semi-leaf) and E (sub-leaf) in each case (31.1%, 19.4% and 26.4%, as well as 20.2%, 29.0% and 19.7% respectively), completed by the variants A (willow-leaf; 12.5%, 6.5%, 11.8%) and D (lateral; 7.7%, 19.4%, 7.5%). It looks like these forms have some meanings within the Szeletian bifacial tool production in Moravia.

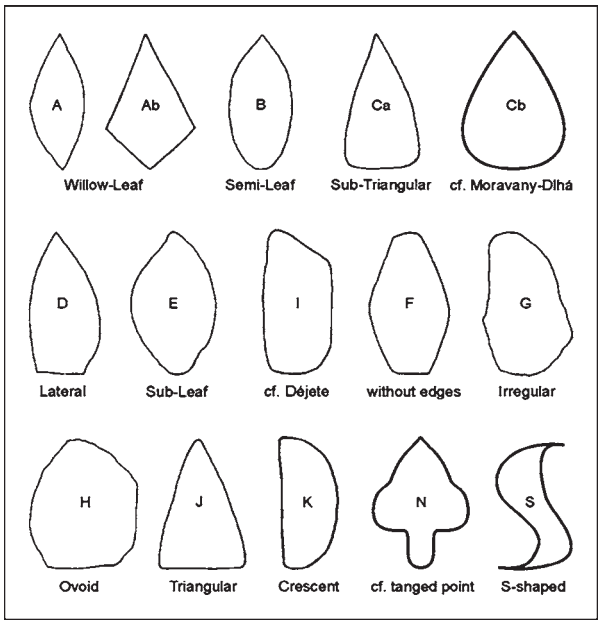


Fig. 3. Morphological shapes of bifacial tools applied in the descriptive schema of pointed bifacial artefacts of Moravian sites (after *Nerudová 2011*, fig. 2: 3).

Taking into account the cognitive framework of the tool production (*Inizan et al. 1999*, 15; *Mester 2014b*, 43, 44; *2018b*, 57; *Tixier 2012*, 40, 41), the shape variants correspond to different tool ideas. Based on this cognitive model, nine tool ideas termed "modules" had been recognized within the collection of leaf-shaped tools of Szeleta Cave (Fig. 2; *Mester 2010*, fig. 1; *2014b*, 48, fig. 12). Five of them are present among the leaf-shaped tools of Jankovich Cave, too (*Mester 2017*, 82, 83, fig. 6). Furthermore, some of these modules occur in Szeletian assemblages in Western Slovakia and Moravia as well, and vice versa some shape variants of Nerudová (or modules) occur in assemblages related to the Szeletian in Hungary and Western Slovakia (*Mester 2018a*, 30).

In conclusion, it seems reasonable to take these common elements of the Moravian, Slovakian and Hungarian leaf-shaped tool assemblages as a basis, if we are looking for a definition of the "Szeletian leaf point" tool-type.

THE SZELETIAN LEAF POINT AS *FOSSILE DIRECTEUR*

The *fossile directeur* or index fossil is a term borrowed from geology. The principle that certain fossils could be used to indicate the geologic age of a rock formation is due to William Smith at the beginning of the 19th century, who based the chronostratigraphic sequence of the geological units on the faunal succession for developing the first map of the United Kingdom published in 1815 (*Harries 2015*). He observed that the distribution of specific fossils through time permit the identification of geologic periods and the correlation of rocks containing these fossils. By analogy, prehistorians of the 19th and early 20th centuries considered specific tool-types as indicators of levels of the chronostratigraphic sequence of human industries (*Leclerc/Tarrête 1988a*; *Pautrat 1993*).

To be able to accomplish this role of indicator, an index fossil in geology have to have the following characteristics, according to *P. Harries* (*2015*, 354):

- rapid evolution so that the temporal intervals represented are short;
- wide geographic distribution allowing correlation over a broad area;
- virtually instantaneous range expansion following origination and simultaneous extinction decreasing the likelihood that these boundaries are time transgressive;
- distinctive morphologic characters allowing differentiation from related taxa;
- mineralized skeletal elements that are preserved in the fossil record;
- sufficient abundance affording the likelihood of finding their remains.

These principles were applicable for selecting *fossiles directeurs* among Palaeolithic stone tools when these were used for chronostratigraphic categorization on a continental scale (*Leclerc/Tarrête 1988a*). For differentiating stages like de Mortillet's Acheulean, Mousterian, Solutrean and Magdalenian the tool-types like large and regular handaxe, triangular retouched point, bifacial leaf point and bone harpoon were convenient because of their assumed successive appearance and disappearance. Similarly, for defining subdivisions within stages researchers could find tool-types with more limited presence in time, like the backed point of Chatelperron type and that of La Gravette type or the shouldered point with bifacial flat retouch, the *raclette* and the parrot beak burin, indicating respectively Breuil's Lower Aurignacian, Upper Aurignacian, Upper Solutrean, Magdalenian I and Magdalenian VI (*Demars/Laurent 1992*, 66, 86, 96, 100, 140).

During his excavations carried out at La Ferrassie and Laugerie-Haute rock-shelters in the 1930s, D. Peyrony observed that the three kinds of Aurignacian of Breuil's subdivision are not successive in the sequence but the Middle one is parallel with the Lower and Upper ones (*Taborin 1992*, 360). He interpreted this situation as the existence of two contemporaneous cultures, the Aurignacian and the Perigordian (corresponding to the Chatelperronian and the subsequent Gravettian). Consequently, the meaning of the *fossile directeur* had to be changed from chronological to cultural sens. An archaeological culture or unit is conceived as a specific combination of observable cultural elements which can be outlined in time and space (*Leclerc/Tarrête 1988b*). As a consequence, the corresponding index fossil needs to show limited distribution too, intimately linked to the context of the specific combination of cultural elements. *F. Bordes* (*1961*, 2) cited only four such tool-types: the big flat triangular handaxe of the Mousterian of Acheulean tradition, the typical Solutrean shouldered point of the Upper Solutrean, the multiple borer of the Lower Magdalenian and the parrot beak burin of the Upper Magdalenian.

For this reason, the "Szeletian leaf point" has to be unique for the Szeletian to consider its *fossile directeur*. On the one hand, this type has to have something specific (morphology, technique in shaping or retouching, *chaîne opératoire* in the production, tool concept, etc.) by which it can be distinguished from other types of leaf point. On the other hand, it has to appear exclusively in the context of Szeletian assemblages.

To find specificities for this typological definition is not easy and requires a thorough analysis of the leaf points/leaf tools of the Late Middle Palaeolithic and the Early Upper Palaeolithic in Europe. Logically, it is expectable to find a lot of common elements because of the nature of the bifacial shaping

as a method and the direct percussion with a hard or soft hammer as the applied knapping technique (*Inizan et al. 1999*). Moreover, the observed morphology of bifacial tools is largely influenced by some basic components, like the length/width ratio and the position of the maximal with along the longitudinal axis (*Bordes 1961*, 50–52; *Debénath/Dibble 1994*, 130–133; *Iovita/McPherron 2011*; *Roe 1964*). Furthermore, the type of the cross-section is the result of the shaping of the two faces by convex and flat removals (*Boëda 1995*, 58). The combination of these removals on the opposite sides and the dorsal and ventral faces results in a certain number of possible cross-sections. All these elements provide a limited chance to find specificities for the "Szeletian leaf point". On the contrary, the production process should be characteristic (*Kot 2016*; *Neruda/Nerudová 2017*). In this aspect, it is crucial to differentiate the operations for creating from the operations for transforming, re-sharpening and from damages originating from use. In my view, the most promising approach is to look for the tool concept (*Mester 2014b*; *2018b*). The overall form of the leaf-shaped tools (a tendency for symmetry or even asymmetry, dimensions), as well as the combination of components (delineation of the base and the edges, character and angle of the tip, etc.), are linked to the technical system of the human group (*Geneste 1991*; *Lemonnier 1983*; *1991*), and so are culturally determined.

Several shape variants of bifacial leaf points until now recognized in Szeletian assemblages should be a general type. Nerudová's shape variant A, the rhomboid bipointed form appears in the context of the Lincombian-Ranisian-Jerzmanowician (LRJ) complex (*Flas 2011*). Exemplars were published from an East Anglian open-air site (*Campbell 1977*, fig. 108: 2), from Ranis 2 (*Flas 2011*, fig. 3: 2) and Mamutowa Cave (*Kozłowski 2017*, fig. 3: 1). The same variant is known in Bohunician context as well from Brno-Bohunice (*Tostevin/Škrdla 2006*, fig. 2: 3, 4), and as single finds without cultural context from Haldenstein Cave in the Swabian Jura (*Bolus 2004b*, fig. 10). My module 3C was also documented in Kent's Cavern in LRJ context (*Campbell 1977*, fig. 86: 4). My module 3D is present in apparently Late Middle Palaeolithic context at Musilievo (*Kot 2013*, fig. 69), in the Aurignacian of Míškovice type at Přestavlky (*Oliva 1990*, fig. 3: 7) and at Míškovice (*Oliva 1990*, fig. 4: 4), as well as in the context of *Keilmessergruppen* at Rörshain (*Kot 2013*, fig. 114) and at Wahlen (*Kot 2013*, fig. 119).

The problem of context has already revealed for the leaf points of the eponymous site (*Simán 1990*). In the sequence of Szeleta Cave, the most regular and symmetrical leaf points were found in Layer 5 and mainly in Layer 6. In Layer 5 a typical La Gravette point was also found (*Kadić 1916*, 286, fig. 32: I). This stratigraphic position fitted well in the general chronostratigraphic sequence at that time: the Late Aurignacian (Gravettian) followed by the Solutrean. *M. Gábori* (*1990*, 104) interpreted this situation as indicating that the Gravettian appeared earlier than the Developed Szeletian. *J. Bárta* (*1988*) unearthed very similar leaf points together with a Gravettian lithic industry at Trenčianske Bohuslavice in the Váh River valley in Western Slovakia (*Kaminská et al. 2008*; *Žaár 2007*). This discovery shed new light on the Developed Szeletian of Szeleta Cave which was attributed to a Gravettian with leaf points (*Lengyel/Mester/Szolyák 2016*; *Simán 1990*). According to the archaeological, radiometric, paleobotanical, stratigraphic, and snail faunal evidence obtained during the recent excavation of Trenčianske Bohuslavice (*Wilczyński et al. 2020*), the bifacial leaf points occur in layer B-1 without diagnostic Late Gravettian tool-types. This layer revealed to be younger than both the Szeletian and the Gravettian. As a consequence, the elongated and symmetrical leaf points of the Szeleta Cave could not be classified typologically as "Szeletian leaf point".

CONCLUSION

The Szeletian is widely accepted as an industry of the Middle to Upper Palaeolithic transition in Central Europe, characterized by the production of leaf points and associated with Neanderthals. As a term, the Szeletian was introduced in 1953 for describing an already existing archaeological unit in Central Europe, which had been defined in relation to the Solutrean in Western Europe. Because of this, the cultural unit is far from being clear, and the term inherited many problems coming from altogether more than one hundred years of research history (*Mester 2018a*).

One of these inherited problems represents the "Szeletian leaf points" tool-type, considered as a kind of *fossile directeur* of this archaeological unit. Originally, the bifacial leaf-shaped points unearthed in Hungarian cave sites were used for subdividing the Solutrean in a developmental concept. This basic concept was not questioned in the framework of the new archaeological unit. On the one hand, this is understandable, taking into account the stratigraphical and chronological problems of the majority

of the concerned lithic assemblages and the regional character of the researches carried out until now. On the other hand, it becomes more and more important to clarify the status of the Szeletian within the archaeological cultures and complexes producing bifacial leaf-shaped tools from the Late Middle Palaeolithic to the Middle Upper Palaeolithic. This clarification requires a comprehensive analysis of the role the leaf-shaped tools played in the processes of the cultural changes during this long period (e.g. *Kozłowski 1990*). Researches of the last fifteen years dealing with leaf-shaped tools, and especially those in Szeletian context, demonstrated how fruitful the technological analysis combined with a behavioural approach can be. But we have to shift from reconstructing to understanding.

The "Szeletian leaf point" is a typologically undefined term. It has rather "feeling" than "meaning" when we use it on the field. As it was illustrated above, there are variants of leaf-shaped tools in the lithic assemblages attributed to the Szeletian in Central Europe which should be considered as real types or subtypes. However, some of them are quite common in the archaeological record of the Middle and Upper Palaeolithic of Europe. Evidently, these types could not have been *fossiles directeurs* of either the Szeletian or the other cultural units. From Szeletian contexts, the only type among the bifacial leaf-shaped tools which have a definition is the leaf point of Moravany-Dlhá type. It seems to be characteristic enough for representing a typological unit. However, it should not be the *fossile directeur* of the Szeletian because of its limited presence at Szeletian sites.

Until we can not demonstrate the existence of a specific type of leaf point linked strictly to the Szeletian, it seems to be better to not use the "Szeletian leaf point" as a typological term. In my view, it would be more reasonable to define more general types for bifacial leaf-shaped tools (like in the case of side scrapers, for example). With the help of such a typology we could better characterize the composition of the tool-kits of the concerned industries and at the same time avoid ambiguities and misunderstandings.

Acknowledgement

I am grateful to Adrián Nemergut for inviting and motivating me to write this paper. I am indebted to Norbert Faragó, György Lengyel and the anonymous reviewers for valuable comments on the first draft of the manuscript.

Translated by author

BIBLIOGRAPHY

Allsworth-Jones 1986 — P. Allsworth-Jones: *The Szeletian and the transition from Middle to Upper Palaeolithic in Central Europe*. Oxford 1986.

Allsworth-Jones 1990 — P. Allsworth-Jones: Les industries à pointes foliacées d'Europe centrale. Questions de définitions et relations avec les autres techno-complexes. In: C. Farizy (dir.): *Paléolithique moyen récent et Paléolithique supérieur ancien en Europe. Actes du Colloque international de Nemours, 9–11 mai 1988*. Mémoires du Musée de Préhistoire d'Ile-de-France 3. Nemours 1990, 79–95.

Andrée 1930 — J. Andrée: Über die deutschen Benennungen eiszeitlicher Kulturstufen. *Nachrichtenblatt für Deutsche Vorzeit* 6, 1930, 8–11.

Bárta 1960 — J. Bárta: K problému listovitých hrotov typu Moravany-Dlhá. *Slovenská archeológia* 8, 1960, 295–324.

Bárta 1988 — J. Bárta: Trenčianske Bohuslavice un habitat gravettien en Slovaquie occidentale. *L'Anthropologie* 92, 1988, 173–182.

Bárta 1990 — J. Bárta: Blattspitzenindustrien in der Westslowakei. In: J. K. Kozłowski (ed.): *Feuilles de pierre. Les industries à pointes foliacées du Paléolithique supérieur européen*. ERAUL 42. Liège 1990, 235–238.

Boëda 1995 — E. Boëda: Caractéristiques techniques des chaînes opératoires lithiques des niveaux micoquiens de Külna (Tchécoslovaquie). In: *Les industries à pointes foliacées d'Europe centrale. Actes du Colloque de Miskolc, 10–15 septembre 1991*. Paléo – Supplement 1. Les Eyzies 1995, 57–72.

Bolus 2004a — M. Bolus: Der Übergang vom Mittel- zum Jungpaläolithikum in Europa. Ein Bestandsaufnahme unter besonderer Berücksichtigung Mitteleuropas. *Germania* 82, 2004, 1–54.
DOI: https://doi.org/10.11588/ger.2004.69198

Bolus 2004b M. Bolus: Settlement analysis of sites of the Blattspizen Complex in Central Europe. In: N. J. Conard (ed.): *Settlement Dynamics of the Middle Palaeolithic and Middle Stone Age II*. Tübingen 2004, 201–226.

Bordes 1961 F. Bordes: *Typologie du Paléolithique ancien et moyen*. Publications de l'Institut de Préhistoire de l'Université de Bordeaux 1. Bordeaux 1961.

Bourdier 1967 F. Bourdier: *Préhistoire de France*. Paris 1967.

Breuil 1912 H. Breuil: Les subdivisions du Paléolithique supérieur et leur signification. In: *Congrès international d'Anthropologie et d'Archéologie préhistorique, Compte-rendu*. Genève 1912, 165–238.

Brézillon 1968 M. N. Brézillon: *La dénomination des objets de pierre taillée. Matériaux pour un vocabulaire des préhistoriens de langue française*. IVe supplément à Gallia Préhistoire. Paris 1968.

Brézillon 1972 M. Brézillon: *Dictionnaire de la Préhistoire*. Paris 1972.

Campbell 1977 J. B. Campbell: *The Upper Palaeolithic of Britain. The Study of Man and Nature in the Late Ice Age*. Oxford 1977.

Camps/Chauhan eds. 2009 M. Camps/P. Chauhan (eds.): *Sourcebook of Palaeolithic Transitions. Methods, Theories, and Interpretations*. New York 2009.

Combier 1962 J. Combier: Nouvelles recherches sur le Paléolithique supérieur de la Tchécoslovaquie. *L'Anthropologie* 66, 1962, 558–574.

Conard ed. 2006 N. J. Conard (ed.): *When Neandertals and Modern Humans met*. Tübingen 2006.

Debénath/Dibble 1994 A. Debénath/H. L. Dibble: *Handbook of Paleolithic typology I. Lower and Middle Paleolithic of Europe*. Pennsylvania 1994.

Demars/Laurent 1992 P.-Y. Demars/P. Laurent: *Types d'outils lithiques du Paléolithique supérieur en Europe*. Paris 1992.

Farizy dir. 1990 C. Farizy (dir.): *Paléolithique moyen récent et Paléolithique supérieur ancien en Europe. Actes du Colloque international de Nemours, 9–11 mai 1988*. Mémoires du Musée de Préhistoire d'Ile-de-France 3. Nemours 1990.

Flas 2011 D. Flas: The Middle to Upper Paleolithic transition in Northern Europe: the Lincombian-Ranisian-Jerzmanowician and the issue of acculturation of the last Neanderthals. *World Archaeology* 43, 2011, 605–627.
DOI: https://doi.org/10.1080/00438243.2011.624725

Flas 2014 D. Flas: Les industries à pointes foliacées dans les régions septentrionales de l'Europe. In: M. Otte (dir.): *Neandertal/Cro Magnon – La Rencontre*. Arles 2014, 97–122.

Freund 1952 G. Freund: *Die Blattspitzen des Paläolithikums in Europa*. Quartär-Bibliothek 1. Bonn 1952.

Gábori 1953 M. Gábori: Solyutreyskaya kul'tura Vengrii (Le Solutréen en Hongrie). *Acta Archaeologica Academiae Scientiarum Hungaricae* 3, 1953, 1–68.

Gábori 1990 M. Gábori: Aperçus sur l'origine des civilisations du Paléolithique supérieur en Hongrie. In: C. Farizy (dir.): *Paléolithique moyen récent et Paléolithique supérieur ancien en Europe. Actes du Colloque international de Nemours, 9–11 mai 1988*. Mémoires du Musée de Préhistoire d'Ile-de-France 3. Nemours 1990, 103–106.

Gábori-Csánk 1983 V. Gábori-Csánk: La grotte Remete „Felső" (Supérieure) et le „Szeletien de Transdanubie". *Acta Archaeologica Academiae Scientiarum Hungaricae* 35, 1983, 249–285.

Gábori-Csánk 1993 V. Gábori-Csánk: *Le Jankovichien. Une civilisation paléolithique en Hongrie*. ERAUL 53. Liège 1993.

Geneste 1991 J.-M. Geneste: Systèmes techniques de production lithique: variations techno-économiques dans les processus de réalisation des outillages paléolithiques. *Techniques & culture* 17–18, 1991, 1–35.

Groenen 1994 M. Groenen: *Pour une histoire de la Préhistoire. Le Paléolithique*. Grenoble 1994.

Harries 2015 P. Harries: Index Fossil. In: W. J. Rink/J. W. Thompson (eds.): *Encyclopedia of Scientific Dating Methods*. Encyclopedia of Earth Sciences Series. Dordrecht 2015, 353, 354.
https://link.springer.com/referenceworkentry/10.1007%2F978-94-007-6304-3_77#springerlink-search [11.01.2021]

Hillebrand 1935 J. Hillebrand: *Die Ältere Steinzeit Ungarns*. Archaeologia Hungarica 17. Budapest 1935.

Inizan et al. 1999 M.-L. Inizan/M. Reduron-Ballinger/H. Roche/J. Tixier: *Technology and Terminology of Knapped Stone*. Préhistoire de la Pierre Taillée 5. Nanterre 1999.

Iovita/McPherron 2011 R. Iovita/S. P. McPherron: The handaxe reloaded. A morphometric reassessment of Acheulian and Middle Paleolithic handaxes. *Journal of Human Evolution* 61, 2011, 61–74.
DOI: https://doi.org/10.1016/j.jhevol.2011.02.007

Julien 1992 M. Julien: Du fossile directeur à la chaîne opératoire. In: J. Garanger (dir.): *La Préhistoire dans le monde*. Paris 1992, 163–193.

Kadić 1916 O. Kadić: Ergebnisse der Erforschung der Szeletahöhle. *Mitteilungen aus dem Jahrbuche der königlichen Ungarischen Geologischen Reichsanstalt* 23, 1916, 161–301.

Kadić 1934 O. Kadić: Der Mensch zur Eiszeit in Ungarn. *Mitteilungen aus dem Jahrbuch der kgl. Ungarischen Geologischen Anstalt* 30, 1934, 1–147.

Kaminská zost. 2014 Ľ. Kaminská (zost.): *Staré Slovensko 2. Paleolit a mezolit*. Archaeologica Slovaca Monographiae. STASLO 2. Nitra 2014.

Kaminská 2015 Ľ. Kaminská: Szeletian finds from Trenčianske Teplice. *Anthropologie* 53, 2015, 203–213.

Kaminská/Kozłowski/Škrdla 2011 Ľ. Kaminská/J. K. Kozłowski/P. Škrdla: New approach to the Szeletian – chronology and cultural variability. *Eurasian Prehistory* 8, 2011, 29–49.

Kaminská et al. 2008 Ľ. Kaminská/J. K. Kozłowski/K. Sobczyk/J. A. Svoboda/T. Michalík: Štruktúra osídlenia mikroregiónu Trenčína v strednom a mladom paleolite. *Slovenská archeológia* 56, 2008, 179–238.

Klíma 1957 B. Klíma: Übersicht über die jüngsten paläolithischen Forschungen in Mähren. *Quartär* 9, 1957, 85–130.

Kot 2013 M. A. Kot: *The earliest Palaeolithic bifacial leafpoints in Central and Southern Europe. Techno-functional approach*. PhD. Thesis. Warsaw University. Warsaw 2013. Unpublished.

Kot 2014 M. A. Kot: The earliest Palaeolithic bifacial leafpoints in Central and Southern Europe: Techno-functional approach. *Quaternary International* 326–327, 2014, 381–397. DOI: https://doi.org/10.1016/j.quaint.2013.10.030

Kot 2016 M. A. Kot: Technological analysis of bifacial leafpoints from Middle/Upper Palaeolithic transitional industries. *Quartär* 63, 2016, 61–88.

Kozłowski 1990 J. K. Kozłowski: Certains aspects techno-morphologiques des pointes foliacées de la fin du paléolithique moyen et du début du Paléolithique supérieur en Europe centrale. In: C. Farizy (dir.): *Paléolithique moyen récent et Paléolithique supérieur ancien en Europe. Actes du Colloque international de Nemours, 9–11 mai 1988*. Mémoires du Musée de Préhistoire d'Ile-de-France 3. Nemours 1990, 125–133.

Kozłowski 1995 J. K. Kozłowski: La signification des „outils foliacés". In: *Les industries à pointes foliacées d'Europe centrale. Actes du Colloque de Miskolc, 10–15 septembre 1991*. Paléo – Supplement 1. Les Eyzies 1995, 91–99.

Kozłowski 2000 J. K. Kozłowski: Southern Poland between 50 and 30 kyr BP., environment and archaeology. In: J. Orschiedt/G.-C. Weniger (eds.): *Neanderthals and Modern Humans – Discussing the Transition: Central and Eastern Europe from 50.000–30.000 B. P.* Wissenschaftliche Schriften des Neanderthal Museums 2. Mettmann 2000, 76–91.

Kozłowski 2017 J. K. Kozłowski: Transcarpathian cultural connections and raw material circulation in the Middle/Upper Palaeolithic transition. *Anthropologie* 55, 2017, 27–41.

Kozłowski J./Kozłowski S. 1996 J. K. Kozłowski/S. K. Kozłowski: *Le Paléolithique en Pologne*. Préhistoire d'Europe 2. Grenoble 1996.

Leclerc/Tarrête 1988a J. Leclerc/J. Tarrête: Fossile directeur. In: A. Leroi-Gourhan (dir.): *Dictionnaire de la Préhistoire*. Paris 1988, 402.

Leclerc/Tarrête 1988b J. Leclerc/J. Tarrête: Culture. In: A. Leroi-Gourhan (dir.): *Dictionnaire de la Préhistoire*. Paris 1988, 280.

Lemonnier 1983 P. Lemonnier: L'étude des systèmes techniques: une urgence en technologie culturelle. *Techniques & culture* 1, 1983, 11–26.

Lemonnier 1991 P. Lemonnier: De la culture matérielle à la culture? Ethnologie des techniques et Préhistoire. In: *25 ans d'études technologiques en Préhistoire. XIe Rencontres Internationales d'Archéologie et d'Histoire d'Antibes*. Juan-les-Pins 1991, 15–20.

Lengyel/Mester/Szolyák 2016 Gy. Lengyel/Zs. Mester/P. Szolyák: The Late Gravettian and Szeleta Cave, North-East Hungary. *Quaternary International* 406, 2016, 174–183. DOI: https://doi.org/10.1016/j.quaint.2015.09.014

Marks/Monigal 2000 A. E. Marks/K. Monigal: The Middle to Upper Paleolithic interface at Buran-Kaya-III, Eastern Crimea. In: J. Orschiedt/G.-C. Weniger (eds.): *Neanderthals and Modern Humans – Discussing the Transition. Central and Eastern Europe from 50.000-30.000 BP.* Wissenschaftliche Schriften 2. Mettmann 2000, 212–226.

Mester 2010 Zs. Mester: Technological analysis of Szeletian bifacial points from Szeleta Cave (Hungary). *Human Evolution* 25, 2010, 107–123.

Mester 2014a Zs. Mester: *Le Szélétien*. In: M. Otte (dir.): *Neandertal/Cro Magnon – La Rencontre*. Arles 2014, 149–188.

Mester 2014b Zs. Mester: Technologie des pièces foliacées bifaces du Paléolithique moyen et supérieur de la Hongrie. In: K. T. Biró/A. Markó/K. P. Bajnok (eds.): *Aeolian scripts. New ideas on the lithic world. Studies in honour of Viola T. Dobosi*. Inventaria Praehistorica Hungariae 13. Budapest 2014, 41–62.

Mester 2017 Zs. Mester: Considérations sur le Szélétien en Hongrie. La relation du Jankovichien au Szélétien ancien. *Anthropologie* 55, 2017, 75–92.

Mester 2018a Zs. Mester: The problems of the Szeletian as seen from Hungary. *Recherches Archéologiques*. Nouvelle Série 9, 2018, 19–48.

Mester 2018b Zs. Mester: Technology and typology of Szeletian leaf-shaped tools: Theoretical and methodological considerations. In: P. Valde-Nowak/K. Sobczyk/M. Nowak/J. Źrałka (eds.): *Multas per gentes et multa per saecula. Amici magistro et collegae suo Ioanni Christopho Kozłowski dedicant*. Kraków 2018, 55–61.

Morgan 1877 L. H. Morgan: *Ancient Society: or researches in the lines of human progress from savagery, through barbarism to civilization*. New York 1877.

Mottl 1938 M. Mottl: Faunen, Flora und Kultur des ungarischen Solutréen. *Quartär* 1, 1938, 36–54.

Nemergut 2010 A. Nemergut: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bártu z rokov 1963 a 1990. *Slovenská archeológia* 58, 2010, 183–206.

Nemergut et al. eds. 2019 A. Nemergut/I. Cheben/J. Ruttkayová/K. Pyźewicz (eds.): *16th SKAM Lithic Workshop. "Fossile directeur" – A phenomenon over time and space. 21–23 of October 2019, Nitra, Slovak Republic. Abstract Book*. Nitra 2019.

Neruda/Nerudová 2013 P. Neruda/Z. Nerudová: The Middle-Upper Palaeolithic transition in Moravia in the context of the Middle Danube region. *Quaternary International* 294, 2013, 3–19. DOI: https://doi.org/10.1016/j.quaint.2011.08.035

Neruda/Nerudová 2017 P. Neruda/Z. Nerudová: Technology of Moravian Early "Szeletian leaf point" shaping: A case study of refittings from Moravský Krumlov IV open-air site (Czech Republic). *Quaternary International* 428, Part A, 2017, 91–108. DOI: https://doi.org/10.1016/j.quaint.2015.09.065

Nerudová 2009 Z. Nerudová: Archeologie szeletienské vrstvy 0 z Moravského Krumlova IV. Archaeology of Szeletian layer 0 from Moravský Krumlov IV. In: P. Neruda/Z. Nerudová (eds.): *Moravský Krumlov IV – vícevrstevná lokalita ze středního a počátku mladého paleolitu na Moravě. Moravský Krumlov IV – multilayer Middle and Early Upper Palaeolithic site in Moravia*. Anthropos 29 (N. S. 21). Brno 2009, 148–173.

Nerudová 2011 Z. Nerudová: Analysis of bifacial artefacts from the Palaeolithic site of Trboušany IIb (South Moravia, Czech Republic). *Anthropologie* 49, 2011, 59–78.

Nerudová/Neruda/Sadovský 2011 Z. Nerudová/P. Neruda/P. Sadovský: Srovnávací analýza paleolitických bifaciálních artefaktů. *Památky archeologické* 102, 2011, 21–58.

Nigst 2006 Ph. R. Nigst: The first Modern Humans in the Middle Danube area? New evidence from Willendorf II (Eastern Austria). In: N. J. Conard (ed.): *When Neandertals and Modern Humans met*. Tübingen 2006, 269–304.

Oliva 1990 M. Oliva: La signification des pointes foliacées dans l'Aurignacien morave et dans le type Míškovice. In: J. K. Kozłowski (ed.): *Feuilles de pierre. Les industries à pointes foliacées du Paléolithique supérieur européen*. ERAUL 42. Liège 1990, 224–232.

Oliva 1991 M. Oliva: The Szeletian in Czechoslovakia. *Antiquity* 65/247, 1991, 318–325.

Oliva 1995 M. Oliva: Le Szélétien de Tchécoslovaquie: industrie lithique et répartition géographique. In: *Les industries à pointes foliacées d'Europe centrale. Actes du Colloque de Miskolc, 10-15 septembre 1991*. Paléo – Supplément 1. Les Eyzies 1995, 83–90.

Otte ed. 2014 M. Otte (ed.): *Neandertal/Cro Magnon – La Rencontre*. Arles 2014.

Pautrat 1993 J.-Y. Pautrat: „Le Préhistorique" de Gabriel de Mortillet (1883): une histoire géologique de l'homme. *Bulletin de la Société préhistorique française* 90, 1993, 50–59.

Prošek 1953 F. Prošek: Szeletien na Slovensku. *Slovenská archeológia* 1, 1953, 133–194.

Riel-Salvatore/Clark eds. 2007 J. Riel-Salvatore/G. A. Clark (eds.): *New approaches to the study of Early Upper Palaeolithic 'transitional' industries in Western Eurasia. Transitions great and small*. BAR International Series 1620. Oxford 2007.

Ringer 1989 Á. Ringer: L'origine du Szélétien de Bükk en Hongrie et son évolution vers le Paléolithique supérieur. *Anthropologie* 27, 1989, 223–229.

Ringer 2001 Á. Ringer: Le complexe techno-typologique du Bábonyien-Szélétien en Hongrie du Nord. In: D. Cliquet (dir.): *Les industries à outils bifaciaux du Paléolithique moyen d'Europe occidentale. Actes de la table-ronde internationale organisée à Caen (Basse-Normandie – France) 14 et 15 octobre 1999*. ERAUL 98. Liège 2001, 213–220.

Ringer/Mester 2000 Á. Ringer/Zs. Mester: Résultats de la révision de la grotte Szeleta entreprise en 1999 et 2000. *Anthropologie* 38, 2000, 261–270.

Roe 1964 D. A. Roe: The British Lower and Middle Palaeolithic. Some problems, methods of study and preliminary results. *Proceedings of the Prehistoric Society* 30, 1964, 245–267.

Simán 1990 K. Simán: Considerations on the "Szeletian unity". In: J. K. Kozłowski (ed.): *Feuilles de pierre. Les industries à pointes foliacées du Paléolithique supérieur européen*. ERAUL 42. Liège 1990, 189–198.

Svoboda 2001 J. Svoboda: La question szélétienne. In: D. Cliquet (dir.): *Les industries à outils bifaciaux du Paléolithique moyen d'Europe occidentale. Actes de la table-ronde internationale organisée à Caen (Basse-Normandie – France) 14 et 15 octobre 1999*. ERAUL 98. Liège 2001, 221–230.

Svoboda 2006 J. A. Svoboda: The Danubian gate to Europe: patterns of chronology settlement archaeology, and demography of late Neandertals and early Modern Humans on the Middle Danube. In: N. J. Conard (ed.): *When Neandertals and Modern Humans met.* Tübingen 2006, 233–267.

Svoboda/Simán 1989 J. Svoboda/K. Simán: The Middle-Upper Paleolithic transition in Southeastern Central Europe (Czechoslovakia and Hungary). *Journal of World Prehistory* 3, 1989, 283–322.

Taborin 1992 Y. Taborin: L'Aurignacien. In: J. Garanger (dir.): *La Préhistoire dans le monde*. Paris 1992, 359–378.

Tixier 2012 J. Tixier: *A method for the study of stone tools/Méthodes pour l'étude des outillages lithiques*. ArchéoLogique 4. Luxembourg 2012.

Tostevin/Škrdla 2006 G. B. Tostevin/P. Škrdla: New Excavations at Bohunice and the Question of the Uniqueness of the Type-site for the Bohunician Industrial Type. *Anthropologie* 44, 2006, 31–48.

Valoch 1957 K. Valoch: Étude statistique du Szélétien. *L'Anthropologie* 61, 1957, 84–89.

Valoch 1990 K. Valoch: Le Szeletien en Moravie. In: J. K. Kozłowski (ed.): *Feuilles de pierre. Les industries à pointes foliacées du Paléolithique supérieur européen*. ERAUL 42. Liège 1990, 213–221.

Valoch 1996 K. Valoch: *Le Paléolithique en Tchéquie et en Slovaquie.* Préhistoire d'Europe 3. Grenoble 1996.

Valoch et al. 1993 K. Valoch/A. Kočí/W. G. Mook/E. Opravil/J. van der Plicht/L. Smolíková/Z. Weber: Vedrovice V, eine Siedlung des Szeletien in Südmähren. *Quartär* 43/44, 1993, 7–93.

Vértes 1956 L. Vértes: Problematika szeletienu. *Slovenská archeológia* 4, 1956, 318–340.

Vértes 1958 L. Vértes: Beiträge zur Abstammung des ungarischen Szeletien. *Folia Archaeologica* 10, 1958, 3–15.

Vértes 1962–1963 L. Vértes: Einige Angaben des ungarischen Szeletiens. *Arheološki Vestnik* 13–14, 1962–1963, 167–195.

Vértes 1968 L. Vértes: Szeleta-Symposium in Ungarn. *Quartär* 19, 1968, 381–390.

Wilczyński et al. 2020 J. Wilczyński/O. Žaár/A. Nemergut/B. Kufel-Diakowska/M. Moskal-del Hoyo/P. Morczek/B. Páll-Gergely/T. Oberc/Gy. Lengyel: The Upper Palaeolithic at Trenčianske Bohuslavice, Western Carpathians, Slovakia. *Journal of Field Archaeology*, 2020. DOI: https://doi.org/10.1080/00934690.2020.1733334

Zotz 1951 L. F. Zotz: *Altsteinzeitkunde Mitteleuropas*. Stuttgart 1951.

Žaár 2007 O. Žaár: *Gravettienska stanica v Trenčianskych Bohuslavicach*. MA. Thesis. Constantine the Philosopher University in Nitra. Faculty of Arts. Nitra 2007. Unpublished.

Szeletiensky listovitý hrot ako *fossile directeur?*

Zsolt Mester

Súhrn

Odkedy *F. Prošek* (*1953*) zaviedol pre industriu zo staršej fázy mladého paleolitu pojem szeletien, charakteristický bifaciálnymi listovitými nástrojmi v oblasti stredodunajskej kotliny, neexistuje všeobecne akceptovaný názor na to, čo termín szeletien presne predstavuje (*Mester 2014a*, 160–165). Dôvodom je, že vedci z jednotlivých krajín svoje názory založili na archeologických záznamoch zo svojich území (*Bárta 1990*; *Gábori 1990*; *Kaminská zost. 2014*; *Kaminská/Kozłowski/Škrdla 2011*; *Neruda/Nerudová 2013*; *Ringer 2001*; *Svoboda/Simán 1989*; *Valoch 1990*; *Vértes 1968*). Po publikovaní monografie *P. Allsworth-Jonesa* (*1986*) bol szeletien všeobecne akceptovaný ako jeden z kultúrnych celkov prechodu stredného paleolitu a staršej fázy mladého paleolitu v strednej Európe, súvisiacich s neandertálcami (*Bolus 2004a*; *Marks/Monigal 2000*; *Nigst 2006*; *Svoboda 2006*). Predpokladá sa, že tento celok charakterizujú bifaciálne listovité hroty, hoci takéto nástroje možno nájsť v rôznych kultúrnych a chronologických kontextoch od Veľkej Británie po Rusko (*Allsworth-Jones 1990*; *Bolus 2004b*; *Kot 2014*; *Kozłowski 1995*).

Návrh F. Proška na definovanie szeletienu, kultúry zo včasného mladého paleolitu, sa vzťahoval už na existujúci celok (solutréen), avšak s novým názvom a novou chronologickou pozíciou. Nevytvoril definíciu nového celku, ale aplikoval model, ktorý maďarskí bádatelia vytvorili na opísanie vývoja solutréenu v Maďarsku. Tento model bol založený výlučne na typológii listovitých hrotov (*Hillebrand 1935*; *Kadić 1934*; *Mottl 1938*) a rozlišuje protosolutréen,

včasný solutréen, rozvinutý a neskorý solutréen (obr. 1). Maďarskí archeológovia klasifikovali ich typy v porovnaní s „klasickými" vavrínovými listovitými hrotmi solutréenu vo Francúzsku. V dôsledku toho je „szeletiensky listovitý hrot" typologicky nedefinovaným nástrojom. Jedinou výnimkou je „listovitý hrot typu Moravany-Dlhá", ktorý opísal *J. Bárta* (*1960*, 302).

Počas posledného desaťročia boli vykonané analýzy bifaciálnych a listovitých nástrojov z moravských a maďarských lokalít (*Kot 2014*; *Mester 2014b*; *Neruda/Nerudová 2017*; *Nerudová 2009*; *Nerudová/Neruda/Sadovský 2011*). Tieto výskumy využili technologické a kognitívne prístupy, vrátane spätného skladania artefaktov, technicko-funkčnej analýzy, skúmania operačného reťazca, opotrebovania, GIS, 2D morfometrie a štatistiky. Morfometrické výskumy však odhalili existenciu istých základných foriem, ktoré sú časté a mohli by reprezentovať typy alebo subtypy „szeletienskych listovitých hrotov". *Z. Nerudová* (*2009*, 165–167) opísala 13 základných tvarových variantov, ktoré aplikovala na analýzu bifaciálnych nástrojov z moravských lokalít (obr. 3). Najčastejším variantom bol B (takmer listovitý) a E (čiastočne listovitý), doplnené variantmi A (v tvare vŕbového listu) a D (laterálny).

Ak vezmeme do úvahy kognitívny rámec výroby nástrojov (*Inizan et al. 1999*, 15; *Tixier 2012*, 40, 41), tieto tvarové varianty zodpovedajú rôznym nástrojom. Na základe tohto modelu bolo v súbore listovitých nástrojov z jaskyne Szeleta definovaných deväť druhov nástrojov, nazvaných „moduly" (obr. 2; *Mester 2014b*, 48). Päť z nich sa nachádzali aj medzi listovitými hrotmi z jaskyne Jankovich (*Mester 2017*, 82, 83). Niektoré z týchto modulov sa objavili v szeletienskych súboroch zo západného Slovenska, Moravy a naopak, niektoré z variantov Z. Nerudovej boli zistené v súboroch súvisiacich so szeletienom v Maďarsku a na západnom Slovensku (*Mester 2018a*, 30). Zdá sa, že použitie týchto spoločných prvkov pre súbory moravských, slovenských a maďarských listovitých nástrojov ako základ pri hľadaní definície typu nástroja „szeletienskeho listovitého hrotu" je dostatočne opodstatnené.

Fossile directeur, resp. vedúca fosília je termín zapožičaný z geológie. Princíp, že isté fosílie by mohli indikovať geologický vek skalnej formácie sa objavuje na začiatku 19. stor., vďaka Williamovi Smithovi (*Harries 2015*). Vypozoroval, že rozšírenie špecifických fosílií v čase nám dovoľuje identifikovať geologické obdobia a koreláciu hornín obsahujúcich tieto fosílie. Prehistorici 19. a 20. stor. analogicky považovali konkrétne typy nástrojov za indikátory úrovne chronostratigrafickej sekvencie ľudských činností (*Leclerc/Tarrête 1988a*; *Pautrat 1993*). Na to, aby bol „szeletiensky listovitý hrot" *fossile directeur*, musí mať niečo špecifické (morfológiu, techniku tvarovania alebo retušovania, *chaîne opératoire* vo výrobe, koncept nástroja, atď.), čo ho odlišuje od iných typov listovitých hrotov a musí sa vyskytovať výlučne v kontexte szeletienskych súborov. Kým nemôžeme demonštrovať existenciu špecifického typu listovitého hrotu spojeného len so szeletienom, je zrejme lepšie nepoužívať pojem „szeletiensky listovitý hrot" ako typologický termín.

Obr. 1. Listovité hroty z fáz „solutréenu" v Maďarsku. 1–3 – protosolutréen z jaskyne Szeleta (podľa *Kadić 1934*, tab. IV: 2, 5, 7, pôvodná fotografia G. Toborffy); 4–6 – raný solutréen z jaskyne Jankovich (podľa *Gábori-Csánk 1993*, tab. IIb: 5, 8, 10, pôvodná fotografia A. Dabasi); 7, 8 – rozvinutý solutréen z jaskyne Szeleta (podľa *Kadić 1934*, tab. V: 1, 3, pôvodná fotografia G. Toborffy); 9, 10 – neskorý solutréen zo skalného previsu Puskaporos (podľa *Kadić 1934*, tab. VI: 2, 7, pôvodná fotografia T. Dömök). Bez mierky.

Obr. 2. Rozlíšené moduly bifaciálnych listovitých nástrojov z jaskyne Szeleta. 1 – široké, predĺžené a symetrické typy so zaoblenou bázou (A) alebo hrotitou bázou (B); 2 – úzke, predĺžené a symetrické typy s maximálnou šírkou v proximálnej časti (A) alebo v stredovej časti (B); 3 – asymetrické typy v tvare vavrínového listu (A–C), tvar malého vavrínového listu (D), malý subtriangulárny tvar (E); (podľa *Mester 2014b*, obr. 12).

Obr. 3. Morfologické tvary bifaciálnych nástrojov aplikované v opisnom systéme hrotitých bifaciálnych artefaktov z moravských lokalít (podľa *Nerudová 2011*, obr. 2: 3).

Preložila Viera Tejbusová

Zsolt Mester Dr. habil. CSc.
Institute of Archaeological Sciences
Eötvös Loránd University
Múzeum krt. 4/B
HU – 1088 Budapest

and

UMR 7194 HNHP CNRS/MNHN/UPVD
Equipe NOMADE
Institut de Paléontologie humaine
1 rue René Panhard
FR – 750 13 Paris
mester.zsolt@btk.elte.hu

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 63–82

FIRST RESULTS OF USE-WEAR ANALYSIS OF THE LEAF POINTS FROM MORAVANY NAD VÁHOM-DLHÁ[1]

Katarzyna Pyżewicz – Adrián Nemergut

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.5

Keywords: Early Upper Palaeolithic, Szeletian, Western Slovakia, leaf points, use-wear analysis

Abstract: In the last century, a big number of specific poplar-leaf shape points were obtained during the archaeological research at the Moravany nad Váhom-Dlhá. The assemblage contains numerous points of various sizes, methods of production at different stages of completion. The paper presents the results of use-wear analysis of the selected leaf points from Moravany nad Váhom-Dlhá. The study focuses on the relation between the morphology, raw material use, size of the points and the character of macroscopic and microscopic traces associated with their use and hafting, as well as the localization on the points. However, from the aspect of use-wear analysis, the collection is a bit problematic. It has been obtained a long time ago, mostly in 1943 and 1963. Instead of being packed separately, numerous leaf points were stored together only in few boxes. Many of them are damaged either by production, or as a result of post-depositional processes, lowering the visibility of the original use-wear traces. First microscopic analysis indicates that these types of tools were probably used as hunting equipment.

INTRODUCTION

The leaf point collection from Moravany nad Váhom-Dlhá is very important as regards a specific technocomplex of the Early Upper Palaeolithic (EUP) in Western Slovakia. The assemblage is renowned because it consists of a big number of triangular points shaped by bifacial retouch, with a slightly convex base (poplar-leaf shape). These specific leaf points were introduced by *L. Zotz* (*1951*, 183) as Moravany-Dlhá type points. *F. Prošek* (*1953*, 146) included the finds from Moravany nad Váhom-Dlhá in his detailed definition of the Szeletian culture in which leaf points represented the main *fossiles directeurs.* In recent years, opinions on Szeletian material concept have been changed and refined due to newly obtained results from excavations and lithic collections from central Europe, even though many new questions have arisen (*Kaminská et al. 2017*; *Kaminská/Kozłowski/Škrdla 2011*; *Lengyel/Mester 2008*; *Markó 2016*; *Mester 2018*; *Neruda/Nerudová eds. 2009*; *2013*; *Oliva 2008–2009*; *Škrdla 2017*; *Valoch 2012*). The lithic collection from Moravany nad Váhom-Dlhá has a great potential to contribute to this discussion. The collection comprises of all elements within the *chaîne opératoire*, including rough pre-forms, production waste, final products – leaf points or reutilized pieces, due to what the site has been interpreted as a leaf point workshop (*Freund 1952*, 249; *Zotz 1951*, 181). The paper presents preliminary results of the use-wear analysis of selected leaf points, with the aim of determining whether these tools were used and what for, what could eventually contribute to identification of the site's function. This is a pilot study focusing only on selected leaf points from the site. This is why points in different stages of production (almost finished, finished, and reutilized), points made of different raw materials and of different quality, including even weathered pieces were selected for the analysis. In order to determine what specimen are suitable for the analysis in the future.

THE SITE

Moravany nad Váhom-Dlhá is located in Southwestern Slovakia, at the foothills of the Považský Inovec mountain range, on the left bank of the Váh River. The site is situated at an altitude of approx. 330 m, on a slope leaning northwards to the Váh River valley, about 3 km far from the river (Fig. 1).

[1] This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-20-0521 and project VEGA 2/0101/19.

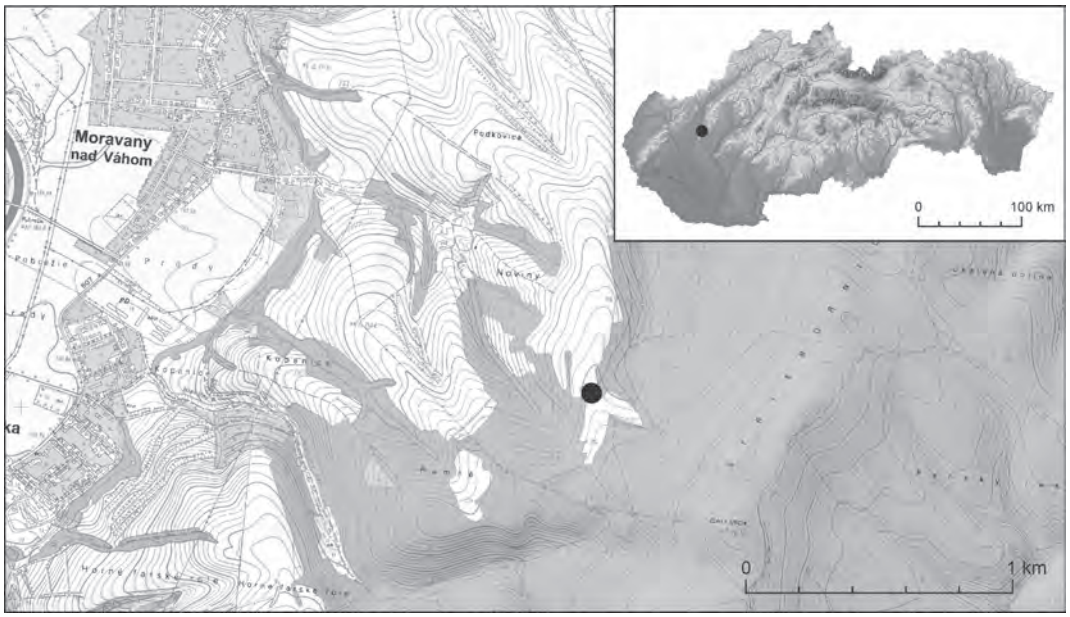


Fig. 1. Location of Moravany nad Váhom-Dlhá.

The site was first systematically excavated by *L. Zotz* (*1951*, 181) in the first half of the last century. Later, his work was followed up on by K. Absolon (*Nerudová/Valoch 2009*). Exact locations of the areas excavated by these researches remain unknown. More detailed information about the site was obtained during the excavations lead by J. Bárta in 1963 and 1990 (*Bárta 1967*; *1970*). In 1963, 25 trenches spreading over a large area of about 150 m^2 were excavated (*Nemergut 2010*, 184). The artefacts were located in two superposing layers, as indicated by the profile drawings (*Nemergut 2010*, fig. 4). According to J. Bárta, the cultural layer was found mainly at the level of fossil soil, and rarely also in the layer of loess, which is why he believes that the finds were not found in their primary positions (*Bárta 1970*, 39). This was probably caused by extensive deflations and erosion of overlying loess layers. Revising archaeological excavation was carried out in 2008 (*Kaminská/Kozłowski/Škrdla 2011*, 39), during which three trenches were excavated. Lithic finds were discovered in Trench III, namely in the layer B horizon of fossil soil (*Kaminská et al. 2017*, 43).

The AMS dating (Poz-29011) of a fragment of *Picea* sp./*Larix* sp. from L. Zotz's 1943 excavation is 33,600 ±300 uncal BP (*Kaminská/Kozłowski/Škrdla 2011*, 40).

LITHIC INDUSTRY

Several big collections of lithic industry were obtained from the site. They are deposited in various institutions, even though some assemblages have been lost. The collections have been analysed by several researchers (*Bárta 1960*; *Freund 1952*; *Kaminská et al. 2017*; *Nemergut 2010*; *Nemergut/Cheben/Gregor 2012*; *Nerudová/Valoch 2009*; *Zotz 1951*). The most numerous finds come from the excavations of L. Zotz and J. Bárta. From J. Bárta's excavations, 5012 lithic artefacts were obtained (*Nemergut 2010*, 188). 4795 pieces coming from the excavations lead by L. Zotz (*Nemergut/Cheben/Gregor 2012*, 381) are deposited at the Institute of Archaeology of the Slovak Academy of Sciences (IA SAS). The latter number of specimen is probably not final, as the finds keep being discovered in misplaced/wrongly labelled boxes. Part of the collection, partially analysed by *J. Bárta* (*1960*), is still deposited in the Balneological Museum in Piešťany. As the finds were obtained during the excavations conducted a long time ago, the information regarding their contexts is very limited. The finds from the excavation led by L. Zotz in 1943 were packed in boxes with no context information (trenches, layers or depths). The finds from excavations led by J. Bárta were packed by individual trenches and depths, but information on layers and parts of the trenches or sectors is missing. Nevertheless, the assemblage seems to be homogeneous, which is why it is analysed as a whole.

As regards raw materials, most of the lithic artefacts (91%) were made of local radiolarite of different colours (*Nemergut/Cheben/Gregor 2012*, 382). Presence of pebble cortex indicates that radiolarite was

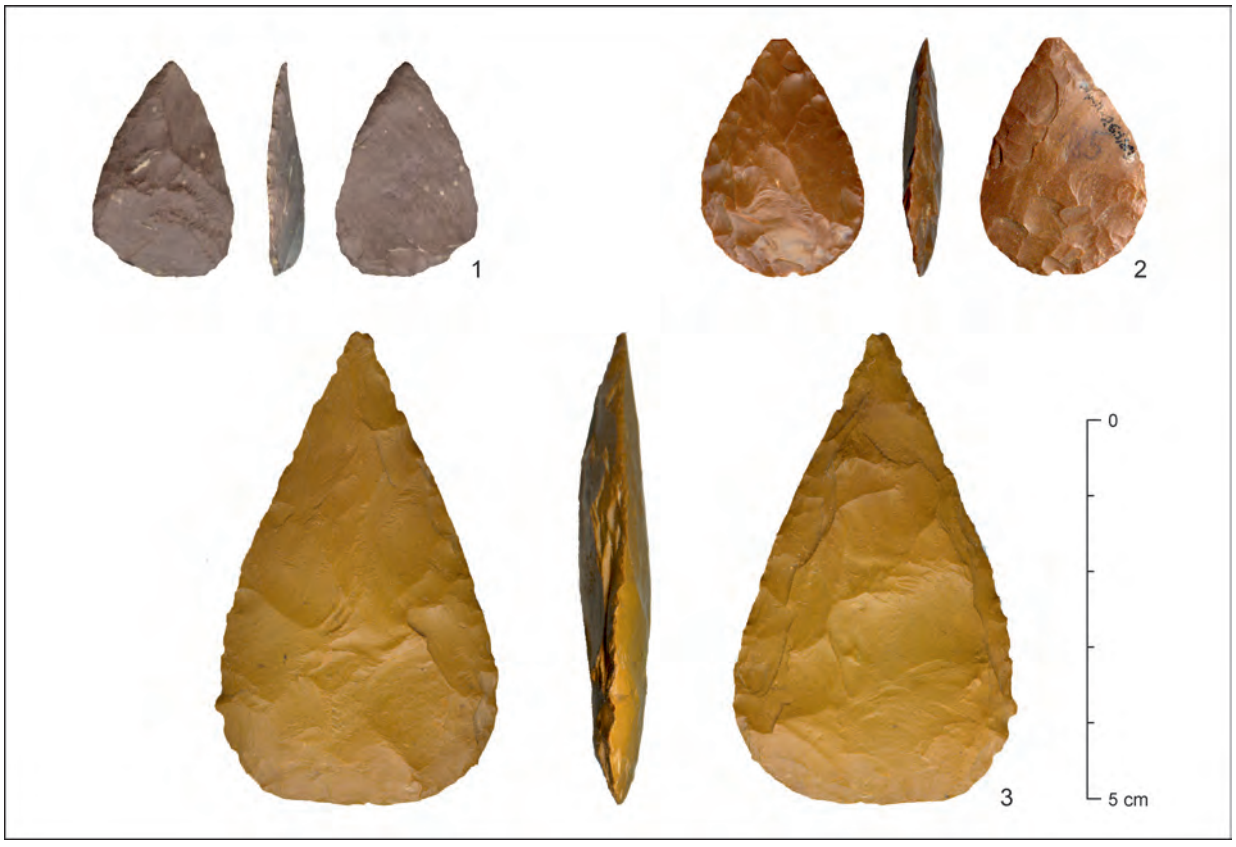


Fig. 2. Moravany nad Váhom-Dlhá. Variability of leaf points. 1 – unifacial, sometimes with lateral retouch (sample 9); 2 – partial bifacial (sample 8); 3 – bifacial (sample 58).

obtained from nearby gravel terraces of the Váh River. Quartz, opal-chalcedony, siliceous siltstone and sandstone were less frequent materials. Limnosilicite (approx. 70 km), felsitic porphyry (approx. 210 km) and obsidian (approx. 280 km) imported from more distant territories were used as well.

From technological aspect, flakes, their fragments and small flakes absolutely prevail in the collections. Only a small proportion of the assemblages comprises of blades, retouched tools and cores (*Nemergut 2010*, table 1; *Nemergut/Cheben/Gregor 2012*, table 1).

LEAF POINTS

Moravany nad Váhom-Dlhá site became famous for a finding of a large number of leaf points. *L. Zotz* (*1951*, 183) states that up to 200 pieces come from his excavation. 67 specimens come from the excavations led by J. Bárta, 23 of which represent complete artefacts (*Nemergut 2010*, 192). The remaining 44 pieces are fragmented, and include distal (15 pcs), lateral (14 pcs), proximal (6 pcs), mesial-distal (4 pcs), proximal-mesial (4 pcs), and mesial parts (1 pc) of leaf points. Some of the fragments fit together, and usually compose of mesial-distal and proximal-mesial parts (*Nemergut 2010*, pl. IV: 4, 6). Interestingly, in one case, a proximal-mesial fragment of a broken leaf point was re-retouched (*Nemergut 2010*, pl. IV: 8).

Almost all leaf points were made of local radiolarite (*Nemergut/Cheben/Gregor 2012*, fig. 2: 6, 8, 10), only some were made of local siliceous siltstone and sandstone (*Nemergut/Cheben/Gregor 2012*, fig. 2: 1–3). One asymmetrical point was even made of a poor-quality quartz. Exceptionally, the points were made of raw materials originating in more distant places, such as limnosilicite and felsitic porphyry (*Nemergut/Cheben/Gregor 2012*, fig. 2: 4, 5). *G. Freund* (*1952*, 249) even mentions obsidian, but it has not been directly documented in the collection deposited in the IA SAS. There is only indirect evidence, in the form of production waste – the bifacial thinning flakes (BTF).

The collection contains numerous finished leaf points but also various exemplars discarded at different production stages. There are two main methods of production (*Nemergut/Klaric 2014*, 16). First, the leaf points are produced by direct processing of raw material blocks, pebbles or pebble fragments, by discoid reduce strategy. This method is used for making bifacial samples of larger size (Fig. 2: 3). Second method is based on flakes with partial bifacial work (Fig. 2: 2), or unifacial work (Fig. 2: 1), sometimes even only using lateral retouch. The lengths of the leaf points from the collection of J. Bárta varies between 23 and 58 mm. Average length is 38 mm, with standard deviation of 9.6. Widths vary from 18 to 41 mm, with average width being 26 mm and standard deviation 6.8. The ratio of length to width varies from 1.1 : 1 to 1.8 : 1. Average ratio is 1.45 : 1, with standard deviation of 0.16 (*Nemergut 2010*, 192).

USE-WEAR ANALYSIS

Method

Microscopic analysis was conducted using Nikon LV150 metallographic microscope and Keyence VH-Z100R digital microscope. Before the examination, the artefacts were cleaned with warm water, detergent, and acetone. The leaf points were examined under the magnification of 50 x to 400 x, a common procedure in microscopic analysis (e.g. *Juel Jensen 1988*; *Keeley 1980*; *Levi Sala 1996*; *Moss 1983*; *Rots 2010*; *Van Gijn 1990*; *Vaughan 1985*). The observations were compared mainly with the macroscopic and microscopic traces and especially with the experimental reference dataset kept at the Faculty of Archaeology, University of Warsaw, Poland. This dataset consists of about 200 specimens originally used for hunting, and for processing hide, meat, bones, antler, wood, plant, shells, amber, and minerals. The dataset also includes about 80 blocks of lithic industry associated with technology, and a few hundred specimens linked to postdepositional aspects (like trampling, plowing). The experiments were conducted during the last few years and refer generally to the activities possibly performed in the Stone Age. It is important to emphasize that these experiments had been made before the microscopic analysis of Moravany-Dlhá leaf points, and so they are not directly related to the technology and the usage of leaf points.

Material

A detailed microscopic analysis was conducted on 64 artefacts. The analysed group consists of whole leaf points of Moravany-Dlhá type and their fragments (Table 1). The assemblage is rather challenging, as the leaf points were not packed separately. They were all deposited together in only few boxes. Much of the postdepositional damage of the specimens was probably caused by frequent manipulation with the boxes, resulting in poor visibility of the original traces of use-wear. In order to examine potential microscopic technological and usage traces, we have selected finished, almost finished and reutilized points differing in morphology, type, and size. The analysed group of artefacts comprises of: finished tools, symmetrical, bifacial, and very thin leaf points with a rounded base; partially bifacially retouched points representing finished or almost finished leaf points; unifacially or laterally retouched artefacts; or some reutilized points. The most common are the bifacial variants, which are also the largest, mostly made of radiolarite (Table 1; 2). As for the *chaîne opératioire*, finished points are the most frequent of all.

Table 1. Moravany nad Váhom-Dlhá. Variants of analysed leaf points in relation to fragmentation and *chaîne opératoire*.

	Whole and almost whole			Fragments		Total
	Finished	Almost finished	Reutilized	Mesio-basal/ mesio-terminal parts	Tips	
Unifacial	5	3	0	0	3	11
Partially bifacial	6	0	0	2	0	8
Bifacial	20	2	3	10	7	42
Unknown	0	0	0	0	3	3
Total	31	5	3	12	13	64

Table 2. Moravany nad Váhom-Dlhá. Types of macroscopic and microscopic traces observed on the leaf points. xx – the surface is badly damaged mostly due to the postdepositional processes, or the raw material was not fine-grained, causing problems with identification of use-wear traces.

Sample no.	Raw material	Variant of leaf point	*Chaîne opératoire*	Size (mm)			Fragmentation	Postdepositional traces/not well preserved surface	Hafting/ transporting traces	Breaks of tips	Linear traces	Photo
				length	width	thickness						
1	radiolarite	partially bifacial	finished	42.81	20.24	6.61	whole	x	x	–	–	–
2	radiolarite	bifacial	finished	47.98	22.81	6.64	whole	x	x	–	–	–
3	radiolarite	bifacial	finished	45.77	22.97	7.87	lateral break	x	x	x	–	Fig. 5: 2
4	radiolarite	partially bifacial	finished	47.97	22.98	6.37	whole	xx	–	–	–	–
5	radiolarite	bifacial	reutilized?	56.08	35.08	10.13	bilateral breaks	xx	–	–	–	–
6	radiolarite	bifacial	reutilized	54.88	34.69	9.95	almost whole	–	x	x	x	–
7	radiolarite	unifacial	finished	26.62	19.03	3.12	whole	xx	x?	–	x?	–
8	radiolarite	partially bifacial	finished	31.57	22.23	5.12	almost whole	xx	–	x?	–	Fig. 2: 2
9	unknwon	unifacial	finished	32.07	23.18	8.57	whole	xx	–	–	–	Fig. 2: 1
10	radiolarite	partially bifacial?	finished?	22.78	18.38	3.52	mesio-basal part	–	x?	x?	–	–
11	radiolarite	partially bifacial	finished	36.56	27.31	4.21	almost whole	xx	–	x	x	Fig. 3: 3, 4
12	radiolarite	unifacial	finished?	23.64	18.74	2.97	almost whole	xx	–	x	–	Fig. 3: 1
13	radiolarite	unifacial	finished	22.55	20.32	3.95	almost whole	–	x	x	–	–
14	radiolarite	unifacial	finished	24.55	17.95	3.13	almost whole	x	x?	x?	x	Fig. 4: 2
15	radiolarite	unifacial	finished	34.64	18.89	2.95	lateral break	xx	–	–	x?	Fig. 4: 1
16	radiolarite	unifacial	unfinished?	30.08	21.46	6.55	whole	xx	–	–	–	–
17	radiolarite	unifacial	unfinished?	30.32	22.66	5.36	whole	xx	–	–	–	–
18	radiolarite	unifacial?	finished?	29.05	21.02	3.11	tip	xx	x?	x	–	–
19	radiolarite	bifacial	finished	38.68	31.03	8.98	mesio-basal part	xx	–	x	–	–
20	radiolarite	bifacial	finished	36.82	36.48	11.28	mesio-basal part	xx	x?	x	–	Fig. 3: 2
21	radiolarite	bifacial	finished?	53.43	35.37	13.95	almost whole	xx	–	x	–	Fig. 3: 5
22	radiolarite	bifacial	finished	35.21	25.15	5.98	almost whole	xx	–	x	–	–

Table 2. Continuation.

Sample no.	Raw material	Variant of leaf point	*Chaîne opératoire*	Size (mm)			Fragmentation	Postdepositional traces/not well preserved surface	Hafting/ transporting traces	Breaks of tips	Linear traces	Photo
				length	width	thickness						
23	radiolarite	bifacial	finished	33.82	20.14	5.19	whole	xx	–	–	–	–
24	radiolarite	bifacial	finished	37.25	25.65	6.77	whole	x	x	–	–	–
25	radiolarite	bifacial	finished	41.93	31.38	8.27	whole	xx	–	–	–	–
26	radiolarite	bifacial	finished	48.02	34.45	9.61	almost whole	xx	–	x?	–	–
27	radiolarite	bifacial	finished	47.44	34.4	8.33	whole	xx	–	–	–	–
28	radiolarite	bifacial	reutilized	56.75	39.21	9.91	tip (technological break) + reutilized mesio-basal part	xx	–	x?	–	–
29	radiolarite	bifacial	finished	36.27	24.54	4.58	whole	xx	–	–	–	–
30	radiolarite	partially bifacial	finished	61.8	32.84	4.93	whole	xx	–	–	–	–
31	radiolarite	bifacial	finished	37.86	52.69	8.95	basal part	xx	–	–	–	–
32	radiolarite	bifacial	finished	85.73	43.88	12.75	whole	x	x?	–	–	–
33	felsitic porphyry	bifacial	finished	44.53	26.61	5.94	lateral notch	x	x	–	–	Fig. 5: 3
34	radiolarite	?	?	19.85	10.19	3.23	tip	xx	–	x	–	–
35	radiolarite	?	?	13.01	12.84	3.17	tip	x	x	x?	–	Fig. 6: 5, 6
36	radiolarite	?	?	19.33	13.11	2.52	tip	x	x	x	–	Fig. 6: 3, 4
37	radiolarite	bifacial	finished	23.22	17.02	3.52	tip	xx	–	x?	–	–
38	radiolarite	bifacial	finished	18.13	22.58	5.25	tip	x	x	x	–	–
39	radiolarite	unifacial?	finished?	21.42	21.83	5.48	tip	xx	–	x?	–	–
40	radiolarite	bifacial	finished	25.47	29.33	8.67	tip	x	x?	x?	x	Fig. 4: 3
41	radiolarite	bifacial	finished	27.58	24.71	5.31	tip	xx	–	x?	–	–
42	radiolarite	bifacial	finished	19.4	22.86	5.23	tip	xx	–	x	–	–
43	radiolarite	bifacial	finished	36.38	26.13	7.91	mesio-terminal part	xx	–	x?	–	–
44	radiolarite	bifacial	finished	28.41	28.16	9.97	mesio-terminal part	xx	–	x?	–	–

Table 2. Continuation.

Sample no.	Raw material	Variant of leaf point	*Chaîne opératoire*	Size (mm)			Fragmentation	Postdepositional traces/not well preserved surface	Hafting/ transporting traces	Breaks of tips	Linear traces	Photo
				length	width	thickness						
45	radiolarite	partially bifacial	finished	27.04	25.55	4.54	mesio-basal part	x	x	x?	–	–
46	radiolarite	bifacial	finished	35.07	23.97	5.72	lateral break	xx	–	x	–	–
47	radiolarite	bifacial	finished	26.35	35.12	7.88	basal part	xx	–	x?	–	–
48	radiolarite	bifacial	finished	15.23	17.23	5.67	tip	xx	–	x	–	–
49	radiolarite	bifacial	finished	31.98	31.43	4.87	tip	x	x?	x?	–	–
50	radiolarite	bifacial	finished	24.72	42.67	7.38	basal part	x	x?	–	–	–
51	radiolarite	bifacial	finished	36.26	29.32	6.58	almost whole	x	–	x	–	–
52	radiolarite	partially bifacial	finished	43.76	30.24	5.25	whole	x	x?	–	x	–
53	radiolarite	bifacial	finished	37.79	47.96	7.56	mesio-terminal part	x	x?	x	–	Fig. 3: 6
54	radiolarite	bifacial	finished	41.39	39.61	8.74	mesio-terminal part	x	x	x	–	Fig. 5: 1
55	radiolarite	bifacial	finished	55.06	51.79	7.49	mesio-basal part	x	x	x?	–	–
56	unknwon	bifacial	finished	54.38	35.63	6.22	lateral break	x	x		x	–
57	radiolarite	bifacial	finished	49.68	32.87	5.84	whole	xx	x?	–	–	–
58	radiolarite	bifacial	finished	61.83	37.35	7.08	whole	x	–	–	–	Fig. 2: 3
59	radiolarite, Sedmerovec-Kašnák type	bifacial	finished	79.78	51.42	9.86	whole	xx	–	–	–	–
60	limnosilicite	bifacial	finished	50.37	36.67	8.62	almost whole	xx	–	x?	–	–
61	siliceous siltstone	bifacial	finished	62.83	37.79	6.23	almost whole	xx	–	x	x?	–
62	radiolarite, Sedmerovec-Kašnák type	bifacial	finished	84.93	40.96	10.15	whole	xx	–	–	–	–
63	radiolarite	bifacial	unfinished?	74.48	46.96	18.41	whole	x	–	–	–	–
64	radiolarite	unifacial?	finished?	18.58	9.11	4.02	tip	?	?	x	?	Fig. 6: 1, 2

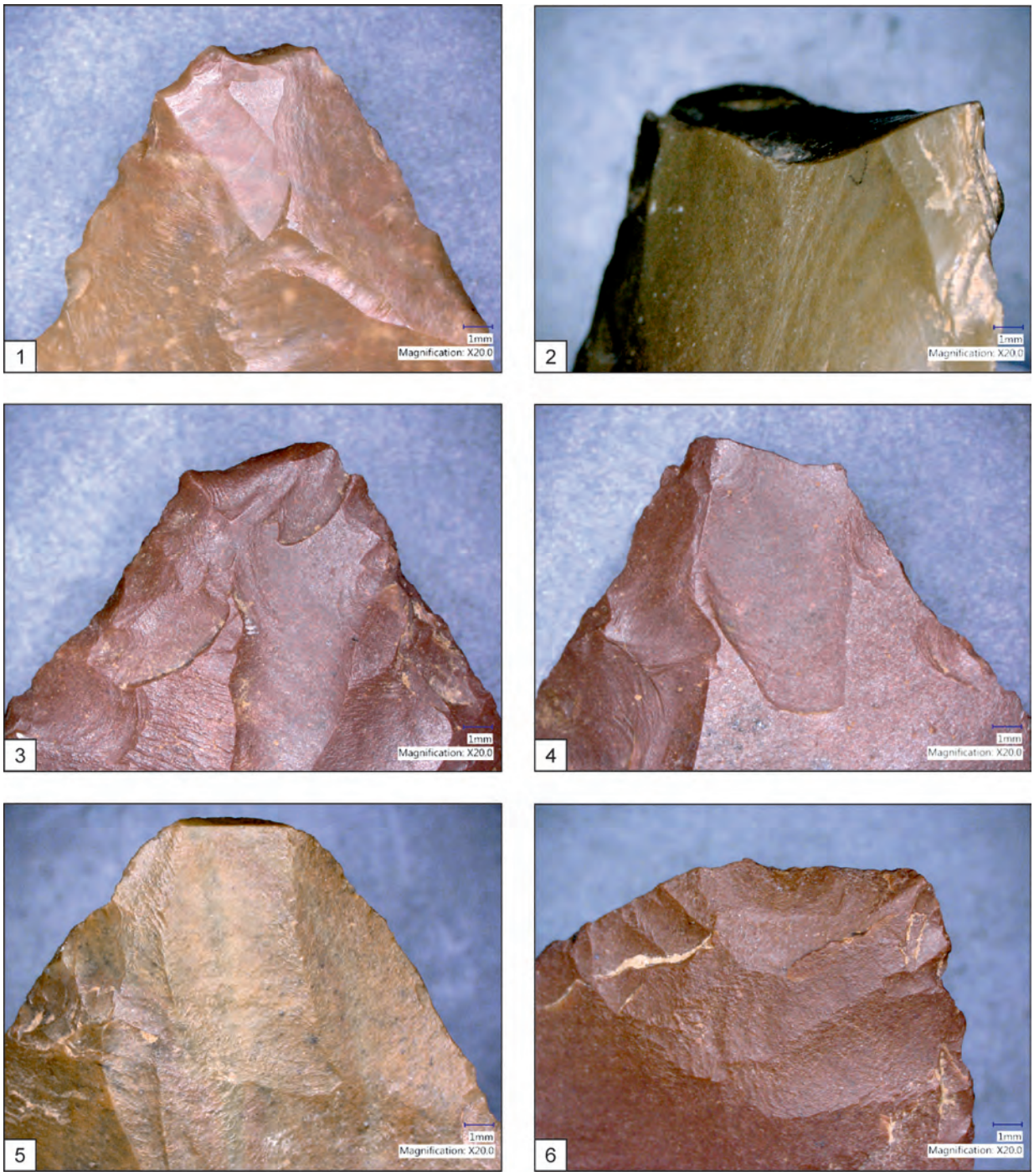


Fig. 3. Moravany nad Váhom-Dlhá. Details of use-wear traces on leaf points. 1 – spin-off fracture (sample 12); 2 – hinge terminating bending fracture (sample 20); 3, 4 – spin-off and hinge terminating bending fractures (sample 11); 5 – feather terminating bending fracture (sample 21); 6 – hinge terminating bending fracture (sample 53).

What is very important in the context of use-wear studies, analysed artefacts were made of various types of raw-material, and they are characterized by a different states of preservation. It can be concluded that the most important raw material was local one, i.e. radiolarite. Some of the artefacts were made of local quartz or siliceous sandstone. There are some specimens made of raw materials brought from further locations. In some cases, the type of raw-material limited the research. Microscopic analysis of other than "fine-grained" materials and/or those that were weathered was much more complicated. In such cases, diagnostic elements of polishing were poorly preserved and vague. These postdepositional factors limited the identification and

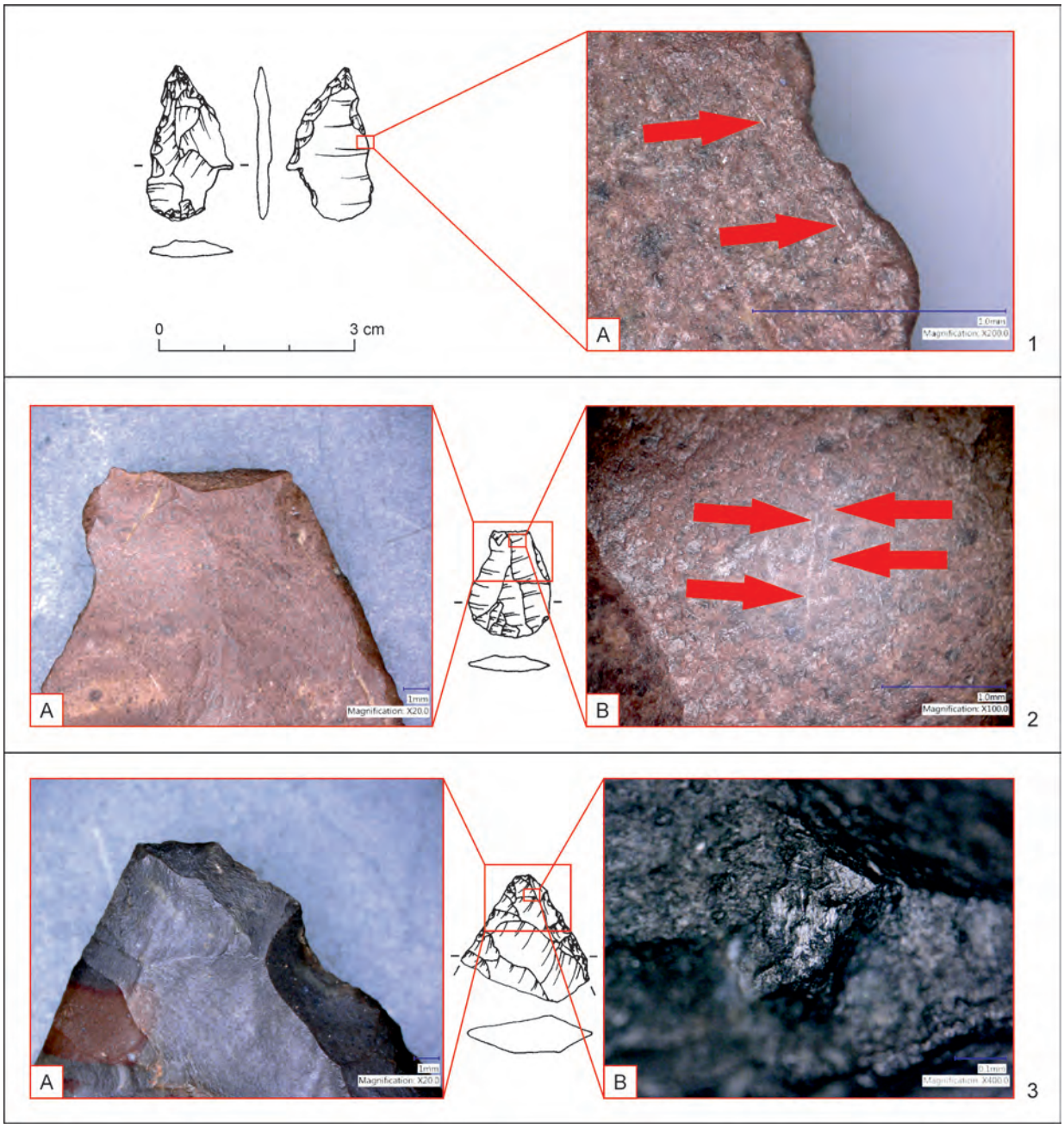


Fig. 4. Moravany nad Váhom-Dlhá. Details of use-wear traces on leaf points. 1 – linear trace (A) of sample 15; 2 – break of the tip (A) and linear traces (B) of sample 14; 3 – break of the tip (A) and polishing probably resulting from contact with a bone (B) of sample 40.

recognition of the origin of the traces on the artefacts (e.g. *Burroni/Donahue/Pollard 2002*; *Kamińska/Szymczak 1994*; *Levi Sala 1996*; *Plisson/Mauger 1988*; *Shea/Klenck 1993*; *Van Gijn 1990*, 51–53). Because of a bad state of preservation, the use-wear analysis of some leaf points was made only on the macroscopic level.

Results

Table 2 shows the results of the analysis. They were influenced by numerous postdepositional traces located on different parts of analysed points. For instance, breakings of the tips, microscopic linear traces, and polishing were detected (Fig. 3–6). Figures 7 and 8 show that the traces of use-wear can be seen on all types of points, regardless their variant or size.

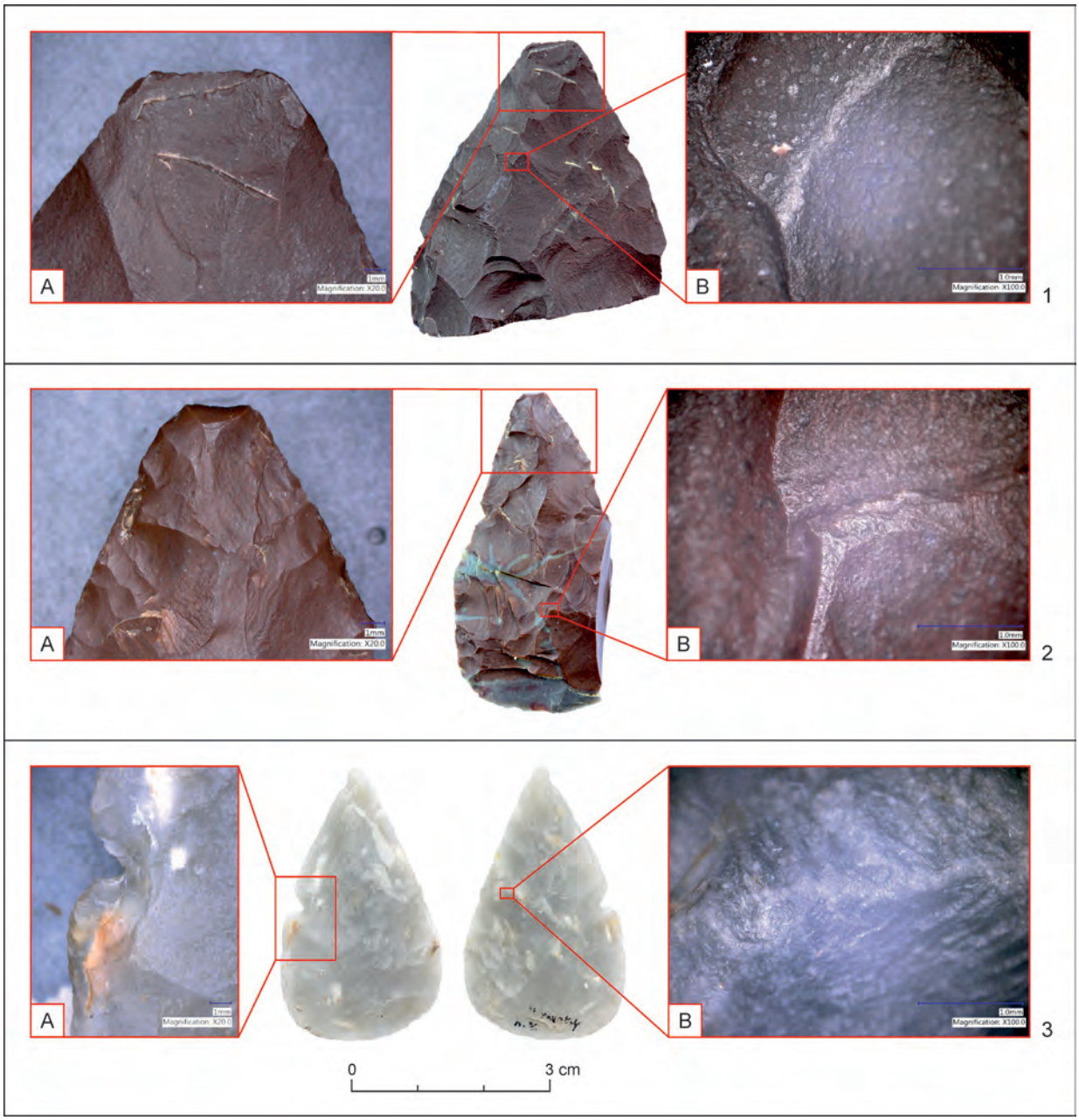


Fig. 5. Moravany nad Váhom-Dlhá. Details of use-wear traces on leaf points. 1 – step terminating bending fracture (A) and polished part (hafting or transporting traces?; B) of sample 54; 2 – hinge terminating bending fracture (A) and polished part (hafting or transporting traces?; B) of sample 3; 3 – notch (A) and polished part (hafting or transporting traces?; B) of sample 33.

Broken tips are the most common macroscopic traces. They were observed on many specimens, on finished, almost finished and reutilized specimens (Fig. 7: A). On all known variants, large broken bifacial tips were recognised, on both the partially retouched or on small unifacial forms (Fig. 7: B). These broken tips are characterized by specific morphology. There are some examples of impacts with a convex profile called "hinge" (Fig. 3: 2–4, 6; 5: 2), "step" (Fig. 5: 1) and "feather", depending on fracture bending of the edge (Fig. 3: 5). Also, "spin-off" fractures were recognized (Fig. 3: 1, 3, 4), characterized by the breaks with straight profiles and some negatives of small chips, usually with hinged or step endings that were placed under the breaks. The morphology of the mentioned fractures indicates that some of them are probably related to tools such as projectiles, and these breaks were created during hitting the target. This is indicated by a series of different experiments (cf. *Bergman/Newcomer 1983*; *Coppe/Rots 2017*; *Fischer/*

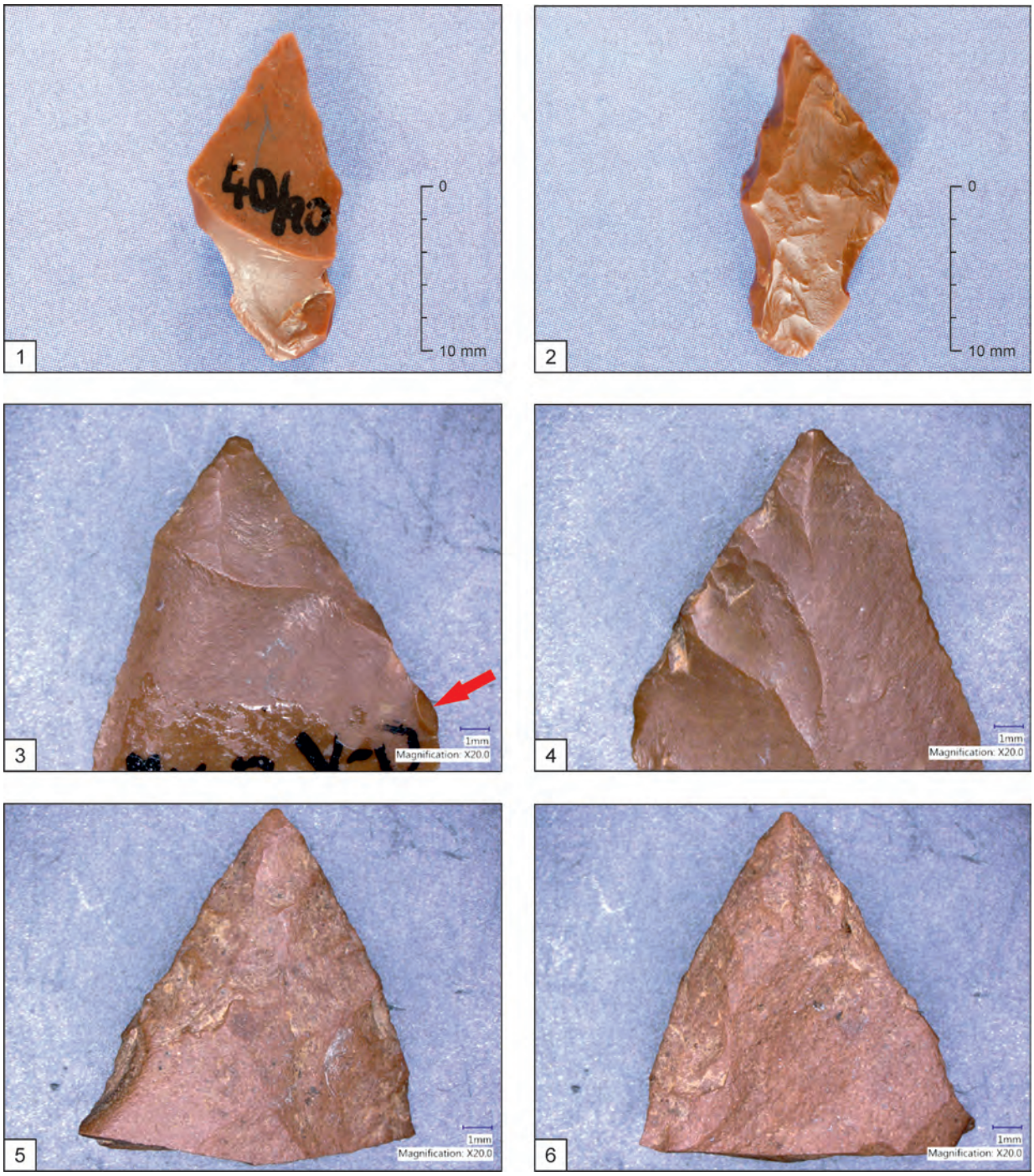


Fig. 6. Moravany nad Váhom-Dlhá. Details of leaf point tips. 1 – functional fracture (?); 2 – technological fracture (the arrow showing a butt); 3 – postdepositional fracture (?). 1, 2 – sample 64; 3, 4 – sample 36; 5, 6 – sample 35.

Vemming Hansen/Rasmussen 1984; *Hutchings 2016*; *Lombard 2005*; *Odell/Cowan 1986*; *Rots/Plisson 2014*; *Shea/Davis/Brown 2001*). Additionally, some leaf points are broken in an unusual way – the breakages have only straight profiles. In such cases, it is not possible to answer the question if they were created during hunting, were formed during the production stage, or they are related to postdepositional factors (like for example trampling).

Among the group of analysed artefacts, tips of the leaf points were recognized. They represent positives of previously described traces. Some of them bear the negatives of hinged or step fractures – they have deep and concave profiles, and the one end of the breakage is much longer than the other

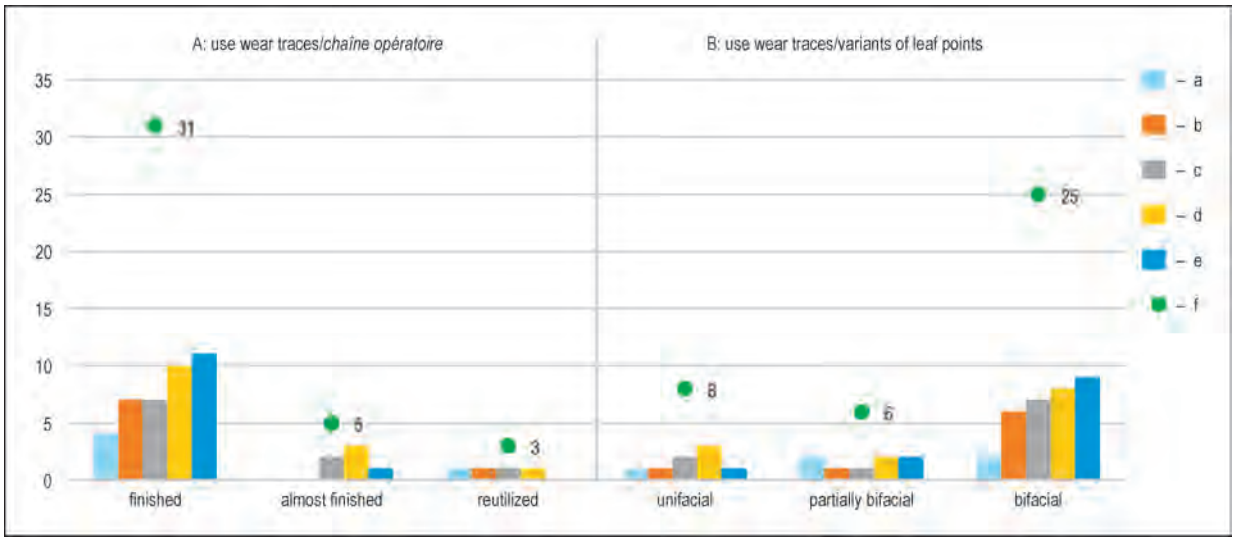


Fig. 7. Moravany nad Váhom-Dlhá. Use-wear traces on whole and almost-whole leaf points in relation to their variants and *chaîne opératoire*. Legend: a – linear traces; b – hafting/transporting traces; c – terminal break; d – without traces; e – postdepositional traces; f – total.

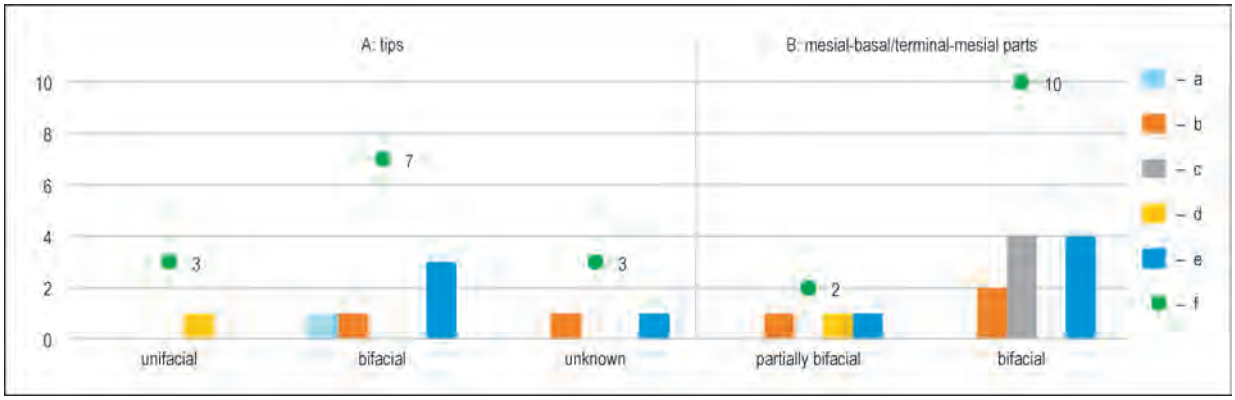


Fig. 8. Moravany nad Váhom-Dlhá. Use-wear traces on tips and leaf points fragments in relation to their variants. Legend: a – linear traces; b – hafting/transporting traces; c – terminal break; d – without traces; e – postdepositional traces; f – total.

(Fig. 6: 1, 2). It is possible that these fractures were formed during use or technical stage when the leaf points were made (cf. *Beyries/Janny/Audouze 2005*; *Polanská 2018*), e.g., with visible butt on the edge (Fig. 6: 3) or post*d*epositional (probably Fig. 6: 5, 6). There are no tips from partially bifacial variants (Fig. 8: A), what is related with the poorer presence of terminal breaks on partially bifacial points (Fig. 7: B). On the tips, there are some traces that could be related to transporting or hafting (Fig. 8: A), but some of these traces can be related to postdepositional processes. Linear traces were detected exclusively on bifacial variants of tips, as they were statistically most numerous (Fig. 8: A).

On microscopic level, the leaf points are characterized by linear traces. These linear traces are visible on 10 leaf points. They are placed near the tips of the leaf points (Fig. 4: 1, 2), under the already-mentioned macroscopic fractures or near the negatives of the microchips. Linear traces are either multiple, parallel next to each other, or individual. They are parallel or slightly oblique to the tool's axis of symmetry. Possibly, some of them had been created during the penetration of the target by point, they could be a result of scratching of a surface by stone chips. In one case (Fig. 4: 3B), there are visible linear polishes whose morphology is similar to traces resulting from getting in contact with bone. So, possibly, they may have been created as a result of hitting an animal bone.

Some of the leaf points are covered by traces that could be related to some kind of hafts or transporting (Fig. 5: 1B, 2B, 3B). On protruding parts such as ridges or edges, rounded and polished margins are visible

(they are usually dull, slightly "greasy" and penetrating the microstructure; e.g. *Lombrad 2005*; *Rots 2003*; *2008a*; *2008b*; *2009*; *2010*; *2011*; *2015*; *Rots/Van Peer/Vermeersch 2011*; *Rots/Vermeersch 2004*; *Van Gijn 2010*). It should be added that these traces occur on large parts of artefacts and are not visible only on specific parts of the tools (for example, near the tip or at the base). Due to the insufficient level of distinction, it was impossible to identify the type of potential haft and the method of fixing the leaf points. Considering the issue of leaf point mounting, the appearance of small notches located on individual specimens edges, lateral (Fig. 5: 3A) or bilateral (distributed symmetrically), at 1/3 to 1/2 of the artefact, should be taken into consideration. However, in this case this observation is not supported by specific results of microscopic analysis. Additionally, on the surface of leaf points, there are clear bright spots - they appear individually or in group, and in a chaotic way. The formation of such traces is related to the activity of natural and mechanical factors (e.g. *Levi Sala 1993*; *1996*) and with the use of hafts (e.g. *Rots 2010*; *Rots/Vermeersch 2004*).

DISCUSSION

Traces observed on the leaf points from Moravany nad Váhom-Dlhá are related to macroscopic breakages of the tips, microscopic linear traces, and some kind of polishing (see other experimental and use-wear analysis related to hunting weapons, e.g. *Barton/Bergman 1982*; *Bergman/Newcomer 1983*; *Coppe/Rots 2017*; *Crombe et al. 2001*; *Dockall 1997*; *Fischer 1990*; *Fischer/Vemming Hansen/Rasmussen 1984*; *Hutchings 2016*; *Iovita/Sano eds. 2016*; *Lombard 2005*; *Lombard/Parsons/van der Ryst 2004*; *Moncel et al. 2009*; *Moss/Newcomer 1982*; *Nuzhnyĭ 1990*; *Odell 1988*; *Odell/Cowan 1986*; *Plisson/Beyries 1998*; *Rots 2011*; *2015*; *Rots/Plisson 2014*; *Shea 1988*; *1990*; *2006*; *Shea/Davis/Brown 2001*; *Villa/Lenoir 2006*; *Villa et al. 2009*).

Unfortunately, at the current stage of the research, there is still a lack of comprehensive use-wear studies related to Central European points belonging to transitional assemblages, including Szeletian. The only analysis was performed on the material from the Moravia region – the leaf points from Vedrovice V and Moravský Krumlov IV (*Nerudová/Dušková-Šajnerová/Sadovský 2010*; *Šajnerová-Dušková 2009*). Microscopic traces were recorded on 19 leaf points and several other tools. They were suggested to have been related to hide processing, scraping of soft and medium-hard material (possibly also hide), as well as drilling or piercing of medium-hard material. Some of them could have been used during hunting, the function of other tools was not specified. In general, the results show that these leaf points were used as multifunctional tools. In comparison, the data on selected leaf points from Siberia indicate that this type of artefacts was used to process soft organic material. These activities were undertaken using the side edges (*Shalagina et al. 2019*). Apart from single cases suggesting different function, latest microscopic studies of Jerzmanowice leaf points from Nietoperzowa Cave revealed that the majority of tools contain traces of use indicating a hunting weapon. The research showed that these tools were made indeed to be used in hunting areas (*Pyżewicz et al. 2020*, 81).

At the same time, it should be noted that in the camp area, other activities associated with animal carcasses were performed. These specimens were parts of composite tools, as potential traces of hafting were observed on their surfaces. Based on preliminary use-wear analysis of endscrapers it can be concluded that these types of tools were used for scraping hide. It can be assumed that if further analyses of the other groups of artefacts were undertaken, it would also be possible to identify other tools for other activities related to the processing of animal carcasses, such as functional knives. Additionally, it should be noted that, based on preliminary results of the use-wear analysis of artefacts from Moravany nad Váhom-Dlhá, there is some evidence of plant processing using the lithic tools. Two examples, one large flake, and the other retouched flake are covered by intensive, very bright and flat gloss, which has overlapping the inner surfaces.

CONCLUSION

Lithic collection from Moravany nad Váhom-Dlhá represents an important (probably homogeneous) assemblage crucial for EUP (Szeletian), as suggested by many finished leaf points, semi-finished products, BTF, etc. On the other hand, the collection is problematic because it was obtained during older

excavations, and the context of the finds is absent. It is also chronologically old assemblage and the authors are aware of the fact that they cannot expect such results as those obtained from the finds from younger periods cannot be expected. Studying other assemblages from surrounding countries show that it is possible to detect traces also on Middle Palaeolithic or transitional industries (*Neruda/Nerudová/Šajnerová-Dušková 2010*; *Nerudová/Dušková-Šajnerová/Sadovský 2010*; *Šajnerová-Dušková 2009*). The problem lies mainly in the deposition of analysed finds in the depository and the moving of the collection which has led to fresh traces on the finds and partial covering/removing of the original traces. The aim of the presented article was not to analyse all points, but rather a representative part of the assemblage. These are preliminary results which must be further validated on other points in the collection of the IA SAS. Analysis of assemblages stored in other institutions should also be attempted. Main preliminary results of this study can be summarised as follows:

- The analysis has clearly shown that significant number of fractures is associated with fresh fractures or with accidents production, which is logical, since the leaf points were massively produced at the site.
- Absence of traces on edges which might interpret the points as multifunctional tools. This is an interesting discovery, since it is remarkably different from, e.g., Szeletian points from Moravia (*Nerudová/Dušková-Šajnerová/Sadovský 2010*; *Šajnerová-Dušková 2009*). On the other hand, other activities on other tools (sidescrapers, endscrapers) were documented at the site of Moravany nad Váhom-Dlhá; thus, if the original users had wanted to use the points universally, they would have. It has not been confirmed so far that the points from the analysed site were used as multifunctional tools.
- Rarely, traces suggesting use during hunting, such as microscopic linear traces and diagnostic impact and spin-off fractures, were documented. The cases when a combination of such traces was discovered on a single specimen are interesting, as this cannot be considered a coincidence (e.g. samples 6, 14, 40; Table 2).

To sum up the use-wear analysis of artefacts from Moravany nad Váhom-Dlhá, it can be concluded that at the site activities related to hunting were performed. The leaf points were most probably specialized tools used during hunting activities. This preliminary conclusion should be confirmed by further research.

As a result of conducted microscopic analysis, some further questions associated with the recognition of microscopic traces have arisen. Conducting a series of experiments connected with production and using (cutting, throwing, hafting, etc.) would be helpful. We would like to know:

- if macroscopic and microscopic traces (technological, usage, hafting, transporting) observed on experimental leaf points made from analogical raw materials such as artefacts from Moravany nad Váhom-Dlhá could be similar;
- how the type of raw material influences the readability of microscopic technological, use-wear or hafting traces;
- if particular types of macroscopic breakages of tips of Moravany-Dlhá type leaf points should be associated with using or technological aspects during their creation.

Translated by authors and Viera Tejbusová

BIBLIOGRAPHY

Barton/Bergman 1982 — R. N. E. Barton/C. A. Bergman: Hunters at Hengistbury: some evidence from experimental archaeology. *World Archaeology* 14, 1982, 237–248. DOI: https://doi.org/10.1080/00438243.1982.9979864

Bárta 1960 — J. Bárta: K problému listovitých hrotov typu Moravany-Dlhá. *Slovenská archeológia* 8, 1960, 295–323.

Bárta 1967 — J. Bárta: Stratigraphishce Übersicht der paläolitischen Funde in der Westslowakei. *Quartär* 18, 1967, 57–80.

Bárta 1970 — J. Bárta: Sídliská zo staršej doby kamennej na okolí Moravian nad Váhom. In: *Almanach Balneologického múzea v Piešťanoch*. Piešťany 1970, 31–40.

Bergman/Newcomer 1983 — C. A. Bergman/M. H. Newcomer: Flint Arrowhead Breakage: Examples from Ksar Akil, Lebanon. *Journal of Field Archaeology* 10, 1983, 238–243.

Beyries/Janny/Audouze 2005 S. Beyries/F. Janny/F. Audouze: Débitage, matière première et utilisations des becs sur le site de Verberie "Le Buisson Campin" (Oise) dans le Nord de la France. *Revue archéologique de Picardie* 22, 2005, 15–24.

Burroni/Donahue/Pollard 2002 D. Burroni/R. E. Donahue/A. M. Pollard: The Surface Alteration Features of Flint Artefacts as a Record of Environmental Processes. *Journal of Archaeological Science* 29, 2002, 1277–1287.
DOI: https://doi.org/10.1006/jasc.2001.0771

Coppe/Rots 2017 J. Coppe/V. Rots: Focus on the target. The importance of a transparent fracture terminology for understanding projectile points and projecting modes. *Journal of Archaeological Science: Reports* 12, 2017, 109–123.
DOI: https://doi.org/10.1016/j.jasrep.2017.01.010

Crombe et al. 2001 P. Crombe/Y. Perdaen/J. Sergant/J.-P. Caspar: Wear Analysis on Early Mesolithic Microliths from Verrebroek Site, East Flanders, Belgium. *Journal of Field Archaeology* 28/3–4, 2001, 253–269.
DOI: https://doi.org/10.1179/jfa.2001.28.3-4.253

Dockall 1997 J. E. Dockall: Wear traces and Projectile Impact: A Review of the Experimental and Archaeological Evidence. *Journal of Field Archaeology* 24/3, 1997, 321–331.
DOI: https://doi.org/10.1179/009346997792208113

Fischer 1990 A. Fischer: Hunting with Flint-Tipped Arrows: Results and Experiences from Practical Experiments. In: C. Bonsall (ed.): *The Mesolithic in Europe. Papers presented at the Third International Symposium, Edinburgh 1985.* Edinburgh 1990, 29–39.

Fischer/Vemming Hansen/Rasmussen 1984 A. Fischer/P. Vemming Hansen/P. Rasmussen: Macro and Micro Wear Traces on Lithic Projectile Points. Experimental Results and Prehistoric Examples. *Journal of Danish Archaeology* 3, 1984, 19–46.
DOI: https://doi.org/10.1080/0108464X.1984.10589910

Freund 1952 G. Freund: *Die Blattspitzen des Paläolithikums in Europa.* Bonn 1952.

Hutchings 2016 W. K. Hutchings: When Is a Point a Projectile? Morphology, Impact Fractures, Scientific Rigor, and the Limits of Inference. In: R. Iovita/K. Sano (eds.): *Multidisciplinary Approaches to the Study of Stone Age Weaponry.* Dordrecht 2016, 3–12.

Iovita/Sano eds. 2016 R. Iovit/K. Sano (eds.): *Multidisciplinary Approaches to the Study of Stone Age Weaponry.* Dordrecht 2016.

Juel Jensen 1988 H. Juel Jensen: Functional Analysis of Prehistoric Flint Tools by High-Power Microscopy: A Review of West European Research. *Journal of World Prehistory* 2/2, 1988, 53–87.

Kaminská et al. 2017 Ľ. Kaminská/J. K. Kozłowski/M. Moskal-Del Hoyo/A. Nemergut/P. Škrdla: Moravany-Dlhá a phenomen of the poplar-leaf shape points. *Eurasian Prehistory* 14/1–2, 2017, 41–54.

Kaminská/Kozłowski/Škrdla 2011 Ľ. Kaminská/J. K. Kozłowski/P. Škrdla: New approach to the Szeletian-Chronology and cultural variability. *Eurasian Prehistory* 8/1–2, 29–49.

Kamińska/Szymczak 1994 J. Kamińska/K. Szymczak: Patyna powierzchni zabytków krzemiennych jako wyznacznik chronologiczny. *Światowit* 39, 1994, 215–223.

Keeley 1980 L. H. Keeley: *Experimental Determination of Stone Tool Uses: a Microwear Analysis.* Chicago 1980.

Lengyel/Mester 2008 G. Lengyel/Z. Mester: A new look at the radiocarbon chronology of the Szeletian in Hungary. *Eurasian Prehistory* 5/2, 2008, 73–84.

Levi Sala 1993 I. Levi Sala: Use-Wear Traces: Process of Development and Post-depositional alterations. In: P. C. Anderson/S. Beyries/M. Otte/H. Plisson (eds.): *Traces et fonction, les gestes retrouvés. Actes du colloque international de Liège, 8-9-10 décembre 1990.* ERAUL 50. Liège 1993, 401–416.

Levi Sala 1996 I. Levi Sala: *A Study of Microscopic Polish on Flint Implements.* Oxford 1996.

Lombard 2005 M. Lombrad: Evidence of hunting and hafting during the Middle Stone Age at Sibidu Cave, KwaZulu-Natal, South Africa: a multianalytical approach. *Journal of Human Evolution* 48, 2005, 279–300.
DOI: https://doi.org/10.1016/j.jhevol.2004.11.006

Lombard/Parsons/van der Ryst 2004 M. Lombard/I. Parsons/M. M. van der Ryst: Middle Stone Age lithic point experimentation for macro-fracture and residue analyses: the process and preliminary results with reference to Sibudu Cave points. *South African Journal of Science* 100, 2004, 159–166.

Markó 2016 A. Markó: Considerations on the lithic assemblages from the Szeleta Cave. *Communicationes Archaeologicae Hungariae* 2015–2016, 2016, 5–44.

Mester 2018 Z. Mester: The problems of the Szeletian as seen from Hungary. *Recherches Archéologiques* 9, 2018, 19–48.

Moncel et al. 2009 M.-H. Moncel/M. Gema Chacón/A. Coudenneau/P. Fernandes: Points and convergent tools in the European Early Middle Palaeolithic site of Payre (SE, France). *Journal of Archaeological Science* 36/9, 2009, 1892–1909. DOI: https://doi.org/10.1016/j.jas.2009.04.018

Moss 1983 E. Moss: *The Functional Analysis of Flint Implements. Pincevent and Pont d'Ambon: Two Cases from the French Final Paleolithic.* Oxford 1983.

Moss/Newcomer 1982 E. H. Moss/M. H. Newcomer: Reconstruction of tool use at Pincevent: microwear and experiments. In: D. Cahen (ed.): *Tailler! Pour quoi faire: Préhistoire et technologie lithique II. Recent progress in microwear studies*. Terveuren 1982, 289–312.

Nemergut 2010 A. Nemergut: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bártu z rokov 1963 a 1990. *Slovenská archeológia* 58, 2010, 183–206.

Nemergut/Cheben/Gregor 2012 A. Nemergut/M. Cheben/M. Gregor: Lithic raw material use at the Palaeolithic site of Moravany nad Váhom-Dlhá. *Anthropologie* 50/4, 2012, 379–390.

Nemergut/Klaric 2014 A. Nemergut/L. Klaric: Analysis of leaf points from the Szeletian site of Moravany nad Váhom-Dlhá (Slovak Republic). Preliminary report. In: *11th SKAM Lithic Workshop: The multifaceted biface – Bifacial technology in Prehistory. 20th–22nd of October, 2014, Miskolc, Hungary.* Budapest 2014, 16.

Neruda/Nerudová eds. 2009 P. Neruda/Z. Nerudová (eds.): *Moravský Krumlov IV. Vícevrstevná lokalita ze středního a počátku mladého paleolitu na Moravě.* Brno 2009.

Neruda/Nerudová 2013 P. Neruda/Z. Nerudová: The Middle-Upper Palaeolithic transition in Moravia in the context of the Middle Danube region. *Quaternary International* 294, 2013, 3–19. DOI: https://doi.org/10.1016/j.quaint.2011.08.035

Neruda/Nerudová/Šajnerová-Dušková 2010 P. Neruda/Z. Nerudová/A. Šajnerová-Dušková: Trasologická analýza micoquienských bifaciálních nástrojú z jeskyně Kůlna. *Acta Musei Moraviae, Scientiae sociales* 95, 2010, 3–15.

Nerudová/Dušková-Šajnerová/Sadovský 2010 Z. Nerudová/A. Dušková-Šajnerová/P. Sadovský: Bifaciální artefakty. Odznaky moci nebo funkční nástroje? In: J. Fridrichová-Sýkorová (ed.): *Ecce Homo. In memoriam Jan Fridrich*. Praha 2010, 130–151.

Nerudová/Valoch 2009 Z. Nerudová/K. Valoch: *Moravany nad Váhom. Katalog paleolitických industrií z výzkumu prof. Karla Absolona.* Brno 2009.

Nuzhnyĭ 1990 D. Nuzhnyĭ: Projectile Damage on Upper Paleolithic Microliths and the Use of Bow and Arrow among Pleistocene Hunters in the Ukraine. In: B. Gräslund/H. Mutsson/K. Knutsson/J. Taffinder (eds.): *Proceedings of the International Conference on Lithic Use-wear Analysis 15th–17th February 1989, Uppsala, Sweden*. Uppsala 1990, 113–124.

Odell 1988 G. H. Odell: Addressing Prehistoric Hunting Practices Through Stone Tool Analysis. *American Anthropologist, New Series* 90/2, 1988, 335–356.

Odell/Cowan 1986 G. H. Odell/F. Cowan: Experiments with Spears and Arrows on Animal Target. *Journal of Field Archaeology* 13/2, 1986, 195–211. DOI: https://doi.org/10.1179/009346986791535780

Oliva 2008–2009 M. Oliva: Questions du Szélétien supérieur en Moravie. *Praehistoria* 9–10, 2008–2009, 61–70.

Plisson/Beyries 1998 H. Plisson/S. Beyries: Pointes ou outils triangulaires? Données fonctionnelles dans le Moustérien levantin. *Paléorient* 24/1, 1998, 5–24.

Plisson/Mauger 1988 H. Plisson/M. Mauger: Chemical and mechanical alteration of microwear polishes: An experimental approach. *Helinium* 28, 1988, 3–16.

Polanská 2018 M. Polanská: *Questionnement sur la diversité du Pavlovien morave par l'étude technologique des gisements de Milovice I, Pavlov I, Pavlov VI, Dolní Věstonice II–WS, Předmostí Ib (République tchèque).* Doctoral thesis. Université Paris 1, Panthéon-Sorbonne. Paris 2018. Unpublished.

Prošek 1953 F. Prošek: Szeletien na Slovensku. *Slovenská archeológia* 1, 1953, 133–164.

Pyżewicz et al. 2020 K. Pyżewicz/A. Wiśniewski/K. Serwatka/M. Kot/W. Grużdż/K. Kerneder-Gubała: On the function of Jerzmanowice points. In: *Back to the Gravettian: 62nd Confrerence of the Hugo Obermaier-Society. Abstracts.* Erlangen 2020, 80, 81.

Rots 2003 V. Rots: Towards an understanding of hafting: the macro- and microscopic evidence. *Antiquity* 77, 2003, 805–815. DOI: https://doi.org/10.1017/S0003598X00061743

Rots 2008a V. Rots: Hafting and raw materials from animals. Guide to the identification of hafting traces on stone tools. *Anthropozoologica* 43, 2008, 43–66.

Rots 2008b V. Rots: Hafting traces on flint tools. In: L. Longo/N. Skakun (eds.): *"Prehistoric Technology" 40 Years Later: Functional Studies and the Russian Legacy. Proceedings of the International Congress Verona (Italy), 20–23 April 2005.* Oxford 2008, 75–84.

Rots 2009 V. Rots: The functional analysis of the Mousterian and Micoquian assemblages of Sesselfelsgrotte, Germany: Aspect of tool use and hafting in the European Late Middle Paleolithic. *Quartär* 56, 2009, 37–66.

Rots 2010 V. Rots: *Prehension and Hafting Traces on a Flint Tools. A Methodology.* Leuven 2010.

Rots 2011 V. Rots: Tool Use and Hafting in the Western European Middle Palaeolithic. In: M. Toussaint/K. Di Modica/S. Pirson (eds.): *Le paléolithique moyen en Belgique: mélanges Marguerite Ulrix-Closset.* Liège 2011, 277–287.

Rots 2015 V. Rots: Hafting and Site Function in the European Middle Paleolithic. In: N. J. Conard/A. Delagnes (eds.): *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age IV.* Tübingen 2015, 383–410.

Rots/Plisson 2014 V. Rots/H. Plisson: Projectiles and the abuse of the use-wear method in a search for impact. *Journal of Archaeological Science* 48, 2014, 154–165. DOI: https://doi.org/10.1016/j.jas.2013.10.027

Rots/Vermeersch 2004 V. Rots/P. M. Vermeersch: Experimental characterization of hafting traces and their recognition in archaeological assemblages. In: E. A. Walker/F. Wenban-Smith/F. Healy (eds.): *Lithics in Action. Papers from the Conference "Lithic Studies in the Year 2000".* Oxford 2004, 156–168.

Rots/Van Peer/Vermeersch 2011 V. Rots/P. Van Peer/P. M. Vermeersch: Aspects of tool production, use, and hafting in Palaeolithic assemblages from Northeast Africa. *Journal of Human Evolution* 60, 2011, 637–664. DOI: https://doi.org/10.1016/j.jhevol.2011.01.001

Shalagina et al. 2019 A. V. Shalagina/L. V. Zotkina/A. A. Anoikin/N. A. Kulik: Listovidnye bifasy v kompleksakh nachal'nogo verkhnego paleolita yuzhnoy Sibiri i severa tsentral'noy Azii. *Teoriya i praktika arkheologicheskikh issledovaniy* 26/2, 2019, 47–60.

Shea 1988 J. J. Shea: Spear Points from the Middle Paleolithic of Levant. *Journal of Field Archaeology* 15/4, 1988, 441–450. DOI: https://doi.org/10.1179/jfa.1988.15.4.441

Shea 1990 J. J. Shea: Further note on Mousterian spear points. *Journal of Field Archaeology* 17, 1990, 111–114. DOI: https://doi.org/10.1179/009346990791548529

Shea 2006 J. J. Shea: The origins of lithic projectile point technology: evidence from Africa, the Levant, and Europe. *Journal of Archaeological Science* 33, 2006, 823–846. DOI: https://doi.org/10.1016/j.jas.2005.10.015

Shea/Davis/Brown 2001 J. J. Shea/Z. Davis/K. Brown: Experimental tests of Middle Paleolithic spear points using a calibrated crossbow. *Journal of Archaeological Science* 28, 2001, 807–816. DOI: https://doi.org/10.1006/jasc.2000.0590

Shea/Klenck 1993 J. J. Shea/J. D. Klenck: An Experimental Investigation of the Effects of Trampling on the Results of Lithic Microwear Analysis. *Journal of Archaeological Science* 20, 1993, 175–194. DOI: https://doi.org/10.1006/jasc.1993.1013

Šajnerová-Dušková 2009 A. Šajnerová-Dušková: Treaseologická analýza szeletienských artefaktů z Moravy. In: *Neruda/Nerudová eds. 2009*, 174–177.

Škrdla 2017 P. Škrdla: Middle to Upper Paleolithic transition in Moravia: New sites, new dates, new ideas. *Quaternary International* 450, 2017, 116–125. DOI: https://doi.org/10.1016/j.quaint.2016.07.029

Valoch 2012 K. Valoch: Szeletien na Moravě a na západním Slovensku. *Acta Musei Moraviae, Scientiae sociales* 97, 2012, 167–198.

Van Gijn 1990 A. L. Van Gijn: *The wear and tear of flint. Principles of functional analysis applied to Dutch Neolithic assemblages.* Leiden 1990.

Van Gijn 2010 A. L. Van Gijn: *Flint in focus. Lithic Biographies in the Neolithic and Bronze Age.* Leiden 2010.

Vaughan 1985 P. C. Vaughan: *Use-Wear Analysis of Flaked Stone Tools.* Tucson 2010.

Villa/Lenoir 2006 P. Villa/M. Lenoir: Hunting weapons of the Middle Stone Age and the Middle Palaeolithic: spear points from Sibudu, Rose Cottage and Bouheben. *Southern African Humanities* 18, 2006, 89–122.

Villa et al. 2009 P. Villa/P. Boscato/F. Ranaldo/A. Ronchitelli: Stone tools for the hunt: points with impact scars from a Middle Paleolithic site in Southern Italy. *Journal of Archaeological Science* 36, 2009, 850–859. DOI: https://doi.org/10.1016/j.jas.2008.11.012

Zotz 1951 L. Zotz: *Alsteinzeitkunde Mitteleuropas.* Stuttgart 1951.

Prvé výsledky trasologickej analýzy listovitých hrotov z lokality Moravany nad Váhom-Dlhá

Katarzyna Pyżewicz – Adrián Nemergut

Súhrn

Predložená štúdia predstavuje výsledky trasologickej analýzy listovitých hrotov z lokality Moravany nad Váhom-Dlhá s cieľom zistiť, či tieto nástroje boli používané a za akým účelom. Pri analýze bol využitý metalografický mikroskop Nikon LV150 a digitálny mikroskop Keyence VH-Z100R. Artefakty boli skúmané pri zväčšení od 50 x do 400 x. Zistené makroskopické a mikroskopické stopy sa porovnávali s experimentálnou porovnávacou zbierkou Katedry archeológie Varšavskej univerzity. Tá pozostáva z približne 200 exemplárov použitých počas lovu a spracovania kože, mäsa, kostí, parohu, dreva, rastlín, mušlí, jantáru a minerálnych materiálov. Žiaľ, absentujú v nej experimentálne výrobky listovitých hrotov. Obsahuje tiež 80 predmetov súvisiacich s technológiou a niekoľko stoviek exemplárov s postdepozičnými procesmi. Mikroskopická analýza sa uskutočnila na 64 listovitých hrotoch typu Moravany-Dlhá a ich fragmentoch (tabela 1). Tie sa od seba líšili veľkosťou, tvarom a najmä typom suroviny použitej na ich výrobu (tabela 2). To čiastočne ovplyvnilo aj samotnú analýzu, nakoľko u hrubozrnnejších zvetraných a patinovaných surovín boli pracovné stopy zachované a viditeľné minimálne. V analyzovanej skupine sú príklady bifaciálnych (obr. 2: 3), čiastočne bifaciálnych (obr. 2: 2) a unifaciálnych listovitých hrotov (obr. 2: 1), niekedy retušovaných len na hranách. Ide o pilotnú štúdiu, ktorá neobsahuje všetky známe listovité hroty z predmetnej lokality, ale len reprezentatívnu vzorku. Z tohto dôvodu boli do analýzy vybrané takmer dokončené, dokončené a reutilizované hroty. Vybrané boli aj exempláre z rôznych surovín, horšej kvality, dokonca aj zvetraných kusov, aby sa z metodického hľadiska vedelo, aké kusy má zmysel analyzovať v budúcnosti.

Výsledky trasologickej analýzy sú obsiahnuté v tabele 2. Ide o problematickú kolekciu z hľadiska zachovania pracovných stôp, nakoľko listovité hroty neboli balené separátne, ale vo väčších množstvách boli uložené spolu v krabiciach. Zrejme kvôli častému prekladaniu krabíc sa na nich vytvorilo množstvo postdepozičných poškodení, ktoré zapríčiňujú zlú viditeľnosť pôvodných pracovných stôp. Tie sa nachádzajú v rôznych častiach analyzovaných hrotov. Sledované stopy sa vyskytujú na všetkých typoch hrotov, bez výnimky na variant či veľkosť (obr. 7; 8; tabela 2). Zistené boli stopy ako makroskopické fraktúry špičiek hrotov a mikroskopické lineárne stopy. Makroskopické fraktúry špičiek boli zistené na mnohých listových hrotoch, na bifaciálnych aj na čiastočne retušovaných variantoch (obr. 7: B). Negatívy šikmo ulomených špičiek sa vo viacerých prípadoch vyznačujú špecifickou morfológiou. Tieto fraktúry boli vytvorené zrejme pri zasiahnutí cieľa počas použitia hrotov ako projektilov. Existuje niekoľko príkladov impaktov ukončených ohybom (obr. 3: 2–4, 6; 5: 2), schodíkom (obr. 5: 1) a s perovitým ukončením (obr. 3: 5). Boli tiež rozpoznané tzv. „spin-off" fraktúry (obr. 3: 1, 3, 4), ktoré sa vyznačujú fraktúrou s priamym profilom a negatívmi malých úštepov umiestnených pod lomom (*Fischer/Vemming Hansen/Rasmussen 1984*). Špičky niektorých listovitých hrotov sú zlomené odlišným spôsobom, čoho výsledkom sú iba lomy s priamym profilom. V takýchto prípadoch je ťažké identifikovať, či boli vytvorené počas lovu, alebo vznikli v rôznych technologických fázach ich výroby, prípadne v dôsledku postdepozičných procesov (napr. pri zašliapnutí). Mimoriadne dôležitý bol objav mikroskopických lineárnych stôp (obr. 4: 1, 2). Jedná sa o ryhy, ktoré sú zvyčajne výsledkom použitia nástrojov formou projektilov. Lineárne ryhy sú umiestnené v blízkosti špičiek. S najväčšou pravdepodobnosťou boli vytvorené pri zasiahnutí, resp. preniknutí do cieľa a následným poškriabaním povrchu kamennými trieskami alebo zrnkami piesku (ktoré sa napríklad nachádzali v srsti zvieraťa). Nemožno ani vylúčiť, že boli vytvorené v dôsledku nárazu, kontaktu s povrchom fragmentu kosti zvieraťa. V kolekcii sa nachádzajú aj samotné ulomené špičky listových hrotov (obr. 6). Sú prakticky pozitívom vyššie opísaných makroskopických fraktúr špičiek. Z prítomných exemplárov nebolo možné jednoznačne určiť, ako boli ulomené. Na analyzovaných hrotoch boli na vyčnievajúcich častiach viditeľné ďalšie stopy, rôzne zaoblenia (obr. 4: 3B; 5: 1B, 2B, 3B). Ide o stopy, ktoré sa mohli teoreticky interpretovať ako výsledok umiestnenia v násadách alebo ich prepravy (*Lombrad 2005*; *Rots 2003*; *2008a*; *2008b*; *2009*; *2010*; *2011*; *2015*; *Rots/Vermeersch 2004*; *Rots/Van Peer/Vermeersch 2011*; *Van Gijn 2010*). Je potrebné dodať, že tieto stopy sa vyskytujú na veľkých častiach artefaktov a nie sú viditeľné iba v konkrétnej časti nástrojov (napr. v blízkosti hrotu alebo v bazálnej časti). Z dôvodu nízkej úrovne rozlíšenia nebolo možné určiť typ potenciálnej násady, prípadne spôsob upevnenia listových hrotov.

Predložený súbor predstavuje na jednej strane veľmi dôležitú kolekciu, zrejme homogénnu, ktorá je kľúčová pre staršiu fázu mladého paleolitu a szeletienu. Poukazuje na to množstvo hotových listovitých hrotov, polotovarov, odpadu z ich výroby a pod. Na druhej strane je problematická kvôli tomu, že bola získaná počas starších výskumov, nálezy sú tak bez kontextu. Ide taktiež chronologicky o starú kolekciu a uvedomujeme si, že nemožno od nej

očakávať výsledky, ako z nálezov z mladších období. Problematické bolo hlavne uloženie nálezov v depozitári, resp. jeho prekladanie, vďaka čomu vznikli recentné stopy na nálezoch a časť pôvodných stôp bola prekrytá alebo odstránená. Štúdie iných súborov poukazujú, že je možné zistiť stopy aj na starších artefaktoch zo stredného paleolitu, prípadne staršej fázy mladého paleolitu (*Neruda/Nerudová/Šajnerová-Dušková 2010*; *Nerudová/Dušková-Šajnerová/Sadovský 2010*; *Šajnerová-Dušková 2009*).

Predložená práca reprezentuje predbežné výsledky, ktoré treba ďalej validovať na ostatných hrotoch v kolekcii Archeologického ústavu SAV a pokúsiť sa o analýzu kolekcií z iných inštitúcií. Za hlavné predbežné výsledky považujeme:

- Analýza jednoznačne poukázala, že značné množstvo zlomenín súvisí s ich výrobou, resp. s nehodami, prípadne s recentnými zlomeninami, čo je logické, keďže sa na predmetnej lokalite listovité hroty vo veľkých množstvách vyrábali.
- Absencia stôp na hranách, ktoré by hroty interpretovali ako multifunkčný nástroj. Ide o zaujímavé zistenie, keďže sa odlišuje od záverov napr. moravských hrotov zo szeletienu (*Nerudová/Dušková-Šajnerová/Sadovský 2010*; *Šajnerová-Dušková 2009*). Na druhej strane na lokalite Moravany nad Váhom-Dlhá boli doložené iné aktivity na iných nástrojoch (škrabadlá, driapadlá), takže ak by boli využívané hroty univerzálne, tak by to bolo viditeľné aj na predmetnej kolekcii. Nateraz sa však nepotvrdilo, aby hroty z analyzovanej lokality boli využívané ako multifunkčné nástroje.
- Ojedinele boli doložené stopy, ktoré naznačujú použitie počas lovu, ako napr. línie a ulomené terminálne časti. Zaujímavé sú exempláre, keď sa na jednom hrote zistila kombinácia týchto stôp, čo nemožno považovať za náhodu (napr. vzorky 6, 14, 40; tabela 2).

Z hľadiska interpretácie listovitých hrotov z Moravian nad Váhom-Dlhej možno skonštatovať, že mohlo ísť o špecializované nástroje používané počas lovu. Zároveň je potrebné poznamenať, že v areáli tábora sa vykonávali ďalšie činnosti spojené so spracovaním mŕtvych zvierat. Predbežná analýza škrabadiel poukázala, že sa používali na oškrabávanie kože. V niektorých ďalších prípadoch kamenných nástrojov boli zistené dokonca dôkazy o spracovaní rastlín.

Do budúcna by bolo zaujímavé rozšíriť trasologickú analýzu aj na ostatné typy artefaktov a identifikovať ďalšie nástroje súvisiace so spracovaním tiel zvierat, akými sú napr. nože. Prezentovaná analýza otvorila aj mnoho otázok, ktoré súvisia najmä s rozpoznávaním mikroskopických stôp. K ich jednoznačnejšej identifikácii by určite pomohlo uskutočniť sériu experimentov spojených s výrobou a použitím hrotov (rezanie, vrhanie, umiestnenie v násade a pod.), na základe čoho by sme sa mohli dozvedieť:

- aké makroskopické a mikroskopické stopy (technologické, po použití, po umienstnení v násade, pri transporte) boli zistené na experimentálnych listových hrotoch vyrobených z analogických surovín v porovnaní s artefaktmi z Moravian nad Váhom-Dlhej;
- ako druh suroviny ovplyvňuje čitateľnosť mikroskopických technologických stôp, stôp po opotrebovaní alebo po umiestnení v násade;
- aký je rozdiel medzi makroskopickými fraktúrami špičiek listových hrotov odlomených počas lovu a pri ich výrobe.

Obr. 1. Situovanie lokality Moravany nad Váhom-Dlhá na mape.

Obr. 2. Moravany nad Váhom-Dlhá. Variabilita listovitých hrotov. 1 – unifaciálny, ojedinele retušovaný len na hranách (vzorka 9); 2 – čiastočne bifaciálny (vzorka 8); 3 – bifaciálny (vzorka 58).

Obr. 3. Moravany nad Váhom-Dlhá. Detaily negatívov šikmých fraktúr špičiek listovitých hrotov. 1 – „spin-off" fraktúra (vzorka 12); 2 – fraktúra ukončená ohybom (vzorka 20); 3, 4 – „spin-off" a fraktúra ukončená ohybom (vzorka 11); 5 – perovito ukončená fraktúra (vzorka 21); 6 – fraktúra ukončená ohybom (vzorka 53).

Obr. 4. Moravany nad Váhom-Dlhá. Detaily stôp na listovitých hrotoch. 1 – lineárna stopa (A) vzorky 15; 2 – fraktúra špičky hrotu (A) a lineárna stopa (B) vzorky 14; 3 – fraktúra špičky hrotu (A) a vyhladená časť pravdepodobne po kontakte s kosťou (B) vzorky 40.

Obr. 5. Moravany nad Váhom-Dlhá. Detaily stôp na listovitých hrotoch. 1 – fraktúra ukončená schodíkom (A) a vyhladená časť (výsledok umiestnenia v násade prípadne transportu; B) vzorky 54; 2 – fraktúra ukončená ohybom (A) a vyhladená časť (výsledok umiestnenia v násade prípadne transportu; B) vzorky 3; 3 – vrub (A) a vyhladená časť (výsledok umiestnenia v násade prípadne transportu; B) vzorky 33.

Obr. 6. Moravany nad Váhom-Dlhá. Detaily ulomených špičiek listovitých hrotov. 1 – funkčná fraktúra (?); 2 – technologická fraktúra (šípka ukazuje na pätku); 3 – postdepozičná fraktúra (?). 1, 2 – vzorka 64; 3, 4 – vzorka 36; 5, 6 – vzorka 35.

Obr. 7. Moravany nad Váhom-Dlhá. Stopy na celých a takmer celých listovitých hrotoch vo vzťahu k ich variantom a vyhotovenia v rámci operačného reťazca. Legenda: a – lineárne stopy; b – umiestnenie v násade/transport; c – fraktúra špičky; d – bez stôp; e – postdepozičné stopy; f – spolu.

Obr. 8. Moravany nad Váhom-Dlhá. Stopy na ulomených špičkách a fragmentoch listovitých hrotov vo vzťahu k ich variantom. Legenda: a – lineárne stopy; b – umiestnenie v násade/transport; c – fraktúra špičky; d – bez stôp; e – postdepozičné stopy; f – spolu.

Tabela 1. Moravany nad Váhom-Dlhá. Varianty listovitých hrotov vo vzťahu k ich fragmentácii a vyhotovenia v rámci operačného reťazca.
Tabela 2. Moravany nad Váhom-Dlhá. Makroskopické a mikroskopické stopy na listovitých hrotoch. xx – problém s identifikáciou stôp z dôvodu vážne poškodeného povrchu vplyvom postdepozičných procesov alebo hrubozrného povrchu suroviny.

Dr. Katarzyna Pyżewicz
Faculty of Archaeology
University of Warsaw
Krakowskie Przedmieście 26/28
PL – 00-927 Warsaw
k.pyzewicz@uw.edu.pl

Mgr. Adrián Nemergut, Ph.D.
Archeologický ústav SAV
Akademická 2
SK – 949 21 Nitra
adrian.nemergut@savba.sk

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 83–92

SPIŠSKÉ PODHRADIE-DREVENÍK, AN IMPORTANT PALAEOLITHIC SITE OF THE LOWER SPIŠ[1]

Marián Soják – Maciej Wawrczak

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.6

Keywords: Early Upper and Late Palaeolithic, Szeletian, Aurignacian, Lower Spiš, Hornád basin, chipped stone industry, analysis

Abstract: This paper presents analysis of the chipped stone industry from the upland settlement in Spišské Podhradie-Dreveník. The site has been devastated by the exploitation of travertine. The survey yielded 33 artefacts which can be dated to the beginning of the Upper Palaeolithic (Szeletian, Aurignacian), the Late Palaeolithic or the Mesolithic. Two bifacially retouched points and a combined endscraper/burin tool made of radiolarite can be dated to the Szeletian. As for raw materials, radiolarite prevails over patinated silicite and chocolate flint.

INTRODUCTION

Intense occupancy from different stages of the Palaeolithic has been recorded in the territory of Spiš, especially in the Poprad River basin in the Upper Spiš region. On the contrary, fewer Palaeolithic sites have been recorded in the Lower Spiš region along the Hornád River basin. It can be assumed that this disproportion is caused by poor state of the research and partially also by insufficient publishing of older finds (*Žaár 2015*, 174).

By presenting the finds from the site of Spišské Podhradie-Dreveník (from now on referred to as Dreveník), this paper aims to shed more light into the Palaeolithic of the sub-Tatran region. Dreveník is an important polycultural hilltop settlement (comprising of open-air settlements as well as traces of local cave settlements) with dominating Eneolithic (Baden culture) and protohistoric elements (e.g. *Javorský 1999*; *Soják 2001*). Only few traces of the Palaeolithic occupancy are reported from this site (see below).

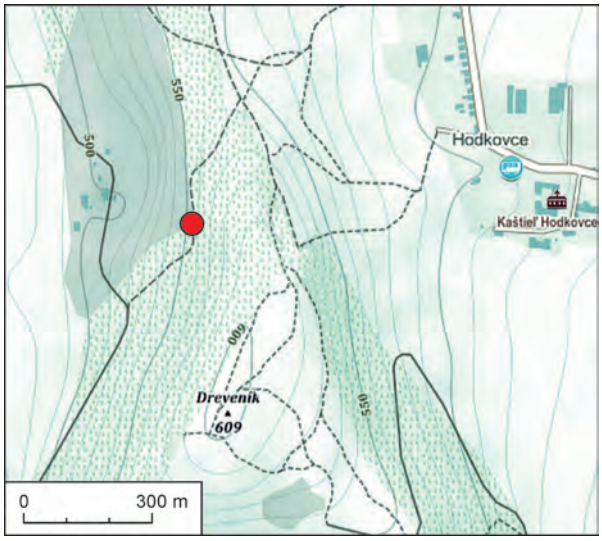


Fig. 1. Location of the site on the map.

LOCATION OF THE SITE

The travertine open-air site complex of Dreveník is located in the eastern part of the Hornád River basin, south of the popular Spiš Castle. The cadastral border between the town of Spišské Podhradie (western part) and the village of Žehra (eastern part) runs through the centre of the site. Dreveník is situated at 600 m a.s.l., on the western slope of the north-western elevation at Žehra, above a still active quarry (Fig. 1).

[1] This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-20-0521 and project VEGA 2/0101/19, 2/0075/21.

Fig. 2. Northern view of the destroyed part of the Palaeolithic site.

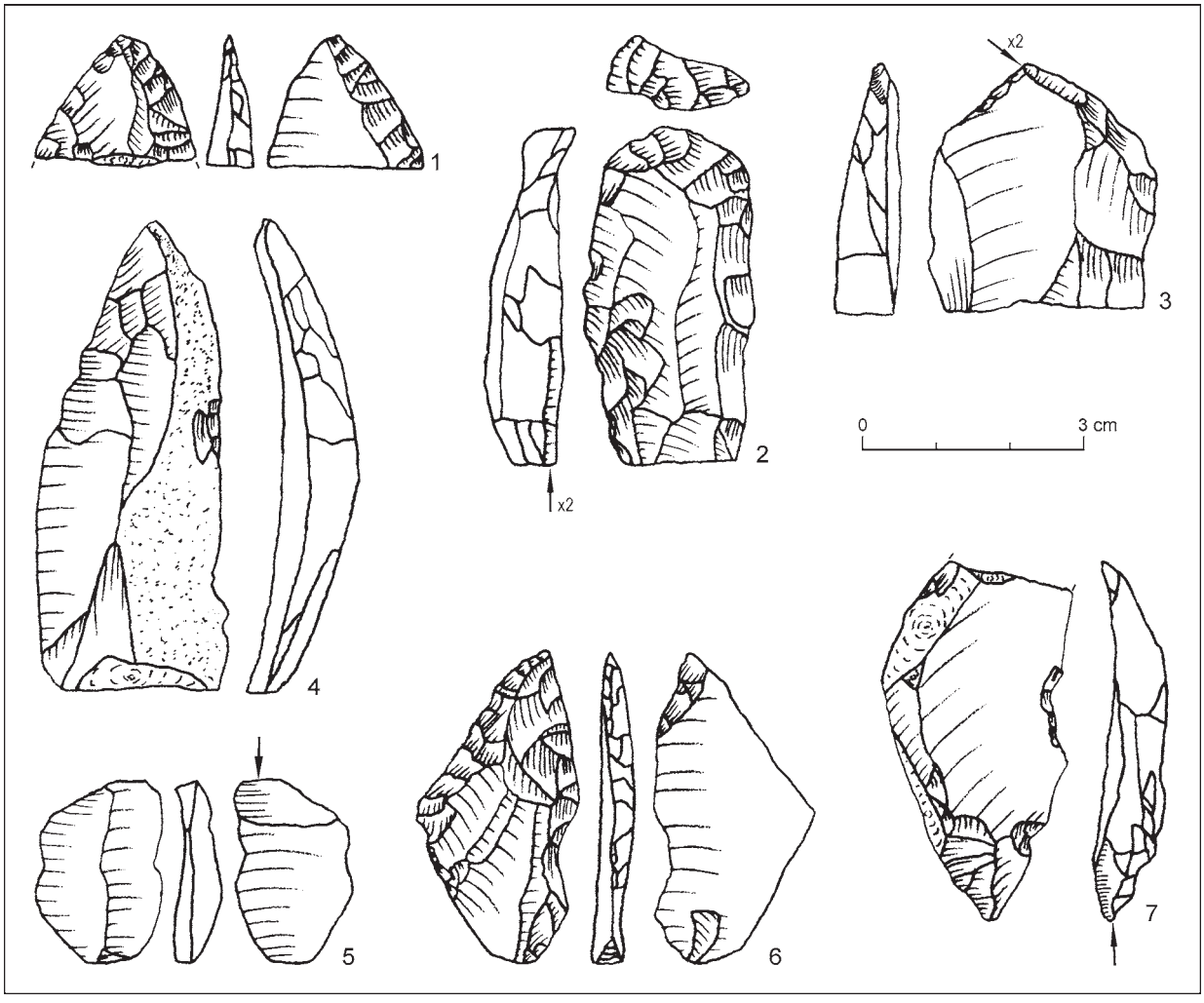


Fig. 3. Chipped stone industry from the Early Upper Palaeolithic. 1, 2, 6, 7 – radiolarite; 3–5 – patinated silicite.

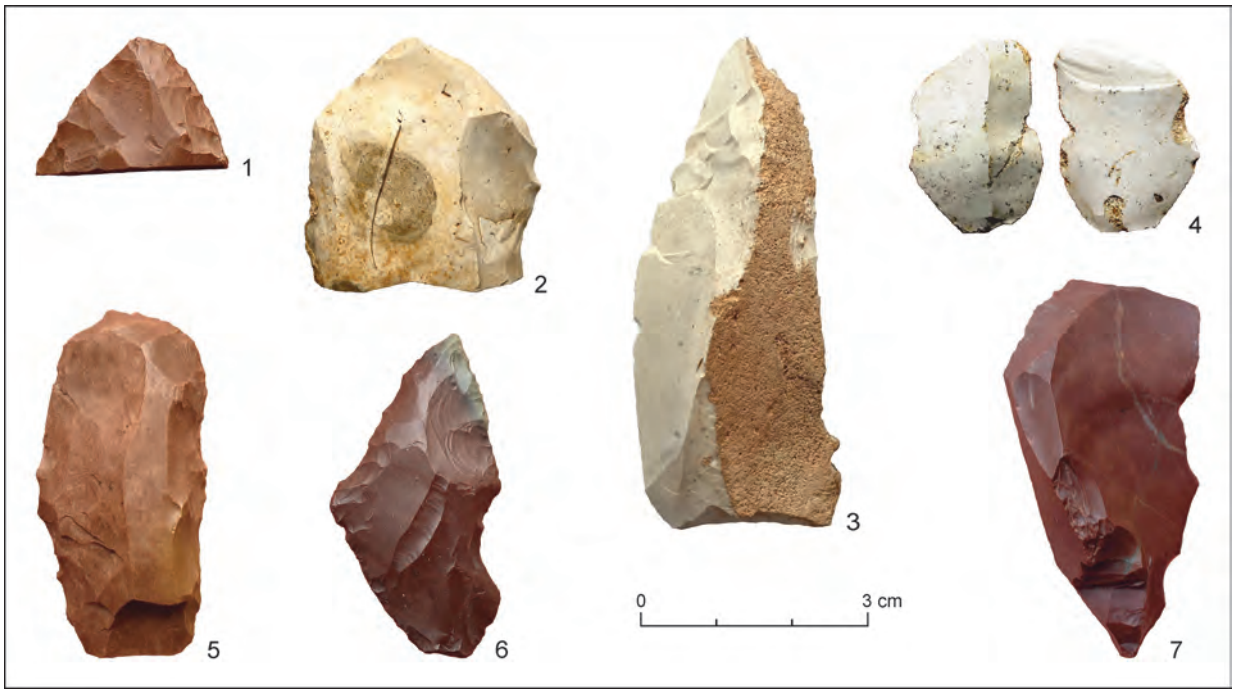


Fig. 4. Photographic documentation of the chipped stone industry from the Early Upper Palaeolithic. 1, 5–7 – radiolarite; 2–4 – patinated silicite.

Intense exploitation of travertine at the turn of the 20th and 21st centuries resulted in continuous destruction of the site, from which the analysed chipped lithic assemblage was obtained during several surveys performed in 1989 (M. Soják and his father O. Soják). The items come exclusively from Dreveník, and no other deposits were found in the vicinity (Fig. 2).

DESCRIPTION OF ARTEFACTS

33 analysed chipped stone artefacts come from the surveys of M. Soják. They can be classified into three chronological horizons. The dimensions of the artefacts are listed as follows: length x width x thickness.

Early Upper Palaeolithic

1. Leaf point – distal fragment; from a uniplatform core; bifacially retouched distal part, full retouch on both sides; dusky red radiolarite; 18 x 21 x 6 mm (Fig. 3: 1; 4: 1).
2. Combined tool – endscraper/burin; fragment of a regular blade with a broken base from a uniplatform core; head with semi-abrupt and abrupt retouch, with abruptly dorsally retouched right and semi-abruptly and abruptly retouched left edges; two burin percussions on the base of the right side; dusky red radiolarite; 46 x 23 x 11 mm (Fig. 3: 2; 4: 5).
3. Burin – central, lateral; distal flake fragment; from a uniplatform core; two burin percussions on the right side and multi-directional negatives of chipping on the dorsal side; patinated silicite; 33 x 31 x 9 mm (Fig. 3: 3; 4: 2).
4. Blade – distal fragment; from a bipolar core; partly preserved smooth cortex; patinated flint; 64 x 24 x 10 mm (Fig. 3: 4; 4: 3).
5. Blade – flat burin (?); proximal fragment; from a bipolar core; patinated silicite; 25 x 17 x 6 mm (Fig. 3: 5; 4: 4).
6. Truncation (notched point) – from a uniplatform core; full and semi-abrupt retouch on the dorsal side and partial retouch of ventral side; red-green radiolarite; 43 x 21 x 4 mm (Fig. 3: 6; 4: 6).
7. Burin – proximal fragment of the crested blade of the first stage of preparation; burin percussions on the left side; partial dorsal retouch with an indistinct notch on the right side; red radiolarite; 49 x 25 x 9 mm (Fig. 3: 7; 4: 7).

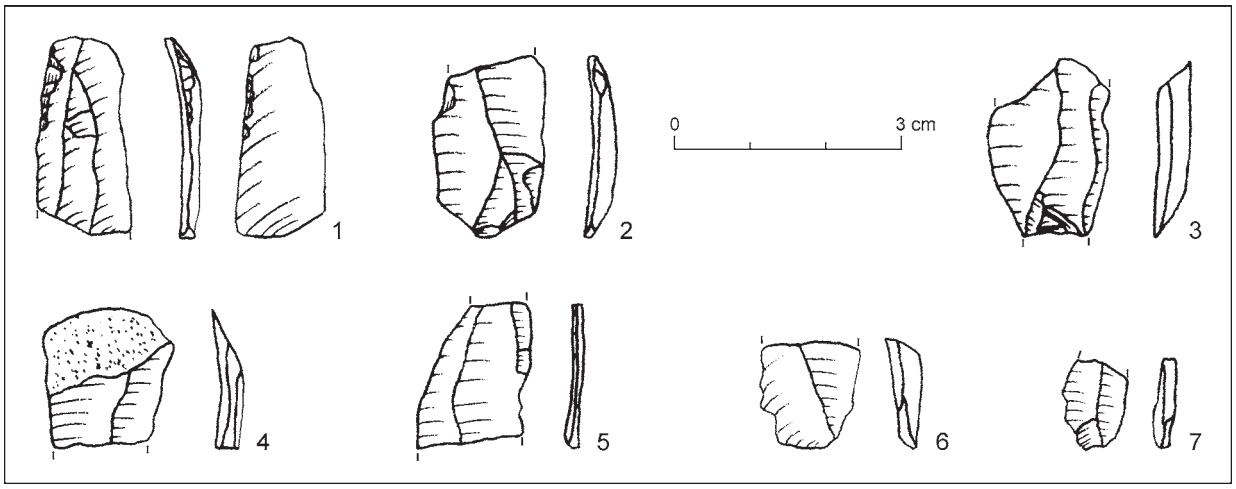


Fig. 5. Chipped stone industry from the Late Palaeolithic or the Mesolithic. 1, 2, 5–7 – radiolarite; 3, 4 – chocolate flint.

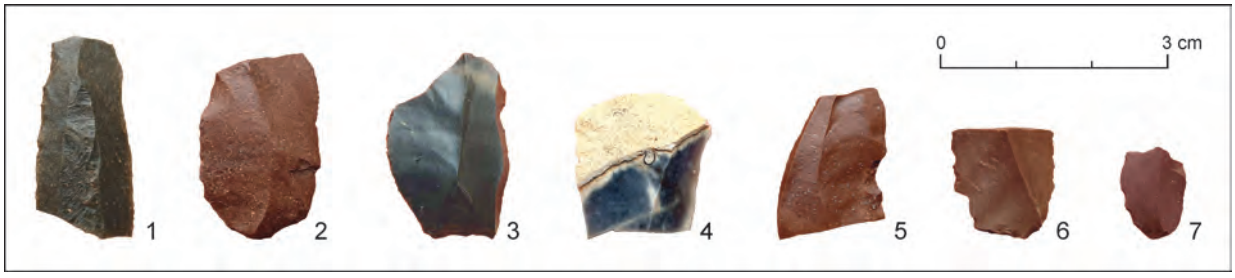


Fig. 6. Photographic documentation of the chipped stone industry from the Late Palaeolithic or the Mesolithic. 1, 2, 5–7 – radiolarite; 3, 4 – chocolate flint.

Late Palaeolithic/Mesolithic

1. Blade – with broken proximal part; from a uniplatform core; partial fine ventral retouch of the right side and partial dorsal retouch of the left side; dark green radiolarite; 26 x 13 x 3 mm (Fig. 5: 1; 6: 1).
2. Blade – proximal part; red radiolarite; 24 x 14 x 4 mm (Fig. 5: 2; 6: 2).
3. Blade – mesial part; dark chocolate flint; 24 x 16 x 4 mm (Fig. 5: 3; 6: 3).
4. Blade – distal part with smooth cortex; from a uniplatform core; chocolate flint with partial fine patina; 18 x 17 x 3 mm (Fig. 5: 4; 6: 4).
5. Blade – mesial part; red radiolarite; 19 x 14 x 2 mm (Fig. 5: 5; 6: 5).
6. Blade – proximal part; red radiolarite; 12 x 8 x 3 mm (Fig. 5: 7; 6: 7).

Prehistory (Palaeolithic?)

1. Blade – distal part; patinated silicite; 28 x 16 x 4 mm (Fig. 7: 1).
2. Flake – fragment of a crested blade of the first stage of preparation; dusky red-green radiolarite; 30 x 14 x 7 mm (Fig. 7: 2).
3. Blade – mesial part; from a uniplatform core; finely burned red radiolarite; 17 x 17 x 5 mm (Fig. 7: 3).
4. Flake – flat; dusky red radiolarite; 38 x 25 x 2 mm (Fig. 7: 4).
5. Flake – dusky red radiolarite; 20 x 19 x 7 mm (Fig. 7: 5).
6. Flake – red radiolarite; 20 x 35 x 4 mm (Fig. 7: 6).
7. Blade – mesial part; from a uniplatform core; burned silicite; 27 x 18 x 4 mm (Fig. 7: 7).
8. Flake – fragment; grey-green radiolarite; 31 x 15 x 5 mm (Fig. 7: 8).
9. Flake – fragment; creamy-grey radiolarite; 9 x 14 x 4 mm (Fig. 7: 9).
10. Small flake – fragment; grey-green radiolarite; 9 x 12 x 2 mm (Fig. 7: 10).
11. Flake – red radiolarite; 15 x 10 x 2 mm (Fig. 7: 11).

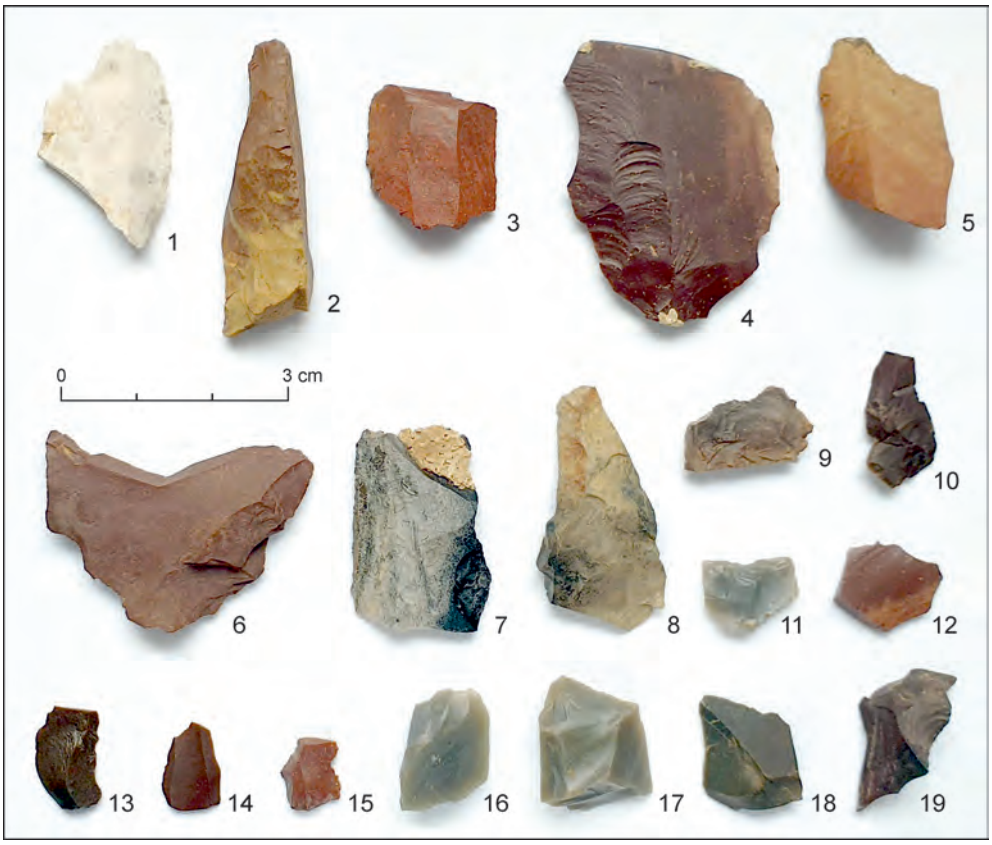


Fig. 7. Photographic documentation of indistinct chipped stone industry from prehistory (Palaeolithic?). 1 – patinated silicite; 2–5, 7–19 – radiolarite; 6 – burned silicite.

12. Flake – fragment; red radiolarite; 11 x 14 x 2 mm (Fig. 7: 12).
13. Flake – red radiolarite; 14 x 8 x 2 mm (Fig. 7: 13).
14. Flake or blade – distal part; from a double-platform core; red radiolarite; 11 x 7 x 1 mm (Fig. 7: 14).
15. Microflake – red radiolarite; 10 x 7 x 2 mm (Fig. 7: 15).
16. Chunk – grey-green radiolarite; 15 x 11 x 7 mm (Fig. 7: 16).
17. Chunk – grey-green radiolarite; 18 x 15 x 8 mm (Fig. 7: 17).
18. Flake – green-brown radiolarite; 13 x 15 x 7 mm (Fig. 7: 18).
19. Flake – fragment; brown-red radiolarite; 9 x 21 x 7 mm (Fig. 7: 19).

ANALYSIS OF FINDS

The presented collection of chipped stone industry from the site of Dreveník includes 33 artefacts from several chronological horizons. They are dated to the Upper Palaeolithic, and possibly also to the Mesolithic (?).

Early Upper Palaeolithic

Seven artefacts can be dated to this period. As regards the type of raw material, radiolarite and unidentified patinated silicite are present. Being a sedimentary rock of organogenic origin, radiolarite can be assumed to originate in the Klippen Belt, most probably in the territory of the Pieniny Mountains situated about 35 km north of the site (*Kaminská 2014a*, fig. 2; *Valde-Nowak/Kerneder-Gubała 2019*, 160 ff.). Silicites covered with white patina probably come from the area of the outcrops in the Kraków – Częstochowa Upland, situated about 140 km north-west of the site (*Kaczanowska/Kozłowski 1976*).

From the typological point of view, the artefacts might be associated with the Szeletian culture, indicate, e.g., by a fragment of a broken bifacially retouched point (Fig. 3: 1; 4: 1). Such points are quite common, for instance, in the vicinity of Moravany nad Váhom (*Kaminská et al. 2008*, 189, fig. 7: 4; *Nemergut 2010*, 199, pl. VI: 1–6). The combined endscraper/burin tool (Fig. 3: 2; 4: 5) have been found at several Central European sites of the Szeletian culture (*Kaminská et al. 2017*, 45, fig. 2: 3; *Kowalski 1969*, pl. II: 2; *Kozłowski/Kozłowski 1977*, 110, pl. 24: 17; *Nemergut 2010*, 196, pl. III: 4; *Škrdla et al. 2014*, 98, fig. 12: 16; *Valoch 1993*, fig. 17: 4, 5), but also at the sites associated with the Aurignacian culture (*Bánesz 1960a*, fig. 6: 11; *Kaminská 2014b*, 167, fig. 71: 9; *Kozłowski/Kozłowski 1977*, 120, pl. 26: 2; *Sachse-Kozłowska/Kozłowski 1975*, pl. 6: 1). A flake burin similar to the one from Dreveník (Fig. 3: 3; 4: 2) was discovered in the Obłazowa Cave, Poland (*Valde-Nowak 2003*, 46, fig. 27: 11). Bifacially retouched blade is a typologically well-defined artefact (Fig. 3: 6; 4: 6). This type of tool has a clear analogy in the Szeletian culture at the site of Moravany nad Váhom-Dlhá (*Kaminská et al. 2017*, 46, fig. 3: 4; *Nemergut 2010*, 198, pl. V: 7).

The flat burin made of basal part of a blade, from a double-platform core, is an interesting artefact (Fig. 3: 5; 4: 4). Analogies can be found in Szeletian culture as well as in Aurignacian collections of chipped stone industry. In the former culture, there is a certain similarity with a flat burin from the Polish site of Dzierżysław 1 (*Kozłowski/Kozłowski 1977*, 110, pl. 24: 11) or those found at some Slovak sites, for instance, at Moravany nad Váhom-Dlhá (*Nemergut 2010*, 201, pl. VIII: 11). On the contrary, Barca II near Košice (Slovakia) can be mentioned as an example of a site with more frequent occurrence of such artefacts in the Aurignacian cultural context (*Bánesz 1968*, 165, fig. 45: 15). Additionally, items from Nowa Biała 2, the cave in Obłazowa Rock in Poland (*Valde-Nowak 2003*, 62, fig. 39: 1) and the recent find from Štrba (*Soják 2015*, 154 f., fig. 4: 6) can be mentioned. The cultural affiliation of the two incomplete blades has not been yet determined (Fig. 3: 4, 7; 4: 3, 7), although their dating to the Aurignacian is very probable (e.g. *Bánesz 1968*, 150, fig. 34; *Kaminská 2014b*, 174, fig. 76: 22–27). Hypothetically, based on the state of preservation distinct white patina and partial retouch (Fig. 3: 7; 4: 7), the other two fragments (the blade and the flake) could potentially be dated to the Upper Palaeolithic (?; Fig. 7: 1, 2).

Late Palaeolithic/Mesolithic

Most probably, seven artefacts can be dated to this chronological horizon. Red radiolarite prevails, even though one specimen is of dark green colour. The nearest primary sources are located – similarly to the radiolarite artefacts from the earlier stage of the Upper Palaeolithic – in the Klippen Belt of the Pieniny Mountains (see above).

Two artefacts are made of chocolate flint, one is made of its distinctly dark type. Exploitation sites of chocolate flint are located mainly in the Świętokrzyskie Mountains in Poland and their surroundings, about 200 km north of Dreveník (*Budziszewski 2008*, 47; *Schild 1971*). However, deposits of this type of flint can also be found in the northern part of the Kraków – Częstochowa Jura in Poland (*Sudoł-Procyk et al. 2018*), also about 200 km north of the studied site.

Only one complete tool from this chronological phase has been identified among the analysed artefacts – a partially retouched blade with a broken base (Fig. 5: 1; 6: 1). Other six artefacts represent fragments of various parts of blades, some of them microlithic. Dating to the identified chronological stage is thus problematic and it seems that the six fragments could alternatively be dated to the Late Palaeolithic or the Mesolithic (*Bárta 1965*, pl. LXIII: 15–21; LXIV: 3–9; *Kaminská/Javorský 1996*, fig. 3; *Soják 2002*, fig. 3: 3; 4: 2, 10; 5: 1; 6: 1–3; *Svoboda et al. 2017*, 134, fig. 3.8: 3–8).

Prehistory (Palaeolithic?)

The majority of the chipped artefacts from Dreveník do not bear any distinct typological features. As mentioned above, two artefacts could belong to the Early Upper Palaeolithic. The remaining prehistoric artefacts, identified as flakes and fragments of blades, might represent the Late Palaeolithic, Mesolithic, or even later prehistoric periods, e.g., the Eneolithic (*Javorský 1999*; *Soják 2001*).

Fig. 8. Map of Palaeolithic and Mesolithic sites in the Spiš region mentioned in the article. 1 – Spišské Podhradie-Dreveník; 2 – Spišská Belá; 3 – Štrba; 4 – Haligovce; 5 – Poprad-Matejovce; 6 – Smižany; 7 – Beharovce; 8 – Spišské Vlachy; 9 – Domaňovce; 10 – Smižany/Spišská Nová Ves.

SETTLEMENT DEVELOPMENT IN THE LOWER SPIŠ REGION FROM THE EARLY UPPER PALAEOLITHIC AND LATE PALAEOLITHIC TO THE MESOLITHIC

Based on the finds, only few sites in the Lower Spiš region can be dated to the Upper Palaeolithic. Until now, no archaeological finds of the Szeletian culture were discovered in this region. Except for the finds from Spišská Belá (Fig. 8: 2; *Soják 2006*, 28 f.), Štrba (Fig. 8: 3; *Soják 2015*, 144 ff.), Spišské Podhradie-Dreveník (Fig. 8: 1; *Bánesz 1981*, 191, fig. 2: upper left), and other allegedly Aurignacian sites (Fig. 8: 4, 5; Haligovce-Aksamitka and Poprad-Matejovce), there are no indications of occupancy in the region in the Early Upper Palaeolithic.

A formerly discovered fragment of a leaf point from Spišské Podhradie-Dreveník has been recently dated to the Middle Palaeolithic, corresponding with the Mousterian (*Kaminská 2014c*, 115). However, the site was associated with this culture based on a single artefact. Yet, with regard to the finds presented in this paper, it seems that the site of Dreveník should rather be dated to Early Upper Palaeolithic (Szeletian with Aurignacian admixture), as suggested by the former chronological concept. Unfortunately, no further fieldwork is possible at the site due to the exploitation of travertine and complete devastation of the site.

Travertine complex of Dreveník is located between the clusters of Szeletian sites situated in South-Western and Eastern Slovakia, the nearest sites being recorded in the vicinity of Veľký Šariš (*Bánesz 1960b*, 313 ff.; *Kaminská et al. 2017*, 49, fig. 5). Since Dreveník is a destroyed site, Aurignacian origin of the site with admixture of Szeletian leaf points cannot be excluded, similarly to the typical site at Kechnec (*Bánesz 1959*).

Late Palaeolithic sites are not numerous in Eastern Slovakia, especially in the Lower Spiš region, where – unlike in the case of the Upper Spiš region (*Soják 2002*, more references here) – Late Palaeolithic occupancy are rather scarce. There are few vaguely dated finds from several sites; in addition to those, the site of Hradisko I near Smižany (Fig. 8: 6), dated to the Late Palaeolithic, is the most significant site from the period, and is believed to have been a seasonal hunting settlement (*Kaminská/Javorský 1996*), even though some artefacts could potentially be dated to the Mesolithic. Another certainly Late Palaeolithic site, comprising also of workshops, was discovered in Beharovce (Fig. 8: 7), where an accumulation of radiolarite artefacts was discovered in a sunken feature/object (*Soják 2000a*, 111). Similar finds, collected from the surface, come from the site of Spišské Vlachy-Plantal (Fig. 8: 8), where an arch-backed point typical for the Federmesser culture was the most distinct from the obtained artefacts (*Soják 2015*, 148 f.). Multiple Late Palaeolithic finds collected in the Hornád River basin (near Spišské Podhradie; *Soják 2011*, 12) indicate that the occupancy of the region was much denser in this period than previously assumed.

As far as Mesolithic occupancy of the Spiš region is concerned, even fewer sites are known. A recognised site, unfortunately studied only during short surveys, is situated in Spišské Vlachy-Plantal (*Soják 2015*, 148 f.). In addition, it is possible that some of the microlithic industry from Beharovce dates to the Mesolithic (*Soják 2011*, 13). Some of the isolated finds come from several sites in the above-mentioned part of the Spiš region, e.g., the sites in the area of Domaňovce (Fig. 8: 9; *Furman/Soják 2008*, 17 f.), from the border area between Smižany and Spišská Nová Ves (Fig. 8: 10; *Soják 2000b*, 182 f.), or from Žehra-Hlinky I (unpublished collections of M. Soják).

CONCLUSION

Based on the analysed chipped stone industry from Dreveník, the site seems to have been a very important polycultural site. The analysis of the artefacts points to the presence of cultures dated to the Early Upper Palaeolithic (Szeletian, Aurignacian; Fig. 3), as suggested mainly by the finds of leaf points, truncation and the combined tool (endscraper/burin). Considering contemporary state of the research, it cannot be definitely decided if the site was an independent camp of the Szeletian culture, later settled by the folk of the Aurignacian culture, or if the finds represent an Aurignacian site with Szeletian admixture. The following stage of prehistoric occupancy currently seems to be represented by yet-unidentified Late Palaeolithic or Mesolithic groups of hunters and gatherers (Fig. 5). Unfortunately, continuous exploitation of travertine at Dreveník has destroyed the site completely, with no possibility of revising archaeological excavation. In the light of these circumstances, the few presented finds can be considered an important contribution to the topic of Palaeolithic (and Mesolithic) occupancy of this part of Eastern Slovakia.

Translated by Viera Tejbusová

BIBLIOGRAPHY

Bárta 1965 — J. Bárta: *Slovensko v staršej a strednej dobe kamennej*. Bratislava 1965.

Bánesz 1959 — L. Bánesz: Paleolitické stanice pri Kechneci. *Slovenská archeológia 7*, 1959, 205–240.

Bánesz 1960a — L. Bánesz: Die Problematik der paläolitischen Besiedlung in Tibava. *Slovenská archeológia* 8, 1960, 7–58.

Bánesz 1960b — L. Bánesz: K otázke listovitých hrotov z Veľkého Šariša. *Archeologické rozhledy* 12, 1960, 313–318.

Bánesz 1968 — L. Bánesz: *Barca bei Košice – paläolithische Fundstelle*. Bratislava 1968.

Bánesz 1981 — L. Bánesz: Počiatky mladšieho paleolitu na východnom Slovensku. *Historica Carpatica* 11, 1980, 185–217.

Budziszewski 2008 — J. Budziszewski: Stan badań nad występowaniem i pradziejową eksploatacją krzemieni czekoladowych. In: W. Borkowski/J. Libera/B. Sałacińska/S. Sałaciński (eds.): *Krzemień czekoladowy w pradziejach. Materiały z konferencji w Orońsku, 08–10. 10. 2003*. Warszawa – Lublin 2008, 33–106.

Furman/Soják 2008 — M. Furman/M. Soják: Domaňovce vo svetle archeologických výskumov. In: A. Žifčáková a kol.: *Z dejín Domaňoviec 1258 – 2008*. Druhé doplnené vydanie. Domaňovce 2008, 15–30.

Javorský 1999 F. Javorský: Kronika písaná v zemi. In: F. Žifčák a kol.: *Kronika mesta Spišské Podhradie slovom i obrazom.* Spišské Podhradie 1999, 5–11.

Kaczanowska/Kozłowski 1976 M. Kaczanowska/J. K. Kozłowski: Studia nad surowcami krzemiennymi południowej części Wyżyny Krakowsko – Częstochowskiej. *Acta Archeologica Carpathica* 16, 1976, 201–216.

Kaminská 2014a Ľ. Kaminská: Zdroje kamenných surovín a ich využívanie v paleolite Slovenska. In: Ľ. Kaminská (zost.): *Staré Slovensko 2. Paleolit a mezolit*. Archaeologica Slovaca Monographiae. STASLO 2. Nitra 2014, 44–47.

Kaminská 2014b Ľ. Kaminská: Staršia fáza mladého paleolitu. In: Ľ. Kaminská (zost.): *Staré Slovensko 2. Paleolit a mezolit*. Archaeologica Slovaca Monographiae. STASLO 2. Nitra 2014, 119–193.

Kaminská 2014c Ľ. Kaminská: Stredný paleolit. In: Ľ. Kaminská (zost.): *Staré Slovensko 2. Paleolit a mezolit.* Archaeologica Slovaca Monographiae. STASLO 2. Nitra 2014, 53–118.

Kaminská/Javorský 1996 Ľ. Kaminská/F. Javorský: Drobnotvará štiepaná kamenná industria zo Smižian. *Študijné zvesti AÚ SAV* 32, 1996, 5–14.

Kaminská et al. 2017 Ľ. Kaminská/J. K. Kozłowski/M. Moskal-del Hoyo/A. Nemergut/P. Škrdla: Moravany-Dlhá: A phenomenon of the poplar-leaf shape points. *Eurasian Prehistory* 14, 2017, 41–54.

Kaminská et al. 2008 Ľ. Kaminská/J. K. Kozłowski/K. Sobczyk/J. A. Svoboda/T. Michalík: Štruktúra osídlenia mikroregiónu Trenčína v strednom a mladom paleolite. *Slovenská archeológia* 56, 2008, 179–238.

Kowalski 1969 J. Kowalski: Nowe dane do poznania kultury jerzmanowickiej w Polsce. *Światowit* 30, 1969, 177–188.

Kozłowski/Kozłowski 1977 J. K. Kozłowski/S. K. Kozłowski: *Epoka kamienia na ziemiach polskich*. Warszawa 1977.

Nemergut 2010 A. Nemergut: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bártu z rokov 1963 a 1990. *Slovenská archeológia* 58, 2010, 183–206.

Sachse-Kozłowska/Kozłowski 1975 E. Sachse-Kozłowska/S. K. Kozłowski: Nowa kultura górnopaleolityczna w Europie środkowej. Ze studiów nad materiałami ze stanowiska Zwierzyniec I. *Archeologia Polski* 22, 1975, 275–313.

Schild 1971 R. Schild: Lokalizacja prahistorycznych punktów eksploatacji krzemienia czekoladowego na północno-wschodnim obrzeżeniu Gór Świętokrzyskich. *Folia Quaternaria* 31, 1971, 1–60.

Soják 2000a M. Soják: Výskum a prieskumy na trase diaľnice. *AVANS* 1999, 2000, 110–113.

Soják 2000b M. Soják: Terénny prieskum na Spiši. *AVANS* 2000, 2001, 175–185.

Soják 2001 M. Soják: Sídliská ľudu badenskej kultúry na Spiši. In: M. Metlička (ed.): *Otázky neolitu a eneolitu našich zemí – 2000.* Plzeň 2001, 161–190.

Soják 2002 M. Soják: Osídlenie horného Spiša na sklonku staršej doby kamennej. In: J. Gancarski (red.): *Starsza i środkowa epoka kamienia v Karpatach polskich*. Krosno 2002, 255–278.

Soják 2006 M. Soják: Pred prvou písomnou zmienkou. In: Z. Kollárová (zost.): *Spišská Belá*. Prešov 2006, 23–51, 130.

Soják 2011 M. Soják: Nové archeologické objavy. In: F. Žifčák (ed.): *Kronika mesta Spišské Podhradie slovom i obrazom.* Druhé doplnené vydanie. Spišské Podhradie 2011, 12–15.

Soják 2015 M. Soják: Príspevok k novým pravekým nálezom zo Spiša. *Študijné zvesti AÚ SAV* 57, 2015, 141–166.

Sudoł-Procyk et al. 2018 M. Sudoł-Procyk/J. Budziszewski/M. Krajcarz/M. Jakubczak/M. Szubski: The chocolate flint mines at the Udorka Valley (Częstochowa Upland) – a preliminary reporton the field and lidar surveys. In: D. H. Werra/M. Woźny (eds.): *Between history and archaeology. Papers in honour of Jacek Lech.* Oxford 2018, 89–102.

Svoboda et al. 2017 J. Svoboda/J. Novák/S. Sázelová: Janova zátoka, k. ú. Jetřichovice, okr. Děčín. In: J. A. Svoboda (ed.): *Mezolit severních Čech II. Komplexní výzkum skalních převisů na Českolipsku a Děčínsku 2003–2015*. Brno 2017, 129–135.

Škrdla et al. 2014 P. Škrdla/L. Nejman/T. Rychtaříková/P. Nikolajev/L. Lisá: New observations concerning the Szeletian in Moravia. *Quartär* 61, 2014, 87–101.

Valde-Nowak 2003 P. Valde-Nowak: Upper Palaeolithic sequence. In: P. Valde-Nowak/A. Nadachowski/T. Madeyska (eds.): *Obłazowa Cave. Human activity, stratigraphy and palaeoenvironment.* Kraków 2003, 44–63.

Valde-Nowak/Kerneder-Gubała 2019 P. Valde-Nowak/K. Kerneder-Gubała: Mapping the radiolarite outcrops as potential source of raw material in the Stone Age. Characterisation of Polish part of the Pieniny Klippen Belt. *Anthropologica et Praehistorica* 128, 2019, 157–174.

Valoch 1993 K. Valoch: Vedrovice V. Eine Siedlung des Szeletien in Südmähren. *Quartär* 43/44, 1993, 7–93.

Žaár 2015 O. Žaár: Topografia paleolitických a mezolitických lokalít na Slovensku. *Študijné zvesti AÚ SAV* 57, 2015, 167–184.

Spišské Podhradie-Dreveník, dôležitá paleolitická lokalita dolného Spiša

Marián Soják – Maciej Wawrzczak

Súhrn

Lokalita Spišské Podhradie-Dreveník je lokalizovaná na dolnom Spiši, v povodí rieky Hornád. Ide o travertínový komplex, na ktorom je evidované polykultúrne osídlenie z rozličných fáz obdobia praveku až po včasný stredovek. Z viacerých prieskumov na západnom svahu vrchu pochádza kolekcia 33 kusov štiepaných kamenných artefaktov. Z chronologického hľadiska je zastúpená staršia fáza mladého paleolitu (szeletien a aurignacien), ako aj neskorý paleolit a pravdepodobne mezolit. Do szeletienu možno zaradiť listovitý hrot (fragment špičky hrotu), čepeľ so šikmou koncovou retušou (*półtylczak*) s bifaciálnou retušou (obr. 3: 1, 6; 4: 1, 6) a jeden kombinovaný nástroj – škrabadlo/rydlo (obr. 3: 2; 4: 5). Ploché rydlo/dláto zhotovené z bazálnej časti čepele z dvojpodstavového jadra (obr. 3: 5; 4: 4), ktoré sa bežne vyskytuje v szeletienskych a tiež v aurignacienskych kolekciách. Na základe stavu zachovania (výrazná biela patina a náznak plošnej retuše) tu pravdepodobne môžeme začleniť tiež nasledujúce dva fragmenty (čepeľ a úštep), zaradené vyššie do praveku (paleolit?; obr. 7: 1, 2). Do neskorého paleolitu alebo aj mezolitu možno s najväčšou pravdepodobnosťou zaradiť sedem artefaktov. Spomedzi analyzovaných artefaktov je len jeden nástroj – fragmentárne retušovaná čepeľ so zlomenou bazálnou časťou (obr. 5: 1; 6: 1). Zvyšných šesť výrobkov predstavujú torzá rôznych častí čepelí. Datovanie do vymedzeného chronologického rámca je problematické. Zdá sa však, že podľa technológie štiepania ich možno začleniť do neskorého paleolitu, resp. i mezolitu. Ostatné opísané artefakty možno zaradiť len všeobecne do praveku. Keďže miesto objavu kamenných artefaktov je momentálne akeramické, možno usudzovať na ich paleolitický, resp. mezolitický vek. V tejto súvislosti uvedieme, že na Dreveníku je evidované bohaté polykultúrne osídlenie z praveku (neolit, eneolit, doba bronzová). Žiaľ, pokračujúca exploatácia travertínu zničila lokalitu úplne, a preto je na nej realizácia revízneho archeologického výskumu už nemožná.

Obr. 1. Situovanie lokality.
Obr. 2. Severný pohľad na zničenú časť paleolitickej lokality.
Obr. 3. Štiepaná kamenná industria zo staršej fázy mladého paleolitu. 1, 2, 6, 7 – rádiolarit; 3–5 – patinovaný silicit.
Obr. 4. Fotografická dokumentácia štiepanej kamennej industrie zo staršej fázy mladého paleolitu. 1, 5–7 – rádiolarit; 2–4 – patinovaný silicit.
Obr. 5. Štiepaná kamenná industria z neskorého paleolitu alebo mezolitu. 1, 2, 5–7 – rádiolarit; 3, 4 – čokoládový pazúrik.
Obr. 6. Fotografická dokumentácia štiepanej kamennej industrie z neskorého paleolitu alebo mezolitu. 1, 2, 5–7 – rádiolarit; 3, 4 – čokoládový pazúrik.
Obr. 7. Fotografická dokumentácia nevýraznej štiepanej kamennej industrie z praveku (paleolitu?). 1 – patinovaný silicit; 2–5, 7–19 – radiolarit; 6 – spálený silicit.
Obr. 8. Mapa paleolitických a mezolitických lokalít Spiša. 1 – Spišské Podhradie-Dreveník; 2 – Spišská Belá; 3 – Štrba; 4 – Haligovce; 5 – Poprad-Matejovce; 6 – Smižany; 7 – Beharovce; 8 – Spišské Vlachy; 9 – Domaňovce; 10 – Smižany/Spišská Nová Ves.

PhDr. Marián Soják, PhD.
Archeologický ústav SAV, OZV – Spiš
Mlynská 6
SK – 052 01 Spišská Nová Ves
sojak@ta3.sk

Mgr. Maciej Wawrczak
Archeologický ústav SAV, OZV – Spiš
Mlynská 6
SK – 052 01 Spišská Nová Ves
m.wawrzczak@interia.pl

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 93–110

EPIAURIGNACIAN INDUSTRY WITH SAGAIDAK-MURALOVKA-TYPE MICROLITHS INDUSTRY IN THE SOUTH OF EASTERN EUROPE AND EASTERN CENTRAL EUROPE AND ITS LITHIC ARTEFACT FOSSIL TYPES

Yuri E. Demidenko – Petr Škrdla – Joseba Rios-Garaizar – Jaroslav Bartík – Tereza Rychtaříková

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.7

Keywords: Eastern and Central Europe, LGM, Epiaurignacian, lithic artefact fossil types

Abstract: In the article, Eastern and Central European Last Glacial Maximum (LGM) specific Epiaurignacian industry with Sagaidak-Muralovka-type microliths (EASMM) is discussed in terms of its lithic artefact fossil types. The proposed fossil types are carinated atypical endscraper-cores and Sagaidak-Muralovka-type microliths. These two lithic artefact types with some other techno-typological features of the considering EASMM industry type make it distinct within the LGM Early Late UP archaeological context in both Eastern and Central Europe.

INTRODUCTION

The onset of LGM *sensu lato* with Heinrich Event 2 (HE-2), ca. 26.5–23.5 ka cal BP, and Greenland Interstadial-2 (GI-2), ca. 23.5–23 ka cal BP (*Clark et al. 2009*; *Rasmussen et al. 2006*; *2014*), before the start of LGM *sensu stricto* (*Mix/Bard/Schneider 2001*), ca. 23–19 ka cal BP, with only Greenland Stadials-2c and 2b (GS-2c and GS-2b) with its harsh climatic conditions not only significantly changed the environment and climate in Europe but it also had a great impact on the continent archaeological industrial techno-complex and industry type structure. It is the time when the long-lasting Pan-European Gravettian techno-complex with its various industry types had either already disappeared or was about to disappear (e.g. *Maier/Zimmermann 2017*), and new techno-complexes and assemblages started appearing from HE-2 and GI-2. In Western Europe, new artefact assemblages are mainly represented by Solutrean and Badegoulian techno-complexes (*Ducasse 2012*; *Renard 2011*; *Zilhão/Aubry/Almeida 1999*). In Eastern and Central Europe, the newly appeared artefact assemblages are basically associated with Epigravettian (e.g. *Lengyel 2018*; *Nuzhnyy 2015*; *Olenkovskiy 2008*). From our point of view, however, Epigravettian is not the sole techno-complex present at the beginning of LGM *sensu lato*, not even mentioning here some variable industry types within the Epigravettian. At least two more techno-complexes in Central Europe and one more techno-complex in Eastern Europe are known in addition to Early Epigravettian for the considered time period. One of the techno-complexes is so-called Epiaurignacian and in particular the Epiaurignacian with Sagaidak-Muralovka-type microliths (EASMM) industry type being known in both the south of Eastern Europe and Eastern Central European (*Demidenko/Škrdla/Rios-Garaizar 2016*; *2018*; *2019*). Specifically, the EASMM and its lithic fossil types will be analyzed in the present article, also testifying to a not industrially uniform but diverse archaeological picture for the start of the LGM.

Fig. 1. Map of Central and Eastern Europe with EASMM sites. Created in Google Earth, Image source Lansat, captured 12/14/2015. A view from 2257.98 km.

MATERIAL AND METHODS

Indeed, one of the basic problems with the LGM archaeological context is an industrial-chronological understanding of the Epigravettian techno-complex by different archaeologists. In contrast to all known chronologically earlier European Early and Middle Upper Palaeolithic (UP) techno-complexes primarily defined through strictly recognized industrial techno-typological criteria for lithic artefacts (e.g. Chatelperronian, Uluzzian, Szeletian, Bohunician, Aurignacian, Gravettian), the Epigravettian techno-complex is very often and especially in Central Europe understood in an off way mainly ignoring the strict artefact characteristics. In fact, it is usually proposed to see it as chronologically a sort of post-Gravettian assemblage package, containing varying industry types.

In Central Europe, the approach started in the early 2000s when *J. Svoboda* and *M. Novák* (*2004*, 473) underlined that "*the term 'Epigravettian' ... is only based on the chronological setting (i.e., industries following the Gravettian in terms of time)*".

Such a really non-industrial approach for Epigravettian is further under development now for Central Europe by *G. Lengyel* (e.g. *2018*). He eventually grouped all the known Carpathian Basin LGM UP assemblages under the single "Early Epigravettian umbrella". Accordingly, the "unifying approach" started almost 20 years ago has now reached its climax when it has not actually paid any real attention to LGM industry type variability.

From our point of view, at least five industry types are known particularly for the LGM Eastern Central Europe, instead of Lengyel's merely "Early Epigravettian". These are namely the EASMM industry, two Early Epigravettian industry types (Kašov I and Ságvár), Early Badegoulian with the Kammern-Grubgraben industry type and the Stránská skála IV-type assemblages. All the industry types need to be analyzed thoroughly and in detail, and some first steps in this direction have been already undertaken (e.g. *Škrdla et al. 2021*). The EASMM industry, the only one identified with certainty so far among the noted five industry types also for Eastern Central Europe, in the south of Eastern Europe, can serve as a good example for further studies of the LGM Early Late UP industries. The EASMM industry's basic lithic techno-typological data and also fossil artefact types will be summarized for showing the EASMM distinct industrial affiliation within the UP context of both Eastern and Central Europe.

EASMM INDUSTRY AND ITS SITES IN EASTERN EUROPE IN RESEARCH SINCE 1950S

Seven sites not fitting into the Mid UP–Late UP record with various Gravettian and Epigravettian industry types were studied in the south of Eastern Europe between the late 1950s and late 1990s (*Demidenko 2007*; *2008*; *Demidenko/Škrdla/Rios-Garaizar 2019*). These are Raşkov VII and VIII in Transnistria (Moldova); Sagaidak I and Anetovka I in the western part of the North Black Sea region (Southern Ukraine); Muralovka, Zolotovka I and Mikhailovskaya Balka in the eastern part of the Sea of Azov and Lower Don River (Southern Russia; Fig. 1). Geochronologically, these sites have been always associated with the LGM and now they are more precisely related to ca. 25.5–23 ka cal BP, HE-2 and GI-2.

The industry can be characterized by lithic artefacts (organic artefacts have not yet been recovered) as follows. Technologically, it is basically a flakey industry with the additional presence of elongated chips and microblades, while blades are of occasional reduction origin (except the Sagaidak I assemblage with serial tools on the blades). The small-sized debitage blanks were mainly produced from carinated atypical endscraper-cores (Fig. 2A: 1–10) and only some of them were flaked from elongated chip and microblade cores (Fig. 2A: 11, 12). Some flake cores served for the detachment of blanks for both carinated endscraper-cores and so-called domestic tools. Typologically, the small-sized debitage pieces were often transformed into "hunting projectile weaponry" – a sort of pseudo-Dufour, but really morphologically distinct and metrically tiny Sagaidak-Muralovka-type microliths bearing dorsal marginal abrasion retouch and having slightly incurvate, non-twisted profiles (Fig. 2B: 1–38). At the same time, "domestic" UP tool types (simple-endscrapers, various non-multifaceted burins, truncated pieces) were represented only by a single very specific type, a transversal non-multifaceted burin on a lateral retouch (*Demidenko/Škrdla/Rios-Garaizar 2019*, fig. 3: 43–46; 5: 28–34; 6: 18–26; 7: 7–10; 8: 5–10).

Regarding subsistence practices within the LGM periglacial steppe and grass-herb steppe, EASMM humans hunted bison, reindeer and horse, with also occasional occurrence of rhino and mammoth bone remains. The latter species' presence probably can be explained by scavenging, bone collecting and/or hunting of ill – naturally trapped large-sized animals.

Moreover, all these sites and their finds have been analyzed for many years, almost 60 years since the Raşcov VII site discovery in the late 1950s, only within the Eastern European UP archaeological context due to their occurrence only in this part of the continent and nowhere else in Europe.

EASMM SITES IN CENTRAL EUROPE REVISITED

However, the discovery in 2013 and since then ongoing excavations at the Mohelno-Plevovce site (Southern Moravia) headed by one of our team members (*Škrdla et al. 2016*) has radically changed the situation with the considered Epiaurignacian industry now being represented in Central Europe too. Moreover, our 2015 survey of already known LGM sites in Central Europe did lead us to recognition of one more such site, Rosenburg, in Lower Austria, situated only ca. 50km to the south-west of Mohelno-Plevovce within the same Bohemian Massif, excavated in 1988 by G. Trnka and then published as an Epigravettian site by one of his students (*Ott 1996*). The data on the two Central European sites are very similar one to another and can be summarized in the following way (*Demidenko/Škrdla/Rios-Garaizar 2019*). First of all, it is indeed needed to state here the very similar character of the Moravian and Austrian assemblages (Fig. 3; 4) to the East European assemblages having the same elongated chip and microblade cores (Fig. 3A: 1–3), carinated atypical endscraper-cores (Fig. 3A: 4–6; 3B: 1–5), Sagaidak-Muralovka microliths (Fig. 3A: 7–30; 4: 1–36) and even transversal burins on the lateral retouch (Fig. 3B: 7). Moreover, the Mohelno-Plevovce refit of a secondary burin spall to the transversal burin on the lateral retouch shows multiple and consistent practice to make transversal burins on the lateral retouch repeatedly for one and the same piece (Fig. 3B: 6, 7). The only seemingly single technological difference for the Central and East European assemblages is the use of bipolar anvil core reduction in Central Europe (*Demidenko/Škrdla/Rios-Garaizar 2019*, fig. 11: 7–10; 15; 16), even for some microlith production.

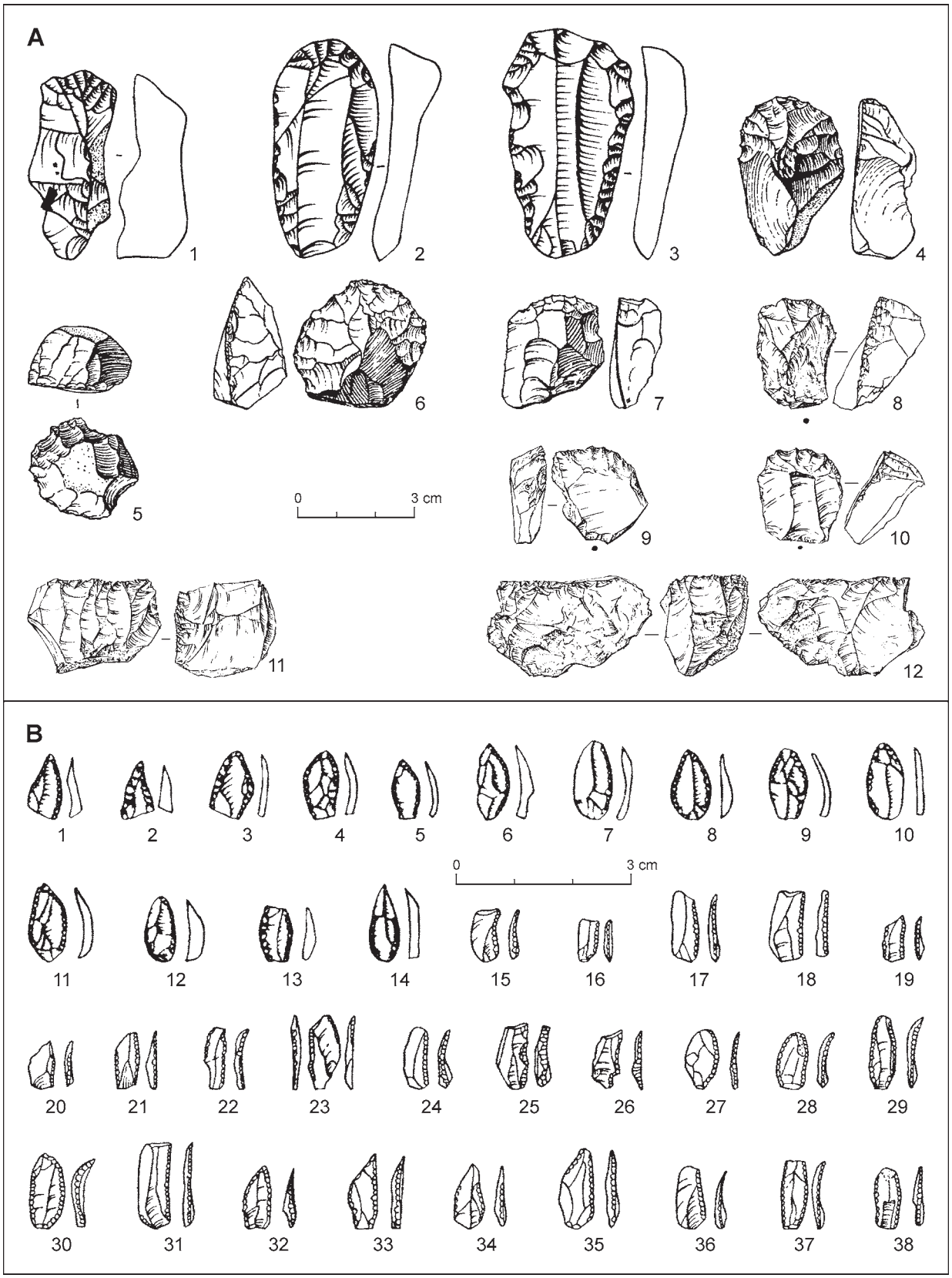


Fig. 2. EASMM Eastern European site lithic artefacts. A – 1–10 – carinated atypical endscraper-cores; 11, 12 – elongated chip/microblade micro-cores; B – 1–38 – Sagaidak-Muralovka-type microliths. A – 1–3; B – 1–14 – Sagaidak I site (modified after *Smol'yaninova 1990*); A – 4–7; B – 15–38 – Muralovka site (modified after *Praslov 1972*); A: 8–12 – Anetovka I site (modified after *Demidenko/Škrdla/Rios-Garaizar 2019*).

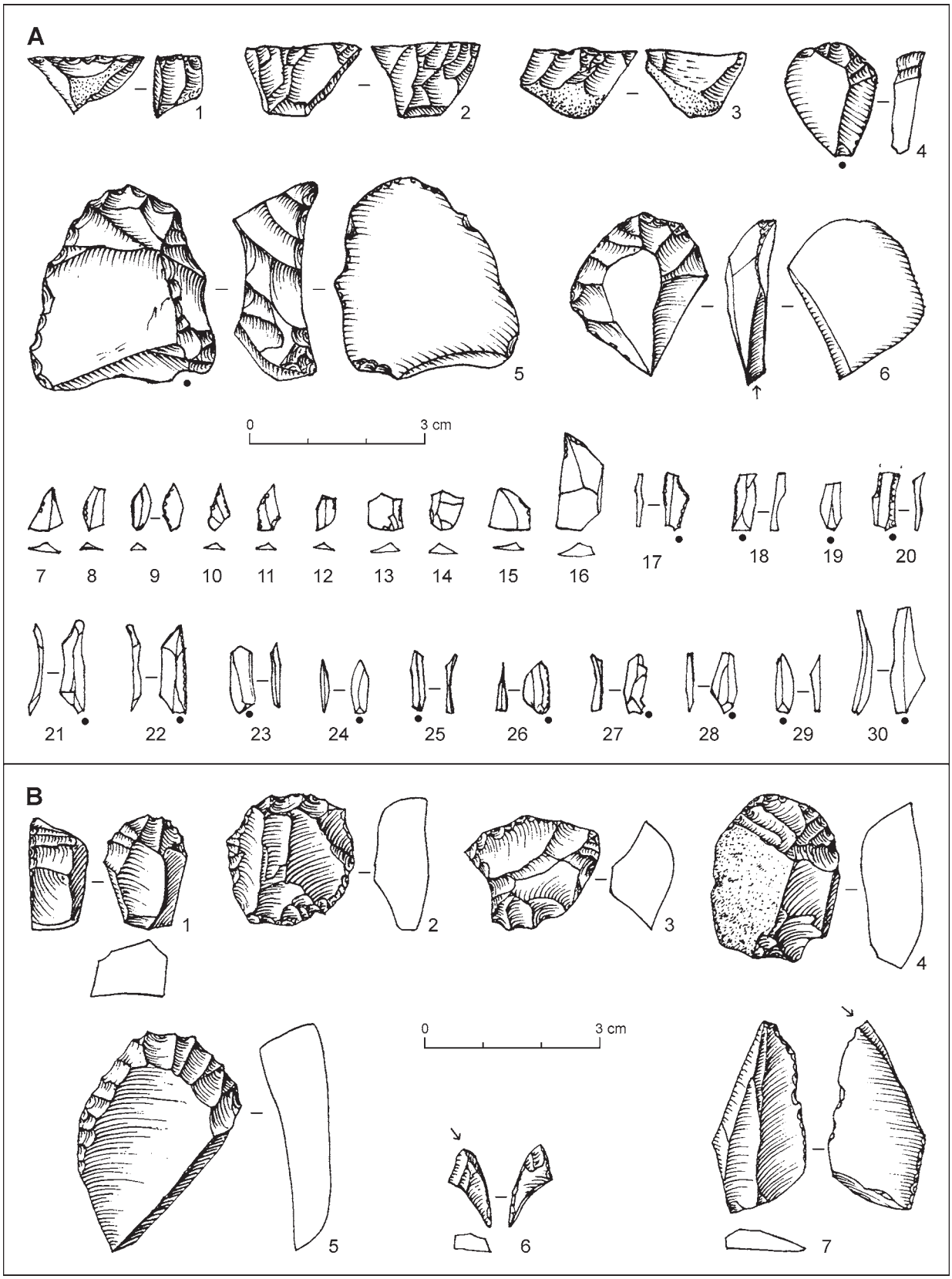


Fig. 3. EASMM Central European site lithic artefacts. A – 1–3 – elongated chip/microblade micro-cores; 4–6 – carinated atypical endscraper-cores; 7–30 – Sagaidak-Muralovka-type microliths; B – 1–5 – carinated atypical endscraper-cores; 6, 7 – secondary burin spall refitted onto transversal burin on lateral retouch. A – Rosenburg site (modified after *Ott 1996*); B – Mohelno-Plevovce KSA site (modified after *Demidenko/Škrdla/Rios-Garaizar 2019*).

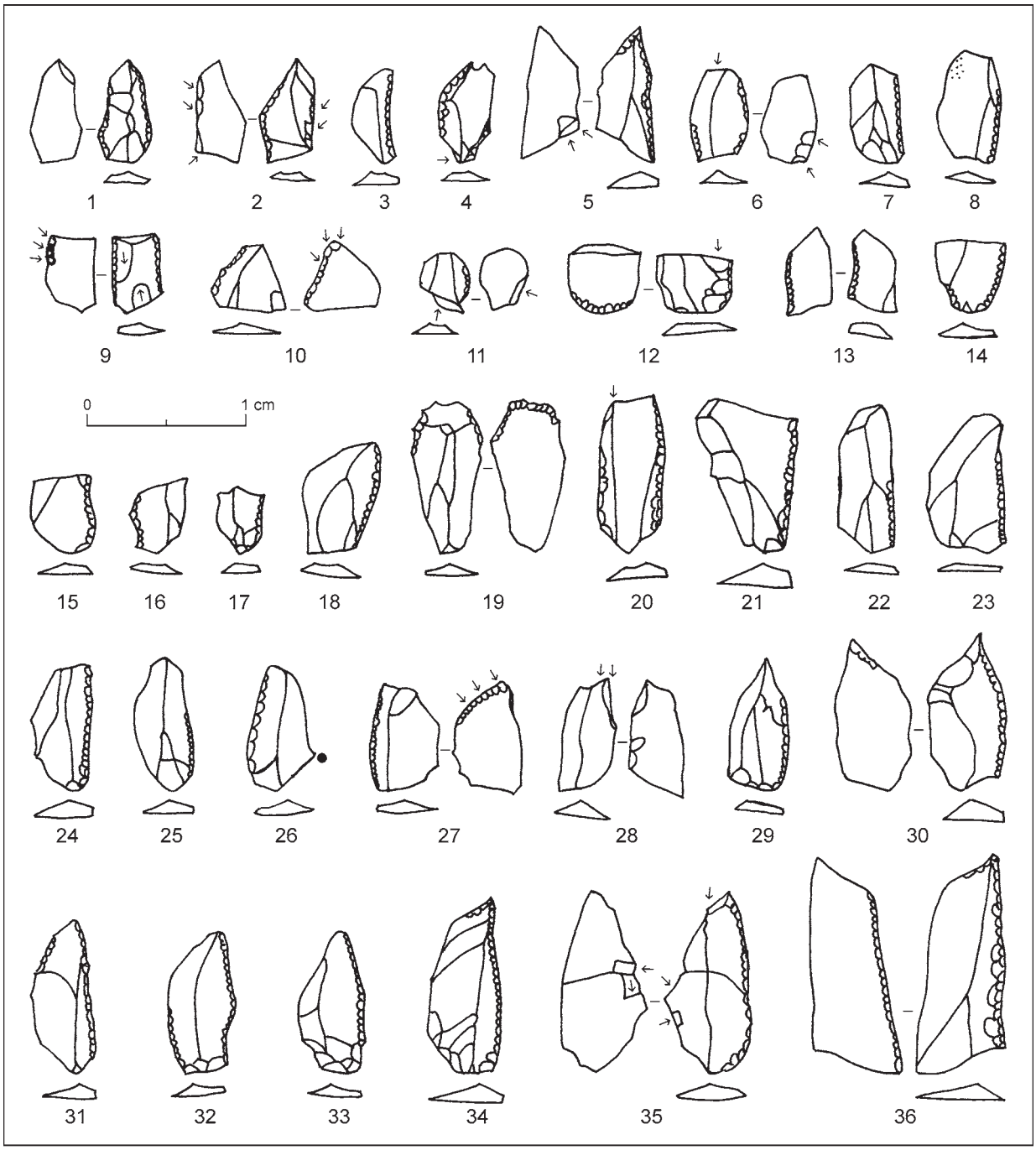


Fig. 4. EASMM Central European site lithic artefacts. 1–36 – Sagaidak-Muralovka-type microliths; Mohelno-Plevovce KSA site (modified after *Demidenko/Škrdla/Rios-Garaizar 2019*).

"PREHISTORIC VICISSITUDES OF ORIGIN FATE" OF THE EASMM INDUSTRY TYPE: VARIOUS SUGGESTIONS

Before the discovery and recognition of the EASMM sites in the Bohemian Massif of Central Europe, the particular LGM industry type origin in the south of Eastern Europe, at that time described as an "Aurignacoid industry", has been always considered by Russian and Ukrainian archaeologists (e.g. *Gvozdover/Ivanova 1969*; *Praslov 1972*; *Stanko 1982*; *Stanko/Grigor´eva/Shvaiko 1989*) to be the result of a Late Aurignacian human group move from Central Europe, taking into consideration an Aurigna-

cian assemblage of the Góra Puławska II site in Poland having both carinated typical endscrapers and dorsally retouched microblades (*Krukowski 1948*; *Sachse-Kozlowska 1978*). In 1999, an alternative name, "North Black Sea Region Epiaurignacian of Krems-Dufour type" was proposed for the discussed industry due to its both a basic similarity to the also LGM former Aurignacian V in Western Europe and still a possible generic connection to Evolved Aurignacian Góra Puławska II materials with pseudo-Dufour microliths (*Demidenko 1999*). Also, aside from more details proposed for defining the sites and lithics of the Epiaurignacian industry type, it has also been proposed that the reason Late Aurignacian humans probably moved to the south of Eastern Europe is because these vast territories were almost unpopulated during the preceding LGM Middle Upper Palaeolithic/Gravettian time period (*Demidenko 2007*; *2008*).

Nevertheless, new data for the above-noted new sites of the Epiaurignacian industry type in Central Europe made it possible to recognize the EASMM industry type and its site occurrence in both parts of Europe, as well as increasing the understanding of the Góra Puławska II assemblage and adding some additional, similar materials recently found served for recognition of the Evolved Aurignacian industry type with Góra Puławska II-type microliths (*Demidenko/Škrdla/Nejman 2017*; *Demidenko/Škrdla/Rios-Garaizar 2016*). These new data have forced the team to reject the previously proposed Late Aurignacian generic background for the EASMM.

That is mainly related to the fact that the Evolved Aurignacian and EASMM industry types are separated by an almost 10,000-year chronological gap, enveloping the entire Gravettian *sensu stricto* in these parts of Europe.

Accordingly, EASMM possible industrial "generic roots" are now under consideration using chronologically a bit earlier, ca. 26–25 ka cal BP/HE-2, Western European Aurignacian V/Terminal Gravettian/Proto-Solutrean industry type (*Demidenko/Škrdla/Rios-Garaizar 2016*; *2018*; *2019*). The industry is also recognized as an "industrial-chronological transitional bridge" between Late Gravettian and Solutrean in the West of Europe (see *Almeida 2000*; *Aubry/Detrain/Kervazo 1995*; *Verpoorte et al. 2019*; *Zilhão/Aubry/Almeida 1999*). In core reduction technology, it has serial bladelet and microblade production from "regular" blade and bladelet cores, and from both carinated endscrapers (both typical and atypical) and especially thick nosed endscrapers. In typology, "micro-debitage" was used for the production of microliths bearing mainly marginal and sometimes thin backed retouch. Still having some lithic artefact differences with EASMM industry, the occurrence of EASMM sites in Central Europe is notable at the time when Lower Solutrean already replaced Aurignacian V/Terminal Gravettian/Proto-Solutrean industry in Western Europe. Accordingly, it is possible to put forward a hypothesis that under harsh LGM climate conditions a part of the western industry's humans moved into Central Europe giving a direct rise of the EASMM industry type or an indirect complex trans-cultural diffusion/stimulus diffusion "generic process".

Finally, concerning EASMM's "industrial fate", there are not yet any reasonable hypotheses for the industry in Eastern Europe, although some ideas are now under consideration for Central Europe. A possible generic connection has been suggested between the EASMM industry and the Badegoulian of the Kammern-Grubgraben type in Central Europe (*Demidenko et al., in press*).

EASMM TWO LITHIC ARTEFACT FOSSIL TYPES

The LGM EASMM industry type has been always recognized in both Eastern and Central Europe through the serial presence of two lithic artefact types: carinated atypical endscraper-cores and tiny Sagaidak-Muralovka-type microliths. These two distinct features clearly distinguish the industry type among all pre-LGM, LGM and post-LGM UP industries. Moreover, despite the fact that the two lithic types were systematically found at all the EASMM sites, except for Mikhailovskaya Balka, the best recovered respective lithic samples come from the Mohelno-Plevovce site in Southern Moravia, which is still under field investigation. That is because it is the only EASMM site where all artefact bearing sediments have been wet-sieved, providing the best objective samples on retouched microliths and unretouched tiny debitage items, additionally allowing the only EASMM refitting done yet of some of them onto their primary flaking reduction objects, carinated atypical endscraper-cores. Conformably, the Moravian site data will be the core ones for the most detailed two lithic fossil types descriptions and analyses, although data from other sites will serve as basic data material.

Carinated atypical endscraper-cores

The lithic type, as an endscraper-core, was first properly recognized by N. D. Praslov in the early 1970s during a lithic artefact analysis after his investigations of the Muralovka site in the 1960s (*Praslov 1972*). He literally technologically connected "*thick-formed endscrapers*" (ca. 30 items), serving mainly as cores, with "*miniature retouched bladelets and points*" (158 items). He paid special attention to the following endscraper morphological features (Fig. 2A: 4–7): "*made on thick short flakes*", "*their working edges were formed on the most massive flake's parts*", "*most of the endscrapers working edges are uneven, denticulated*", "*facet removal negatives deeply come onto the tools surface and correspond to the shapes of bladelets and chips used for manufacture of the Muralovka-type miniature retouched bladelets and points*", while "*such facet removal negatives are absent on cores*" (*Praslov 1972*, 75). As a result, *N. D. Praslov* (*1972*, 75) came to the conclusion that "*most of the blanks for the miniature items were received during treatment of these particular endscrapers*". Along with this, Praslov did not establish a unified term for the endscraper type, using terms like "*thick-formed endscrapers*"/"*core-like endscrapers*"/"*keeled endscrapers*"/"*high core-like endscrapers*" equally for the same thing (see also *Praslov/Filippov 1967*; *Praslov/Ivanova/Malyasova 1980*). Namely, the work of Praslov then allowed his Ukrainian and Moldovan colleagues to understand in a correct way materials similar to those from Muralovka from their own excavated sites (see *Ketraru/Grigor'eva/Kovalenko 2007*; *Stanko/Grigor'eva 1977*).

Understanding the lithic type terminology problem, it was proposed more than 10 years ago that the term "*carinated atypical endscraper*" be used for the considered "Epiaurignacian" industry type in the south of Eastern Europe (*Demidenko 2004*; *2008*). This was based on the endscrapers' basic morphological features bearing non-lamellar, rather short but actually elongated chip-like removal negatives on their fronts/flaking surfaces. Such a definition fits well into the classic definition of "*grattoir careen atypique*", "*si les facettes d'enlèvement sont larges et non lamellaires ou si le profil est mal dessiné*" (*Sonneville-Bordes/Perrot 1954*, 332, fig. 1; 3; 12). The newly applied 2000s term also made it possible to put the industry type in the concrete LGM "Epiaurignacian" context, escaping its usual industrially uncertain "Aurignacoid" status in Eastern European Palaeolithic archaeology. Very recently, accentuating the technology, the considered endscrapers' definition was finally a little re-modified into proper endscraper-cores, "*carinated atypical endscraper-cores*" (*Demidenko/Škrdla/Rios-Garaizar 2019*). At the same time, the gross excavation methods applied to the EASMM Eastern European sites in the late 1950s–1990s and fine excavations of actually redeposited sediments at Anetovka I site in 2005–2006 by one of our team members (Yu. D.) do not permit real *chaîne opératoire* technological reconstructions, not to even mention possible refitting attempts here. However, as was pointed out above, the newly recovered Mohelno-Plevovce site materials offer a unique first chance for the EASMM assemblages to realize both refits and *chaîne opératoire* approach studies for the endscraper-cores and microliths.

Mohelno-Plevovce first excavated stony structure (KSA) lithic assemblages in the total number of ca. 985 items revealed the presence of both 5 carinated atypical endscraper-cores and 47 microliths, exclusively produced/flaked from very distant for the site erratic flint. Three of the endscraper-cores got refits with mainly microliths and a few non-elongated, tiny chips. They can be listed briefly as follows.

1. Double carinated atypical endscraper-core with refitted onto its wider front/flaking surface of 8 microliths (Fig. 3B: 1; 5).

Fig. 5. EASMM Central European site lithic artefacts. Refit of carinated atypical endscraper-core and 8 Sagaidak-Muralovka-type microliths; Mohelno-Plevovce KSA site (modified after *Demidenko/Škrdla/Rios-Garaizar 2017*).

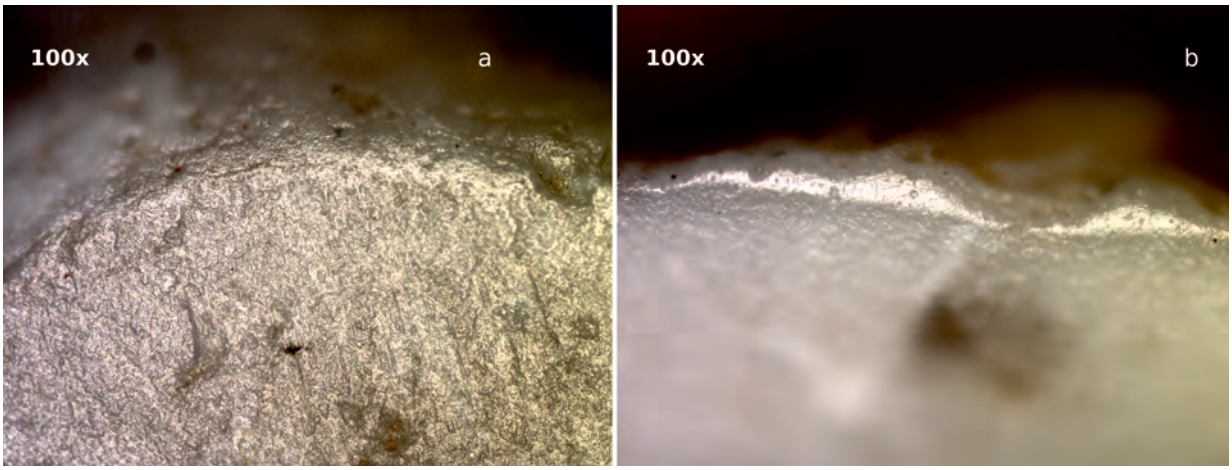


Fig. 6. EASMM Central European site lithic artefacts. Mohelno-Plevovce KSA site carinated atypical endscraper-core with a dry hide (a) and hard organic material (b) scraping traces.

2. Carinated atypical endscraper-core with refitted onto its front/flaking surface one microlith and one chip (Fig. 3B: 4).
3. Carinated atypical endscraper-core with refitted onto its front/flaking surface one microlith, two chips and one fronto-lateral maintenance flake (Fig. 3B: 5).

Although the site's refitting program, data and illustrations will be forthcoming in more studies and illustration realization, the already existing data still allow some basic *chaîne opératoire* technological observations to be made.

Flakes ca. 1.5 cm thick have been serving as blanks for carinated atypical endscraper-cores. The endscraper-cores' convex fronts/flaking surfaces were usually formed by some lateral chip removal negatives. Then, the proper microlith-blanks were serially detached mostly in a convergent order from the central convex area of the prepared front/flaking surface. The flaking surfaces' rejuvenation processes were going on only sporadically by removing specific fronto-lateral maintenance flakes that were cleaning the surface for one more possible primary reduction cycle. At the same time, the core tablet technique was never noted to be applied during re-preparation of the carinated atypical endscraper-cores. The technique's absence is connected to the thinness of these reduction objects of no more than 1.5 cm, the reason a detachment of almost any, even 3–4 mm thick core tablet would make the flaking surface too short for a microlith-blank detachment. It is also worth noting the absence of the *lame à crête* technique here. Accordingly, the carinated atypical endscraper-core reduction was almost never long and/or really multiple as most of traditional primary flaking objects, like various large-sized cores were. These endscraper-cores were, however, "short-lived" and rather simple in the creation of reduction objects.

Such short/limited reduction characteristics of the endscraper-cores have also an important "subsistence implication" pointing out that these pieces were certainly not "vitally important" so-called curated items, which Late UP humans would carry with them from one to another site for a recurring flaking at each site. In fact, most likely, flake cores, reduction objects for getting thick flake-blanks for then on-site formation and primary flaking of carinated atypical endscraper-cores, were such curated items. The latter suggestion finds additional support in the fact that real flake cores are either absent or represented by very few pieces at each EASMM site, although some morphologically unidentifiable core fragments and/or residues were in reality such flake cores, but fully exhausted at their last time flaked site.

Finally, the recently conducted use-wear studies of Mohelno-Plevovce carinated atypical endscraper-cores (*Rios-Garaizar/Škrdla/Demidenko 2019*) definitely indicated that some of these items were used after serving for core reduction as actual tools. For example, one of the KSA endscraper-cores (Fig. 3B: 2; 6: a, b) bears scraping traces on a dry hide (Fig. 6: a) and a hard organic material (Fig. 6: b) use. Accordingly, the double term "endscraper-cores" indeed reflects the dual functionality of these specific EASMM fossil type pieces.

Sagaidak-Muralovka-type microliths

One more EASMM fossil type also received more understanding with Mohelno-Plevovce lithic analyses (Fig. 4).

Microlith type recognition

The serial tiny microliths found bearing a marginal, not true backed retouch at the EASMM sites in Eastern Europe called for their typological classification. Their definition as a class started with the pioneering studies of Praslov in the late 1960s and the early 1970s with the differentiation between convergently retouched items, called "micro-points", and laterally/bilaterally retouched specimens, called "retouched bladelets/microblades" (Fig. 2B: 15–38). It is important to note here that the latter non-pointed pieces have been always much more numerous than pointed pieces in Eastern European EASMM sites and it is also noted for the newly recognized Central European EASMM sites. The common agreement between Soviet Palaeolithic archaeologists on the EASMM microliths was probably summed up by a Ukrainian archaeologist S. P. Smol'yaninova in her 1990 book. The "micro-points" were called "*Sagaidak-Muralovka-type micro-points*" (Fig. 2B: 1–14) produced on "*thin, incurvate, with sub-triangular shape endscrapers chips*" where the micro-point type's name was based on two samples of such pieces from Muralovka and Sagaidak I sites (*Smol'yaninova 1990*, 89). At the same time, other microliths were merely called simple laterally/bilaterally retouched microliths. One of our team members (Yu. D.), being aware of the truly common morphological, metrical and retouch features for both pointed and non-pointed microliths for the discussed Eastern European sites, later proposed defining all these microliths collectively as "*Sagaidak-Muralovka-type microliths with a fine dorsal marginal abrasion bilateral and lateral retouch on chips and metrically shortened microblades*" (*Demidenko 2007*, 69). As a result, the microlith type (Fig. 2B: 1–38) was used later during the recognition of the EASMM industry type for both Eastern and Central European sites (*Demidenko/Škrdla/Rios-Garaizar 2019*).

Microlith-blank type recognition

It was in the beginning of 1970s when again Praslov viewed the Muralovka site microliths found by him as "*diminutive bladelets with retouched lateral edges*", being, however, cautious to consider them true bladelets due to their morphology: "*they are very tiny, amorphous, with no parallel edges and not well-developed dorsal scar patterns*" (*Praslov 1972*, 71). Accordingly, he proposed to define the microliths' blank type as "*chips*", linking their primary flaking with the so-called "*high endscrapers*" because "*a great majority of blanks for the diminutive pieces were received during treatment of namely such endscrapers*" (*Praslov 1972*, 71, 75). Most of the Praslov's colleagues, however, preferred calling the Sagaidak-Muralovka-type microliths' blanks "*microblades*" or "*diminutive bladelets*" and not chips (e.g. *Stanko/Grigor´eva 1977*, 43, 45–47). Moreover, later Praslov himself virtually dropped the term "*chip*" when describing the Zolotovka I assemblage: "*high endscrapers of the so-called Aurignacian type are actually often specific cores for microblade production and then the microblades were transformed by a secondary treatment into tiny micro-points*" (*Praslov/Ivanova/Malyasova 1980*, 172). The 1980 definition was used more recently by Shchelinsky when he published the Zolotovka I 1996 excavation lithics, and referred to "*diminutive retouched bladelets of the Muralovka type*" (*Praslov/Shchelinsky 1996*, 64). This lack of agreement on the terminology for the Sagaidak-Muralovka-type microliths' blanks in the East European assemblages continued, and it actually prevented a more precise technological and typological definition of these important pieces.

The Mohelno-Plevovce case has definitely helped with the definition of the microliths-blanks. The site's KSA final microliths sample is comprised of 47 items (Fig. 4). Before (*Demidenko/Škrdla/Rios-Garaizar 2019*) it was noted 49 microliths for KSA but then two pairs of the fragmented items had been conjoined that made the discussed stony structure's final microlith number with 47 now. Complete microliths (27 items) have the following mean metrical data: 0.85 cm long, 0.4 cm wide, 0.1 cm thick. Metrically, the fragmented microliths (20 items) are very similar to the complete pieces. They have such mean indices: 0.67 cm long (fragmented length), 0.41 cm wide, 0.1 cm thick. Their actual metrics are also in such dimensions: 0.6–1.2 cm long, 0.3–0.5 cm wide. Only two fragmented pieces have thickness of greater than 0.2 cm (Fig. 4: 21, 36), while the other 45 microliths are only 0.1 cm thick. Taking into consideration the metrics of the great majority of the Mohelno-Plevovce microliths, it is proposed here to name them "elongated chips". All of the microliths are less than 1.5 cm long and it

is the usual size limit for chips in UP assemblages (e.g. *Demidenko 2012a*, 104), while their rather small width (0.3–0.5 cm) make them of some elongated chip character. Namely, the demonstrated elongation did lead to their often being called microblades and bladelets. Also, the above-noted Mohelno-Plevovce fragmented retouched bladelet and microblade were, high likely, selected for retouching in the already fragmented condition because in this way they corresponded well to the elongated chips' "ideal metrical standards". It is also worth noting that the already published East European data on such microliths correspond well to the Mohelno-Plevovce microliths' blanks metrics. Indeed, numerically few more elongated and wider microliths are present on formally bladelets and microblades (e.g. *Demidenko 2012a*, 96), and most of them were probably chosen for retouching when already fragmented. In such a way, the term "elongated chips" fits perfectly for most of the Sagaidak-Muralovka-type microliths. It can be additionally noted that these "elongated chips" were the basic product of carinated atypical endscraper–cores and the microliths-blanks then, whereas some microlith-blanks can also include bladelets and microblades flaked from "true" bladelet-microblade cores on nodules/chunks. Some further research might indicate a possible link between the availability of high quality raw material sources and the greater use of bladelets and microblades obtained from the "true" cores for microlith production.

Microlith morphology and function

As was shown above, Soviet archaeologists agreed about the presence of some real convergently retouched items among the EASMM microliths in Eastern Europe, even giving them the new established term "Sagaidak-Muralovka points". Now, after studies of Central European EASMM microliths and coming back to the published and unpublished data on the Eastern European EASMM microliths, there is no confidence about the presence of a distinct micro-point type items within the discussed industry type. First, the pointed items have been indeed numerically rare microliths. Second, taking a closer look at the pointed items, a partial convergent bilateral retouch is actually mostly seen at best (Fig. 4: 1, 2, 5, 30–32, 34, 36). As a result, from a strict morpho-typological point of view, most or almost all of the so-called pointed microliths are not in fact points. Moreover, taking all the EASMM microliths, it is again seen that a great deal of them only have a single retouched edge, therefore falling typologically into a laterally retouched microlith type with a continuous marginal abrasion dorsal retouch. At the same time, there are many microliths that often bear some retouch-like facets for another lateral edge, for which they are still usually classified as bilaterally retouched microliths. However, such retouch-like facets are really of irregular and/or partial character, being projectile damage facets – "diagnostic impact fractures" as demonstrated by the use-wear analyses conducted (Fig. 4: 6, 9, 10, 27, 28, 35; 7; *Rios-Garaizar/Škrdla/Demidenko 2019*). The microliths' "diagnostic impact fractures" showed a combination (Fig. 7) or a separate occurrence of axial fractures (burinations, spin-off fractures) and lateral oblique damage. The latter damage can be regarded as the most commonly occurring and such lateral damage always appears in the edge opposed to the retouched back suggesting that namely the retouched back was the inserted edge while the non-retouched edge was the exposed part of a complex organic point. That is why there was actually no need to have regularly and continuously retouched both lateral edges on the microlith-blanks, elongated chips. Hence, these microliths were laterally positioned inserts within projectile organic points of darts/arrows. Although axial fractures are less abundant, they also indicate direct, axial damage was caused, which is the reason some of the armatures were also pointed. Nevertheless, the question still remains open for further studies, if microliths used as tips for organic points were morpho-typologically convergently retouched points or not.

All in all, the newly realized EASMM microlith studies have indeed demonstrated the very dominant use of microliths as projectile weapon armatures. It is one more modern step in the EASMM microlith studies remembering that their exclusive domestic scraping/cutting functions had previously been claimed (e.g. *Filippov 1977*).

Microlith production and use efficiency rate

Following below, the Mohelno-Plevovce KSA and KSB stony structures' assemblage data allow two more studies of the EASMM microliths to be conducted.

First, it is related to some production efficiency data and only the KSA data will be used for this particular study. There are 47 retouched microliths, 22 unretouched complete elongated chips, 6 bladelets and

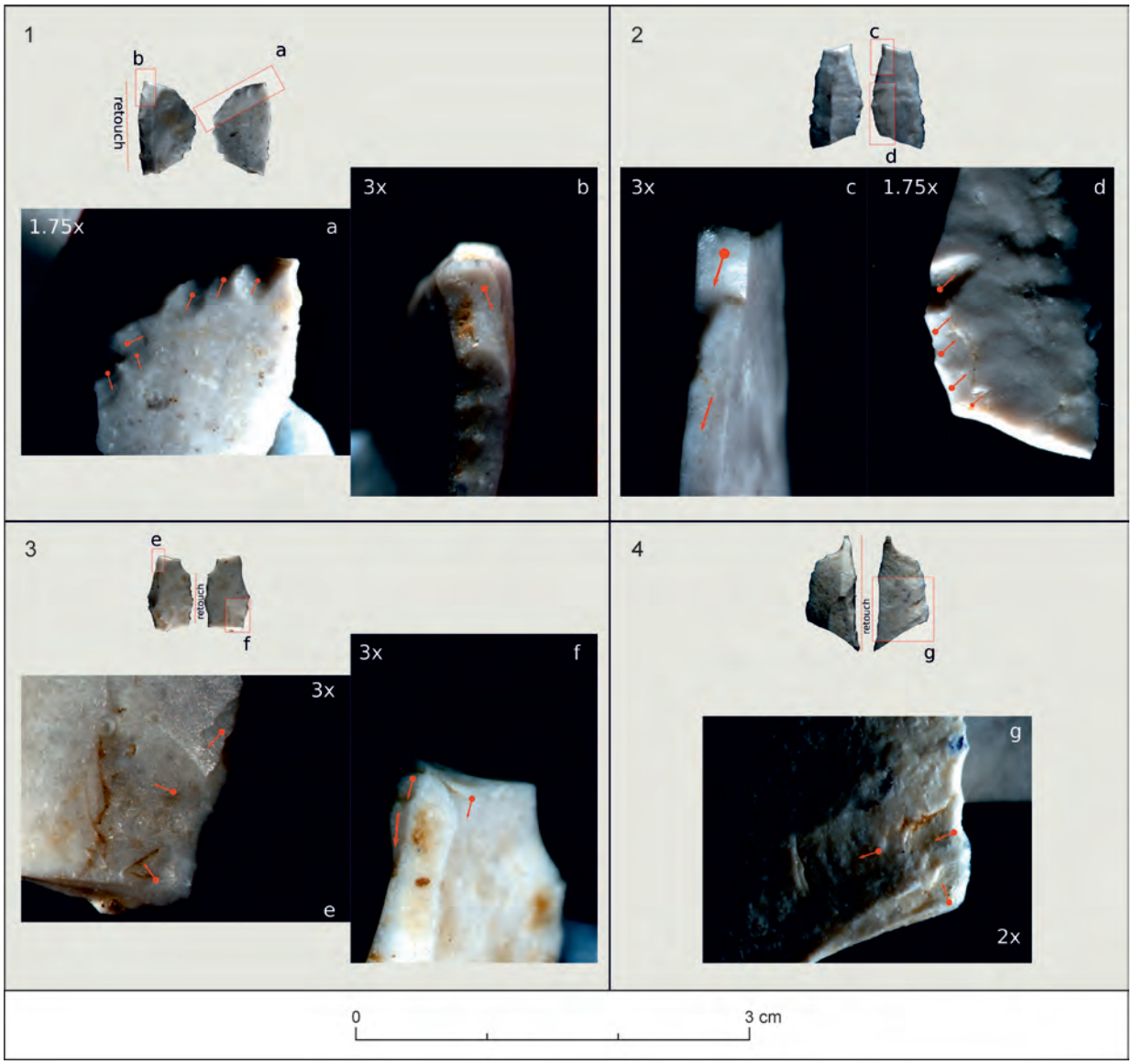


Fig. 7. EASMM Central European site lithic artefacts. Mohelno-Plevovce KSA site Sagaidak-Muralovka-type microliths with diagnostic impact fractures (DIF; modified after *Rios-Garaizar/Škrdla/Demidenko 2019*).

3 microblades in the Mohelno-Plevovce KSA assemblage. Remembering the tiny size of these retouched and unretouched pieces, it is clear that part of the unretouched items was simply lost after their detachment from mostly carinated atypical endscraper-cores. Such a loss of unretouched tiny pieces also can indirectly explain why many namely retouched microliths were refitted onto carinated atypical endscraper-cores. Also, some more microliths were probably taken away from the site within the "repaired" and/or newly made hunting projectile weaponry darts/arrows. Accordingly, the retouching rate for the elongated chips and a few bladelets/microblades was very high when almost all potential microlith-blanks were retouched. At the same time, carinated atypical endscraper-core reduction was also very productive, taking into account the presence of 5 such primary reduction objects and 78 microliths taken together with all their possible blanks, with the mean ratio 1 to 15.6. As a result, although the carinated atypical endscraper-cores were not curated pieces, they were indeed simple and easy flaking objects for an efficient and serial microlith-blank reduction.

Second, by studying UP microliths, it is also important to analyze a correlation between unretouched complete microlith blanks and all, including the fragmented items, the retouched microliths. In a case of really tiny microliths, only those UP assemblages can be used for such a study when the sites' artefact-

bearing sediments have been thoroughly dry screened/wet sieved during excavations. One of our team members (Yu. D.) has already realized such studies for Siuren I Aurignacian assemblages excavated in the 1990s in Crimea, Ukraine (*Demidenko 2012b*). Siuren I Proto-Aurignacian and Late/Evolved Aurignacian assemblages demonstrate varying correlation data for microliths and unretouched complete *lamelles.* The Siuren I Units H and G Proto-Aurignacian record with a dominant Dufour sub-type microlith use as lateral component inserts for organic projectile points shows the basic prevalence ratio of microliths over complete blanks, 1 complete blank vs 2.59 retouched microliths. Directly opposite, the Siuren I Unit F Late/Evolved Aurignacian data, being mainly characterized by Roc de Combe sub-type microlith functioning as binary tips of arrow heads, display the presence of much fewer microliths in comparison to complete blanks, 1 complete blank vs 0.18 retouched microliths.

Again, of all the currently known EASMM sites, only Mohelno-Plevovce can be used for such a study after wet sieving its entire artefact bearing sediments, although Rosenburg site sediments were also wet sieved but only partially. The so-far classified lithic artefacts of Mohelno-Plevovce, two stony structures KSA and KSB, are characterized by similar ratios of blanks (mostly complete elongated chips and a few bladelets/microblades for each stony structure) to microliths, 1 vs 1.52 for KSA, 1 vs 1.65 for KSB. These Mohelno-Plevovce EASMM microliths to blanks ratios correlate well enough with the Siuren I Proto-Aurignacian data and might indirectly indicate the already suggested predominant use of the EASMM microliths as lateral inserts of projectile organic points but more work on the subject would be desirable on this point.

CONCLUSION

The above-represented Eastern and Central European LGM EASMM industry type data allow us to propose the following few considerations.

The discussed carinated atypical endscraper-cores and Sagaidak-Muralovka-type microliths on elongated chips are indeed EASMM lithic artefact fossil types. Moreover, the two technologically interconnected artefact types make EASMM a distinct Early Late UP industry type. At the same time, EASMM does not have any Epigravettian lithic artefact features, like systematic blade, blade/bladelet or bladelet core reduction and truly backed microlith manufacture on bladelets. Conformably, EASMM cannot be regarded as a separate facies or industry type within Early Epigravettian *sensu stricto* in both Eastern and Central Europe either. At the same time, neither Early Epigravettian assemblage of Kašov I, upper layer nor Ságvár industry types in Eastern Central European have the serial and fundamental presence of both EASMM carinated atypical endscraper-cores and Sagaidak-Muralovka-type microliths. Of course, there are a few similar items there, like any Palaeolithic assemblage having a few weird lithics, but they are just "random noise specimens" against the truly Epigravettian background in the sites' lithic collections of Kašov I, upper layer and Ságvár industry types.

Here, it is also worth remembering the excavation recovery subject for the EASMM microliths in Eastern Europe. Before one of our team members (Yu. D.) undertook field work with a double dry screening of all artefact bearing sediments at the Anetovka I site in 2005–2006, all excavations at 6 EASMM sites, aside from the just excavated test pits at the Mikhailovskaya Balka site, were conducted last century with no dry screening/wet sieving procedures, although (*sic*) these still thorough excavations did lead to the discovery of serial tiny microliths at all the sites. The best example of such non-screening/sieving but fine excavations is Praslov's work at the Muralovka site in 1964 and 1967 when he and his team still found 158 retouched microliths composing more than 40% of all found tools (*Praslov 1972*; *Praslov/Filippov 1967*). Of course, systematic dry screening/wet sieving would lead to the recovery of more microliths then but still good excavations with just knives have been enabling these tiny tools' good series discovery. Accordingly, the sediment screening/sieving that was not conducted at true Early Epigravettian sites excavated some years ago cannot serve as an indirect argument for claims on the still possible hypothetical presence of Sagaidak-Muralovka-type microliths within the Epigravettian assemblages.

Finally, the above-described endscraper-cores and microliths data can have some implications for our understanding of the Late UP human use of EASMM sites. Some significant variability appears in the use of various raw material types and their artefact categories at different sites and their particular loci. The best example for such a study so far is also the Mohelno-Plevovce site.

On the one hand, when sites are located far away from the outcrops of the basic raw material used, as is the case with the Mohelno-Plevovce KSA assemblage where erratic flints (very distant for the site's raw material) reach up to ca. 70% of all artefacts and all carinated atypical endscraper-cores and microliths are of this raw material, curated erratic flint pieces brought to the site, were cores and pre-cores. Also, some hunting projectile weaponry with microliths inside darts/arrows and a few domestic tools (like transversal burins on lateral retouch rejuvenated in the same manner multiple times; Fig. 3B: 6, 7) were also among the pieces brought. Cores mainly served for flake reduction producing blanks for both carinated atypical endscraper-cores (aiming to manufacture then some more microliths to "repair" and produce some new hunting equipment) and "domestic" tools used during processing of killed ungulates. Some local raw materials also supplied a little for these on-site lithic treatment processes. After a short stay at the KSA loci, humans were moving away taking with them again the most important curated pieces, cores/pre-cores, and in addition hunting projectile weaponry and a few domestic tools. Accordingly, such EASMM lithic exploitation system could be named "circulating/residential mobility system" (e.g. *Marks/Freidel 1977*) that is logical for the LGM sites.

On the other hand, the Mohelno-Plevovce KSB assemblage represents some differences for the lithic exploitation system with the same EASMM artefacts used. There is no more than ca. 10% of all pieces of distant erratic flint, while up to ca. 70% of all artefacts are of local rock crystal. So, it is like a reverse order of the raw materials used in comparison to the KSA assemblage. There microliths are on both erratic flint (mostly brought to the site within darts/arrows) and rock crystal being very mostly produced from bipolar anvil cores. And it looks like KSA was the first EASMM loci at Mohelno-Plevovce and KSB was next in the time loci when EASMM humans already knew about local rock crystal outcrops. There is already one such rock crystal source identified ca. 400 m from the site. So, KSB shows still the same "circulating/residential mobility system" but with much more supply for lithic reduction on the part of local raw materials.

The materials of the two more EASMM stony structures already found at the Mohelno-Plevovce site where one of them was also excavated (KSE) "open more doors" for further research on basic and specific lithic exploitation EASMM industry type data and their humans' life styles in Eastern Central Europe.

Acknowledgements

We are sincerely grateful to Adrián Nemergut for both inviting us to the thought-provoking Nitra SKAM 2019 conference and proposing the preparation of our article for publication there. Also, the last two years of the Mohelno-Plevovce site studies were supported by the Institute of Archaeology (Brno) project RVO 68081758.

Translated by authors

BIBLIOGRAPHY

Almeida 2000 — F. Almeida: *The Terminal Gravettian of Portuguese Estremadura: technological variability of the lithic industries*. Ph.D. Thesis. Dedman College of Southern Methodist University. Dallas 2000. Unpublished.
DOI: https://doi: 10.13140/RG.2.2.23479.32169

Aubry/Detrain/Kervazo 1995 — Th. Aubry/L. Detrain/B. Kervazo: Les niveaux intermediaires entre le Gravettien et le Solutreen de l'Abri Casserole (Les Eyzies de Tayac). Mise en evidence d'un mode de production original de microlithes. Implications. *Bulletin de la Societe prehistorique francaise* 92, 1995, 296–301.

Clark et al. 2009 — P. U. Clark/A. S. Dyke/J. D. Shakum/A. E. Carlson/J. Clark/B. Wohlfarth/J. X. Mitrovica/S. W. Hostetler/A. M. McCabe: The Last Glacial Maximum. *Science* 325, 2009, 710–714.
DOI: https://doi.org/10.1126/science.1172873

Demidenko 1999 — Yu. E. Demidenko: Orin'yak tipa Krems-Dyufur Syureni-I (Krym): ego variabel'nost' i mesto v orin'yake Evropy. In: *Tezisy dokladov konferentsii „Lokal'nye razlichiya v kamennom veke", posvyashchennye 100-letiyu so dnya rozhdeniya S. N. Zamyatnina.* Sankt-Peterburg 1999, 113–115.

Demidenko 2004 — Yu. E. Demidenko: Vostochnaya Evropa v kontekste problematiki orin'yaka Evropy: proshlye podkhody i novye perspektivy. *Arkheologicheskiy Al'manakh* 16, 2004, 161–194.

Demidenko 2007 — Yu. E. Demidenko: Severnoe Prichernomor'e v Evropeyskom kontekste problematiki rannego i srednego periodov verkhnego paleolita. In: A. A. Prigarin (red.):

Chelovek v istorii i kul'ture: Sbornik nauchnykh rabot v chest' 70-letiya V. N. Stanko. Odessa 2007, 52–79.

Demidenko 2008 — Yu. E. Demidenko: The Early and Mid-Upper Palaeolithic of the North Black sea region: an overview. *Quartär* 55, 2008, 99–114.

Demidenko 2012a — Yu. E. Demidenko: The classification and attribute analysis system applied to the Siuren I lithic assemblages. In: Yu. E. Demidenko/M. Otte/P. Noiret (eds.): *Siuren I rock-shelter. From Late Middle Paleolithic and Early Upper Paleolithic to Epi-Paleolithic in Crimea*. ERAUL 129. Liège 2012, 91–107.

Demidenko 2012b — Yu. E. Demidenko: Inter-Unit and Inter-Level comparisons of assemblages from the 1990s Units H, G and F. In: Yu. E. Demidenko/M. Otte/P. Noiret (eds.): *Siuren I rock-shelter. From Late Middle Paleolithic and Early Upper Paleolithic to Epi-Paleolithic in Crimea*. ERAUL 129. Liège 2012, 287–303.

Demidenko/Škrdla/Nejman 2017 — Yu. E. Demidenko/P. Škrdla/L. Nejman: Aurignacian in Moravia. New geochronological, industrial and settlement data. *Památky archeologické* 108, 2017, 5–38.

Demidenko/Škrdla/Rios-Garaizar 2016 — Yu. E. Demidenko/P. Škrdla/J. Rios-Garaizar: A peculiar LGM Late UP industry in Central and Eastern Europe: background & new data. In: *Hugo Obermaier Gesellschaft fur Erforschung des Eiszeitalters und der Steinzeit e.V.: 58th annual meeting in Budapest*. March 29th–April 2nd 2016. Erlangen 2016, 25, 26.

Demidenko/Škrdla/Rios-Garaizar 2017 — Yu. E. Demidenko/P. Škrdla/J. Rios-Garaizar: Epiaurignacian with Sagaidak-Muralovka-type microliths in the south of Eastern Europe and its European perspectives. *Archaeology and ancient history of Ukraine* 24, 2017, 38–52.

Demidenko/Škrdla/Rios-Garaizar 2018 — Yu. E. Demidenko/P. Škrdla/J. Rios-Garaizar: European perspectives of the East European LGM Epiaurignacian with Sagaidak-Muralovka-type microliths. In: P. Valde-Nowak/K. Sobczyk/M. Nowak/J. Zralka (eds.): *Multas per gentes et multa per saecula amici magistro et collegae suo Ioanni Christopho Kozłowski dedicant*. Kraków 2018, 85–92.

Demidenko/Škrdla/Rios-Garaizar 2019 — Yu. E. Demidenko/P. Škrdla/J. Rios-Garaizar: In between Gravettian and Epigravettian in Central and Eastern Europe. A peculiar LGM Early Late Upper Paleolithic industry. *Přehled výzkumů* 60, 2019, 11–42.

Demidenko et al., in press — Yu. E. Demidenko/P. Škrdla/J. Rios-Garaizar/Th. Einwoegerer/A. Maier: The formation of the Badegoulian in the light of possible contributions of Central and Eastern European LGM industries. *Anthropologie*, in press.

Ducasse 2012 — S. Ducasse: What is left of the Badegoulian "interlude"? New data on cultural evolution in Southern France between 23,500 and 20,500 cal BP. In: L. G. Straus/Th. Terberger/D. Leesch (eds.): *The Magdalenian Settlement of Europe*. Quaternary International 272–273. Amsterdam – Boston – London – New York – Oxford – Paris – Philadelphia – San Diego – St. Louis 2012, 150–165.

Filippov 1977 — A. K. Filippov: Trasologicheskiy analiz kamennogo i kostyanogo inventarya iz verkhnepaleoliticheskoy stoyanki Muralovka In: N. D. Praslov (red.): *Problemy paleolita Vostochnoy i Tsentral'noy Evropy.* Leningrad 1977, 167–181.

Gvozdover/Ivanova 1969 — M. D. Gvozdover/I. K. Ivanova: Paleolit In: I. P. Gerasimov (red.): *Less – Periglyatsial – Paleolit na territorii Sredney i Vostochnoy Evropy.* Moskva 1969, 589–615.

Ketraru/Grigor'eva/Kovalenko 2007 — N. A. Ketraru/G. V. Grigor'eva/S. I. Kovalenko: *Verkhnepaleoliticheskaya stoyanka Rashkov 7*. Kishinev 2007.

Krukowski 1948 — S. Krukowski: Paleolit. In: S. Krukowski/J. Kostrzewski/R. Jakimowicz (eds.): *Prehistoria Ziem Polskich*. Encyklopedia Polska 4. Kraków 1948, 65–71, tab. 16; 17.

Lengyel 2018 — G. Lengyel: Lithic analysis of the Middle and Late Upper Palaeolithic in Hungary. *Folia Quaternaria* 86, 2018, 5–157.

Maier/Zimmermann 2017 — A. Maier/A. Zimmermann: Populations headed south? The Gravettian from a palaeodemographic point of view. *Antiquity* 91/357, 2017, 573–588. DOI: https://doi.org/10.15184/aqy.2017.37

Marks/Freidel 1977 — A. E. Marks/D. Freidel: Prehistoric settlement patterns in the Avdat/Aqev area. In: A. E. Marks (ed.): *Prehistory and Paleoenvironments in the Central Negev, Israel II*. Dallas 1977, 131–158.

Mix/Bard/Schneider 2001 — A. C. Mix/E. Bard/R. Schneider: Environmental processes of the ice age: land, oceans, glaciers (EPILOG). *Quaternary Science Reviews* 20, 2001, 627–57. DOI: https://doi.org/10.1016/S0277-3791(00)00145-1

Nuzhnyy 2015 — D. Yu. Nuzhnyy: *Verkhniy paleolit Zakhidnoyi i Pivnichnoyi Ukrayiny (tekhniko-typolohichna variabel'nist' ta periodyzatsiya).* Kiev 2015.

Olenkovskiy 2008 — N. Olenkovskiy: *Epigravett Vostochnoy Evropy (kul'turno-istoricheskiy aspekt).* Kherson 2008.

Ott 1996 — I. Ott: Die Artefakte der jungpaläolithischen Fundstelle von Rosenburg am Kamp, Niederösterreich. *Archaeologia Austriaca* 80, 1996, 43–114.

Praslov 1972 N. D. Praslov: Nekotorye spetsificheskie formy kamennykh orudiy Muralovskoy paleoliticheskoy stoyanki. *Kratkie Soobshcheniya Instituta Arkheologii AN SSSR* 131, 1972, 70–77.

Praslov/Filippov 1967 N. D. Praslov/A. K. Filippov: Pervaya nakhodka paleoliticheskogo iskusstva v yuzhnorusskikh stepyakh. *Kratkie Soobshcheniya Instituta Arkheologii AN SSSR* 111, 1967, 24–30.

Praslov/Ivanova/Malyasova 1980 N. D. Praslov/M. A. Ivanova/E. S. Malyasova: Zolotovka I — poselenie okhotnikov na zubrov na Nizhnem Donu. *Byulleten' Komissii po Izucheniyu Chetvertichnogo Perioda* 50, 1980, 168–175.

Praslov/Shchelinsky 1996 N. D. Praslov/V. Ye. Shchelinsky: *Verkhnepaleoliticheskoye poseleniye Zolotovka I na Nizhnem Donu*. Arkheologicheskiye Izyskaniya 38. Sankt-Peterburg 1996.

Rasmussen et al. 2006 S. O. Rasmussen/K. K. Andersen/A. M. Svensson/J. P. Steffensen/B. M. Vinther/H. B. Clausen/M.-L. Siggard-Andersen/S. J. Johnsen/L. B. Larsen/D. Dahl-Jensen/M. Bigler/R. Röthlisberger/H. Fischer/K. Goto-Azuma/M. E. Hansson/U. Ruth: A new Greenland ice core chronology for the last glacial termination. *Journal of Geophysical Research* 111, 2006, 1–16.
DOI: https://doi.org/10.1029/2005JD006079

Rasmussen et al. 2014 S. O. Rasmussen/M. Bilger/S. P. Blockley/Th. Blunier/S. L. Buchardt/H. B. Clausen/I. Cvijanovic/D. Dahl-Jensen/S. J. Johnsen/H. Fischer/V. Gkinis/M. Guillevic/W. Z. Hoek/J. Lowe/J. B. Pedro/T. Popp/I. K. Seierstad/J. P. Steffensen/A. M. Svensson/P. Vallelonga/B. M. Vinther/M. J. C. Walker/J. J. Wheatley/M. Winstrup: A stratigraphic framework for abrupt climatic changes during the Last Glacial period based on three synchronized Greenland ice-core records: refining and extending the INTIMATE event stratigraphy. *Quaternary Science Reviews* 106, 2014, 14–28.
DOI: http://dx.doi.org/10.1016/j.quascirev.2014.09.007

Renard 2011 C. Renard: Continuity or discontinuity in the late glacial maximum of South-Western Europe: the formation of the Solutrean in France. *World Archaeology* 43, 2011, 726–743.
DOI: https://doi.org/10.1080/00438243.2011.624789

Rios-Garaizar/Škrdla/Demidenko 2019 J. Rios-Garaizar/P. Škrdla/Yu. E. Demidenko: Use-wear analysis of the lithic assemblage from LGM Mohelno-Plevovce site (Southern Moravia, Czech Republic). *Comptes Rendus Palevol* 18, 2019, 353–366.
DOI: https://doi.org/10.1016/j.crpv.2018.11.002

Sachse-Kozlowska 1978 E. Sachse-Kozlowska: *Polish Aurignacian assemblages*. Folia Quaternaria 50. Kraków 1978.

Smol'yaninova 1990 S. P. Smol'yaninova: *Paleolit i mezolit Stepnogo Pobuzh'ya*. Kiev 1990.

Sonneville-Bordes/Perrot 1954 D. de Sonneville-Bordes/J. Perrot: Lexique typologique du Paléolithique supérieur. Outillage lithique. I Grattoirs – II Outils solutréens. *Bulletin de la Société préhistorique française* 51, 1954, 327–335.

Stanko 1982 V. N. Stanko: *Mirnoe. Problema mezolita stepey Severnogo Prichernomor'ya*. Kiev 1982.

Stanko/Grigor'eva 1977 V. N. Stanko/G. V. Grigor'eva: Issledovanie pamyatnikov kamennogo veka na r. Ingule. In: O. G. Shaposhnikova (red.): *Drevnosti Poingul'ya*. Kiev 1977, 37–51.

Stanko/Grigor'eva/Shvaiko 1989 V. N. Stanko/G. V. Grigor'eva/T. N. Shvaiko: *Pozdnepaleoliticheskoe poselenie Anetovka II. Voprosy kul'turno-istoricheskoy periodizatsii pozdnego paleolita Severnogo Prichernomor'ya*. Kiev 1989.

Svoboda/Novák 2004 J. Svoboda/M. Novák: Eastern Central Europe after the Upper Pleniglacial: changing points of observation. *Archäologisches Korrespondenzblatt* 34, 2004, 463–477.

Škrdla et al. 2016 P. Škrdla/L. Nejman/J. Bartík/T. Rychtaříková/P. Nikolajev/J. Eigner/M. Nývltová Fišáková/M. Novák/M. Polanská: Mohelno – a terminal LGM industry with microlithic tools made on carenoidal blanks. *Quaternary International* 406, Part A, 2016, 184–194.
DOI: http://dx.doi.org/10.1016/j.quaint.2015.05.055

Škrdla et al. 2021 P. Škrdla/M. Vlach/L. Nejman/J. Bartík/Yu. E. Demidenko/T. Rychtaříková: Settlement strategies in Eastern Central Europe during the maximum extent of the last glacial ice sheet. *Quaternary International* 581–582, 2021, 164–174.
DOI: https://doi.org/10.1016/j.quaint.2020.09.047.

Verpoorte et al. 2019 A. Verpoorte/R. Cosgrove/R. Wood/F. Petchey/A. Lenoble/J.-P. Chadelle/C. Smith/H. Kamermans/W. Roebroeks: Improving the chronological framework for Laugerie-Haute Ouest (Dordogne, France). *Journal of Archaeological Science* 23, 2019, 574–582.
DOI: https://doi.org/10.1016/j.jasrep.2018.11.017

Zilhão/Aubry/Almeida 1999 J. Zilhão/T. Aubry/F. Almeida: Un modèle technologique pour le passage du Gravettien au Solutréen dans le sud-ouest de l'Europe. In: D. Sacchi (ed.): *Les faciès leptolithiques du nord-ouest méditerranéen*. Milieux naturels et culturels. XXIVe Congrès Préhistorique de France. Carcassonne, 26–30 Septembre 1994. Carcassonne 1999, 165–183.

Epiaurignacká industrie s mikrolity typu Sagaidak-Muralovka v období posledního glaciálního maxima na jihu východní Evropy a ve východní části střední Evropy a její vůdčí artefakty

Yuri E. Demidenko – Petr Škrdla – Joseba Rios-Garaizar – Jaroslav Bartík – Tereza Rychtaříková

Souhrn

Poslední glaciální maximum (LGM), které započalo s Heinrichovým eventem (HE) 2 přibližně 26,5 ka cal BP a skončilo 19 ka cal BP, mělo výrazný dopad nejen na klima a environment, ale i na osídlení Evropy. V té době mizí pan-evropský gravettský technokomplex a je nahrazován novými technokomplexy. V západní Evropě solutréenem a badegoulienem, ve východní části se tyto nové technokomplexy obecně zahrnují pod pojem epigravettien. Jedním z těchto technokomplexů objevujících se na počátku LGM *sensu stricto* je epiaurignacien s mikrolity typu Sagaidak-Muralovka (EASMM). Tento technokomplex a zejména jeho vůdčí typy (*fossile directeur*) jsou detailně analyzovány na následujících řádcích.

Studium LGM industrií je ovlivněno různými pohledy archeologů. Obyčejně je posuzováno v chronologickém smyslu jako postgravettské industrie (*Svoboda/Novák 2004*), případně časný epigravettien (*Lengyel 2018*). My ale v současnosti rozlišujeme nejméně pět typů industrie v období LGM ve východní části střední Evropy – EASMM, dva typy epigravettských industrií (jmenovitě Kašov I, svrchní vrstva, a Ságvár), časný badegoulien s industrií typu Kammern-Grubgraben a blíže nespecifikovanou industrii typu Stránská skála IV.

EASMM industrie byly nejdříve popsány ve východní Evropě (*Demidenko 2007*; *2008*; *Demidenko/Škrdla/Rios-Garaizar 2019*) a zahrnují lokality Raşkov VII a VIII v Podněstří (Moldávie); Sagaidak I a Anetovka I v západní části severního Přičernomoří (Ukrajina); Muralovka, Zolotovka I a Mikhailovskaya Balka ve východní části Azovského moře a na spodním toku Donu (Rusko; obr. 1). V poslední dekádě došlo k objevu téměř identických industrií ve východní části střední Evropy, konkrétně na lokalitě Mohelno-Plevovce (*Škrdla et al. 2016*) a k technokomplexu byla taktéž přiřazena (*Demidenko/Škrdla/Rios-Garaizar 2019*) lokalita Rosenburg (*Ott 1996*), již v roce 1988 zkoumaná G. Trnkou.

Vůdčí typy EASMM industrií představují atypická karenoidální škrabadla-jádra a mikrolity typu Sagaidak-Muralovka.

Atypická karenoidální škrabadla-jádra

Tento typ poprvé rozpoznal *N. D. Praslov* (*1972*) na základě analýzy materiálu z lokality Muralovka. Popsal vysoká škrabadla, která sloužila jako jádra na miniaturní retušované čepelky a hrůtky. Bohužel Praslov nezavedl jednoznačný termín pro tento typ artefaktu. *Yu. E. Demidenko* (*2004*; *2008*) proto navrhl termín atypické karenoidální škrabadlo, které později, s ohledem na technologické aspekty, modifikoval na atypické karenoidální škrabadlo-jádro (*Demidenko/Škrdla/Rios-Garaizar 2019*). Materiál z Mohelna-Plevovců, kde byl na rozdíl od předchozích výzkumů podobných lokalit veškerý sediment plaven, se podařilo přiložit retušované mikrolity typu Sagaidak-Muralovka I i neretušované karenoidální úštěpy na tato škrabadla. Hypotéza, že tato škrabadla sloužila nejen jako škrabadla (řada z nich sloužila po vyčerpání jako skutečná škrabadla – stopy po opracování suché kůže a tvrdého organického materiálu, *Rios-Garaizar/Škrdla/Demidenko 2019*), ale i jako jádra na polotovary mikrolitů, byla potvrzena.

Mikrolity typu Sagaidak-Muralovka

Těchto mikrolitů si všímal již *N. D. Praslov* (*1972*), který rozlišoval mikrohroty a retušované čepelky, později *S. P. Smol'yaninova* (*1990*) zavedla termín mikrohroty typu Sagaidak-Muralovka. Později navrhl *Yu. E. Demidenko* (*2007*) zahrnout všechny tyto mikrolity do společné kategorie mikrolity typu Sagaidak-Muralovka s jemnou dorsální okrajovou abrazivní retuší, laterálně nebo bilaterálně, vyrobených na úštěpcích a zkrácených (metricky) čepelkách. Ačkoli již *N. D. Praslov* (*1972*) správně rozpoznal, že tyto mikrolity byly vyráběny na úštěpcích z vysokých škrabadel, byl to až materiál z Mohelna-Plevovců, který umožnil bližší analýzu polotovarů těchto mikrolitů. Metrická data pro celé mikrolity ze struktury KSA jsou následující: průměrná délka 0,85 cm, průměrná šířka 0,40 cm, průměrná tloušťka 0,1 cm. Technologicky jde o prodloužené úštěpky, které většinou pochází z atypických karenoidálních škrabadel-jader, ale využity byly i čepelky (často již ve zlomeném stavu) těžené s čepelkových mikrojader. V budoucnu bude zajímavé sledovat vazbu zmíněných polotovarů na kvalitu použité suroviny. Analýza tvaru mikrolitů ukázala, že charakteristických mikrohrotů je v souboru poměrně málo a mnohé jsou ne úplně charakteristické, pouze částečně

konvergentně retušované. Převládají tedy nehrotité exempláře. Traseologická analýza ukázala (*Rios-Garaizar/Škrdla/Demidenko 2019*), že některé fasety představují odštípnutí po impaktu – buď axiálního, nebo šikmo na hranu anebo jejich kombinaci. Tyto mikrolity tak lze interpretovat jako laterálně vsazené součásti komplexních hrotů z organického materiálu.

Analýza jednotlivých kamenných struktur naznačila jisté rozdíly mezi soubory ze zkoumaných kamenných struktur (KSA a KSB) a zahrnutí dalších, dosud detailně nezpracovaných souborů (KSE a KSD) jistě otevře více otázek pro studium EASMM industrií ve východní části střední Evropy.

Obr. 1. Mapa střední a východní Evropy s lokalitami EASMM. Vytvořeno v Google Earth, zdroj Landsat, uloženo 12/14/2015. Pohled z výšky 2257,98 km.

Obr. 2. Artefakty EASMM ve východní Evropě. A – 1–10 – karenoidální škrabadla-jádra; 11, 12 – mikrojádra na produkci prodloužených úštěpů/mikročepelí; B – 1–38 – mikrolity typu Sagaidak-Muralovka. A – 1–3; B – 1–14 – Sagaidak I (modifikováno podle *Smol'yaninova 1990*); A – 4–7; B – 15–38 – Muralovka (modifikováno podle *Praslov 1972*); A – 8–12 – Anetovka I (modifikováno podle *Demidenko/Škrdla/Rios-Garaizar 2019*).

Obr. 3. Artefakty EASMM ve střední Evropě. A – 1–3 – mikrojádra na produkci prodloužených úštěpů/mikročepelí; 4–6 – karenoidální škrabadla-jádra; 7–30 – mikrolity typu Sagaidak-Muralovka; B – 1–5 – karenoidální škrabadla-jádra; 6, 7 – sekundární rydlový odpad přiložený na příčné rydlo na laterálně retušované hraně. A – Rosenburg (modifikováno podle *Ott 1996*); B – Mohelno-Plevovce KSA (modifikováno podle *Demidenko/Škrdla/Rios-Garaizar 2019*).

Obr. 4. Artefakty EASMM ve střední Evropě. Mohelno-Plevovce KSA. 1–36 – mikrolity typu Sagaidak-Muralovka (modifikováno podle *Demidenko/Škrdla/Rios-Garaizar 2019*).

Obr. 5. Artefakty EASMM ve střední Evropě. Mohelno-Plevovce KSA. Osm mikrolitů typu Sagaidak-Muralovka přiložených k atypickému karenoidálnímu škrabadlu-jádru (modifikováno podle *Demidenko/Škrdla/Rios-Garaizar 2017*).

Obr. 6. Artefakty EASMM ve střední Evropě. Mohelno-Plevovce KSA. a – atypická karenoidální škrabadla-jádra s pracovními stopami po opracování suché kůže, b – tvrdý organický materiál.

Obr. 7. Artefakty EASMM ve střední Evropě. Mohelno-Plevovce KSA. Mikrolity typu Sagaidak-Muralovka s diagnostickými lomy následkem impaktu (DIF; modifikováno podle *Rios-Garaizar/Škrdla/Demidenko 2019*).

doc. Yuri E. Demidenko, Ph.D.
Ferenc Rakoczi II
Transcarpathian Hungarian Institute
Kossuth square 6
UA – 902 00 Berehove

and

Institute of Archaeology NASU
Geroyiv Stalingrada av. 12
UA – 042 10 Kiev
yu.e.demidenko@gmail.com

Ing. Petr Škrdla, Ph.D., DSc.
The Czech Academy of Sciences
Institute of Archaeology in Brno
Čechyňska 363/19
CZ – 602 00 Brno
ps8a@seznam.cz

Joseba Rios-Garaizar, Ph.D.
Bizkaiko Arkeologi Museoa
Calzadas de Mallona 10
ES – 480 06 Bilbao
jorios76@gmail.com

Mgr. Jaroslav Bartík, Ph.D.
The Czech Academy of Sciences
Institute of Archaeology in Brno
Čechyňska 363/19
CZ – 602 00 Brno
bartik@arub.cz

Mgr. Tereza Rychtaříková
The Czech Academy of Sciences
Institute of Archaeology in Brno
Čechyňska 363/19
CZ – 602 00 Brno
nienna11@gmail.com

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 111–128

EST-IL POSSIBLE D'IDENTIFIER DES GROUPES PAVLOVIENS SUR LE TERRITOIRE D'ACTUELLE SLOVAQUIE ?

Michaela Polanská

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.8

Keywords: Gravettian, Pavlovian, Moravia, Slovakia, *fossiles directeurs*, human groups, variability of industries

Abstract: **Did the Pavlovian groups occupy the current territory of Slovakia?** The mountainous territory of central Europe was occupied during the Early and Middle Gravettian by various human groups. Among these groups, the Pavlovian has a special place. It is world-famous for its rich material culture and symbolic behaviors. Concentrations of its occupations, called microregions, are identified along the natural corridor that crosses Moravia and Czech Silesia (Moravian Corridor). Within this cultural entity, two distinct groups have recently been identified from the lithic industries: a microsaws group and a geometric microliths group. Each of them is characterized by a different behavior towards mineral resources, its stone *fossiles directeurs*, as well as peculiarities in production systems.
This article aims to assess the extension of these two Pavlovian groups to the territory of present-day Slovakia and to identify real series/objects that would validate its analogies. This involves discussing the three sites containing lithic material (the Dzeravá skala Cave, the Nemšová I open-air site, and the Slaninová Cave), which were compared in the past to the Pavlovian or the Early and Middle Gravettian. The first observations suggest that none of these collections delivered material with sufficient quality and quantity to support these analogies.

INTRODUCTION

Le Gravettien est une culture du Paléolithique supérieur dont les idées communes ont traversé l'ensemble de l'ancien continent. En dehors des caractéristiques fédératrices, le Gravettien se compose de plusieurs groupes régionaux, chacun ayant des spécificités dans leur culture matérielle ou leurs manifestations symboliques (par exemple *Garrod 1938*; *Goutas et al. 2011*; *Hromada 1998*; *Klíma 1961*; *Klíma ed. 1976*; *Otte ed. 2013*; *Touzé et al., sous presse*). Le territoire montagneux de l'Europe centrale où l'effet de l'extension des glaciers (alpins et continentaux) a eu pour conséquence de créer des zones refuges isolées et cloisonnées, est occupé par divers groupes humains (Fig. 1). Ces populations s'adaptaient aux nouveaux espaces et/ou aux changements climatiques, ce qui s'est traduit par le choix de l'implantation des sites, mais aussi dans des stratégies et des logiques territoriales pour l'acquisition de ressources minérales et animales (*Oliva 2002*; *2007*; *Svoboda 1995*). Parmi ces groupes, le Pavlovien tient une place particulière (par exemple *Delporte 1959*; *Klíma 1959*). Il est mondialement connu pour sa culture matérielle riche (objets en terre cuite, riches industries et art mobilier en matières dures animales), ses aspects symboliques (sépultures, art mobilier) ou encore ses concentrations de sites à occupations répétées (par exemple *Goutas 2015*; *Hromadová 2016*; *Klíma 1961*; *Lázničková-Galetová 2015*; *2019*; *2021*; *Oliva 2007*; *Polanská 2020*; *Rašková-Zelinková 2011*; *Svoboda 1995*; *1996*; *2004*; *Teschler-Nicola et al. 2020*; *Valoch 1986*; *Verpoorte 2001*) ; quant à l'industrie lithique, elle a été essentiellement décrite par son outillage caractéristique (fossiles directeurs) et ses importations lointaines de matériaux provenant des moraines ou des sédiments fluvio-glaciaires de Silésie et de Petite Pologne (par exemple *Klíma 1997*; *Novák 2016*; *Oliva 2007*; *Polanská 2020*; *Svoboda 1996*; *Škrdla 1997*; *Škrdla ed. 2005*; *Verpoorte 1997*; *2000*).

Depuis une vingtaine d'années, les études sur le Gravettien d'Europe centrale ont repris un nouveau souffle grâce au réexamen d'anciennes collections, à des révisions critiques ou à la découverte de nouveaux gisements (par exemple *Lengyel/Mester/Szolyák 2016*; *Nigst 2006*; *Polanská/Hromadová 2015*; *Svoboda ed. 2011*;

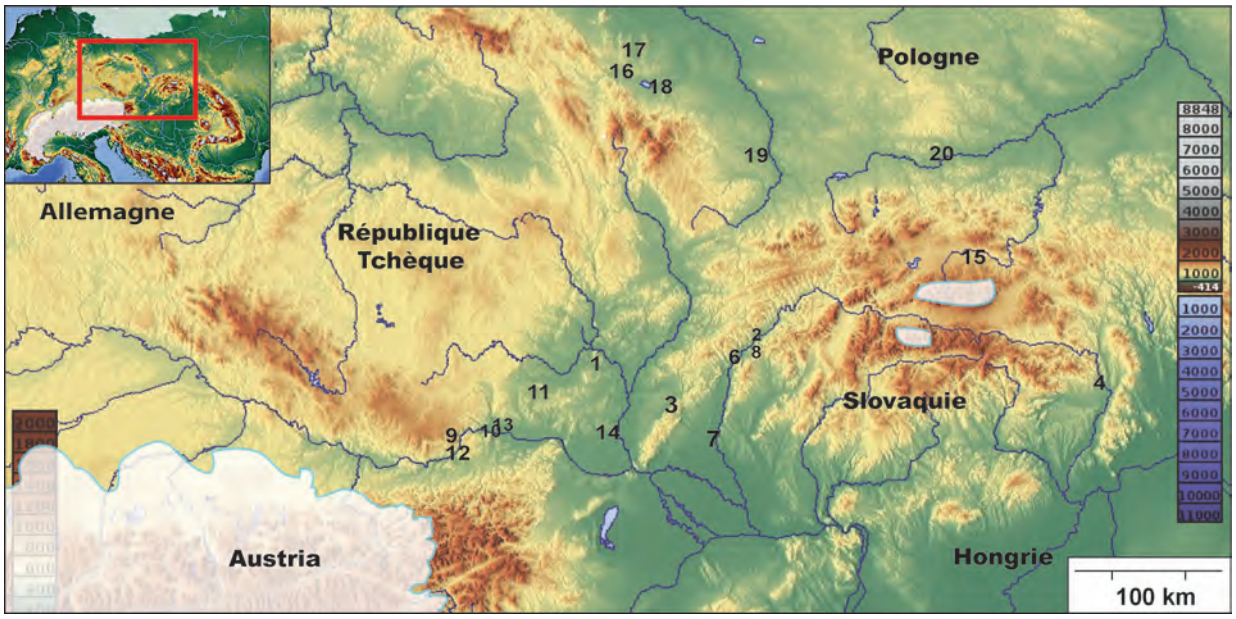


Fig. 1. Principaux sites gravettiens d'Europe centrale. 1 – microrégion de Dolní Věstonice – Pavlov – Milovice; 2 – Nemšová; 3 – grotte Dzeravá skala; 4 – grotte Slaninová; 5 – Zamarovce; 6 – Nové Mesto nad Váhom-Mnešice; 7 – Vlčkovce-Vinohradky; 8 – grotte Čertova pec; 9 – microrégion de Willendorf; 10 – microrégion de Krems; 11 – Alberndorf I; 12 – microrégion d'Aggsbach; 13 – Langenlois A et B; 14 – Grub/Kranawetberg; 15 – grotte Obłazowa; 16 – Henryków 15; 17 – Wójcice; 18 – Cyprzanów; 19 – grotte Borsuka; 20 – Kraków Spadzista (DAO M. Polanská; www.maps-for-free.com).

2016; *Svoboda et al. 2013*; *Šída 2016*; *Vlačiky et al. 2013*; *Wilczyński 2016*; *Wilczyński et al. 2020*). Les résultats de ces études montrent d'ores et déjà la variabilité des industries lithiques. Cela appuie l'hypothèse de la fréquentation du territoire de l'Europe centrale par plusieurs groupes humains distincts pendant le Gravettien, et parmi eux le Pavlovien.

La définition et l'extension chrono-géographique du Pavlovien ne faisait pas pendant longtemps consensus parmi les scientifiques. Pour certains, il couvrait la période plus ancienne de Gravettien d'Europe centrale, pour d'autres, il s'agissait d'un groupe indépendant (*Hromada 1998*; *Klíma 1961*; *Noiret 2013*; *Oliva 2007*; *Otte 1981*; *Svoboda 2004*; *Valoch 1986*). Mais grâce à l'étude de *L. Moreau* (*2012*) du lithique de la couche 5 de Willendorf II en Autriche qu'il a rapproché de celui du Jura Souabe, certaines collections d'Europe centrale ont été classées dans le Gravettien ancien (30 000 à 28 500 BP non cal., environ 34 500 à 33 000 BP cal.)[1] et ont été par défaut différenciées de Pavlovien. En effet, la majorité des occupations en Moravie, dont les dates sont associées au matériel lithique permettant une étude, sont postérieures à l'horizon humifère nommé l'Interstade de Dolní Věstonice (daté de 27 900 ±550 (GrN-15280; 32 167 ±700 BP cal.; *Svobodová 1991*) et antérieures à l'Interstade de Pavlov, daté approximativement de 25 500 BP non cal. (30/29 800 BP cal.; *Haesaerts 1990*). En conséquence, la majorité de ces sites est par défaut attribué au Gravettien moyen et en l'occurrence au Pavlovien, daté entre 28 500/28 000 à 26/25 500 BP non cal. (33 000 à 30/29 800 BP cal.; par exemple *Noiret 2013*; *Polanská 2011*; *2013*; *Simon 2010*; *Thomas/Ziehaus 2014*). En devançant notre propos, la découverte de nouveaux gisements moraves ainsi que l'approche technologique du matériel lithique nous ont permis de classer ces industries « pavloviennes » en deux groupes « industriels » (*Polanská 2020*). Chacun d'eux correspond à un groupe humain indépendant : *Groupe à microscies* et *Groupe à microlithes géométriques*.

Une fois les principales caractéristiques des deux groupes pavloviens *stricto sensu* reconnues, il est justifié de se poser la question de leur extension géographique vers les territoires voisins et de s'interroger notamment sur leur identification en Slovaquie. L'objectif principal de notre article est donc d'évaluer l'extension de ces deux groupes pavloviens *stricto sensu*[2] vers le territoire slovaque en s'appuyant sur l'identification de véritables objets analogues.

[1] Les datations des phases du Gravettien ont été calibrées par OxCal 4.4, courbe IntCal 20 (*Reimer et al. 2020*).

[2] Sous le terme groupes pavloviens *stricto sensu* nous sous-entendons Groupe à microscies et Groupe à microlithes géométriques.

REGARD SUR LE PAVLOVIEN MORAVE A TRAVERS SES INDUSTRIES LITHIQUES. L'IDENTIFICATION DES INDUSTRIES LITHIQUES DES DEUX GROUPES PAVLOVIENS *STRICTO SENSU*

Durant le XXe siècle, divers sites d'Europe centrale (et par défaut de Slovaquie) ont été attribués au Pavlovien sur la base de leurs datations ou sur certaines caractéristiques de l'art mobilier.[3] Il n'est pas seulement mondialement connu pour sa culture matérielle et ses comportements de subsistance et symboliques plutôt rares en Préhistoire, mais aussi pour son lithique abondant.

Depuis une décennie, nous avons entrepris d'approfondir les connaissances sur les industries lithiques du Pavlovien[4] (*Polanská 2011*; *2013*; *2016*; *2018*; *2020*).

Cette démarche a été mise en place, les attributions au Pavlovien se basant essentiellement sur la nature ou la présence/absence des matériaux organiques, il était difficile de faire des analogies en absence de ces matériaux. En conséquence, diverses séries d'Europe centrale ont été rapprochées à tort au Pavlovien morave.

Notre démarche étant fondée sur les recherches des analogies en Slovaquie qui découlent de la caractérisation des deux groupes lithiques pavloviens *stricto sensu,* nous exposerons d'abord ici les principaux traits de chacun des groupes avant de présenter les collections slovaques attribués préalablement au Pavlovien.

Groupe à microscies

Les occupations du Groupe à microscies sont concentrées en microrégions situées approximativement tous les 50 km dans le corridor morave et ses ouvertures (microrégion de Krems, aire de Dolní Věstonice – Pavlov – Milovice, microrégion d'Uherské Hradiště, microrégion de Napajedlá et microrégion de Předmostí; *Polanská 2011*; *2020*). Elles sont datées de 27 000 à 26 000 BP non cal. (environ 32 000 à 30 000 BP cal.).

L'industrie lithique est connue par un comportement peu économe vis-à-vis des matières premières (*Polanská 2020*). Celles-ci sont importées sous forme de blocs ou de lames depuis des gisements secondaires des moraines (Silésie tchèque, Petite Pologne voire trouvées dans les sédiments *fluvio-glaciaires*) ou des gisements primaires de la région du Jura Cracovien. La conception des systèmes techniques de la production laminaire et lamellaire est très proche (débitage unipolaire à cintre étroit). Les types d'outils caractéristiques sont des becs (Fig. 2: 9) et des couteaux à retouches directes envahissantes (préférentiellement sur lame; Fig. 2: 10). Les fossiles directeurs microlithiques sont des microgravettes sous-type Dolní Věstonice (Fig. 2: 6–8), des microscies pavloviennes (Fig. 2: 1–3) et des éléments bitronqués sous-type Dolní Věstonice (Fig. 2: 4, 5).

Ces outils ainsi que les systèmes de production des supports sont totalement différents du Groupe à microlithes géométriques. La démarche accomplie pour ce groupe (tri des séries, caractérisation du groupe) sur l'industrie lithique n'est pas encore réalisée sur les objets en matières dures animales. En conséquence, il est impossible de donner plus de détails sur les objets faits dans ces matériaux organiques.

Groupe à microlithes géométriques

Les occupations du Groupe à microlithes géométriques sont connues seulement sur deux sites homogènes (Předmostí III; *Polanská et al. 2014*; Předmostí Ib; *Polanská 2013*; *2020*) et trois palimpsestes (Předmostí Ia, Pavlov I; *Polanská 2020*). Le cadre chronologique de ce groupe est le même que le précédent. Les occupations se situent entre 27 000 à 26 000 BP non cal. (environ 32 000 à 30 000 BP cal.).

Le comportement est peu économe vis-à-vis des matériaux importés sous forme de blocs (radiolarite et silicites erratiques), en plus de l'adaptation à des matières locales (*Polanská 2013*; *2020*). À la différence du premier groupe, l'utilisation de matières de mauvaise ou médiocre qualité est à noter (nombreuses

[3] A titre d'exemple Wójcice, Grotte Obłazowa, Cyprzanów, Domaszkowice, Nemšová, Grotte Dzeravá skala Slaninová ou Willendorf II (*Cheben/Kaminská 2002*; *Kaminská/Kozłowski/Svoboda 2004*; *Kaminská/Kozłowski/Svoboda eds. 2005*; *Kozłowski ed. 1998*; *Otte 1981*; *Valde-Nowak/Nadachowski/Madeyska 2003*; *Wilczyński 2015*).

[4] De ces industries lithiques étant donné l'hétérogénéité du matériel des collections attribuées à cette entité culturelle.

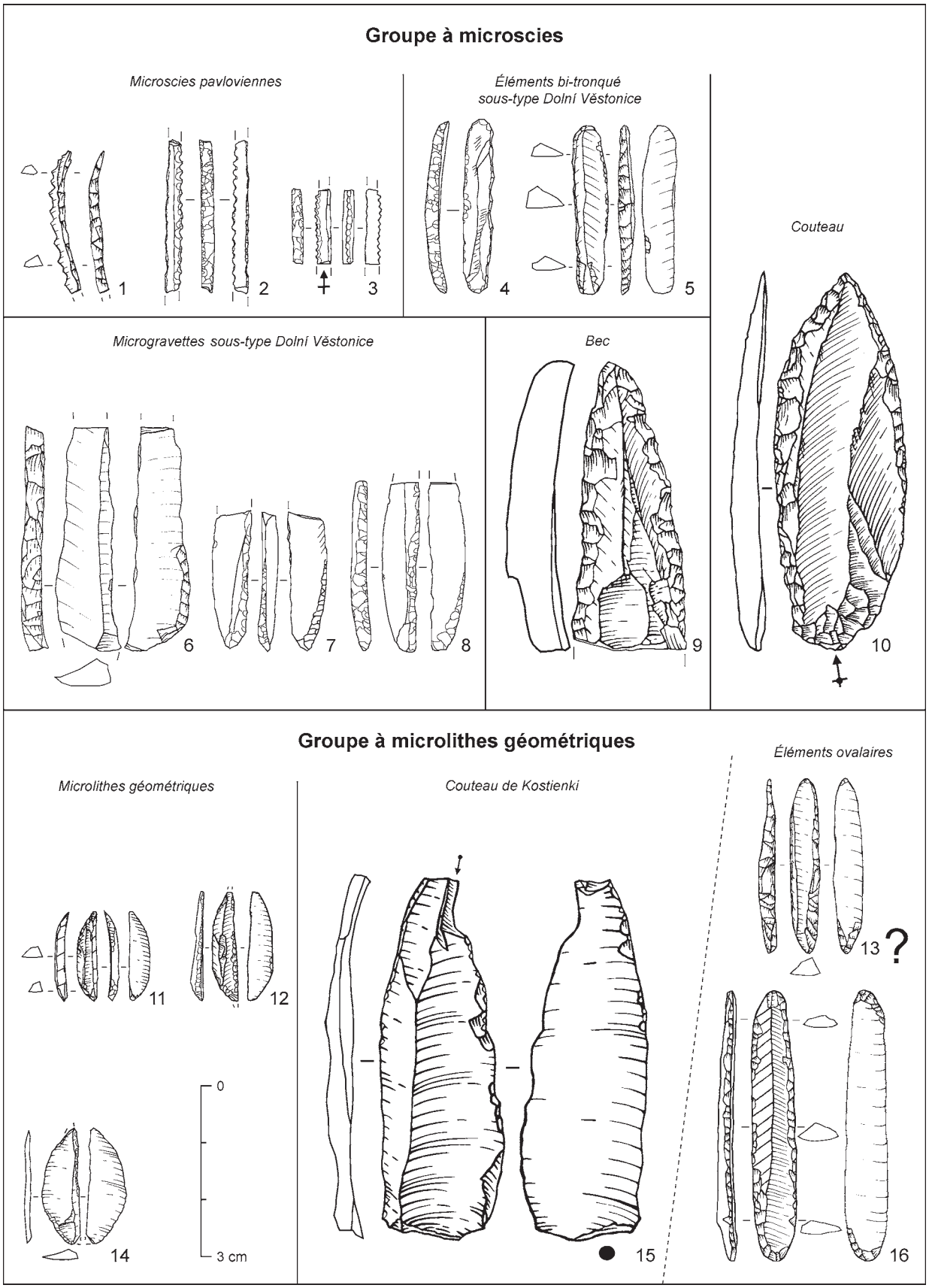


Fig. 2. Fossiles directeurs lithiques des groupes pavloviens *stricto sensu* de Moravie (dessins M. Polanská).

fissures, incrustations, inhomogénéités ; par exemple chert du type Krumlovský les, galets de rivières en radiolarite). La production lamino-lamellaire est unipolaire à cintre étroit, toutefois elle reste à caractériser plus en détail. Le schéma de la production de petits supports pour confectionner des microlithes géométriques est original, puisque l'objectif est de produire des supports courts de forme asymétrique qui demandent le moins d'aménagement possible pour parvenir à la forme souhaitée. Les supports sont débités à partir des tables asymétriques sur les nucléus bien identifiables (sur support, sur bloc, ou réaménagement des tables laminaires ou lamellaires).

Les outils caractéristiques sont les couteaux de Kostienki (Fig. 2: 15), les microlithes géométriques (Fig. 2: 11, 12, 14) et les pointes à dos de forme inconnue[5] (éléments ovalaires ?; Fig. 2: 13, 16) qui reste à caractériser. L'industrie en matières dures animales et l'art mobilier restent à décrire.

À LA RECHERCHE DES OCCUPATIONS PAVLOVIENNES SUR LE TERRITOIRE D'ACTUELLE SLOVAQUIE

Une fois les principaux traits des deux groupes pavloviens *stricto sensu* ont été déterminés, il est justifié de poser la question de leur extension géographique vers les territoires voisins et de s'interroger sur la possibilité de les identifier en Slovaquie. Vu que le Pavlovien constituait, jusqu'aux travaux de *L. Moreau* (*2012*), la phase la plus ancienne du Gravettien d'Europe centrale par opposition au Gravettien plus récent (*Svoboda 1996*), il était nécessaire d'établir un inventaire de tous les sites datés de 30 000 à 25 500 BP non cal. (environ 34 000 à 30/29 800 BP cal.). Pour cela, nous avons entrepris de dresser un inventaire des sites du Gravettien ancien et moyen de territoire d'Europe centrale (*Polanská 2018*) et notamment de Slovaquie sur lequel se focalise le présent article. Cette démarche consiste à réexaminer des données bibliographiques et à un rapide examen des séries slovaques disponibles, en évaluant (Tabl. 1; 2) :

- les données stratigraphiques et les datations permettant de les situer chronologiquement ;
- les données typo-technologiques caractérisant les industries lithiques ;
- et enfin les informations relatives aux autres données de la culture matérielle (industries et artefacts en matières dures animales, autres aspects de la culture matérielle).

Tabl. 1. Classement des différents ensembles lithiques de Slovaquie anciennement comparés au Pavlovien morave. Evaluation, en présence/absence des caractéristiques des sites et de leur culture matérielle.

Sites	Locus/ Niveau	Notre attribution culturelle	Evaluation			
			Industrie lithique	Industrie en matières dures animales	Autres aspects de la culture matérielle	Datations
Grotte Dzeravá skala	Couche 3	Lien avec le Groupe. à microlithes géométriques ?	echantillon restreint/ présence d'autres armatures	oui	non	oui
Grotte Slaninová	–	Paléolithique supérieur ?	non	oui	non	oui
Nemšová I	–	Gravettien ?	non	non	non	oui

Des occupations rapprochées du Gravettien ancien et moyen de Moravie (30 000 à 25 500 BP non cal. ; environ 34 000 à 29 800 BP cal.) ont été identifiées sur le territoire slovaque sur sept sites situés dans des grottes, dans des briqueteries et exceptionnellement en plein air : Nemšová I, Zamarovce, Nové Mesto nad Váhom-Mnešice, Vlčkovce-Vinohradky, Grotte Slaninová, Grotte Dzeravá Skala, Grotte Čertova pec (Tabl. 1; 2; pour la synthèse voir *Kaminská zost. 2014*). Néanmoins, le premier examen bibliographique nous a fait mettre à part de notre évaluation des gisements de Zamarovce, de Nové Mesto nad Váhom-Mnešice, de Vlčkovce-Vinohradky et de Grotte Čertova pec. Il s'agit des sites dont le matériel lithique (mis au jour anciennement, souvent en position secondaire, sans datation, sans fossiles directeurs, avec des

[5] Les séries homogènes ont livré uniquement des fragments à dos à base arrondie ou ogivale, dont la base est aménagée par une retouche inverse rasante (*Polanská 2013*). Il est possible qu'il s'agisse des éléments ovalaires identifiés dans les palimpsestes en Moravie (*Polanská 2020*).

Tabl. 2. Datations ^{14}C non cal BP et cal BP des différents ensembles lithiques de Slovaquie anciennement comparés au Pavlovien morave ou au Gravettien ancien (calibrées par OxCal 4.4, courbe IntCal 20; *Reimer et al. 2020*).

Sites	Couches	Attribution culturelle	N° d'échantillon	Datation C^{14} non calib. (BP)	Déviation	Datation C^{14} calib. (BP)	Probabilité %	Nature d'échantillon	Bibliographie
Grotte Dzeravá skala	couche 3	gravettien	GrA-22756	25 050	+540/-510	30 416–27 996	95,4	non precisé	*Kaminská et al. 2005*
	couche 4	gravettien	GrA-22758	24 800	±130	29 222–28465	95,4	non precisé	*Kaminská et al. 2005*
	couche 5	paléolithique supérieur	OxA-13861	24 760	±130	29 201–28 749	95,4	non precisé	*Kaminská et al. 2005*
			Wk-14866	33 608	±569	39 890–36 921	95,4	os d'animaux	*Kaminská et al. 2005*
	couche 5a	–	OxA-13860	35 100	±400	41 040–39 493	95,4	os d'animaux	*Kaminská et al. 2005*
	couche 4b	gravettien ancien ?	GrA-22759	31 770	±190	36 513–35 592	95,4	non precisé	*Kaminská et al. 2005*
	couche 9b	aurignacien ?	Beta-173341	34 100	±320	40 006–37 977	95,4	non precisé	*Kaminská et al. 2005*
	couche 11/ partie supérieure PP2	paléolithique supérieur ancien	Beta-173342	36 920	±470	42 247–41 132	95,4	non precisé	*Kaminská et al. 2005*
	couche 11/ partie centrale	–	OxA-13973	44 600	–	47 616–46 192	95,4	non precisé	*Kaminská et al. 2005*
	couche 11/ partie inférieure PP1	–	OxA-13859	47 000	±2 300	–	–	non precisé	*Kaminská et al. 2005*
Nemšová I	–	phase plus ancienne du Gravettien	GrN-2470	28 570	±1 345	36 275–30 345	95,4	charbon de pin	*Bárta 1961*
Grotte Slaninová	–	phase plus ancienne du Gravettien	GrN-14832	27 950	±270	32 921–31301	95,4	os d'ours	*Kaminská 1993*

descriptions stratigraphiques moins précises) a été essentiellement rapproché du Pavlovien grâce a sa position stratigraphique.

Notre démarche de travail étant basée sur la recherche des traits des systèmes techniques et des fossiles directeurs identifiés dans des groupes pavloviens *stricto sensu*, ces ensembles ne fournissent ni assez de données chrono-stratigraphiques, ni de matériel lithique de qualité pour effectuer la comparaison. Pour pouvoir faire leur évaluation, il faudrait si possible effectuer des révisions chrono-stratigraphiques, en récupérant plus de matériel. En revanche, seules des occupations de la Grotte Dzeravá skala, de la Grotte Slaninová et du site de plein air Nemšová I sont toutes associées à des datations ^{14}C, avec des couches culturelles contenant du matériel qui permet une discussion plus ou moins approfondie. Nous avons procedé dans leur cas soit par une évaluation bibliographique de materiel lithique soit par une évaluation directe de matériel (recherche des pièces diagnostiques ou des élements de systèmes de production).

La grotte Dzeravá skala (Plavecký Mikuláš, Slovaquie occidentale)

La grotte Dzeravá skala se situe dans une vallée karstique sur le versant ouest des Petites Carpates. Le lieu a été découvert au début du XXième siècle à 450 m d'altitude et fait 18 m de largeur sur 22 m de longueur. Il a été fouillé de 1912 à 1913 par J. Hillebrand, en 1923 par F. Horáček, de 1946 à 1949 par J. Dosedla et en 1950 par F. Prošek (pour la synthèse voir *Kaminská/Kozłowski/Svoboda 2004*). De nouvelles fouilles ont été conduites en 2002–2003 sous la direction de Ľ. Kaminská avec la collaboration de J. K. Kozłowski et J. Svoboda (*Kaminská/Kozłowski/Svoboda 2004*; *Kaminská/Kozłowski/Svoboda eds. 2005*). Il s'agit d'un site à occupations multiples (Industries de transition de Paléolithique moyen et supérieur, Paléolithique supérieur, Néolithique, Énéolithique) connues grâce à différentes découvertes archéologiques, anthropologiques et paléontologiques (*Kaminská zost. 2014*; *Kaminská/Kozłowski/Svoboda 2004*; *Kaminská/Kozłowski/Svoboda eds. 2005*). À notre connaissance, en dehors des gisements moraves de Pavlov I, Milovice IV et Předmostí Ia, Ib et III, c'est le seul site qui ait livré un microlithe ressemblant à un microlithe géométrique pavlovien (Fig. 3: 1). Il s'avère donc nécessaire d'étudier ces analogies de plus près.

Vu notre problématique, nous nous sommes concentrés sur la séquence stratigraphique du

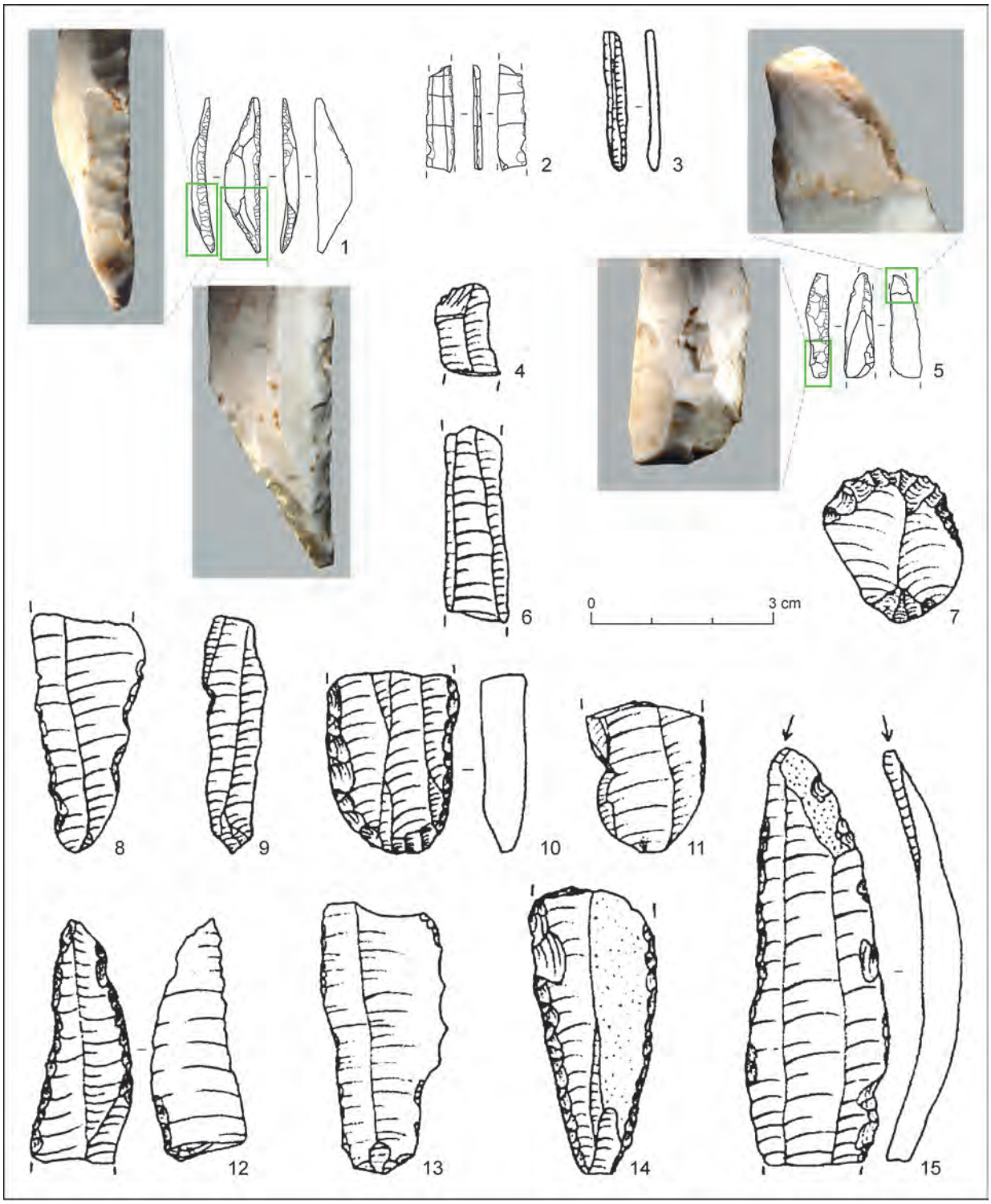


Fig. 3. Artefacts lithiques des fouilles de F. Prošek à Dzeravá skala (1, 2, 5 – dessins et photos M. Polanská; 3, 4, 6–15 – d'après *Kaminská/Kozłowski/Svoboda eds. 2005*, fig. 21, modifié).

Paléolithique supérieur. Les fouilles des années 2000 se sont poursuivies au milieu de la grotte à proximité de la tranchée de 7 m de longueur qui atteignait la roche mère. La corrélation des données de ces deux campagnes de fouilles a permis de mettre en évidence douze niveaux (*Kaminská/Kozłowski/Svoboda 2004*; *Kaminská/Kozłowski/Svoboda eds. 2005*), dont les couches « gravettiennes et aurignaciennes » c'est-à-dire les couches 3 à 5 et la couche 9 (Tabl. 2) :

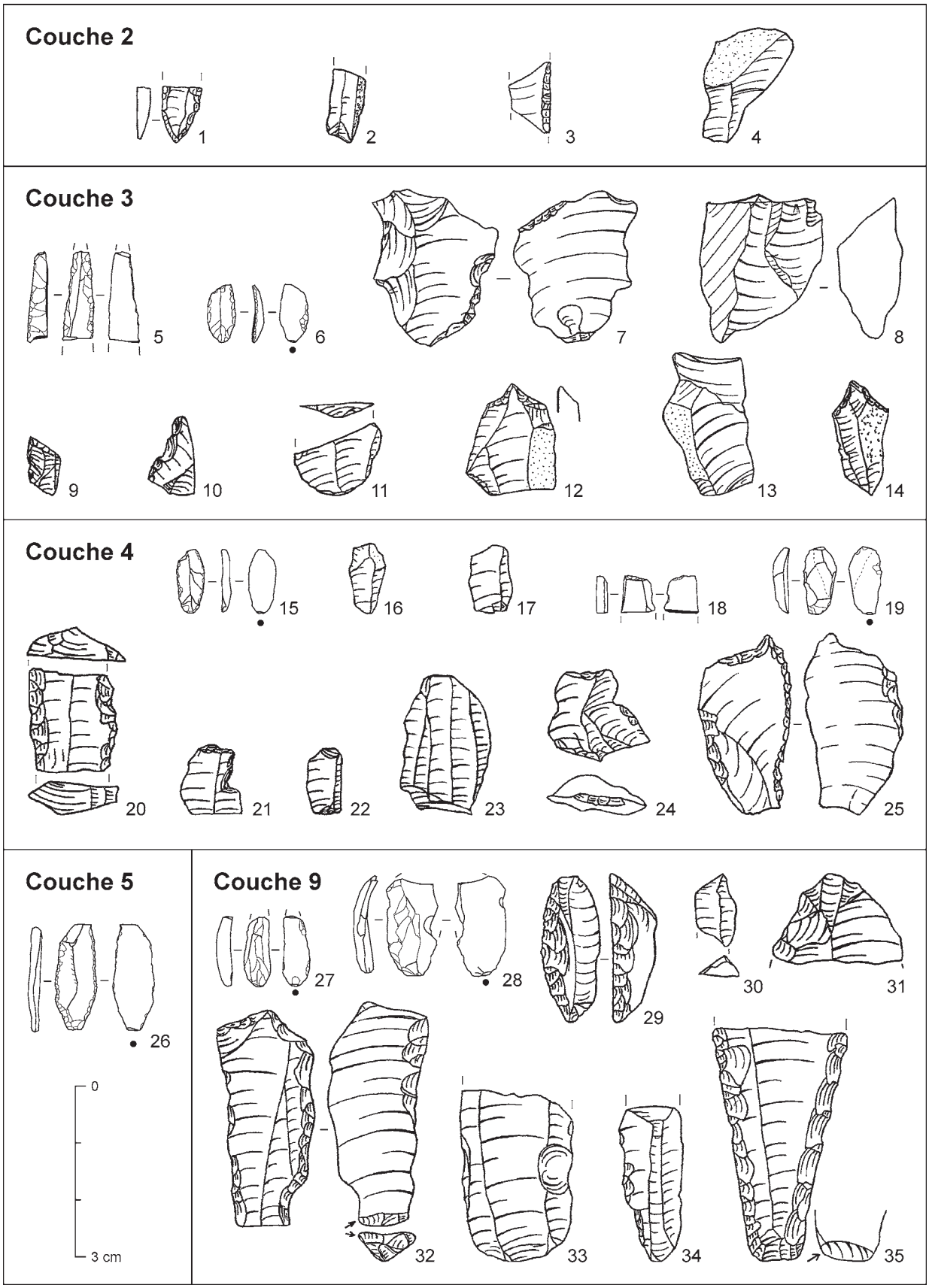


Fig. 4. Des artefacts lithiques des fouilles de 2002–2003 de Dzeravá skala (1–4, 7–14, 16, 17, 20–25, 29–35 – d'après *Kaminská/Kozłowski/Svoboda eds. 2005*; 5, 6, 15, 18, 19, 26–28 – dessins M. Polanská).

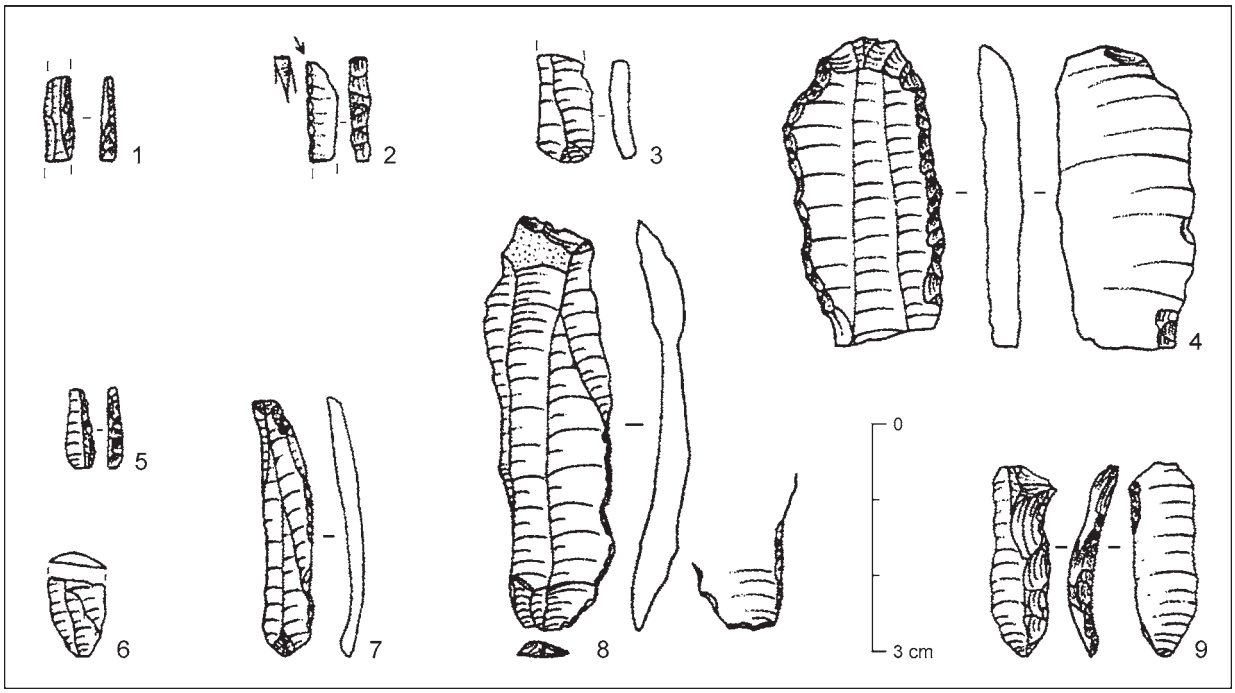


Fig. 5. Des artefacts lithiques des fouilles de J. Hillebrand de Dzeravá skala (d'après *Kaminská/Kozłowski/Svoboda eds. 2005*, fig. 19, modifié).

- *Couche 3 :* La couche 3, datée de 25 050 +540/-510 BP non cal., a livré quelques artefacts lithiques ;
- *Couche 4 :* La couche 4, datée de 24 800 ±130 BP non cal., contenait quelques pièces lithiques ;
- *Couche 5 :* La couche 5 se présente sous la forme de lentilles incluses dans la couche 4 et a été datée à 24 760 ±130 BP non cal.;
- *Couche 9 :* la couche 9 qui contenait de l'industrie lithique et un fragment de pointe en matières dures animales, a donné des datations s'échelonnant de 34 100 à 37 750 BP non cal. (*Kaminská/Kozłowski/Svoboda eds. 2005*).

L'industrie lithique de la Grotte de Dzeravá skala se repartie en trois collections : celle des fouilles de 2002–2003 (Fig. 4), celle de J. Hillebrand (Fig. 5) et celle de F. Prošek (Fig. 3). Le lithique provenant des fouilles de J. Hillebrand a été attribué, selon la terminologie de l'époque, à l'Aurignacien supérieur, ce qui correspond de nos jours au Gravettien (*Kaminská/Kozłowski/Svoboda eds. 2005*). Selon la dernière étude les quatre lamelles à dos (Fig. 5: 1, 2, 5) des fouilles de J. Hillebrand faites en silicite sont en connexion avec les artefacts à bord abattu des couches 3 et 4 des nouvelles fouilles (Fig. 4: 5; *Kaminská/Kozłowski/Svoboda eds. 2005*). Le reste de l'industrie n'est pas diagnostique (*Kaminská/Kozłowski/Svoboda eds. 2005*). Toutefois, *J. Hillebrand* (*1914*) a également identifié une pointe foliacée et une pointe en matière dure animale.

F. Prošek a réparti ses découvertes paléolithiques entre deux horizons culturels Gravettien et Szélétien. Parmi les vingt-sept artefacts lithiques attribués au Gravettien (Fig. 3), nous avons pu consulter les trois pièces en silicite indéterminée à patine blanche (Fig. 3: 1, 2, 5), dont une qui présente de forte ressemblance avec un microlithe géométrique pavlovien (Fig. 3: 1). Rappelons que le microlithe géométrique pavlovien est une armature d'environ 2 cm de long de forme dissymétrique, dont le bord droit à délinéation rectiligne est aménagé par une retouche directe généralement marginale, ainsi que la base du bord gauche est généralement aménagée par une troncature directe oblique. Le reste du bord gauche rejoint naturellement le bord droit en formant une pointe ou peut être aménagé pour former une pointe dissymétrique (Fig. 2: 11, 12, 14; *Polanská 2013*; *2020*). La pièce de Dzeravá skala présente toutes les caractéristiques de ce type d'armature, mis à part le fait que l'aménagement de l'extrémité distale en « pointe » reste atypique et sa taille est légèrement plus grande. Toutefois elle rentre dans la grande variabilité de la forme de ce type (voir notamment *Polanská 2020*, fig. 261–264).

Les couches 3 à 5 et 9 des fouilles 2002–2003 attribuées au Gravettien et à l'Aurignacien ont livré peu de matériel lithique caractéristique d'une phase culturelle (Fig. 4). Les auteurs rapprochent quelques pièces à retouche marginale de la couche trois qui présentent une « forme géométrique » à des microlithes géométriques pavloviens : "*Taking into consideration the dating of layer 3 to the period about 25 000 BP, we can assume that microliths are connected with the Pavlovian settlement in nearby Moravia. The raw materials are also similar to the ones that were used in the Pavlovian (flint from Silesian moraines, radiolarite). Jasper and limnoquartzite are raw materials, which may come from the easterly located territories (Central Slovakia and Northern Hungary)*"; (*Kaminská/Kozłowski/Svoboda 2004*, 27).

Toutefois, grâce à notre récente description de ces microlithes en Moravie (*Polanská 2013*) et la consultation rapide du matériel de Dzeravá skala, nous pensons que les petits microlithes se présentant dans les couches 3 et 4 (Fig. 4: 6), 4 (Fig. 4: 15, 19), 5 (Fig. 4: 26) et 9 (Fig. 4: 27) ne sont pas des microlithes géométriques, malgré leur rapprochement avec le Pavlovien. À notre avis, ils sont à mettre en rapport avec l'occupation aurignacienne attestée dans la couche 9.[6] Celle-ci a d'ailleurs livré quelques nucléus, dont les supports de microlithes sont issus (par exemple Fig. 4: 29, 31).

Pour résumer, le matériel provenant de la Grotte Dzeravá skala est peut-être le témoin de la pénétration des groupes pavloviens en Slovaquie occidentale. Mais les arguments sont peu convaincants, puisqu'ils reposent sur un seul artefact qui ressemble à un microlithe géométrique pavlovien atypique. Malheureusement, il est issu des fouilles anciennes de F. Prošek et absent des fouilles des années 2000. Les petits microlithes en radiolarite à retouches marginales répartis entre couches 3, 4, 5, 9 (Fig. 4: 6, 15, 19, 26, 27) ne présentent pas les mêmes caractéristiques que des microlithes géométriques pavloviens et l'artefact provenant des fouilles de Prošek (Fig. 3: 1). Ces éléments sont vraisemblablement issus d'une production sur des nucléus de formes carénées, dont deux exemplaires ont été identifiés dans la couche 9 attribuée à l'Aurignacien (Fig. 4: 19, 31). Il faudrait procéder à de nouvelles fouilles pour pouvoir prouver les liens unissant potentiellement le matériel de Dzeravá skala et les ensembles pavloviens de Moravie.

La grotte Slaninová (Slovaquie orientale)

« Slaninová jaskyňa v Háji » se situe dans le Karst slovaque (canton de Košice), à 425 m d'altitude (*Kaminská zost. 2014*). La couche paléolithique, avec des pointes en ivoire, a été en partie détruite par des « fouilles amateurs ». La grotte a connu d'autres occupations humaines dont certaines datent de l'Âge du Bronze, de l'Âge du Fer, du Moyen Âge et des Temps modernes. Les fouilles archéologiques ont été réalisées en 1986 sur 10 x 2 m et ont livré des fragments de pointes, quelques pièces lithiques et des restes fauniques (*Kaminská zost. 2014*, 201). La séquence stratigraphique est subdivisée en six couches. Dans la partie inférieure a été trouvée une industrie lithique associée à des fragments de pointes en ivoire et des restes de faune. Une partie de la faune appartient à la fin du Interpleniglaciare, avant le début de Pléniglaciaire, et notamment les os d'ours, datés par le ^{14}C de 27 950 ±270 BP non cal. (GrN-14832; Tabl. 2; *Kaminská 1993*, 16).

L'industrie lithique a été globalement attribuée au Paléolithique supérieur. Il faut signaler la découverte de la partie mésiale d'une lame en radiolarite et la partie mésiale d'une lame à retouche marginale bilatérale faite en limnosilicite grise (*Kaminská et al. 1993*, 16). Les fragments de pointes en ivoire comprennent deux parties basales (*Kaminská zost. 2014*, fig. 90), dont une à section ovalaire et l'autre à section demi-ronde (*Kaminská et al. 1993*, 16).

L'appartenance de l'ensemble de la Grotte Slaninová au Gravettien et plus particulièrement au Pavlovien a été proposée à partir de la datation et de la présence de pointes en ivoire. Néanmoins, la datation étant faite sur les os d'ours, elle témoigne probablement d'une occupation animale de la caverne et pas forcément du passage des Gravettiens. En outre, comme le suggère *L'. Kaminská* (*1993*), le caractère de l'industrie lithique n'est pas significatif et renvoie globalement à des productions de type Paléolithique supérieur sans plus de précisions. Dans ce cas, nous attendons la publication de l'étude détaillée, pour voir si la forme, la fabrication ou le façonnage des pointes en ivoire permet d'argumenter plus affirmativement l'attribution culturelle au Pavlovien (pour leur présentation préliminaire voir *Hromadová/Kaminská 2014*).

[6] Leur provenance des couches gravettiennes est peut etre à mettre en lien avec des processus taphonomiques et les perturbations connues de la conservation des couches culturelles dans des grottes.

Nemšová I (Slovaquie occidentale)

Le complexe des sites Nemšová (I à VIII) se situe sur la rive droite du cours d'eau Váh, à proximité des gisements primaires de radiolarite dans les Carpates blanches. Les sites I et II ont été attribués à la phase ancienne du Gravettien (*Bárta 1961*; *Kaminská zost. 2014*).

Le site Nemšová I est connu depuis la première guerre mondiale par des découvertes de faune pléistocène. Une grande partie du site a été détruite, ce dont témoignent les observations des ouvriers en 1952 qui ont signalés des accumulations d'ossements et de dents de mammouths liées à des tâches charbonneuses (approximativement 3 x 5 m; *Bárta 1961*). Les sondages ont été réalisés par la suite sous la responsabilité de J. Bárta en 1959 et par C. Ambros en 1961. Le site a livré une datation ^{14}C de 28 570 ±1345 BP non cal. (GrN-2470; Tabl. 2), faite sur un échantillon de charbon de pin (*Bárta 1961*). Malheureusement, l'industrie lithique, majoritairement en radiolarite, reste peu riche (61 pièces). Selon J. Bárta, elle témoigne de l'importation de matières premières des proches gisements primaires de la radiolarite et d'un débitage sur place. Elle comprend quelques nucléus et éclats. Les photos et les dessins publiés par *J. Bárta* (*1961*) ne permettent pas de réaliser une évaluation plus précise.

CONCLUSION ET PERSPECTIVES

Pour conclure, le rapprochement des occupations de 30 000 à 26/25 500 BP non cal. (environ 34 000 à 30/29 800 BP cal.) provenant de la Slovaquie aux deux groupes pavloviens *stricto sensu* reste très discutable puisque leurs industries lithiques sont peu représentatives (échantillon limité sans élément diagnostique) ou comprennent des types inconnus des séries pavloviennes de Moravie.

Les nouvelles fouilles de la Grotte Dzeravá skala n'ont pas livré d'autres pièces ressemblant aux microlithes géométriques. La seule pièce évocatrice provient des anciennes fouilles de Prošek. Mais il est impossible d'exploiter des rapprochements entre ce site de Slovaquie occidentale et le Groupe à microlithes géométriques en se basant sur une seule pièce. Toutefois, des analogies ou au moins des contacts restent envisageables puisque plusieurs sites pavloviens moraves ont livré des matériaux (radiolarite, limnosilicite, obsidienne) dont les gisements primaires se situent en Slovaquie ce qui illustre des contacts entre ces territoires. Il s'agit non seulement de pièces importées (une lame en limnosilicite à Pavlov VI; *Polanská 2013*), mais aussi de blocs entiers de radiolarite exploités sur place (Pavlov I, Dolní Věstonice II – Pente ouest; *Polanská 2020*; *Svoboda 1997*; *Škrdla 1997; 2001*). Il nous paraît donc justifié de penser que le territoire de la Slovaquie ait été fréquenté par les Pavloviens pendant le Gravettien moyen.

Toutefois, comme évoqué dans l'introduction, le territoire accidenté d'Europe centrale était composé de différentes entités géographiques, culturelles et écologiques à part de Groupe à microlithes géométriques et de Groupe à microscies. Ces deux entités restent probablement deux des autres groupes (contemporains?) à identifier et à caractériser. Compte tenu de la barrière montagneuse entre la Moravie et la Slovaquie ainsi que de l'éloignement géographique des sites (dans le cas de Grotte Slaninová), il est possible que les deux territoires fussent occupés par des groupes distincts, ce qui n'exclut pas bien évidemment des contacts ou interactions (Fig. 1). L'autre possibilité est qu'au moins une partie des occupations de Slovaquie ne soit pas contemporaine du Pavlovien morave vu les datations anciennes de Nemšová I.

De manière générale, en l'état actuel des recherches sur le Gravettien ancien et moyen d'Europe centrale, il s'avère nécessaire de procéder à un réexamen critique des anciennes collections, accompagné de l'évaluation de leur position stratigraphique et chronologique. Cette évaluation des séries passe notamment par des analogies basées sur les fossiles directeurs lithiques et les systèmes techniques qui aboutiront à un classement des collections (*Polanská 2018*). Celui-ci, basé sur des groupes/composantes industrielles définies ou en phases chronologiques plus générales (Gravettien ancien, moyen, récent, final) permettra ensuite de nous questionner sur la signification anthropologique de ces groupes et de reconstituer des territoires de chacun. La discussion autour de ces trois gisements de Slovaquie et de leur lien avec le Pavlovien morave s'inscrivait dans cette démarche. Pour avancer sur la problématique de l'extension du Pavlovien, il est aujourd'hui nécessaire d'évaluer des séries lithiques en précisant et hiérarchisant des arguments de leur attribution culturelle. C'est-à-dire en précisant s'il s'agit de véritables séries analogues avec la présence de l'un/des fossiles directeurs lithiques de tel ou tel groupe culturel ou si le rapprochement s'est fait grâce à l'un des éléments de l'industrie en matières dures organiques ou d'autres aspects de la culture matérielle. De cette façon, nous avons pu par exemple mettre en avant que

parmi les seuls gisements d'Autriche analogue à l'un des groupes pavloviens – Groupe à microscies - est celui de Krems-Wachtberg (*Polanská 2018*, 423–430)[7]. Les sites comme Willendorf II comprennent des types d'outils lithiques différents. Dans cette optique, s'ouvrent de nouveaux horizons de recherche de l'identification et de la caractérisation des groupes culturels qui fréquentaient le territoire de l'Europe centrale pendant le Gravettien ancien et moyen.

Remerciements

L'auteur remercie l'Institut d'archéologie SAS pour avoir la possibilité de consulter le matériel de Dzeravá skala, Dr. Solène Denis, Mme Sylvaine Scheffer-Farray pour la relecture linguistique et Dr. Zsolt Mester pour les conseils. Ce travail a été soutenu par Académie tchèque des sciences (program PPLZ) et partiellement réalisé pendant les études doctorales (Panthéon-Sorbonne University ; UMR 7041-ArScAn).

BIBLIOGRAPHIE

Bárta 1961 — J. Bárta : K problematike paleolitu Bielych Karpát. *Slovenská archeológia* 9, 1961, 9–32.

Buchinger et al. 2021 — N. Buchinger/M. Brandl/Th. Einwögerer/K. Pasda : The lithic industry at Gösing-Setzergraben: New insights on the Early Gravettian in Lower Austria. In : *62nd Annual Meeting. April 6th–April 8th 2021. Moravské zemské muzeum Brno. Hugo Obermaier Society for Quaternary Research and Archaeology of the Stone Age. Conference booklet*. Brno 2001, 27, 28.

Delporte 1959 — H. Delporte : Notes de voyage leptolithique en Europe centrale I. La Tchécoslovaquie. *Rivista di Scienze preistoriche* 14, 1959, 19–57.

Garrod 1938 — D. A. E. Garrod : The Upper Palaeolithic in the Light of Recent Discovery. *Proceedings of the Prehistoric Society* 1, 1938, 155–172.

Goutas 2015 — N. Goutas : Données inédites sur le Gravettien oriental : apport de la technologie osseuse à la caractérisation des occupations de Kostienki 4 (Alexandrovska, région de Voronej, Russie). *Bulletin de la Société préhistorique française* 112, 2015, 647–692.

Goutas et al. 2011 — N. Goutas/L. Klaric/D. Pesesse/P. Guillermin : *À la recherche des identités gravettiennes : actualités, questionnements et perspectives. Actes de la table ronde sur le Gravettien en France et dans les pays limitrophes, Aix-en-Provence, 6–8 octobre 2008.* Bulletin de la Société préhistorique française, Mémoire 52. Paris 2011.

Haesaerts 1990 — P. Haesaerts : Évolution de l'environnement et du climat au cours de l'Interpleniglaciaire en Basse Autriche et en Moravie. In : J. K. Kozłowski (ed.) : *Les industries à pointes foliacées du Paléolithique supérieur européen.* ERAUL 42. Liège 1990, 523–538.

Hillebrand 1914 — J. Hillebrand : Ergebnisse meiner Höhlenforschungen im Jahre 1913 (Az 1913; évi barlangkutatásaim ereményei). *Barlangkutatás* 2, 1914, 115–124, 147–153.

Hromada 1998 — J. Hromada : Gravettienske sídliská v Moravanoch nad Váhom a ich miesto vo vývoji mladého paleolitu strednej Európy. *Slovenská archeológia* 44, 1998, 45–167.

Hromadová 2016 — B. Hromadová : Bone, antler and ivory tools. In : J. Svoboda (ed.) : *Dolní Věstonice II. Settlement Units and Human Fossils. Spatial Context, Stratigraphy and Chronology.* The Dolní Věstonice Studies 21. Brno 2016, 273–302.

Hromadová/Kaminská 2014 — B. Hromadová/Ľ. Kaminská : The Upper Palaeolithic ivory points from the cave sites of Slaninová, Čertova pec and Dzeravá skala (Slovakia). In : *Hugo Obermaier-Gesellschaft für Erforschung des Eiszeitalters und der Steinzeit V. 56. Jahrestagung in Braunschweig und Schöningen 22.–26. April 2014.* Erlangen 2014, 30.

Cheben/Kaminská 2002 — I. Cheben/Ľ. Kaminská : Výskum paleolitického náleziska v Nemšovej. *Slovenská archeológia* 50, 2002, 53–67.

Kaminská 1993 — Ľ. Kaminská : Príspevok k osídleniu jaskýň v Slovenskom krase. *Východoslovenský pravek* 4, 1993, 13–25.

Kaminská zost. 2014 — Ľ. Kaminská (zost.) : *Staré Slovensko 2. Paleolit a mezolit.* Archaeologica Slovaca Monographiae. STASLO 2. Nitra 2014.

[7] A celui-ci s'ajoute le site autrichien de Gösing-Setzergraben (*Buchinger et al. 2021*), recement présenté lors de la conférence Back to the Gravettian à Brno.

Kaminská et al. 1993 Ľ. Kaminská/J. Kovanda/V. Ložek/L. Smolíková : Die Travertinfundstelle Hôrka-Ondrej bei Poprad, Slowakei. *Quartär* 42/43, 1993, 95–112.

Kaminská/Kozłowski/Svoboda 2004 Ľ. Kaminská/J. K. Kozłowski/J. A. Svoboda : The 2002–2003 excavation in the Dzeravá skala cave, West Slovakia. *L'Anthropologie* 42, 2004, 321–332.

Kaminská/Kozłowski/Svoboda eds. 2005 Ľ. Kaminská/J. K. Kozłowski/J. Svoboda (eds.) : *Pleistocene environments and archaeology of the Dzeravá skala Cave, Lesser Carpathians, Slovakia.* Kraków – Nitra 2005.

Klíma 1959 B. Klíma : Zur Problematik des Aurignaciens und Gravettiens in Mittel Europa. *Archaeologia Austriaca* 26, 1959, 35–51.

Klíma 1961 B. Klíma : Současný stav problematiky aurignacienu a gravettienu. *Archeologické rozhledy* 13, 1961, 84–121.

Klíma 1997 B. Klíma : Zur Frage der Mikroindustrie aus Pavlov. In : J. Svoboda (ed.) : *Pavlov I – Northwest. The Upper Paleolithic Burial and Its Settlement Context.* The Dolní Věstonice Studies 4. Brno 1997, 289–312.

Klíma ed. 1976 B. Klíma (ed.) : *Périgordien et Gravettien en Europe. Nice UISPP IX Congrés, Colloque XV.* ERAUL 13. Liége 1976.

Kozłowski ed. 1998 J. K. Kozłowski (ed.) : *Complex of Upper Palaeolithic sites near Moravany, Western Slovakia II. Moravany-Lopata II (Excavations 1993–1996).* Kraków 1998.

Lázničková-Galetová 2015 M. Lázničková-Galetová : The phenomenon of Gravettian necklaces–Mammoth ivory necklaces from Dolní Věstonice I (Moravia, Czech Republic). *Quaternary International* 359, 2015, 229–239.
DOI : https://doi.org/10.1016/j.quaint.2014.08.040

Lázničková-Galetová 2019 M. Lázničková-Galetová : The symbolism of breast-shaped beads from Dolní Věstonice I (Moravia, Czech Republic). *Quaternary International* 503, 2019, 221–232.
DOI : https://doi.org/10.1016/j.quaint.2017.08.035

Lázničková-Galetová 2021 M. Lázničková-Galetová : Gravettian ivory ornaments in Central Europe, Moravia (Czech Republic). *Quaternary International* 359, 2021, 102870.
DOI : https://doi.org/10.1016/j.anthro.2021.102870

Lengyel/Mester/Szolyák 2016 G. Lengyel/Z. Mester/P. Szolyák : The Late Gravettian and Szeleta cave, North-East Hungary. *Quaternary International* 406, 2016, 174–183.
DOI : https://doi.org/10.1016/j.quaint.2015.09.014

Moreau 2012 L. Moreau : Le Gravettien ancien d'Europe centrale revisité : mise au point et perspectives. *L'Anthropologie* 116, 5, 2012, 609–638.
DOI : https://doi.org/10.1016/j.anthro.2011.10.002

Novák 2016 M. Novák : Lithics on the peripheries. Variability in assemblages from the southern edge and the Dolní Věstonice IIa sub-site (after 1990). In : J. Svoboda (ed.) : *Dolní Věstonice II. Settlement Units and Human Fossils. Spatial Context, Stratigraphy and Chronology.* The Dolní Věstonice Studies 21. Brno 2016, 246–272.

Nigst 2006 P. R. Nigst : The First Modern Humans in the Middle Danube Area? New evidence from Willendorf II (Eastern Austria). In : N. J. Conard (ed.) : *When Neanderthals and Modern Humans Met.* Tübingen 2006, 269–304.

Noiret 2013 P. Noiret : De quoi Gravettien est-il le nom? In : *Otte ed. 2013*, 29–63.

Oliva 2002 M. Oliva : Využívaní krajiny a zdrojů kamenných surovin v mladém paleolitu českých zemí. *Archeologické rozhledy* 54, 2002, 555–581.

Oliva 2007 M. Oliva : *Gravettien na Moravě.* Disertationes archaeologicae brunenses/pragensesque 1. Brno – Praha 2007.

Otte 1981 M. Otte : *Le Gravettien en Europe centrale 1–2*. Bruges 1981.

Otte ed. 2013 M. Otte (ed.) : *Les Gravettiens.* Errances. Paris 2013.

Polanská 2011 M. Polanská : L'industrie lithique de Pavlov VI. L'apport du regard technologique au sein des industries pavloviennes. In : J. A. Svoboda (ed.) : *Pavlov excavation 2007–2011.* The Dolní Věstonice Studies 18. Brno 2011, 131–154.

Polanská 2013 M. Polanská : L'industrie lithique (fouille 2006). Collection d'une importance significative pour la compréhension de la « composante lithique à microlithes géométriques » du Pavlovien morave. In : J. A. Svoboda/J. Mikulík/M. Novák/M. Polanská/Z. Schenk/J. Wilczyński/P. Wojtal : *Předmostí – Building an authentic museum.* The Dolní Věstonice Studies 19. Brno 2013, 44–63.

Polanská 2016 M. Polanská : L'industrie lithique de Dolní Věstonice II découverte avant 1990. In : J. Svoboda (ed.) : *Dolní Věstonice II. Settlement Units and Human Fossils. Spatial Context, Stratigraphy and Chronology.* The Dolní Věstonice Studies 21. Brno 2016, 161–245.

Polanská 2018 M. Polanská : *Questionnement sur la diversité du Pavlovien morave par l'étude technologique des gisements de Milovice I, Pavlov I, Pavlov VI, Dolní Věstonice II-WS, Předmostí Ib (République tchèque).* PhD. Thesis. Université Paris 1 Panthéon-Sorbonne. Paris 2018. Non publié.

Polanská 2020 M. Polanská : *Questionnement sur la diversité du Pavlovien par l'étude technologique des gisements moraves.* Spisy AÚ AV ČR v Brne 66. Brno 2020.

Polanská et al. 2014 M. Polanská/J. Svoboda/S. Sázelová/B. Hromadová : Předmostí III : un site pavlovien de la porte de Moravie (République tchèque, Europe centrale). *L'Anthropologie* 118, 2014, 255–291.

Polanská/Hromadová 2015 M. Polanská/B. Hromadová : Réflexion autour des industries gravettiennes « post-pavloviennes » de Slovaquie occidentale et de Moravie (25 500/24 500–22 000 BP non calibré). In : S. Sázelová/M. Novák/A. Mizerová (eds.) : *Forgotten times and spaces. Anniversary volume dedicated to J. Svoboda.* Brno 2015, 132–154. DOI : https://doi.org/10.5817/CZ.MUNI.M210-7781-2015-12

Rašková-Zelinková 2011 M. Rašková-Zelinková : Spatula-like tools: Hide processing in the Pavlovian. In : J. A. Svoboda (ed.) : *Pavlov excavation 2007–2011.* The Dolní Věstonice Studies 18. Brno 2011, 180–199.

Reimer et al. 2020 P. Reimer/W. Austin/E. Bard/A. Bayliss/P. Blackwell/C. Bronk Ramsey/M. Butzin/H. Cheng/R. Edwards/M. Friedrich/P. Grootes/T. Guilderson/I. Hajdas/T. Heaton/A. Hogg/K. Hughen/B. Kromer/S. Manning/R. Muscheler/J. Palmer/C. Pearson/J. van der Plicht/R. Reimer/D. Richards/E. Scott/J. Southon/C. Turney/L. Wacker/F. Adolphi/U. Büntgen/M. Capano/S. Fahrni/A. Fogtmann-Schulz/R. Friedrich/P. Köhler/S. Kudsk/F. Miyake/J. Olsen/M. Sakamoto/A. Sookdeo/S. Talamo : The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon* 62, 2020, 725–757. DOI : https://doi.org/10.1017/RDC.2020.41

Simon 2010 U. Simon : Gravettian Lithic Assemblages of the Excavation Krems-Hundssteig 2000-2002. In : Ch. Neugebauer-Maresch/L. R. Owen (eds.) : *New Aspects of the Central and Eastern European Upper Palaeolithic – methods, chronology, technology and subsistence.* Mitteilungen der Prähistorischen Kommission 72. Wien 2010, 245–254.

Svoboda 1995 J. Svoboda : Palaeolithic landscapes of Moravia: A mosaic of occupation strategies. *Geolines* 2, 1995, 7–9.

Svoboda 1996 J. Svoboda : The Pavlovian.Typology and Behavior. In : J. Svoboda (ed.) : *Paleolithic in the Middle Danube region Anniversary volume to Bohuslav Klíma*. Spisy AÚ AV ČR v Brně 5. Brno 1996, 283–301.

Svoboda 1997 J. Svoboda : Lithic Industries of the 1957 Area. In : J. Svoboda (ed.) : *Pavlov I – Northwest. The upper Paleolithic Burial and Its Settlement Context*. The Dolní Věstonice Studies 4. Brno 1997, 179–209.

Svoboda 2004 J. Svoboda : Afterwords. The Pavlovian as a part of the Gravettian Mosaic. In : J. Svoboda/L. Sedláčková (ed.) : *The Gravettian along the Danube (Proceeding of the Mikulov Conference 20-21, November 2002*. The Dolní Věstonice Studies 11. Brno 2004, 283–297.

Svoboda ed. 2011 J. Svoboda (ed.) : *Pavlov. Excavation 2007–2011.* The Dolní Věstonice Studies 18. Brno 2011.

Svoboda ed. 2016 J. Svoboda (ed.) : *Dolní Věstonice II. Chronostratigraphy, Paleoethnology, Paleoanthropology.* The Dolní Věstonice Studies 21. Brno 2016.

Svoboda et al. 2013 J. Svoboda/J. Mikulík/M. Novák/M. Polanská/Z. Schenk/J. Wilczyński/P. Wojtal : *Předmostí – Building an authentic museum.* The Dolní Věstonice Studies 19. Brno 2013.

Svobodová 1991 H. Svobodová : The pollen analysis of Dolní Věstonice II, Section 1. In : J. Svoboda (ed.) : *Dolní Věstonice II. Western Slope.* ERAUL 54. Liège 1991, 75–88.

Šída 2016 P. Šída : Gravettian lithics assemblages from Lubná (Bohemia). *Quaternary International* 406, 2016, 120–128.

Škrdla 1997 P. Škrdla : The Pavlovian Lithic technologies. In : J. Svoboda (ed.) : *Pavlov I – Northwest.* The Dolní Věstonice Studies 4. Brno 1997, 313–372.

Škrdla 2001 P. Škrdla : Skládanky z Dolních Věstonic II – západní svah. *Památky archeologické* 92, 2001, 153–157.

Škrdla ed. 2005 P. Škrdla (ed.) : *The Upper Paleolithic on the Middle Course of the Morava River.* The Dolní Věstonice Studies 13. Brno 2005.

Teschler-Nicola et al. 2020 M. Teschler-Nicola/D. Fernandes/M. Händel/Th. Einwögerer/U. Simon/Ch. Neugebauer-Maresch/S. Tangl/P. Heimel/T. Dobsak/A. Retzmann/Th. Prohaska/

J. Irrgeher/D. J. Kennett/I. Olalde/D. Reich/R. Pinhasi : Ancient DNA reveals monozygotic newborn twins from the Upper Palaeolithic. *Communications biology* 3, 2020, 1–11.
DOI : https://doi.org/10.1038/s42003-020-01372-8

Thomas/Ziehaus 2014 R. Thomas/J. Ziehaus : Spatial and chronological patterns of the lithics of hearth 1 at the Gravettian site Krems-Wachtberg. *Quaternary International* 351, 2014, 134–145.

Touzé et al., sous presse O. Touzé/N. Goutas/P. Noiret/H. Salomon (eds.) : *NW Europe during the Gravettian: Contributions of recent research to the understanding of the societies and their environments, Proceedings of Liège symposium, 13–14 april 2018.* ERAUL, sous presse.

Valde-Nowak/Nadachowski/Madeyska 2003
P. Valde-Nowak/A. Nadachowski/T. Madeyska : *Cave Obłazowa. Human activity, stratigraphy and palaeoenvironment.* Kraków 2003.

Valoch 1986 K. Valoch : Les questions du Pavlovien. *Antiquités Nationales* 18–19, 1986, 55–62.

Verpoorte 1997 A. Verpoorte : Along the peripheries of a radiolarite concentration: the lithic industry of 1956/ABC and 1958. In : J. Svoboda (ed.) : *Pavlov I – Northwest. The Upper Paleolithic burial and its settlement context.* The Dolní Věstonice Studies 4. Brno 1997, 211–226.

Verpoorte 2000 A. Verpoorte : Pavlov reflexes and the Pompei premise: a spatial analysis of stone artefacts from Pavlov I (Moravia, Czech Republic). *Archeologické rozhledy* 52, 2000, 577–594.

Verpoorte 2001 A. Verpoorte : *Places of Art, Traces of Fire. A Contextual Approach to Anthropomorphic Representations in the Pavlovian.* The Dolní Věstonice Studies 6. Archaeological Studies Leiden University 8. Leiden 2001.

Vlačiky et al. 2013 M. Vlačiky/T. Michalík/M. Nývltová Fišáková/D. Nývlt/M. Moravcová/M. Králik/J. Kovanda/K. Péková/A. Přichystal/A. Dohnalová : Gravettian occupation of the Beckov Gate in Western Slovakia as viewed from the interdisciplinary research of the Trenčianske Bohuslavice-Pod Tureckom site. *Quaternary International* 294, 2013, 41–60.
DOI : https://doi.org/10.1016/j.quaint.2011.09.004

Wilczyński 2015 J. Wilczyński : The Gravettian and Epigravettian settlement of Poland. In : S. Sázelová/M. Novák/A. Mizerová (eds.) : *Forgotten times and spaces. Anniversary volume dedicated to J. Svoboda.* Brno 2015, 191–213.
DOI : 10.5817/CZ.MUNI.M210-7781-2015-16

Wilczyński 2016 J. Wilczyński : Variability of Late Gravettian lithic industries in Southern Poland: A case study of the Kraków Spadzista and Jaksice II sites. *Quaternary International* 406, 2016, 129–143.
DOI : https://doi.org/10.1016/j.quaint.2015.10.026

Wilczyński et al. 2020 J. Wilczyński/O. Žaár/A. Nemergut/B. Kufel-Diakowska/M. Moskal-del Hoyo/P. Mroczek/B. Páll-Gergely/T. Oberc/G. Lengyel : The Upper Palaeolithic at Trenčianske Bohuslavice, Western Carpathians, Slovakia. *Journal of Field Archaeology* 45, 2020, 270–292.
DOI : https://doi.org/10.1080/00934690.2020.1733334

Osídľovali pavlovienske skupiny územie dnešného Slovenska?

Michaela Polanská

Súhrn

Gravettien je jednou z najznámejších kultúr mladého paleolitu, ktorá bola rozšírená naprieč starým kontinentom. Jeho mozaika je tvorená viacerými ľudskými populáciami, z ktorých každá sa vyznačuje svojimi špecifikami v hmotnej kultúre alebo v symbolických prejavoch (napr. *Garrod 1938*; *Klíma 1961*; *Otte 1981*; *Otte ed. 2013*). Územie strednej Európy tvorené pohoriami, ľadovcami, prírodnými koridormi a bránami, slúžiacimi ako priechody, nebolo výnimkou. Jeho členitosť napomáhala k tvorbe refúgií, obývanými rôznymi ľudskými skupinami/kultúrami, etnikami (obr. 1). Tieto skupiny sa prispôsobovali novým územiam a klimatickým zmenám, čo malo za následok voľbu sídelných stratégií, ako aj získavanie minerálnych a živočíšnych zdrojov (*Oliva 2002*; *2007*; *Svoboda 1995*). Medzi nimi má osobitné miesto pavlovien (napr. *Delporte 1959*; *Klíma 1959*), ktorý je celosvetovo známy svojou bohatou materiálnou kultúrou (napr. hlinené antropo-zoomorfné figuríny, ozdobné predmety a bohaté industrie z tvrdých organických materiálov), symbolickými aspektmi (pohreby) a širokou koncentráciou opakovane osídľovaných lokalít, situovaných na území dnešnej Moravy (napr. *Goutas 2015*; *Hromadová 2016*; *Klíma 1961*; *Lázničková-Galetová 2015*; *Oliva 2007*; *Polanská 2020*; *Rašková-Zelinková 2011*; *Svoboda 1995*; *1996*; *2004*; *Teschler-Nicola et al. 2020*; *Valoch 1986*; *Verpoorte 2001*).

V posledných rokoch nabralo štúdium gravettienu aj pavlovienu v strednej Európe nový dych (napr. *Lengyel/Mester/Szolyák 2016*; *Nigst 2006*; *Polanská/Hromadová 2015*; *Svoboda ed. 2011*; *2016*; *Svoboda et al. 2013*; *Šída 2016*; *Vlačiky et al. 2013*; *Wilczyński 2016*; *Wilczyński et al. 2020*). Nálezy nových lokalít, revízie starších zbierok a nová systematická metóda štúdia kamenného materiálu, technologický prístup (*Polanská 2011*; *2013*; *2016*; *2020*) umožnili:

- jeho delenie do dvoch zložiek: skupiny s mikropílkami a skupiny s geometrickými mikrolitmi. Každá z nich zodpovedá nezávislej ľudskej populácii so svojimi špecifikami;
- jeho rámcové datovanie na Morave do stredného gravettienu (od 28 500/28 000 do 26/25 500 BP nekalib., približne od 33 000 do 30/29 800 BP kalib.).

Otázkou však ostáva jeho vznik, príchod, odchod z Moravy (prípadne zánik) a jeho rozšírenie do okolitých oblastí obklopujúcich moravský koridor (Dolné Rakúsko, západné Slovensko, južné Poľsko).

V minulosti boli k pavlovienu zaradené viaceré lokality strednej Európy, na základe rádiokarbonových dát situovaných od 30 000 do 26/25 500 BP nekalib. (približne od 34 000 do 30/29 800 kalib.), kamenných *fossiles directeurs* alebo iných prvkov materiálnej kultúry. Hlavným cieľom nášho príspevku je posúdiť prienik týchto dvoch skupín na územie dnešného Slovenska a poukázať na predmety/produkčné systémy, na základe ktorých je možné potvrdiť alebo vyvrátiť tieto analógie. Prístup spočíva v opätovnom vyhodnotení údajov z odbornej literatúry a opise zbierok (ak sú k dispozícii) z troch lokalít (jaskyňa Dzeravá skala, Slaninová jaskyňa, Nemšová I; tabela 1; 2). Ďalšie súbory z lokalít Zamarovce, Nové Mesto nad Váhom-Mnešice, Vlčkovce-Vinohradky a jaskyňa Čertova pec neposkytli dostačujúce kvalitatívne a kvantitatívne informácie pre ich evaluáciu.

Pohľad na pavlovien prostredníctvom kamennej industrie a charakteristických znakov dvoch definovaných skupín

Kamenná industria pavlovienu bola donedávna známa prostredníctvom niekoľkých typov mikrolitov a vďaka importu surovín z morén alebo z fluviálno-glacigénnych sedimentov zo Sliezska a Poľska (napr. *Klíma 1997*; *Novák 2016*; *Oliva 2007*; *Polanská 2020*; *Svoboda 1996*; *Škrdla 1997*; *Verpoorte 1997*; *2000*). Za posledné desaťročie sa podarilo odlíšiť v mase pavlovienskeho kamenného materiálu dve nezávislé skupiny, ktoré sa líšia nielen kamennými *fossiles directeurs*, ale aj produkciami polotovarov či výberom kamenných surovín.

Skupina s mikropílkami

Skupina je sústredená v mikroregiónoch, nachádzajúcich sa približne každých 50 km v moravskom koridore (mikroregión Krems, sídliskový areál Dolní Věstonice – Pavlov – Milovice, mikroregión Uherské Hradište, mikroregión Napajedla a mikroregión Předmostí; *Polanská 2011*; *2020*). Osídlenia sú datované od 27 000 do 26 000 BP nekalib. (približne od 32 000 do 30 000 BP kalib.). Kamennú industriu charakterizuje import surovín vo forme blokov alebo čepelí zo sekundárnych zdrojov z morén (Sliezsko, Poľsko) alebo z fluviálno-glacigénnych

sedimentov, ako aj z primárnych zdrojov z oblasti Krakowsko-częstochowskej jury. Technické systémy čepeľovo-čepieľkovej výroby sú si veľmi podobné, sú unipolárne na úzkych ťažobných plochách so zúžením v distálnej časti. Charakteristickými *fossiles directeurs* sú zobce (obr. 2: 9) a nože (väčšie čepele upravené rozpínavou priamou retušou; obr. 2: 10). *Armatures* a mikrolity sú zastúpené mikrogravettami podtypu Dolní Věstonice (obr. 6–8), pavlovienskými mikropílkami (obr. 2: 1–3) a elementami s dvojitou priečnou retušou podtypu Dolní Věstonice (obr. 2: 4, 5). Uvedené typy, ako aj systémy produkcie, ktoré sa použili na úpravu, sa úplne líšia od nasledujúcej skupiny, skupiny s geometrickými mikrolitmi.

Skupina s geometrickými mikrolitmi

Táto skupina je zatiaľ známa z dvoch homogénnych lokalít (Předmostí III, *Polanská et al. 2014*; Předmostí Ib, *Polanská 2013*; *2020*) a troch palimpsestov (Předmostí Ia, Pavlov I, Milovice I, *Polanská 2020*). Jej osídlenie je datované od 27 000 do 26 000 BP nekalib. (približne od 32 000 do 30 000 BP kalib.).

Použité suroviny sú importované z väčších vzdialeností (vo forme blokov, medzi nimi rádiolarit a neurčiteľné silicity), ale badať aj využitie miestnych, menej kvalitných surovín ako rohovec typu Krumlovský les a riečne okruhliaky (*Polanská 2013*; *2020*). Čepeľovo-čepieľková produkcia je unipolárna so zúženou ťažobnou plochou, je však potrebné ju podrobnejšie charakterizovať. Systém výroby malých polotovarov na produkciu geometrických mikrolitov je originálny. Jeho cieľom je produkcia malých čepieľok asymetrického tvaru, ktoré si vyžadujú minimálnu úpravu na dosiahnutie požadovaného tvaru. Typickými *fossiles directeurs* sú kostienkovské nože (obr. 2: 15), geometrické mikrolity (obr. 11; 12; 14) a hroty zatiaľ neznámeho typu (oválne prvky?, obr. 2: 13, 16), ktoré je potrebné charakterizovať.

Má pavlovien analógie na území dnešného Slovenska?

Tri lokality z územia dnešného Slovenska boli v minulosti priradené na základe dát (tabela 2) alebo kamenných *fossiles directeurs* k moravskému pavlovienu: jaskyňa Dzeravá skala, Nemšová I a Slaninová jaskyňa.

Kamenný štiepaný materiál z jaskyne Dzeravá skala dnes predstavuje jedinú zbierku, na základe ktorej môžeme vážnejšie uvažovať o prieniku pavlovienskych skupín na západné Slovensko. Argumenty však nie sú postačujúce, pretože sú založené na jedinom artefakte, ktorý pripomína atypický pavloviensky geometrický mikrolit (odlišnosť vo veľkosti a v úprave apikálnej časti). Bohužiaľ, pochádza zo starých výskumov F. Proška a z výskumov z roku 2002–2003 podobné artefakty absentujú. Podľa nášho názoru nemajú malé rádiolaritové mikrolity s okrajovou retušou objavené vo viacerých vrstvách (3, 4, 5, 9), z ktorých bol jeden použitý ako argument pre prirovnanie k pavlovienu (obr. 4: 6, 15, 19, 26, 27), rovnaké znaky ako geometrické pavlovienske mikrolity. Tieto elementy sú pravdepodobne výsledkom produkcie na vysokých formách jadier (tradičné nazývaných vysoké škrabadlá), z ktorých dve pochádzajú z vrstvy 9 priradenej k aurignacienu (obr. 4: 19, 31). Aby bolo možné dokázať potenciálne väzby spájajúce materiál z Dzeravej skaly a pavlovienske skupiny z Moravy sú potrebné nové výskumy.

Slaninová jaskyňa bola osídľovaná v priebehu viacerých období (paleolit, doba bronzová a železná, stredovek, novovek; *Kaminská zost. 2014*; *Kaminská et al. 1993*). Vrstvy boli porušené amatérskymi výkopmi. Paleolitická vrstva datovaná do obdobia 27 950 ±270 BP nekalib. (GrN-14832; tabela 2; *Kaminská 1993*, 16) obsahovala málopočetný kamenný materiál, zlomky hrotu z mamutoviny a faunu. Kamenný štiepaný materiál zo Slaninovej jaskyne je vo všeobecnosti pripisovaný mladému paleolitu a pre jeho nevýrazný ráz neumožňuje diskusiu o kultúrnom priradení k pavlovienu.

Lokalita Nemšová I sa nachádza v blízkosti primárnych zdrojov rádiolaritu v Bielych Karpatoch a jej osídlenie bolo pripísané staršej fáze gravettienu, datovaného na 28 570 ±1345 BP nekalib. (GrN-2470; tabela 2; *Bárta 1961*; *Kaminská zost. 2014*). Podľa *J. Bártu* (*1961*) je málopočetná kamenná industria (61 kusov) vyrobená hlavne z rádiolaritu. Na podklade dostupných fotiek kolekcia obsahuje niekoľko jadier a čepelí, bez možnosti ďalšieho presnejšieho posúdenia.

Záver a perspektívy

Porovnanie industrií dvoch pavlovienskych skupín a zbierok zo Slovenska (jaskyňa Dzeravá skala, Slaninová jaskyňa, Nemšová I; tabela 2) nepotvrdilo priame analógie. V málo početných a charakteristických súboroch absentovali definované *fossiles directeurs*, čo nepodporuje argumentáciu v prospech rozšírenia pavlovienskych skupín z Moravy na územie dnešného Slovenska. Počas stredného gravettienu však členité územie strednej Európy pozostávalo z rôznych geografických, kultúrnych a ekologických entít, ktoré ostávajú na definovanie a charakterizovanie. Vzhľadom na prírodnú bariéru medzi Moravou a Slovenskom (Biele Karpaty), ako aj geografickú vzdialenosť lokalít (v prípade Slaninovej jaskyne) je možné, že územie Slovenska bolo osídlené inými ľudskými skupinami. Netreba zabudnúť, že kontakty medzi týmito územiami sú preukázateľné importovanými surovinami. Nasvedčujú tomu nálezy rádiolaritu, limnosilicitu a obsidiánu v moravských zbierkach, teda surovín, ktorých primárne ložiská sa nachádzajú na západnom a východnom Slovensku (napr. *Polanská 2011*;

Škrdla ed. 2005; *Verpoorte 1997*). Je preto opodstatnené domnievať sa, že počas stredného gravettienu nebolo územie dnešného Slovenska možno osídľované, ale aspoň navštevované nositeľmi pavlovienu. Pokiaľ nebudú nájdené iné zbierky s kvantitatívne a kvalitatívne relevantnou kamennou industriou datované alebo stratigraficky situované do starého, alebo stredného gravettienu, nie je možné plnohodnotne argumentovať o osídlení pavlovienu na Slovensku.

K hypotéze osídľovania územia strednej Európy, počas stredného gravettienu viacerými skupinami, tiež prispieva identifikácia odlišných typických kamenných nástrojov ako tých pavlovienskych (napr. vrstvy 6 až 8 z Willendorfu II; *Noiret 2013*; *Polanská 2018*). Ide o komplexnú problematiku, ktorá vyžaduje predovšetkým charakterizáciu materiálnej kultúry týchto odlišných skupín.

Obr. 1. Najznámejšie gravettienske lokality v strednej Európe. 1 – mikroregión Dolní Věstonice – Pavlov – Milovice; 2 – Nemšová; 3 – jaskyňa Dzeravá skala; 4 – jaskyňa Slaninová; 5 – Zamarovce; 6 – Nové Mesto nad Váhom-Mnešice; 7 – Vlčkovce-Vinohradky; 8 – jaskyňa Čertova pec; 9 – mikroregión Willendorf; 10 – mikroregión Krems; 11 – Alberndorf I; 12 – mikroregión d'Aggsbach; 13 – Langenlois A a B; 14 – Grub/Kranawetberg; 15 – jaskyňa Obłazowa; 16 – Henryków 15; 17 – Wójcice; 18 – Cyprzanów; 19 – jaskyňa Borsuka; 20 – Kraków Spadzista (grafická úprava M. Polanská; www.maps-for-free.com).

Obr. 2. Kamenné *fossiles directeurs* moravských pavlovienskych skupín *stricto sensu* (kresba M. Polanská).

Obr. 3. Kamenná štiepaná industria z výskumu F. Proška z Dzeravej skaly (1, 2, 5 – kresba a foto M. Polanská; 3, 4, 6–15 – upravené podľa *Kaminská/Kozłowski/Svoboda 2005*, obr. 21).

Obr. 4. Kamenná štiepaná industria z výskumov 2002–2003 z Dzeravej skaly (1–4, 7–14, 16, 17, 20–25, 29–35 – upravené podľa *Kaminská/Kozłowski/Svoboda 2005*; 5, 6, 15, 18, 19, 26–28 – kresba M. Polanská).

Obr. 5. Kamenná štiepaná industria z výskumov Hillebranda z Dzeravej skaly (upravené podľa *Kaminská/Kozłowski/Svoboda 2005*, obr. 19).

Tabela 1. Klasifikácia kamenných súborov zo Slovenska v minulosti prirovnávaných k moravskému pavlovienu. Evaluácia prítomnosti/absencie charakteristík lokalít a ich materiálnej kultúry.

Tabela 2. Kalibrované a nekalibrované dáta ^{14}C rôznych kamenných súborov zo Slovenska v minulosti prirovnávaných k moravskému pavlovienu (kalibrované OxCal. 4.4, krivka IntCal 20; *Reimer et al. 2020*).

Dr. Michaela Polanská
The Czech Academy of Sciences
Institute of Archeology Brno
Centre for Palaeolithic and Paleoanthropology
Čechynská 363/19
CZ – 602 00 Brno

and

UMR 7055 – Préhistoire et Technologie
MSH Mondes
21, Allée de L'Université
FR – 92 023 Nanterre Cedex
michaelapolanska@yahoo.fr

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 129–144

ASPECTS OF HARD TISSUE MODIFICATIONS

Three objects from the Gravettian at Dolní Věstonice II (Czech Republic)

Sandra Sázelová – Bibiána Hromadová – Angela Perri – Michaela Polanská

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.9

Keywords: Mid Upper Palaeolithic, Central Europe, taphonomy, faunal remains, bone artefacts

Abstract: The paper presents a case study of three animal hard tissue objects from the Gravettian site of Dolní Věstonice II (Czech Republic), a beaver incisor, a wolf canine and a raven femur, bearing unusual modifications. Detailed archeozoological, archeological and experimental methods provide complex insights into the interpretation of human and non-human taphonomic impacts affecting the morphology of selected examples. In the case of the beaver incisor human manipulation was excluded; dentine modifications were caused by short-term malocclusion. The wolf canine bears traces of intentional raw material selection, changing the mechanical properties of the tooth, along with evidence of pressure causing its longitudinal pre-depositional breakage. The raven femur was freshly defleshed using a dihedral burin or other artefact with similar morphology in its cutting-edge shape.

INTRODUCTION

Some damage and fractures produced during an animal´s life, or after its death during decomposition of soft tissues and disarticulation, along with further deposition and postdeposition processes, could be easily misinterpreted as human intentional manipulation in hard tissue artefacts production, usage and abandonment. If the surface traces detected on the animal hard tissue (bone, tooth, antler, ivory) differ from the standard rank of inter-individual variability and pathological conditions, reconciling the faunal and archeological records is necessary for the most appropriate interpretation in order to avoid misinterpretations in distinguishing the human and non-human impact from those of natural origin (*Vercoutère/San Juan-Foucher/Foucher 2007*).

Bone surface modifications are discussed in various research papers, which focus on the interpretation of selected case studies. The conclusions, however, differ in their degree of importance and compatibility, specifically within comparative traceology of bone surface modification, where natural polishing might be mistaken for use-wear (e.g. *Olsen 1989*; *Pankovskiy/Girya/Sablin 2015*), or other functional (*Jin/Shipman 2010*) and production traces (e.g. *D`Errico 1993*; *D`Errico/Villa 1997*). The specific topics discussed here, such as animal canine knapping, animal tooth usage as tools, and cut marks on bird bones, have been analysed by different authors (*Bello et al. 2013*; *Blumenschine 1988*; *Boschin/Crezzini 2012*; *Castel/Madelaine 2006*; *Domínguez-Rodrigo/Fernández-López/Alcalá 2011*; *Miller-Antonio/Schepartz/Bakken 2000*; *Runnings/Gustafson/Bentley 1989*; *Shipman 1989*).

In this paper we present a case study based on three objects, namely a beaver incisor, wolf canine and raven femur, from the Mid Upper Palaeolithic site of Dolní Věstonice II. The Dolní Věstonice – Pavlov – Milovice microregion presents the area with a pattern of site complexes with different hierarchy of settlement strategies and related activities (*Klíma 1959*; *1963*; *1981*; *1995*; *1997*; *Oliva ed. 2009*; *Svoboda 2016*; *Svoboda ed. 1991*; *1994*; *2005*; *2011*; *2016; Svoboda et al. 2016*). The overall composition of animal species at these sites reflects a hunting strategy focused on middle to extra-large sized herbivores, furbearers and some bird species, such as hare (*Lepus europaeus/Lepus timidus*; 19% NISP), woolly mammoth (*Mammuthus primigenius*; 18% NISP), fox (*Vulpes vulpes/Vulpes lagopus*; 17% NISP), wolf (*Canis lupus*;

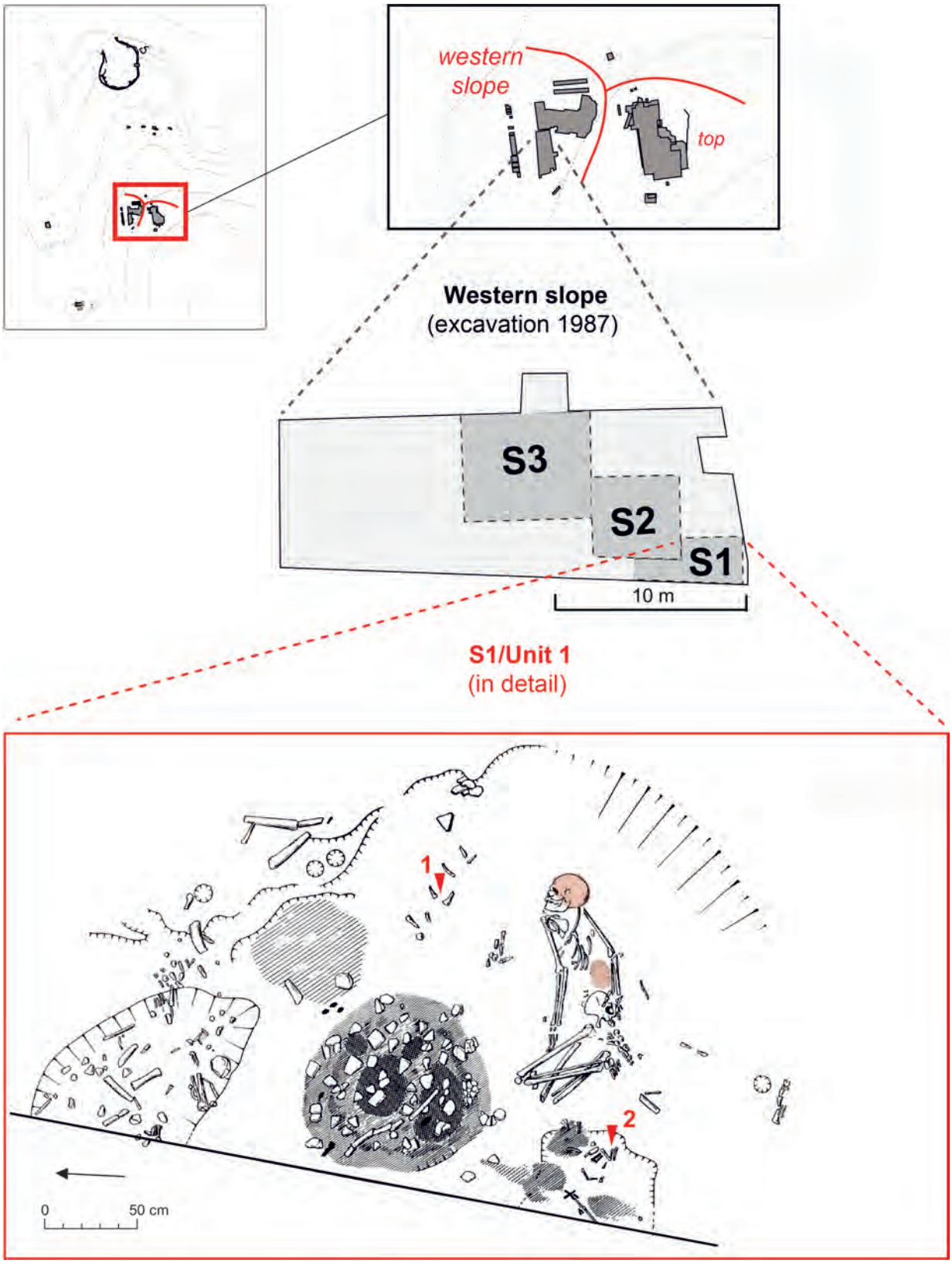


Fig. 1. The Dolní Věstonice II site plan with detail of the S1 settlement unit. 1 – the position of the wolf canine; 2 – raven femur. Vicinity of the male burial DV16 (figure M. Polanská modified after *Klíma 1995*; *Svoboda ed. 1991*; *2016*).

11% NISP), reindeer (*Rangifer tarandus*; 11% NISP), horse (*Equus ferus*; 7% NISP), ptarmigan (*Lagopus* sp.; 6% NISP), raven (*Corvus corax*; 3% NISP), wolverine (*Gulo gulo*; 2% NISP), bear (*Ursus* sp.; 1% NISP) and cave lion (*Panthera leo spelaea*; 1% NISP). The remaining 3% consist of species occurring at these sites with a very low frequency, usually below 1%, such as auroch/bison (*Bos/Bison*), giant deer (*Megaloceros giganteus*), red deer (*Cervus elaphus*), lynx (*Lynx lynx*), beaver (*Castor fiber*), wild cat (*Felis sylvestris*) and others. Naturally, taxon composition differences are observed between individual site zones, especially if domestic zones are compared to mammoth bone deposits, where woolly mammoth is dominant; and between individual sites as well (e.g. *Bocheński et al. 2009*; *Brugère/Fontanta/Oliva 2009*; *Musil 1994*; *1997*; *2005*; *Sázelová 2016*; *Svoboda et al. 2011*; *Wertz/Wilczyński/Tomek 2015*; *West 1997*; *Wilczyński et al. 2015*; *Wojtal et al. 2012*; *Wojtal/Wilczyński 2015*). The area still lacks a comprehensive taphonomic study, although the individual biotic and abiotic depositional and postdepositional agents and processes have been discussed by various authors (e.g. *Hromadová 2016*; *Musil 2005*; *Sázelová et al. 2018*; *Svoboda et al. 2019*; *Trinkaus/Sázelová/Svoboda 2019*; *Trinkaus/Svoboda eds. 2006*; *Wojtal/Wilczyński/Wertz 2016*). In this study, the combination of technological and morphometric approach was applied with an emphasis to distinguish between traces left by human and non-human taphonomic agents.

THE DOLNÍ VĚSTONICE II CONTEXT OF THE OBJECTS

According to recent archeozoological works done by *P. Wojtal*, *J. Wilczyński* and *K. Wertz* (*2016*) on material from excavations in 1985–1989 the occurrence of the three species at site do not exceed a MNI of 11.4% for wolves, 5.3% for ravens and 0.6% for beaver. There is a striking taxon difference between settlement area and the mammoth bone deposit (*Svoboda et al. 2019*). The beaver tooth was found during the excavation leaded by Bohuslav Klíma in 1986 and might be located to the settlement unit K7 at Site top, which is dated 31.0–30.6 ky cal BP (*Klíma 1995*; *Svoboda 2016*). The wolf canine and raven femur was detected a year later in excavations leaded by Jiří Svoboda in the Western Slope (Fig. 1; *Svoboda 2016*; *Svoboda et al. 1991*). Both finds laid in the settlement unit S1 within close vicinity (up to 100 cm) from male burial DV16. The settlement unit possesses radiocarbon dates between 31.0–29.3 ky cal BP (*Fewlass et al. 2019*; *Svoboda 1987*; *Trinkaus/Svoboda eds. 2006*). The wolf canine was found in a northward direction before the human skull and the raven femur laid in western direction under human lower limbs (Fig. 1).

The depositional color changes observed on the bone and tooth surface can be interpreted by soil character, which according to *L. Smolíková* (*1991*, 68) is described as weakly humous flocculated tinted grey to brown matrix with clodded rounded forms and angular fragments of humous and non-humous brown soil material. The matrix contains the dark brown braunlehm nodules too (some of them mechanically damaged) and the primary components are well sorted with prevalence of unweathered silt. The soil groundmass includes carbonate microskeletons accompanied by numerous epithelia with supply channels of amorphous $CaCO_3$. Additionally, charcoal fragments in various stages of preservation and sizes occur in large numbers and traces of biogenic activity (earthworms and mites) were observed. The sediment character around the beaver tooth is similar, however the density of anthropogenic remains is lower. Furthermore, we have observed tiny red and black colored microparticles on the studied bone and tooth surfaces (cf. *Hromadová 2016*). These traces reflect the wet depositional and postdepositional environment of the surrounding sediments (caused by water reservoirs stored in depressions, ice wedges or gullies), which have been observed at different parts of the Dolní Věstonice II site (*Svoboda et al. 2019*).

MATERIAL AND METHODS

This paper focuses on three objects from the Dolní Věstonice II site, displaying specific traces after the surface modifications. Namely, a permanent right lower canine of a wolf (*dens caninus inferior dx.*), the right femur of an adult raven (*femur dx.*) and a permanent upper right beaver incisor (*dens incisivus superior dx.*).

Anatomical and taphonomical methods

Taxonomic and anatomic descriptions follow osteological atlases (*France 2009*; *Hillson 1992*; *2005*; *Schmid 1972*; *Tomek/Bocheński 2000*), taphonomic studies (*Binford 1981*; *Fernández-Jalvo/Andrews 2016*; *Hall/Byrd 2012*; *Tibbett/Carter 2008*) and works with virtual comparative collections VZAP.org (Virtual Zooarcheology of the Arctic project) and ARCHEOZOO.org (Portal of archeozoological information). Due to strong surface modifications the wolf canine and beaver incisor were measured in their greatest length axis and greatest breadth axis. The raven femoral measurements were taken based on recommendations by *A. von den Driesch* (*1976*), where the greatest length (GL) was taken between the major tuber and lateral distal condyle. A Spi digital caliper 6"/.001" was used for all measurements. The * indicates the estimated diameter. Biotic and abiotic taphonomic traces were analysed using a NIKON SMZ 1500 stereomicroscope (Amstelveen, Netherlands) at 7.5–110.0 x magnification.

Archeological methods

The methodological scheme for hard organic tissue artefacts analysis was described in several papers concerning technological analysis (macro-striation analysis) and taphonomical and paleozoological studies of accompanying osteological material (e.g. *Averbouh/Provenzano 1998*; *Dauvois 1977*; *D`Errico 1991*; *Fernández-Jalvo/Andrews 2016*; *Filippov 1983*; *Rigaud 2007*; *Semenov 1957*). The procedure followed in this study might be summed up in the four subsequent points.

1. raw material identification (classification by the anatomical position, description of structure, identification of the surface with alteration);
2. distribution of the traces and its analysis (location, orientation, organization, quantity, size) and the trace morphology (profile, bords, section, shape) according to the macro- and microscopic criteria;
3. distinction between the human impact and nonhuman taphonomic agents, alterations and/or processes;
4. identification of the possible origin of trace.

The objects were documented photographically under the stereomicroscope and the figures were calibrated and analysed by the NIS-element software (Amstelveen, Netherlands). For the macro level photo documentation, a Canon EOS 60 camera with EFS 60 mm and Helicon Focus 5.2 software (Kharkiv, Ukraine) was used.

Bird bone experiment

In order to collect more reference data and to reconstruct the traces of origin on the raven femur, it was necessary to build own experimental material. As raven bones were not available, the experiment was based on six chicken (*Gallus gallus* f. *domesticus*) femurs of similar size and morphology. Each bone was cleaned from soft tissues by different experimental lithic tools (unretouched), present in the Dolní Věstonice II collections, namely a non-retouched blade (8 and 12 cm, *idem silex du Bergeracois*), an endscraper (*idem silex du Bergeracois*), a diherdal burin (*idem silex du Bergeracois*) and a *bec* (*idem silex du Bergeracois*).

RESULTS

Beaver incisor

The upper right beaver incisor with a greatest length 28.2 mm and breadth 8.6 mm is postdepositionally broken (Fig. 2: 1). Its lingual side is heavily affected by a series of impacts causing the removal of dentine and enamel revealed in its uppermost part, extended on 4.0 mm from its occlusal direction. The observed pattern is more irregular in comparison to natural tooth wear, where a shallow, smooth relief is expected. The tooth surface is changed by several clearly separated deep, transverse grooves, which at first glance seem to represent a possible intentional manipulation. The tooth is slightly etched by roots and the dark dot-like pattern is most probably caused by manganese oxides.

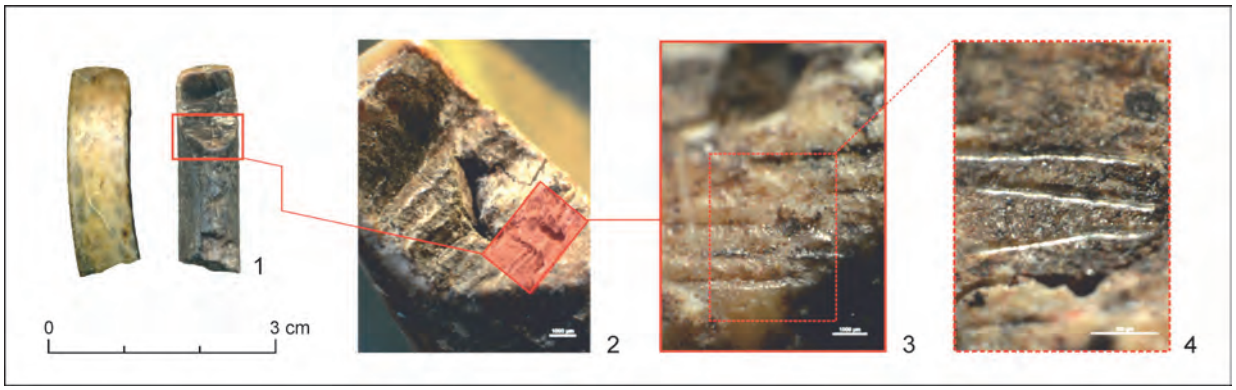


Fig. 2. The Dolní Věstonice II site. Beaver incisor. 1 – buccal (left) and lingual (right) side of the tooth; 2 – a micro-view of the longitudinal microstriation on the bottom of grooves (tooth rotate on +45°); 3, 4 – which create fine parallel lines with a different depth without overlapping. Scales: macro bar = 3cm, micro bar = 1000 microns (photo by S. Sázelová, B. Hromadová).

The grooves have a parallel orientation to the enamel and do not overlap each other (Fig. 2: 2). The relatively smooth surface complicated the microscopic analysis, so we were not able to closely estimate the specific number of grooves. In three instances the beginning and ending of grooves finish within the enamel. Thus, we can suggest here, that the grooves originated earlier than they might be deformed by natural process of enamel abrasion and smoothing. The edges in between grooves create a natural tooth surface disturbed with numerous deformations and gloss. In section, the side and bottom of them bear a U-shape; the edge of individual groove is slightly rounded and often does not create any distinct passage from the natural tooth surface (Fig. 2: 3). A longitudinal microstriation was observed on the bottom of grooves, creating fine lines with same orientation, different depth and without any overlapping. The side surface of grooves is uniform and slightly waved in its orientation (Fig. 2: 4). However, we did not observe any microbarriers within these waved parts left behind the even spreading of groove and the other expectable irregularities or deformations caused by the working artefact were not detected either. According to all these characteristics of microrelief we cannot confirm with at least low degree of certainty a relationship between such deformations and human activities.

Wolf canine

The right lower permanent wolf canine has a total length 42.2 mm and breadth 14.2 mm. Only the distal half of the tooth is preserved (Fig. 3: 1). The enamel was almost fully removed from the crown and the impacts running in the apical direction have affected the neck and root shape too. The dental cavity remained intact in the occlusal plane. The preserved parts reach approximately one half of the length in natural state, which depends on age and abrasion stage. The root size suggests a mature individual, with fully mineralized and closed root apex. The root surface is heavily etched by plants, which means that the tooth was in its taphonomic history in a direct contact with the root system.

Most of the enamel was removed from the crown with the exception of several millimeters remaining on the bucco-dorsal and lingual side. The residual coronal part represents the pointed dentine projection, approx. 13.0 mm in length, which is affected by a longitudinal fissure extending from the occlusal plane down to the pointed part and causing the absence of the mesial half. The crack development remains thus unclear, although the edges are straight, oriented, without shredding and progressively meets in the occlusal direction. The fissure´s ending stops in the tongue fracture with a shallow undulation. Based on the fissure´s color it is obvious that it could be taphonomically dated back to prehistory and we can correlate it with the latest, discarding phase of the object.

The remaining crown part is shaped by a series of three inclined and sequent removals. Their surfaces and mutual arrangement are similar to a sharpened pencil tip (Fig. 3: 2). These negatives overlap each other (Fig. 3: 3), however the smoothness on their surfaces and edges preclude any specification of a knapping manner. Since the radical part is absent, an area of a possible percussion is

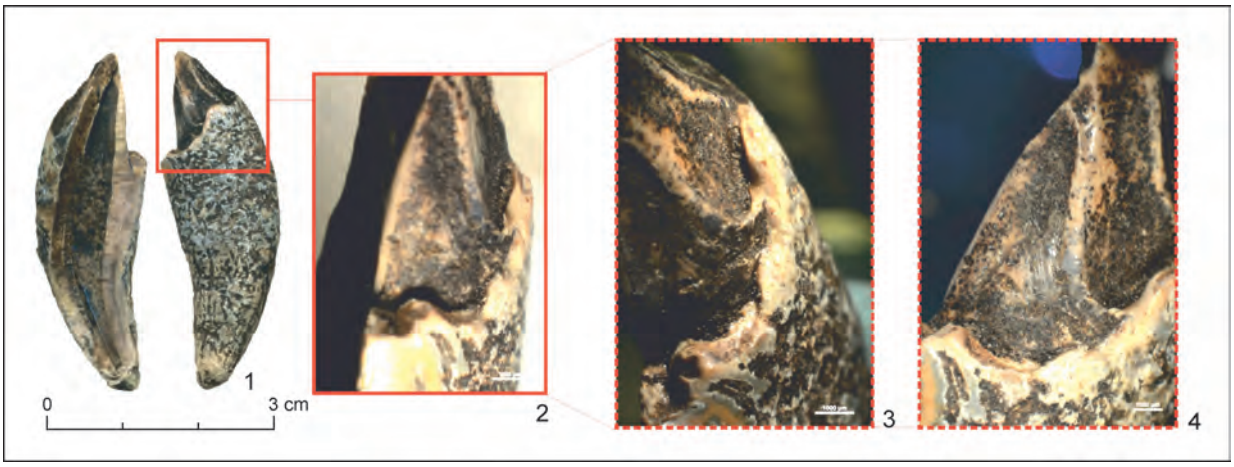


Fig. 3. The Dolní Věstonice II site. Wolf canine. 1 – mesial (left) and distal (right) sides of the tooth; 2 – a micro-view of the pointed tip (tooth rotate on +90°) with two types of intentional alterations; 3 – regular oblique alterations/removals (tooth rotate on -30°); 4 – longitudinal fracture formation, which might be related to the morphology of the point. Scales: macro bar = 3 cm, micro bar = 1000 microns (photo by S. Sázelová, B. Hromadová).

not preserved. The surface of chopping ends at the root border, where it creates a plunging fracture. It seems that the fissure´s spreading was stopped here too. The occlusal part of crown creates a partially preserved and pointed apex, which displays a series of smoothing and tiny negatives of microremovals (Fig. 3: 4). The tooth conservation precludes detection of functional traces under the microscope.

Raven femur

The right femur with both fused epiphyses belongs to an adult bird (GL = 66.8* mm). The bone is nearly complete, except the broken distal condyle on the medial side (Fig. 4: 1). The impacts are located on the dorsal side of the femoral body and extend from the medial to lateral side, most frequently on the proximal part of the diaphysis. Other traces are located on the ventral side above the distal extremity (*extremitas inferior femoris*) and run directly between both condyles on the *facies patellaris femoris*. The bone surface is slightly etched by roots and there is an obvious secondary change of color into the light brown shade with precipitated microparticles of manganese dioxide and iron oxides; the original color of bone surface (beige to light yellow) still occurs at several places.

The raven bone possesses several traces of anthropogenic origin, such as cut marks, depressions and remains after bone modification with a specific microrelief (Fig. 4: 2, 3). The femoral patination helps us to determine the origin and sequence of human intervention (cuts/grooves). Although, we cannot determine the complete taphonomic history step by step, the patination was influenced by the cultural layer with several charcoal lenses. The brown patination with manganese oxides covers the whole bone surface and some of the modification traces, from which we can suggest that the majority of these traces occurred before the bone deposition within the cultural layer.

Firstly, the alterations concentrate on the distal epiphysis and creates the transversal, mostly shallow cuts (Fig. 4: 4). Their breadth is mostly constant across the bone, where some of them are overlapping each other and alternatively display the typical frayed ending, which is connected to the repeated back and forward motion during the cutting. The depth of the incisions varies in the middle and endings and indicates the gradual penetration of artefact into the material with a relatively flat working edge moving on the rounded surface. The accurate cut-profile cannot be closely characterized due the infilling with dark sediment. The overall localization, orientation and character of cuts suggest decarnization, the removing of muscle mass from the bone base with a lower occurrence of meat (*Laroulandie 2001; 2009*).

Secondly, the other type of alteration is located on the dorsal surface of the femoral body and presents tiny linear striations in the form of parallel incisions or linear depressions covering most of the proximal bone. They create miniature shallow lines with a sharp bottom no longer than 3–4 mm; the length is regular across the bone and becomes longer 4–5 mm below the intertrochanteric crest of the proximal

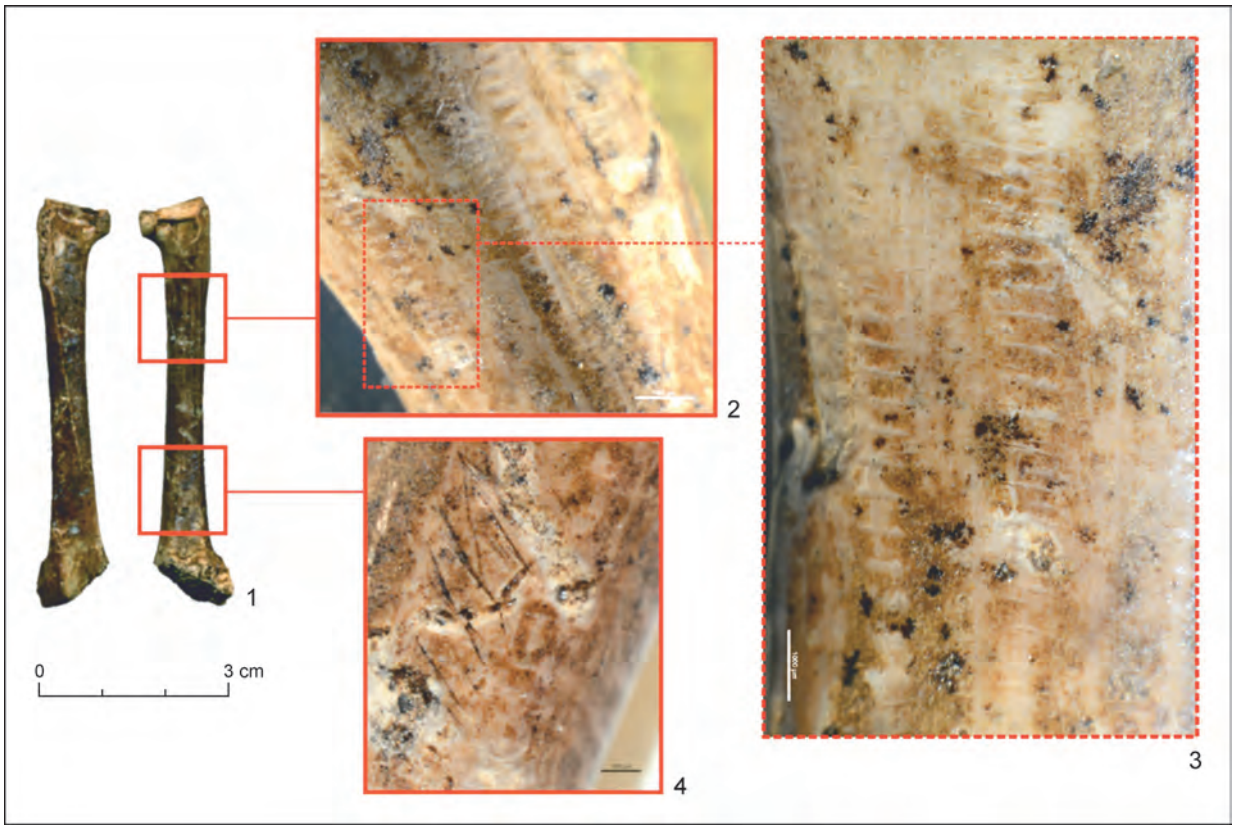


Fig. 4. The Dolní Věstonice II site. Raven femur. 1 – ventral (left) and dorsal (right) sides of the bone; 2 – micro-view (bone rotate on +30°) of linear alterations covering most of the proximal part; 3 – micro-view (bone rotate on 0°) of linear alterations covering most of the proximal part; 4 – micro-view (bone rotate on -30°) of stigmates (incisions) after decarnization. Scales: macro bar – 3 cm; micro bar – 1000 microns (photo by S. Sázelová, B. Hromadová).

part. Morphologically, they comprise of tiny grooves followed by another series of longitudinal striations, running with a regular spacing between each of them. The individual grooves are without any patination, which might suggest that these cuts were caused postdepositionally while the bone was excavated. However, close examination of the bone surface shows that some part of the striations is still covered by this patination (the flat surface of compact bone too), sometimes followed by manganese oxide infilling. The original bone surface seems to be well preserved with a slight weathering. So, we suggest here, that the covering and uncovering of these shallow stigmata was likely caused by infilling them with fine sediment and patine crystallization, which both were subsequently removed when the bone was washed after the rescue excavations (pers. comm. J. Svoboda). Unfortunately, due to the strong patination it was not possible to understand the relation between the longitudinal striations and transversal lines on the diaphysis. However, a direct link between these two main types of alterations confirm their association at the epiphyseal surface. Considering the fact, the part of the striation remains uncovered and filled by the sediment. Moreover we lack any direct evidence supporting post-excavational origin of the traces (e.g. postexcavational cleaning of the bone with metal edge).

Another interesting detail is the overall character of these linear traces, when their breadth and length is stable in size, varying just in depth and orientation to the bone surface. They are much wider on the diaphysis when compared to the proximal end with different side angles and sharp bases. The transversal orientation of these alterations respects the main longitudinal bone axis and their inclination slightly changes in the proximal epiphyseal direction where starts to be oblique in its character. Such difference in overall direction and orientation is likely caused by the changing trajectory of used lithic artefact, which mirrored the general bone shape on its diaphysis – proximal epiphysis transition. However, we did not observe any specific changes in the microrelief of the trace edges. Furthermore, the series of transversal parallel lines are arranged in several rows (Fig. 4: 3). The bone surface with depressions is slightly undulate. Rows are approximately parallel and somewhat overlapping each

other or they are in superposition. The bone surface displays flattening along those rows, the linear striations provide a very fine linear pattern that at some degree can be mistaken with ornamentation. Such alterations, if accompanied by other diagnostic features, result from the activity performed by the straight edged tool, when the linear and progressive motion is applied with increasing force towards the epiphysis.

Around the metaphysis the striations display a deeper character, while lines and row length vary in their trajectory. Change of the depth and orientation of striations can be caused by a different morphology of bone surface, in the transition between diaphysis and distal epiphysis. The diagnostic features have the most pronounced morphology in this part of the bone. The transversal striations have an irregular V-shaped bottom edge and triangular cross-section. The walls form a blunt angle, still differs in angle of inclination to the bone surface. These irregularities define the position of stone tool working edge, change of the applied force and contact pressure. On the other hand, the regularity observed in the microdeformations, the similar length and terminations, and repeating elements of diagnostic features, suggest that the same intentional origin is observed in these linear striations. We propose that the alterations do not result from cutting or sawing (back and forward motion as in the first case), and the whole complex of traces is necessary to be analysed. Together with the longitudinal striations, organization of traces in rows, trajectory and character of the surface we consider their origin resulting in scraping/planning, when the force and contact pressure of the sharp cutting edge on the bone surface is applied. Regularity of marks and straight bottom edge corresponds to the narrow cutting edge. V-shaped and triangular cross-section shows the angle at which the tool was held, as well as the width of the cutting edge. Apparently, the tools went to the bone surface under a constant angle, almost perpendicular to the trajectory of tool. The main question on the final form of the tool, which created the traces, remains unanswered.

DISCUSSION

Beaver incisor

The atypical traces on the beaver incisor (*Hillson 2005*) shift our attention to the pathological conditions during the individual´s end of life. The most possible interpretation seems to be the gnawing of heavy objects, when its jaws misfit each other up to 2–3 mm, which caused a temporary malocclusion before the animal´s death (perhaps when trying to escape from a human or natural trap; pers. comm. I. Horáček).

Wolf canine

The analysis of this object is based on the description of traces, analysis of their development, and interaction between them and a causality of following actions. The very specific shape of the tooth crown excludes other non-intentional and taphonomic agents and processes as being the potential producers of such traces. The oldest trace generation belongs to the negatives of the deeper and oblique removal, extending into the dentine. Regular oblique alterations, organized side by side and inclined on the surface in almost a vertical line from the crown to root, refers to the intentional origin of the traces. All these traces form together the pointed tip, in order to create an appropriate pointed active part or to utilize the primary fracture of the tooth, which appeared to be a result of another accident. Unfortunately, due to the inappropriate preservation of the surface, it is impossible to identify the technique used. In addition, such pointed morphology can be a result of intentional object modification too. Generally, we lack comparative material. There is a low number of published objects with the similar shape or traces, such as recently described modified and used Cercopithecid canines from the Late Pleistocene cave site Fa-Hien Lenain Sri Lanka (*Langley et al. 2020*).

Based on the position and organization of all surface alterations, we suggest that the longitudinal fracture occurred as the latest trace. The pointed tooth morphology has determined the longitudinal spreading of the fracture along the major axis. We can conclude that the general morphology of the point and fracture formation are related. The very deep and slightly bent longitudinal fracture with an orientation to the occlusal part might be a result of contact with another hard surface in pressure. The fracture

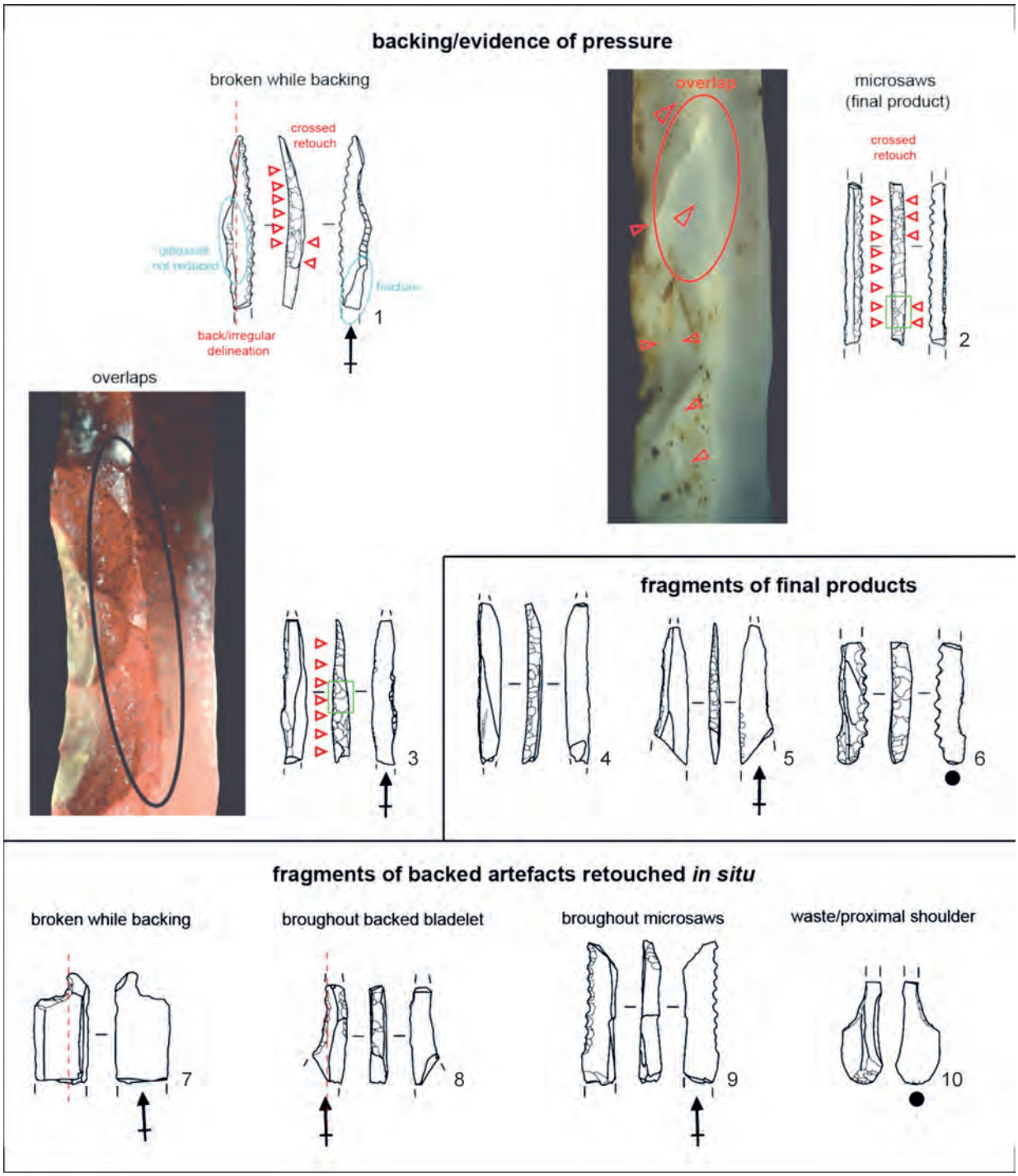


Fig. 5. Selected lithic artefacts from the S1 settlement unit at Dolní Věstonice II (figure M. Polanská).

stopped in the crown tuberculum at the border of histologically different tissues of enamel and dentine. The longitudinal fracture thus most likely occurred as a result of an intentional activity with the pointed part. In order to summarize the previous observations, we can identify two types of alterations: a) short removal scars and b) destructive longitudinal fracture, related to the single and common operation. According to the above-described characteristics both types might occur during intense contact with hard materials.

Such a pointed object, that displays possible contact with a hard surface at the tip can have an interesting contextual explanation. Within its closest vicinity were found several unfinished backed

tools, namely backed microsaws (Fig. 5: 2, 6), backed bladelets (Fig. 5: 3–5) or microgravettes of Dolní Věstonice subtype (*Polanská 2020*; *Svoboda ed. 1991*) and waste after their production. All these lithics were produced *in situ*, as demonstrated by broken pieces abandoned in various stages of backing (Fig. 5: 1, 7–9) and again their waste (Fig. 5: 10). The final backing was made by an organic casually rounded tip which pressed on the edge of an organic raw material. The microverlaps on the retouches present then the characteristic markers after such technique (*Pelegrin 2004*, 163, 164). As an appropriate tool to produce such traces we can consider any pointed piece, including discarded and reutilized tools (for example, needles or tiny awls, etc.). Therefore, one of the possible interpretations for the wolf canine could be its usage as a pressure tool in backed tool production. The usage of retouchers, compressors and other pressure tools from hard animal tissues are widely discussed in the literature and its variability increases (e.g. *Castel/Chauvière/Madelaine 2003*; *Castel/Madelaine 2006*; *David/Pelegrin 2009*; *Hutson et al. eds. 2018*). On the microlithic backs from the settlement units S1–S4 and adjacent areas from Dolní Věstonice II, where a crossed abrupt retouch was used, we documented possible evidence of a pressure usage (Fig. 5: 1–3; cf. *Pelegrin 2004*; *Polanská 2016*). The question of lithic artefact modification, where the retouch produced by direct or partial pressure together with the wolf canine with the traces after negative removals (after the pressure on other objects) remains open. Such interpretation would be an ideal scenario sufficiently supported by the presence of more hard animal tissue artefacts of similar or close morphological type beside the microsaws production in the Moravian Pavlovian. However, the occurrence of similar organic objects, or more precisely their deeper description, is still very low.

Raven femur

Two types of striations have been identified on the raven bone surface. The first type of striation undoubtedly belongs to stigmata related to the bird bone decarnization, similarly identified at other archaeological sites (*Laroulandie 2009*). The second type of traces remains problematic due to the regular diagnostic features that can lead to the misinterpretation of stigmata as a result after sawing. The whole complex of the morphological features and alterations recognized on this raven femur does not correspond to the activities, such as decarnization or disarticulation of bird bones as described in the literature (*Laroulandie 2009*).

The experiment showed (Table 1) that the overall tool morphology played a less important role than its form and modifications caused by the active edge. The experimental bone with soft tissues cleaned by the burin demonstrates the greatest similarity with our archaeological sample, if compared to the bone bearing the traces after blade work. The cleaning resulted into the rows with fine transversal striations and with the regular spacing between each short and shallow incisions. Trajectory of the tool movement is determined just by the flattened surface of rows and is rarely accompanied by the longitudinal direction stigmata. This probably presents the decarnization effect on the fresh bone with soft tissues still preserved (periost and muscles), while the waste from the soft material is accumulated on the active edge of the burin. The striation regularity results from the appropriate tool angle (held close to 90°), steady pressure on the worked material, kinetics of the tool and the quality of the bone tissue. Still, it is necessary to remember, that such stigmata are influenced by the personal choice and skills of the individual cleaning the material too.

The first problematic detail is the V-shaped bottom edge of the striation observed on the archeological sample. Such a feature is nearly absent on the experimental sample and must be correlated to the stone tool edge morphology and the pressure intensity on the bone surface. This question remains thus open for future research. The second group of striations might be associated with decarnization as well, respectively, with a longitudinal bone scraping by a firm edge (burin edge) and with a steady regular pressure on the bone surface. Due to the absence of further details about the activities related to the bird bone processing at the Dolní Věstonice site, this question remains yet unexplained (cf. *Wertz/Wilczyński/Tomek 2015*). The closest example is described by *Z. M. Bocheński et al.* (*2009*, 2658) in the case of a griffon vulture (*Gyps fulvus*) ulnar fragment from the Pavlov I site, where two groups of incisions on its proximal part have been described. Eight incisions have been observed on the ventral bone side and then another 18 slight incisions with a regular interval were located on its dorsal side.

Table 1. Comparative summarization of the experimental background to the human manipulation with chicken femurs.

Tool	Working edge	Retouch	Active part of the tool	Applied technique	Trajectory (kinetic of the movement; motion)	Position of the material	References
Endscraper	convex	yes	corniche of the front (*la ligne de front*, front edge)	scraping	reciprocating (longitudinal) motion	front-face to the user	e.g. *Dauvois 1977*
Blade	straight and linear	no	cutting edge	planing	rectilinear motion, edge is transversal to the worked surface	front-face to the user	e.g. *Rigaud 2007*
Dihedral burin	straight and linear	no	*chanfrein*	planing/ scraping	reciprocating motion, edge is transversal to the worked surface	front-face to the user	e.g. *D`Errico 1991*; *Fillipov 1983*; *Rigaud 2007*

CONCLUSIONS

Here, we present three objects with atypical traces of their surface modifications. The beaver incisor was modified during the short-term malocclusion before the individual´s death. The wolf canine bears evidence of pressure causing the predepositional breakage of the tooth. The enamel (hard and fragile) removal and exposition of dentine (soft and elastic) changed the mechanical properties of the canine during the pressure backing of the selected lithic artefacts. The raven femur was likely defleshed in its fresh stage using a dihedral burin or other closely related artefact with similar cutting-edge shape. If we compare these three case objects to the complex Gravettian animal hard tissue artefacts and art discovered in the Dolní Věstonice – Pavlov – Milovice microregion, they are seemingly of less importance. Still, their study enhances our understanding of human and natural modifications in this time period and opens question which are not fully explored.

Acknowledgements

We are thankful to prof. Jiří Svoboda (Institute of Archeology in Brno, Faculty of Science, Masaryk University, Czech Republic), prof. Ivan Horáček (Faculty of Science, Charles University, Czech Republic), Dr. Jacques Pelegrin (CNRS, UMR 7055 – Préhistoire et Technologie, France) for their comments and suggestions. The paper was supported with the Czech Science Foundation (grant number: 20-26094S).

Translated by authors

BIBLIOGRAPHY

Averbouh/Provenzano 1998 — A. Averbouh/N. Provenzano: Propositions pour une terminologie du travail préhistorique des matiéres osseuses. I – Les techniques. *Préhistoire Anthropologie Méditerranéennes* 7, 1998, 5–25.

Bello et al. 2013 — S. M. Bello/S. A. Parfitt/I. De Groote/G. Kennaway: Investigating experimental knapping damage on an antler hammer: A pilot-study using high-resolution imaging and analytical techniques. *Journal of Archaeological Science* 40, 2013, 4528–4537.
DOI: https://doi.org/10.1016/j.jas.2013.07.016

Binford 1981 — L. R. Binford: *Bones: ancient man and modern myths.* San Diego 1981.

Blumenschine 1988 — R. J. Blumenschine: An experimental model of the timing of hominid and carnivore influence on archaeological bone assemblages. *Journal of Archaeological Science* 15, 1988, 483–502.

Bocheński et al. 2009 — Z. M. Bocheński/T. Tomek/J. Wilczyński/J. Svoboda/K. Wertz/P. Wojtal: Fowling during the Gravettian. The avifauna of Pavlov I, the Czech Republic. *Journal of Archeological Science* 36, 2009, 2655–2665.
DOI: https://doi.org/10.1016/j.jas.2009.08.002

Boschin/Crezzini 2012 — F. Boschin/J. Crezzini: Morphometrical analysis on cut marks using a 3D digital microscope. *International Journal of Osteoarchaeology* 22, 2012, 549–562.
DOI: https://doi.org/10.1002/oa.1272

Brugère/Fontanta/Oliva 2009 A. Brugère/L. Fontanta/M. Oliva: Mammoth procurement and exploitation at Milovice (Czech Republic). New data for the Moravian Gravettian. In: L. Fontana/F.-X. Chauvière/A. Bridault (eds): *In search of total animal expoitation. Case studies from the Upper Palaeolithic and Mesolithic. Proceedings of the XVth UISPP Congress. Session C61, Lisbon, 4–9 September 2006. vol. 42.* Oxford 2009, 45–69.

Castel/Chauvière/Madelaine 2003 J.-Ch. Castel/F.-X. Chauvière/S. Madelaine: Sur os et sur dents: les "retouchoirs" aurignaciens de la Ferrassie (Savignac-de-Miremont, Dordogne). *PALEO* 15, 2003, 29–50.

Castel/Madelaine 2006 J. C. Castel/S. Madelaine: Quelques éléments remarquables de la faune du Solutréen de Laugerie-Haute (Les-Eyzies-de-Tayac, Dordogne). PALEO. *Revue d'archéologie préhistorique* 18, 2006, 275–284.

Dauvois 1977 M. Dauvois: Stigmates d'usure présentés par des outils ayant travaillé l'os. Premiers résultats. In: H. Camps-Fabrer (dir.): *Méthodologie appliquée à l'industrie de l'os préhistorique.* Actes du Colloque International du CNRS 568. Paris 1977, 275–292.

David/Pelegrin 2009 E. David/J. Pelegrin: Possible Late Glacial bone "retouchers" in the Baltic Mesolithic. The contribution of experimental tests with lithics on bone tools. In: M. Street/R. N. E. Barton/T. Terberger (eds.): *Humans, environment and chronology of the Late Glacial of the North European Plain. Proceedings of workshop 14 (Commission XXXII) of the XVth Congrès de l'Union internationale des sciences pré- et protohistoriques UISPP. Lisboa, 4th–9th of September 2006*. Römisch-Germanisches Zentralmuseums Tagungen 6. Mainz 2009, 155–168.

*D`Errico 1991* F. D`Errico: Etude technologique à base expérimentale des entailles sur matière dure animale. Implications pour l'identification de systèmes de notations. In: *25 ans d'Études technologiques en Préhistoire.* XIèmes Rencontres Internationales d'Archéologie et d'Histoire d'Antibes, APDCA. Juan-les-Pins 1991, 83–97.

*D`Errico 1993* F. D`Errico: Identification des traces de manipulation, suspension, polissage sur l'art mobilier en os, bois de cervidé, ivoire. In: P. C. Anderson/S. Beyries/M. Otte/H. Plisson (eds.): *Traces et fonctions: les gestes retrouvés, Actes du colloque international de Liège, décembre 1990.* Vol. 1, ERAUL 50. Études et Recherches archéologiques de l'Université de Liège. Liège 1993, 177–188.

*D`Errico/Villa 1997* F. D`Errico/P. Villa: Holes and grooves. The contribution of microscopy and taphonomy to the problem of art origins. *Journal of Human Evolution* 33, 1997, 1–31.

Domínguez-Rodrigo/Fernández-López/Alcalá 2011 M. Domínguez-Rodrigo/S. Fernández-López/L. Alcalá: How can taphonomy be defined in the XXI Century? *Journal of Taphonomy* 9, 2011, 9–13.

Driesch 1976 A. von den Driesch: *A guide to the measurement of animal bones from archaeological sites.* Harvard University, Peabody Museum of Archaeology and Ethnology Bulletin 1. Cambridge 1976.

Fernández-Jalvo/Andrews 2016 Y. Fernández-Jalvo/P. Andrews: *Atlas of taphonomic identifications: 1001+ images of fossil and recent mammal bone modifications. Springer.* Dotrecht 2016.

Fewlass et al. 2019 H. Fewlass/S. Talamo/B. Kromer/E. Bard/T. Tuna/Y. Fagault/M. Sponheimer/Ch. Ryder/J.-J. Hublin/A. Perri/S. Sázelová/J. Svoboda: Direct radiocarbon dated of mid Upper Palaeolithic human remains from Dolní Věstonice II and Pavlov I, Czech Republic. *Journal of Archaeological Science* 27, 2019, 102000. DOI: https://doi.org/10.1016/j.jasrep.2019.102000

Filippov 1983 A. K. Filippov: Problemy tekhnicheskogo formoobrazovaniya orudiy truda v paleolite. In: A. N. Rogachev (red.): *Tekhnologiya proyzvodstva v epokhu paleolita*. Nauka. Leningrad 1983, 9–72.

France 2009 D. L. France: *Human and nonhuman bone identification. A color atlas.* Boca Raton 2009.

Hall/Byrd 2012 D. W. Hall/J. Byrd: *Forensic botany: A practical guide. Wiley-Blackwell. Chichester.* Hoboken 2012.

Hillson 1992 S. Hillson: *Mammal bones and teeth. An introductory guide to Methods of identification.* London 1992.

Hillson 2005 S. Hillson: *Teeth*. Cambridge 2005.

Hromadová 2016 B. Hromadová: Bone, antler and ivory tools. In: J. Svoboda (ed.): *Dolní Věstonice II. Chronostratigraphy, Paleoethnology, Paleoanthropology.* The Dolní Věstonice Studies 21. Brno 2016, 273–302.

Hutson et al. eds. 2018 J. M. Hutson/A. Garcia-Morena/E. S. Noack/E. Turner/A. Villaluenga/S. Gaudzinski-Windheuser (eds.): *The Origins of Bone Tool Technologies.* Römisch-Germanisches Zentralmuseum Tagungen 35. Mainz 2018.

Jin/Shipman 2010 J. J. Jin/P. Shipman: Documenting natural wear on antlers.A first step in identifying use-wear on purported antler tools. *Quaternary International* 211, 2010, 91–102.
DOI: https://doi.org/10.1016/j.quaint.2009.06.023

Klíma 1959 B. Klíma: Výzkum paleolitického sídliště u Pavlova v roce 1956. *Archeologické rozhledy* 11, 1959, 3–14.

Klíma 1963 B. Klíma: *Dolní Věstonice* Praha 1963.

Klíma 1981 B. Klíma: *Dolní Věstonice tábořiště lovců mamutů.* Praha 1981.

Klíma 1995 B. Klíma: *Dolní Věstonice II. Ein Mammutjägerrastplatz und seine Bestattungen. Servise de préhistoire.* The Dolní Věstonice Studies 3. ERAUL. Liège 1995.

Klíma 1997 B. Klíma: Die Knochenindustrie, Zier- und Kunstgegenstände. In: J. Svoboda (ed): *Pavlov I – Northwest.* The Dolní Věstonice Studies 4. Brno 1997, 227–286.

Langley et al. 2020 M. C. Langley/N. Amano/O. Wedage/S. Deraniyagala/M. M. Pathmalal/N. Perera/N. Boivin/M. D. Petraglia/P. Roberts: Bows and arrows and complex symbolic displays 48,000 years ago in the South Asian tropics. *Science Advances* 6/24, 2020, 1–8.
DOI: https://doi.org/10.1126/sciadv.aba3831

Laroulandie 2001 V. Laroulandie: Les traces liées à la boucherie, à la cuisson et à la consommation d'oiseaux. Apport de l'expérimentation. Association pour la promotion de l'archéologie de Bourgogne. In: L. Bourguignon/I. Ortega/M. C. Frêre-Sautot (eds.): *Préhistoire et Approche expérimentale M. Mergoil.* Montagnac 2001, 97–108.

Laroulandie 2009 V. Laroulandie: De la plume à l'œuf: exploitation des resources aviaires au Magdalénien dans le sud de la France. In: L. Fontana/F.-X. Chauvière/A. Bridault (eds.): *In search of total animal exploitation. Cases studies in Upper Palaeolithic and Mesolithic. Proceedings of the XVth UISPP World Congress. Lisbon, 4–9 September 2006*. Session C 61. Vol. 42. BAR International Series 2040. Oxford 2009, 71–89.

Miller-Antonio/Schepartz/Bakken 2000 S. Miller-Antonio/L. A. Schepartz/D. Bakken: Raw material selection and evidence for rhinoceros tooth tools at Dadong Cave, Southern China. *Antiquity* 74/284, 2000, 372–379.
DOI: https://doi.org/10.1017/S0003598X00059457

Musil 1994 R. Musil: The hunting game of the cultural layer of Pavlov. In: J. Svoboda (ed.): *Pavlov I Excavations 1952–1953*. Études et recherches archéologiques de L´Université de Liège. Liège 1994, 183–209.

Musil 1997 R. Musil: Hunting game analysis. In: J. Svoboda (ed.): *Pavlov I – Northwest.* The Dolní Věstonice Studies 4. Brno 1997, 443–468.

Musil 2005 R. Musil: Animal Prey. In: J. Svoboda (ed.): *Pavlov I Southeast. A window into the Gravettian lifestyles.* The Dolní Věstonice Studies 14. Brno 2005, 190–228.

Pankovskiy/Girya/Sablin 2015 V. B. Pankovskiy/E. Yu. Girya/M. V. Sablin: Trasologicheskie kriterii otlichiya predmetov pervobytnogo iskusstva i ostatkov fauny s estestvennymi vidoizmeneniyami. *Stratum plus* 1, 2015, 169–184.

Oliva ed. 2009 M. Oliva (ed.): *Sídliště mamutího lidu u Milovic pod Pálavou.* Studies in Anthropology, Palaeoethnology, Palaeontology and Quaternary Geology 27/19. Brno 2009.

Olsen 1989 S. L. Olsen: On distinguishing natural from cultural damage on archaeological antler. *Journal of Archaeological Science* 16, 1989, 125–135.

Polanská 2016 M. Polanská: XIV. L'industrie lithique de Dolní Věstonice II découverte avant 1990. In: J. Svoboda (ed.): *Dolní Věstonice II. Chronostratigraphy, Paleoethnology, Paleoanthropology.* The Dolní Věstonice Studies 21. Brno 2016, 161–245.

Polanská 2020 M. Polanská*: Questionnement sur la diversité du Pavlovien par l'étude technologique des gisements moraves.* Spisy AU AV ČR 66. Brno 2020.

Pelegrin 2004 J. Pelegrin: Sur les techniques de retouche des armatures de projectile. In: N. Pigeot (ed.): *Les derniers magdaléniens d'Etiolles. Perspectives culturelles et paléohistoriques (l'unité d'habitation Q31).* CNRS Editions, XXXVIIème supplément à Gallia Préhistoire. Paris 2004, 161–166.

Rigaud 2007 A. Rigaud: Retouchoirs sur éclats diaphysaires ou "affûtoirs" de Labastide (Hautes-Pyrénées). Du barbarisme scientifique à la rigueur artisanale au traversde l'expérimentation. *Archéologie des Pyrénées occidentales et des Landes* 26, 2007, 193–200.

Runnings/Gustafson/Bentley 1989 A. Runnings/C. Gustafson/D. Bentley: Use-wear on bone tools. A technique for study under the scanning electron microscope. In: R. Bonnischen/M. H. Sorg (eds.): *Bone modification. Centre for the Study of the First Americans.* Orono 1989, 259–266.

Sázelová 2016 S. Sázelová: Small osteological elements analysis. Case study of newly excavated faunal remains (after 1990). In: J. Svoboda (ed.): *Dolní Věstonice II. Chronostratigraphy, Paleoethnology, Paleoanthropology.* The Dolní Věstonice Studies 21. Brno 2016, 129–137.

Sázelová et al. 2018 S. Sázelová/J. Wilczyński/P. Wojtal/J. Svoboda/E. Trinkaus: Puzzling pairs from Pavlov and Mortuary diversity in the Mid Upper Paleolithic. *Přehled výzkumů* 59, 2018, 69–88.

Schmid 1972 E. Schmid: *Atlas of animal bones for prehistorians, archaeologists and Quaternary geologists.* Amsterdam – London – New York 1972.

Shipman 1989 P. Shipman: Altered bones from Olduvai Gorge, Tanzania: Techniques, problems, and implications of their recognition. In: R. Bonnischen/M. H. Sorg (eds.): *Bone modification. Centre for the Study of the First Americans.* Orono 1989, 317–334.

Semenov 1957 S. A. Semenov: *Pervobytnaya tekhnika. Opyt izucheniya drevneyshikh orudiy i izdeliy po sledam raboty.* Materialy i issledovaniya po arkheologii SSSR 54. Moscow – Leningrad 1957.

Smolíková 1991 L. Smolíková: Soil micromorphologic investigation of the section at Dolní Věstonice II. In: J. Svoboda (ed.): *Dolní Věstonice II western slope.* ERAUL 54. Liège 1997, 65–74.

Svoboda 1987 J. Svoboda: A new male burial from Dolní Věstonice. *Journal of Human Evolution* 16/7–8, 1987, 827–830.

Svoboda 2016 J. Svoboda: Settlement units and human fossils. Spatial context, stratigraphies and chronology. In: J. Svoboda (ed.): *Dolní Věstonice II. Chronostratigraphy, Paleoethnology, Paleoanthropology.* The Dolní Věstonice Studies 21. Brno 2016, 16–48.

Svoboda ed. 1991 J. Svoboda (ed.): *Dolní Věstonice II western slope.* Liège 1991.

Svoboda ed. 1995 J. Svoboda (ed.): *Pavlov I. Excavations 1952–1953.* ERAUL 66. The Dolní Věstonice Studies 2. Liège 1995.

Svoboda ed. 2005 J. Svoboda (ed.): *Pavlov I – Southeast.* The Dolní Věstonice Studies 14. Brno. Polish – Kraków 2005.

Svoboda ed. 2011 J. Svoboda (ed.): *Pavlov: Excavations 2007–2011.* The Dolní Věstonice Studies 18. Brno 2011.

Svoboda ed. 2016 J. Svoboda (ed.): *Dolní Věstonice II: Chronostratigraphy, Paleoethnology, Paleoanthropology.* The Dolní Věstonice Studies 21. Brno 2016.

Svoboda et al. 1991 J. Svoboda/P. Havlíček/V. Ložek/J. Macoun/R. Musil/A. Přichystal/H. Svobodová/E. Vlček: *Paleolit Moravy a Slezska.* Brno 1991.

Svoboda et al. 2011 J. Svoboda/Z. Bocheński/V. Čulíková/A. Dohnalová/Š. Hladilová/M. Hložek/I. Horáček/M. Ivanov/M. Králík/M. Novák/A. Pryor/S. Sázelová/R. Stevens/J. Wilczyński/P. Wojtal: Paleolithic Hunting in Southern Moravia. The Case of Milovice IV. *Geoarchaeology* 26, 2011, 836–866.
DOI: https://doi.org/10.1002/gea.20375

Svoboda et al. 2016 J. Svoboda/M. Novák/S. Sázelová/J. Demek: Pavlov I: A large Gravettian site in space and time. *Quaternary International* 406, 2016, 95–105.
DOI: https://doi.org/10.1016/j.quaint.2015.09.015

Svoboda et al. 2019 J. Svoboda/O. Krejčí/V. Krejčí/A. Dohnalová/S. Sázelová/J. Wilczyński/P. Wojtal: Pleistocene landslides and mammoth bone deposits. The case of Dolní Věstonice II, Czech Republic. *Geoarcheology* 34, 2019, 745–758.
DOI: https://doi.org/10.1002/gea.21740

Tibbett/Carter 2008 M. Tibbett/D. O. Carter: *Soil analysis in forensic taphonomy. Chemical and biological effects of buried human remains.* London – New York 2008.

Tomek/Bocheński 2000 T. Tomek/M. Z. Bocheński: *The comparative osteology of European corvids (Aves: Corvidae), with a key to the identification of their skeletal elements.* Kraków 2000.

Trinkaus/Svoboda eds. 2006 E. Trinkaus/J. A. Svoboda (eds.): *Early modern human evolution in Central Europe: The people of Dolní Věstonice and Pavlov.* Dolní Věstonice Studies 12. Oxford – New York 2006.

Trinkaus/Sázelová/Svoboda 2019 E. Trinkaus/S. Sázelová/J. Svoboda: Pieces of people in Pavlovian. Burials, body parts and bones in the earlier Upper Paleolithic. *Human Remains and Violence* 5, 2019, 70–87.

Vercoutère/San Juan-Foucher/Foucher 2007 C. Vercoutère/C. San Juan-Foucher/P. Foucher: Human Modifications on cave Bear bones from the Gargas cave (Hautes-Pyrénées, France). In: *Proceeding of the 12th International Cave Bear Symposium Aridéa/Loutra, Greece, 2–5 November 2006.* Scientific Annals of the School of Geology. Special vol. 98. Thessaloniki 2007, 19–23.

West 1997 D. West: *Hunting strategies in Central Europe during the Last Glacial Maximum.* British Archaeological Reports 672. Oxford 1997.

Wertz/Wilczyński/Tomek 2015 K. Wertz/J. Wilczyński/T. Tomek: Birds in the Pavlovian culture. Dolni Vestonice II, Pavlov I and Pavlov II. *Quaternary International* 359–360, 2015, 72–75. DOI: https://doi.org/10.1016/j.quaint.2014.08.008

Wilczyński et al. 2015 J. Wilczyński/P. Wojtal/M. Roblíčková/M. Oliva: Dolní Věstonice I (Pavlovian, the Czech Republic). Results of zooarchaeological studies of the animal remains discovered on the campsite (excavation 1924-1952). *Quaternary International* 379, 2015, 58–70. DOI: https://doi.org/10.1016/j.quaint.2015.05.059

Wojtal et al. 2012 P. Wojtal/J. Wilczyński/Z. Bocheński/J. Svoboda: The scene of spectacular feasts. Animal remains from Pavlov I south-east, the Czech Republic. *Quaternary International* 252, 2012, 122–141. DOI: https://doi.org/10.1016/j.quaint.2011.06.033

Wojtal/Wilczyński 2015 P. Wojtal/J. Wilczyński: Hunters of the giants. Woolly mammoth hunting during the Gravettian in Central Europe. *Quaternary International* 379, 2015, 71–81. DOI: https://doi.org/10.1016/j.quaint.2015.05.040

Wojtal/Wilczyński/Wertz 2016 P. Wojtal/J. Wilczyński/K. Wertz: Pavlovian hunters among bones. The animal remains (before 1990). In: J. Svoboda (ed.): *Dolní Věstonice II. Chronostratigraphy, Paleoethnology, Paleoanthropology*. The Dolní Věstonice Studies 21. Brno 2016, 105–128.

Možnosti modifikace tvrdých tkání

Tři gravettské předměty z Dolních Věstonic II (Česká republika)

Sandra Sázelová – Bibiána Hromadová – Angela Perri – Michaela Polanská

Souhrn

Studie představuje tři předměty z moravské gravettské lokality Dolní Věstonice II, a to bobří řezák, vlčí špičák a krkavčí stehenní kost, které nesou neobvyklé stopy povrchové úpravy. Některá poškození a lomy mohou být na zvířecích kostech a zubech způsobeny ještě během jejich života, jiná vznikají posmrtně během dekompozice měkkých tkání a disartikulace, nebo při následujících depozičních a postdepozičních procesech. Pokud se tato poškození vymykají inter-individuální variabilitě, patologickým podmínkám či tafonomickým stopám běžně pozorovatelným na zbývajícím osteologickém materiálu, je nasnadě úvaha, zda se nejedná o záměrná poškození, způsobená aktivitou člověka, a to během výroby předmětu z tvrdých živočišných tkání, jeho používání i odhození. V této studii jsme tak kladly důraz na komplexní morfometrický a technologický pohled při odlišení stop způsobených člověkem a dalšími tafonomickými činiteli.

Na základě archeozoologické analýzy publikované *P. Wojtalem a kol.* (*2016*) pro výzkum v Dolních Věstonicích II z let 1985–1989 jsou sledované tři druhy zastoupeny 11,4 % MNI pro vlky, 5,3 % MNI pro krkavce a 0,6 % MNI pro bobry. Bobří zub byl nalezen během výzkumu B. Klímy v roce 1986 v sídelním objektu K7 (temeno), datovaném přibližně na 31,0–30,6 tisíce let. Vlčí zub a krkavčí kost byly objeveny o rok později během výzkumu J. Svobody poblíž sídlištního objektu S1 (západní svah), datovaném na 31,0–29,3 tisíce let. Oba předměty se nacházely ve vzdálenosti přibližně 1 m od kostry muže DV16, a to vlčí špičák severně od jeho lebky a krkavčí stehenní kost ležela západním směrem od jeho dolních končetin. Z metodického hlediska byl dodržen běžný anatomický, tafonomický a archeologický protokol při práci s předměty z tvrdých živočišných tkání. Pro srovnání stop na krkavčí kosti byl navíc realizován experiment srovnávající zásahy zanechané neretušovanou čepelí, škrabadlem, klínovým rydlem a zobcem (hrotitým artefaktem) na šesti kuřecích stehenních kostech.

U stop na bobřím řezáku jsme vyloučily zásah člověkem a předpokládáme patologické podmínky ještě za života tohoto jedince. Nejpravděpodobnějším vysvětlením je manipulace s velmi těžkým předmětem, která způsobila vychýlení čelistí o 2–3 mm, a tedy dočasnou malokluzi před úhynem zvířete, např. při pokusu o útěk z lidské nebo přírodní pasti. Stopy na vlčím špičáku můžeme dát do souvislosti s postupným odstraněním skloviny, kdy se pravidelně zešikmené zásahy sbíhají do společné špičky v zubovině (zásahy připomínají ořezanou tužku). Následné

podélné vylomení bylo s velkou pravděpodobností způsobeno jeho dalším použitím při tlaku na objekt s tvrdým povrchem, např. při výrobě mikrolitů technikou tlakem, čemuž nasvědčují i charakteristické stopy pozorované na kamenné industrii v daném místě. Na krkavčí stehenní kosti jsme nalezly komplex stop, a to série mělkých a šikmých zářezů a dále drobné lineární striace formující série krátkých paralelních zářezů, které mohou souviset s řezáním a škrábáním měkkých tkání z jejího povrchu.

Obr. 1. Plán lokality Dolní Věstonice II s detailem sídlištního objektu S1. 1 – vyznačená poloha vlčího špičáku; 2 – krkavčí stehenní kost. Hrob muže DV16 (obrázek upraven M. Polanskou na základě *Klíma 1995*; *Svoboda ed. 1991*; *2016*).
Obr. 2. Dolní Věstonice II. Bobří řezák. 1 – Bukální (vlevo) a linguální (vpravo) strana zubu; 2 – bližší pohled na podélné mikrostriace na dně žlábku (pootočení zubu o +45°); 3, 4 – jemné paralelní a nepřekrývající se linie s různou hloubkou. Měřítka: makro = 3 cm; mikro = 1000 mikronů (foto S. Sázelová, B. Hromadová).
Obr. 3. Dolní Věstonice II. Vlčí špičák. 1 – mesiální (vlevo) a distální (vpravo) strana zubu; 2 – bližší pohled na hrotitou špičku (pootočení zubu o +90°) se dvěma typy záměrných úprav; 3 – přímé šikmé modifkace (odstranění; pootočení zubu o -30°); 4 – podélná fraktura, která souvisí s morfologií špičky. Měřítka: makro = 3 cm; mikro = 1000 mikronů (foto S. Sázelová, B. Hromadová).
Obr. 4. Dolní Věstonice II. Krkavčí stehenní kost. 1 – přední (vlevo) a zadní (vpravo) strana krkavčí stehenní kosti; 2 – bližší pohled (kost pootočena o +30°) na lineární alterace pokrývající většinu proximální části kost; 3 – bližší pohled (kost pootočena o 0°) na lineární alterace pokrývající většinu proximální části kost; 4 – bližší pohled (kost pootočena o -30°) na stigmata (zářezy) po odstranění svaloviny. Měřítka: makro = 3 cm; mikro = 1000 mikronů (foto S. Sázelová, B. Hromadová)..
Obr. 5. Vybrané kamenné artefakty ze sídelní jednotky S1 v Dolních Věstonicích II (obrázek M. Polanská).

Tabela 1. Srovnání experimentálních stop po lidské činnosti na kuřecích stehenních kostech.

Assoc. Prof. Sandra Sázelová
The Czech Academy of Sciences
Institute of Archeology, Brno
Centre for Palaeolithic and Paleoanthropology
Čechyňská 363/19
CZ – 602 00 Brno
sazelova@arub.cz

prom. hist. Bibiána Hromadová, CSc.
UMR 7055 – Préhistoire et Technologie
MSH Mondes
21, Allée de l'Université
FR – 92 023 Nanterre Cedex
bibiana.hromadova@gmail.com

Dr. Angela Perri
Department of Archeology, Durham University
South Road
UK – DH1 3LE Durham
angela.r.perri@durham.ac.uk

Dr. Michaela Polanská
The Czech Academy of Sciences
Institute of Archeology, Brno
Centre for Palaeolithic and Paleoanthropology
Čechyňská 363/19
CZ – 602 00 Brno

and

UMR 7055 – Préhistoire et Technologie
MSH Mondes
21, Allée de L'Université
FR – 92 023 Nanterre Cedex
michaelapolanska@yahoo.fr

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 145–162

FOSSILES DIRECTEURS VARIABILITY IN LATE AND FINAL STAGES OF THE GRAVETTIAN OF CENTRAL EUROPE

Michaela Polanská – Martin Novák – Laurent Klaric

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.10

Keywords: Gravettian, Central Europe, Moravia, Slovakia, *fossiles directeurs*, Kostenki knives, shouldered points, heterogeneity of human groups

Abstract: The Upper Palaeolithic cultures in Central Europe are traditionally defined on the basis of lithic artefacts, predominantly various types of retouched tools, which are usually considered to be typical of a given culture. For the Late and Final Gravettian, the shouldered points and Kostenki knives are supposed to be the main *fossiles directeurs* in this region. Based on the identification of these artefacts in Central and Eastern European lithic assemblages, terms such as "Willendorf-Kostenki/Willendorf-Kostenkian", or "Eastern Gravettian" or even "Shouldered Point Horizon" have emerged, pointing to the analogy between sites hundreds of kilometres apart. However, new excavations, revisions of old collections, as well as modern research methods, have brought new insights into these emblematic artefacts. Although they are likely to be found in some Central European Late and Final Gravettian assemblages, their occurrence is less common than had been anticipated in the past.
Our paper aims to propose a historical "Central European" view on these traditional *fossiles directeurs* considering their identification and cultural value. We also describe their influence on the historical development of terminology in Central European Palaeolithic archaeology.

INTRODUCTION

The Gravettian is one of the pan-European cultures of the Upper Palaeolithic, which has long attracted attention for its rich material culture and symbolic aspects (i.e. Female figurines/Venus, burials, and personal ornaments). Central Europe, located at the intersection of Western and Eastern influences, plays an essential role in defining this term. It was the classical sites of former Czechoslovakia, such as Předmostí Ia and Dolní Věstonice I, which represented one of the first analogies to the sites of La Gravette or Kostenki I, sites that led to the definition of the term Gravettian itself (Fig. 1; e.g. *Garrod 1938*; *Laccore 1960*).

From the first half of the 20th century, a strong emphasis was particularly placed on the analogies between Central and Eastern European sites, based, among others, on the characteristic lithic tools (*fossiles directeurs*; Fig. 2; 3). These typological comparisons led to the separation of the "Western" and the "Eastern Gravettian" (e.g. *Hawkes 1940*). Shouldered points and Kostenki knives were traditionally discussed in the case of comparing Central and Eastern Europe (e.g. *Kozłowski 1969*; *1986*; *Otte 1981*). Considering these comparisons, the terms such as "Willendorf-Kostenki/Willendorf-Kostenkian", "Eastern Gravettian" or even "Shouldered Point Horizon" have emerged, pointing to the analogy between sites hundreds of kilometres apart (e.g. *Grigor'ev 1968*; *1993*; *Gvozdover 1998*; *Hromada 1998*; *Kozłowski 1969*; *Kozłowski/Sobczyk 1987*; *Lisitsyn 2019*; *Svoboda 1996*). Today, however, it is evident that although Kostenki knives and shouldered points are likely to be found in some Late and Final Gravettian assemblages of Central Europe, their occurrence is less common than had been anticipated in the past (*Klaric et al. 2015*; *Polanská/Hromadová 2015*; *Polanská/Hromadová/Sázelová 2021*).

In recent years, the issue of Central European Late and Final Gravettian has received increasing attention, since new excavations, revisions of historical collections, as well as modern research methods, have brought new insights into this topic. Gradually, the occurrence and character of

Fig. 1. Main Central and Eastern European Gravettian sites (CAD M. Polanská; www.maps-for-free.com).

traditional lithic *fossiles directeurs* are critically discussed (*Klaric et al. 2015*; *Polanská/Hromadová 2015*; *Polanská/Hromadová/Sázelová 2021*) and other characteristic tools that illustrate the variability of lithic assemblages have come to the fore (e.g. *Eigner et al. 2020*; *Lengyel/Mester/Szolyák 2016*; *Polanská/Hromadová 2015*; *Wilczyński et al. 2015*; *2020*). It turns out that the assemblages dated later than 25 ky uncal BP (29 ky cal BP), which would be suitable for a full-fledged characterisation of the traditional *fossiles directeurs*, do not appear (or only to a very small extent) in the collections of former Czechoslovakia today.[1]

In our work, we would like to contribute to the discussion of the occurrence of Kostenki knives and shouldered points in collections from former Czechoslovakia, considering their identification and cultural value. The aim is to propose a historical "Central European" view on these traditional *fossiles directeurs* because their initial identification and subsequent influence on the historiography of the term Gravettian in former Czechoslovakia have not received much attention in the literature so far.

MUTUAL INFLUENCES BETWEEN CENTRAL AND EASTERN EUROPEAN SCHOOLS OF THOUGHT IN THE DEFINITION OF THE LATE AND FINAL GRAVETTIAN IN FORMER CZECHOSLOVAKIA

To understand the evolution of the definition of Gravettian in Central Europe, it is essential to know the history of research in both Central and Eastern Europe, and also the differences between their schools of thought (e.g. K. Absolon, P. P. Efimenko, M. D. Gvozdover, B. Klíma, J. K. Kozłowski, S. M. Zamjatnin)

[1] For example, at Moravany-Podkovica, the reassessment of the collection confirmed the presence of shouldered points but no Kostienki knives were to be found.

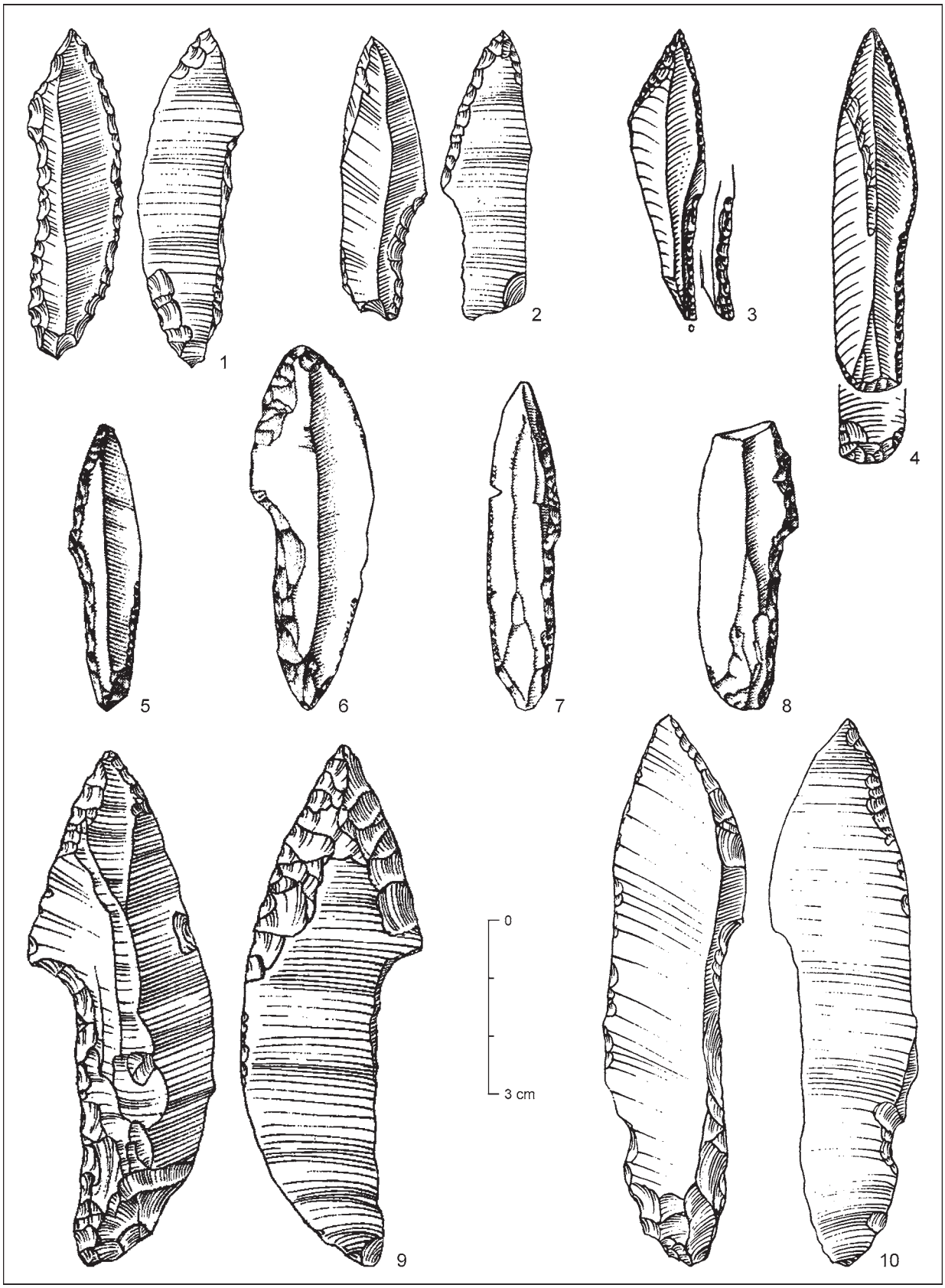


Fig. 2. Shouldered points and questionable "shouldered points" historically identified on various Central and Eastern European sites. 1, 2 – Willendorf I; 3, 4 – Předmostí Ia; 5–8 – Moravany-Podkovica; 9, 10 – Kostenki I (1, 2 – after *Onoratini 1978*; 3, 4 – after *Valoch 1986*; 5–8 – after *Bárta 1965*; 9, 10 – after *Efimenko 1958*).

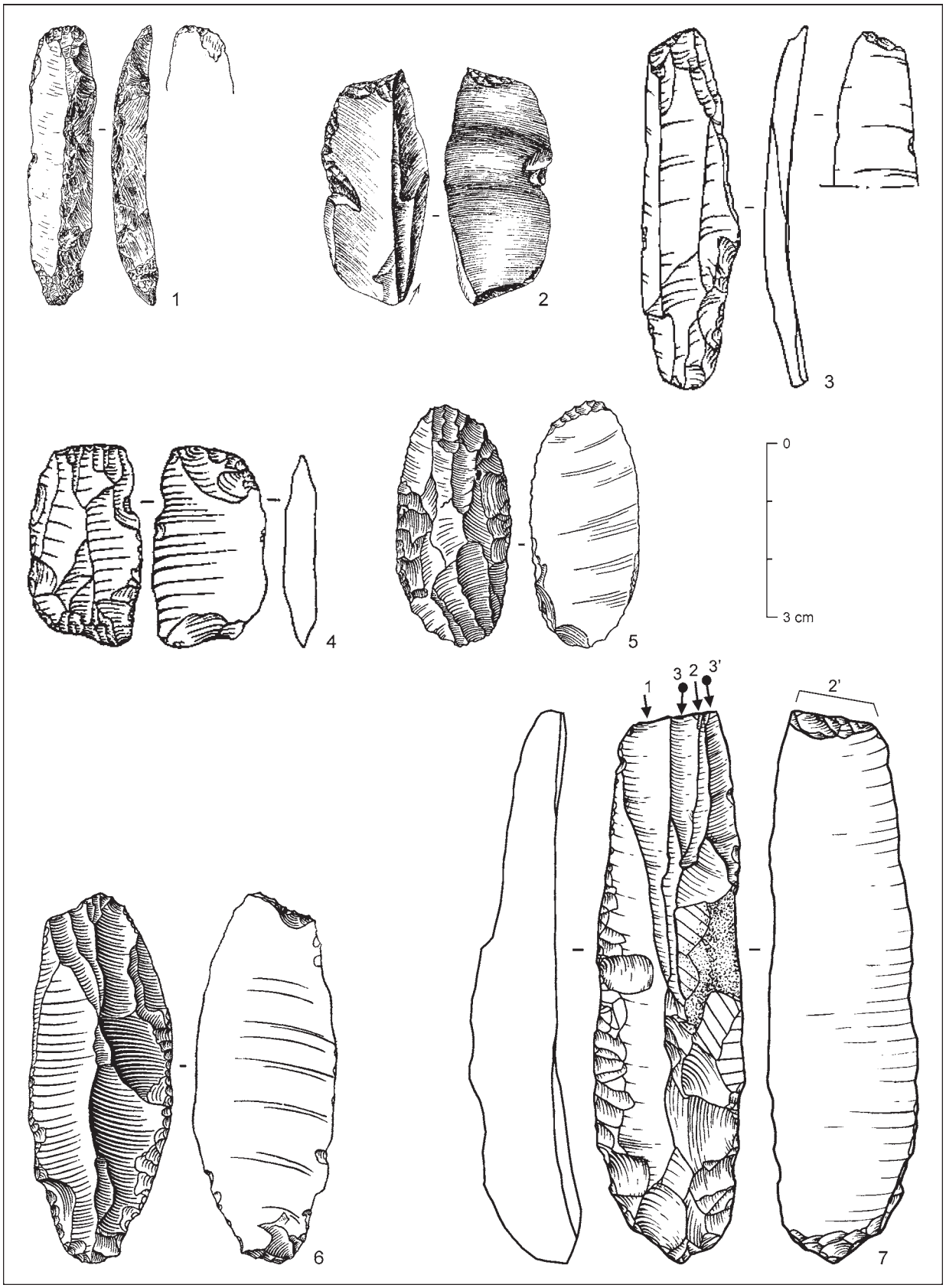


Fig. 3. Kostenki knives and questionable "Kostenki knives" historically identified on various Central and Eastern European sites. 1 – Berdyzh; 2 – Předmostí Ia; 3, 4 – Avdeevo; 5, 6 – Kostenki I; 7 – Pavlov I (1, 2 – after *Absolon 1947*; 3, 4 – after *Gvozdover 1998*; 5, 6 – after *Efimenko 1958*; 7 – drawings by M. Polanská).

each with its own specific methods of work. It is also necessary to consider these schools in the state of research of the given time and the then-available knowledge (known sites, realised studies, etc.).[2]

Each of the schools of thought is the result of the development of archaeology in a given part of Europe and responds to the specifics of its region. In this regard, the definition of archaeological cultures[3] in Eastern Europe, concerning the Middle and Late Gravettian (e.g. *Efimenko 1958*; *Grigor'ev 1970*; *1979*; *Rogachev 1953*), is based on a set of criteria (such as typical lithic and hard animal material tools, characteristic dwelling structures, specific symbolic and aesthetic elements, etc.) in a multilateral association.[4] On the other hand, in Central Europe, there were only two ways regarding the definitions of the archaeological cultures of the Upper Palaeolithic. In the first one, as in Eastern Europe, archaeological cultures were defined on the basis of a set of multiple features, arising from the richness and originality of their material culture and symbolic expressions (e.g. Pavlovian with its specific stone tools, hard animal material industry and personal decorations). However, in most cases (the second way), similar to the system in Western Europe, the cultural definitions were mostly based only on the characteristic stone tools. This is the case, for example, with the Late and Final Gravettian, which, in contrast to Pavlovian, was defined mainly by the presence of shouldered points and Kostenki knives, because the find circumstances or the limited nature of the finds did not allow it otherwise (uncharacteristic, less numerous or completely missing hard animal material industry, faunal remains, etc.). Shouldered points and Kostenki knives thus became the most significant *fossiles directeurs*, which for several decades have served as the primary analogies between the East and Central European Late/Final Gravettian (for more, see *Grigor'ev 1993*; *Kozłowski 1969*; *Lisitsyn 2019*).

As mentioned above, the analogies between Central and Eastern Europe have been developed since the first half of the 20th century (e.g. *Breuil 1924*; *Freund 1944*; *Garrod 1938*; *Zamjatnin 1930*). There were, in particular, Russian researchers looking for stone tools similar to those that found on the sites such as Kostenki I, or later Gagarino and Avdeevo (*Grigor'ev 1965*; *1966*; *1998*; *Gvozdover 1961*; *1998*; *Tarasov 1979*; *Zamjatnin 1930*). The Central European approaches have gone in an independent direction (e.g. *Kozłowski 1969*; *1986*). One of the examples is Kostenki knives. In Central Europe, the attention has been focused on the modification and morphology of the striking surface, leading to their interpretation as "chisels" (for a complete history, see *Klaric et al. 2015*). Shouldered points are another similar example, where morphology and placement of the shoulder retouched part were the main attributes considered (*Kozłowski 1976*).

HISTORIOGRAPHY OF THE TERM "GRAVETTIAN" IN FORMER CZECHOSLOVAKIA AND THE ROLE OF TRADITIONAL LITHIC *FOSSILES DIRECTEURS*

During the Second World War, when Germans militarily occupied Moravia and Slovakia, the research activities focused on confirming the origin of the Aryan race (e.g. *Eickoff 2009*). A German professor L. Zotz from the German University of Prague was one of the leaders of Palaeolithic research in Central Europe. He notably excavated the complex of the Upper Palaeolithic sites around Moravany nad Váhom in Western Slovakia (district of Piešťany). It resulted in the notice that although dated to the "Late Aurignacian" period, the sites around Moravany nad Váhom are chronologically later than Dolní Věstonice (*Zotz/Vlk 1939*). Moreover, Zotz's first comprehensive paper about the finds from the sites of Moravany-Lopata I, Noviny, and Žakovská (*Zotz/Vlk 1939*) is structured according to the modern tendencies in favour of the term "Gravettian" (Fig. 4) proposed by *D. Garrod* (*1938*). She also proposed a term "industry of the Willendorf type" based on the presence of shouldered points within the assemblages from the sites of Dolní Věstonice I, Předmostí Ia, and Kostenki I (*Garrod 1938*, 23). L. Zotz partially agreed with her

[2] Today several obstacles hinder the process of understanding such as the availability of publications, the language used in old publications, and more globally an insufficient knowledge of the archaeological contexts.

[3] The problem of the archaeological culture definition of the Upper Palaeolithic in Eastern Europe is more complex. Our simplified explanation does not include a discussion of the cultural definition problem in the Upper Palaeolithic in the Soviet and post-Soviet school of archaeology (for more information, see *Boriskovsky red. 1984*; *Efimenko 1953*; *Rogachev 1951*; *1957*; *Vasil'ev 2008*).

[4] On the contrary, in Western Europe, the lithic industry was one of the main (and sometimes the only) criteria for the definition of cultures and cultural groups within for the Middle Upper Palaeolithic. But the situation has been changing since the beginning of the 21th century and now more features (art, adornments, bone industry, etc.) are considered. For a definition of prehistoric culture in Western Europe, see *Leclerc/Tarrête* (*2005*, 295) and *Klaric et al., in press*.

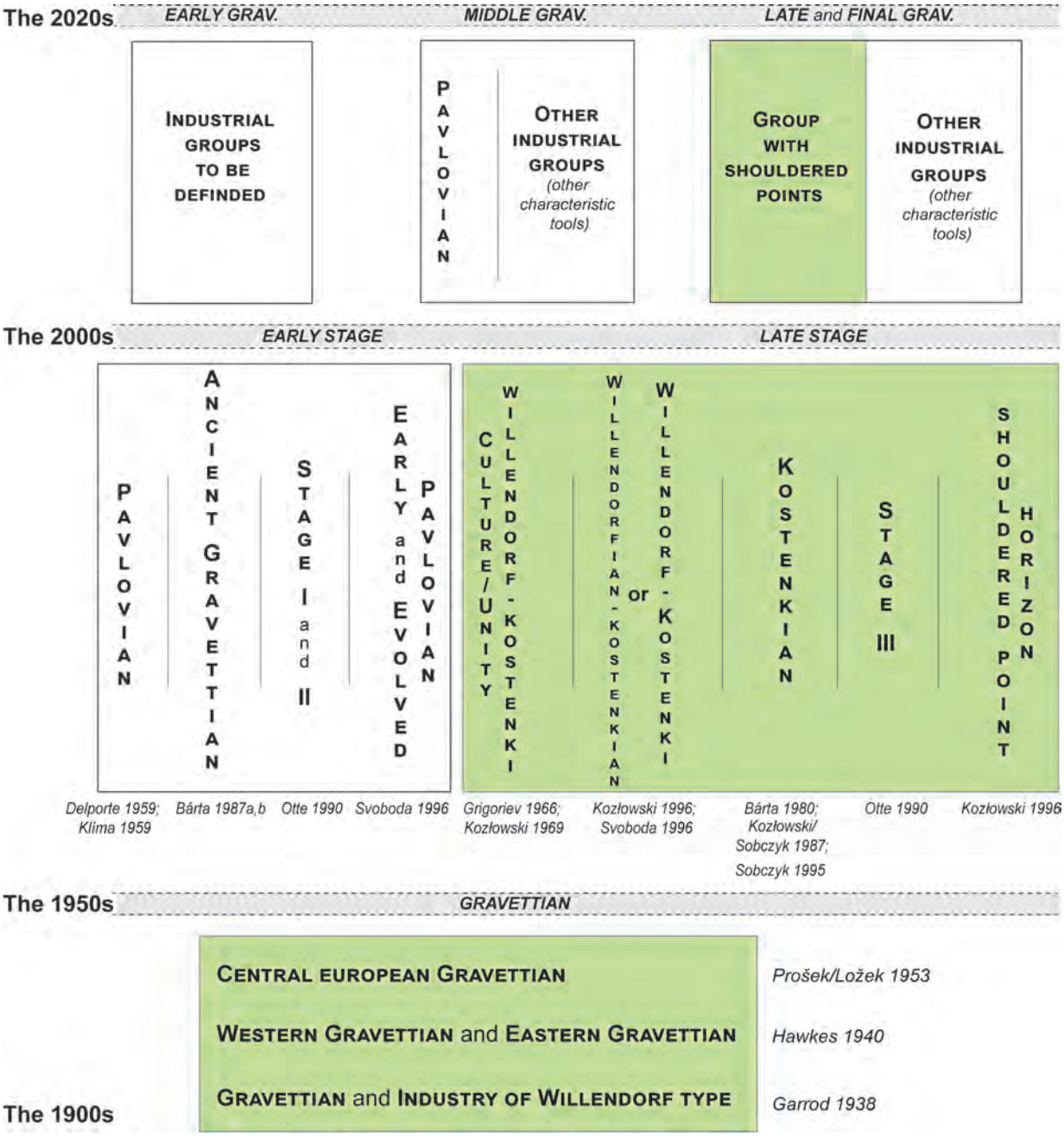


Fig. 4. Historical evolution of the terms used in Central Europe (CAD by M. Polanská).

concept of Gravettian, and under the influence of *B. Richthofen* (*1933*), he underlined the typological resemblance between "Late Aurignacian" finds (shouldered points) from the sites of Moravany nad Váhom and those found at the sites in Eastern Europe (mainly Kostenki I/1, Berdyzh, Gagarino). However, he did not exclude a possible connection between the Moravany sites and those from Austria and Germany (*Zotz/Vlk 1939*). It should be noted that *K. Absolon* (*1947*) also pointed out the similar analogies. He was looking for links between the lithic artefacts from the site of Předmostí Ia and the artefacts (e.g. those looking like Kostenki knives) from the Easter European sites with the presence of specific typological elements (Berdyj and Kostenki I). These artefacts had previously been published in the works of *S. M. Zamjatnin* (*1930*) and *B. Richthofen* (*1933*).

In the 1950s, the Czechoslovak archaeologist F. Prošek considered that the common presence of the shouldered points and the white-patinated flint from the Bugu region in the collection from the site of

Moravany-Podkovica might indicate the relationship between Gravettian industries from Central and Eastern Europe (*Ambrož/Ložek/Prošek 1952*; *Prošek/Ložek 1953*). He suggested the term "Central European Gravettian" (Fig. 4; *Prošek/Ložek 1953*, 58) as an answer to C. F. C. Hawkes's proposal to divide the Gravettian of Europe into two geographical groups – the "Western Gravettian" and the "Eastern Gravettian" (*Hawkes 1940*). In the mid-20th century, the researches increasingly referred to the analogies based on the presence of shouldered points in the collections of Central and Eastern Europe. These points were identified in the collections of Kostenki I (*Efimenko 1915*; *1958*), Willendorf I and II (*Felgenhauer 1959*) and at the complex of sites around Moravany nad Váhom (e.g. *Bohmers 1960*, 31). According to this, they have been called Kostenki points/Kostenki type points or Willendorf points (*Bohmers 1960*; *Zamjatnin 1934*). This process led to the proposal of the term "Willendorf-Kostenki culture/unity or Willendorf-Pavlov-Kostenki-Avdeevo cultural unity" (*Grigor'ev 1966*), which was later accepted by *J. K. Kozłowski* (*1969*), although the sense was different in his conception. Since then, G. P. Grigor'ev and J. K. Kozłowski started to distinguish the Gravettian of Central Europe into two chronological stages – the Pavlovian[5] (a chronologically earlier) and the Willendorf-Kostenki (a chronologically later) cultural phase (Fig. 4). Simultaneously, *J. K. Kozłowski* (*1969*) argued that the atypical lithic assemblage of Petřkovice I could not be classified as the Willendorf-Kostenkian because it showed no analogies with other sites of this culture (such as Willendorf II, layer 9 for example). The same idea was already mentioned by *K. Valoch* (*1959*) and *B. Klíma* (*1961*), who attributed the site to the Early Gravettian on the grounds of the typological character of the assemblage (especially the presence of leaf points).

During the 1970s and 80s, the Palaeolithic research in Slovakia mainly focused on the identification of shouldered points in the Váh valley region, where they could be later than those from the Moravian sites (*Bárta 1987a*; *1987b*). During this period, the most intensive research activity took place in Poland, where the site of Kraków-Spadzista was systematically excavated (e.g. *Kozłowski/Sobczyk 1987*). A new term "Kostenkian" was also introduced here as a synonym to the Willendorf-Kostenki/Willendorf-Kostenkian (*Bárta 1980*; *Kozłowski/Sobczyk 1987*; *Sobczyk 1995*).

Regarding the chronological division of the Gravettian in Central Europe, more important syntheses were published during the 1990s. Among others, *M. Otte* (*1990*) proposed three stages for the Gravettian period based on typological description – the first with microlithic *fléchettes*, the second with large points, and the last one with shouldered points. In another synthesis, *J. Svoboda* (*1996*) proposed to divide the Gravettian into three time-defined stages – the Early Pavlovian stage (30,000–27,000 uncal BP), the Evolved Pavlovian stage (27,000–25,000 uncal BP) and the Willendorf-Kostenkian stage (24,000–20,000 uncal BP). *J. K. Kozłowski* (*1996*) confirmed the two stages of Pavlovian; however, he suggested the term "Shouldered Point Horizon" for the late phase of the Gravettian (Fig. 4). Another valuable asset for the study of Late and Final Gravettian lithic industries represented the systematic field research of J. Hromada at the Moravany nad Váhom settlement area (*Hromada 1998*; *Hromada/Kozłowski eds. 1995*; *Kozłowski ed. 1998*) and a bit later the excavation of L. Kaminská and J. K. Kozłowski at the site of Banka-Horné farské role (*Kozłowski ed. 2000*). In the mid-1990s, some terminological stabilisation occurred in the matter of naming the Late Gravettian, although still differing by individual authors using either the term Willendorf-Kostenki/Willendorf-Kostenkian (e.g. *Hromada 1998*; *Oliva 2007*; *Svoboda 1996*; *2007*), or the term Shouldered Point Horizon (*Kaminská zost. 2014*; *Kaminská/Kozłowski 2002*; *Kozłowski ed. 2000*).

Over the last decade, several ongoing projects and studies have reopened the question of the chronology of the Central European Gravettian. They drew attention to the diversity of lithic assemblages and subsistence strategies in the Gravettian of Central Europe (e.g. *Lengyel/Mester/Szolyák 2016*; *Moreau 2012*; *Polanská/Hromadová 2015*; *Šída 2016*; *Wilczyński et al. 2015*; *2020*; *Wojtal et al. 2019*). Thus, Kostenki knives and shouldered points are still considered to be the characteristic tools of the late phase of the Gravettian, although some critical studies, as well as first interpretations of traditional lithic *fossiles directeurs*, have reassessed the question (e.g. *Klaric/Hromadová 2016*; *Klaric et al. 2015*; *Polanská/Hromadová/Sázelová 2021*; *Polanská/Novák/Klaric 2019*). Currently, terms such as Willendorf-Kostenki or Kostenkian are gradually being replaced by the general term Late and Final Gravettian. The focus remains on the issue of industrial variability and the simultaneous existence of several groups (Fig. 4), which inhabited the territory of former Czechoslovakia as well as the question of analogies with Eastern Europe.

[5] The term Pavlovian has been formerly proposed as a general synonym for the Central European Gravettian and later as a designation for a specific geographic group with a higher occurrence of its sites around the Pavlov Hills (*Delporte 1959*; *Klíma 1959*; *1961*). For more detailed historiography of the term Pavlovian, see *Polanská 2020*.

TRADITIONAL LITHIC *FOSSILES DIRECTEURS* A SUMMARY ON THE STATE OF RESEARCH IN FORMER CZECHOSLOVAKIA

Shouldered points

The issue of shouldered points in the Late and Final Gravettian of Central Europe has recently been commented on in several articles and conference presentations (*Klaric/Hromadová 2016*; *Kufel-Diakowska et al. 2016*; *Polanská/Hromadová 2015*; *Polanská/Hromadová/Sázelová 2021*; *Polanská/Novák/Klaric 2019*; *Wojtal et al. 2019*). From a historical point of view, it is possible to divide the research into three stages.

First stage

In Central Europe, the shouldered points were identified according to the Eastern European finds (from the site of Kostenki I and Avdeevo), which Zamjatnin described under the name "Kostenki points/Kostenki shouldered points" as "*… shoulder on massive blades with invasive inverse retouch…*" (*Zamjatnin 1934*, 51). However, here in Central Europe, these artefacts differ mainly in size and often just in the absence of invasive retouch on the ventral side (Fig. 2; e.g. some pieces from the Willendorf I or Předmostí Ia site). Also, for this reason, they started to be called "atypical", or "Périgordian" shouldered points, according to the original definition of Peyrony (*Brézillon 1971*, 295) or Sonneville-Bordes (*Sonneville-Bordes/Perrot 1956*),[6] who thus referred to similar smaller Western European points without ventral retouch.

Second stage

According to morphological criteria and realised modifications of a blank, J. K. Kozłowski defined several groups of shouldered points (*Kozłowski 1969*; *1976*). However, this approach was focused mainly on describing statistical parameters in collections. Later, the same author, with the collaboration of A. Montet-White (*Kozłowski/Montet-White 2001*), supposed that the morphology of these pieces was related to function and resulting from different activities (cutting implements, hunting points) and the inverse retouch was facultative and non-stylistic.

Third stage

In the last decade, research studies resulting from new excavations of sites and revisions of lithic collections increased the state of knowledge regarding the traditional *fossiles directeurs* (e.g. *Kufel-Diakowska et al. 2016*; *Wojtal et al. 2019*). In former[7] Czechoslovakia, there are 20 post-Pavlovian sites where shouldered points were mentioned (*Polanská/Hromadová/Sázelová 2021*, table 1). Nevertheless, there are not enough of these points in any assemblages to allow their full characterisation as well as a description of their production system. Besides, there is an issue of correct interpretation of the "shoulder" part on the artefact, which can also be the result of various artefact modifications and operations. It is therefore necessary to evaluate these artefacts in the broader context of the whole lithic assemblage and their conservation and technical state – whether they are finished or not, complete or broken, pieces discarded during retouching, pieces representing by-products or a waste of backed blade/bladelet production, and also taking into account their further transformation or reutilisation.[8]

Considering the above mentioned, it is evident that shouldered points are not present either in the Middle Gravettian or in the transitional industries towards the Late and Final Gravettian (the sites of Milovice I[9], Dolní Věstonice III, and Jarošov-Podvršťa; *Polanská 2020*). Also, their presence is questionable in the assemblages from the sites of Nitra-Čermáň and Petřkovice I (Fig. 5; *Polanská/Hromadová/Sázelová 2021*), and in the others, as Banka-Horné farské role[10] (*Alexandrowicz et al. 2000*; *Polanská 2009*)

---

6 *"N 56. Pointe à cran périgordienne, dite atypique"* (*Sonneville-Bordes/Perrot 1956*, 547).

7 The 18 sites summarized by M. Polanská (*Polanská/Hromadová/Sázelová 2021*) are supplemented by two more sites of Cejkov I (*Bánesz 1961*) and Marhaň (*Valde-Nowak 2008*).

8 For more, see *Pelegrin/O'Farrell 2005*.

9 For a different point of view, see *Wilczyński et al. 2019*.

10 The small sized collection of the Banka – Horné farské role site (Kopanica part, trench n. IV) includes a shouldered point

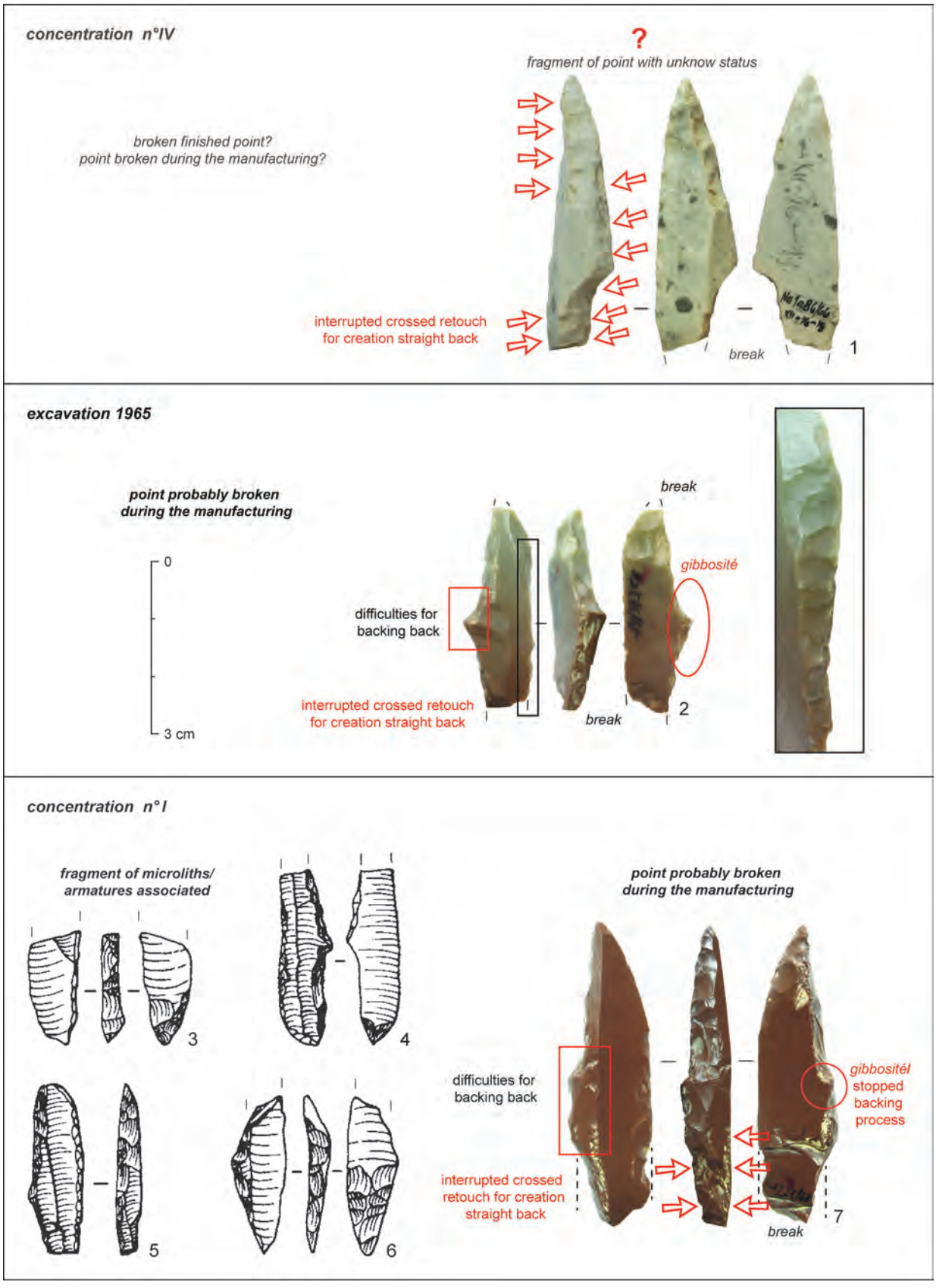


Fig. 5. Broken points of Nitra-Čermáň (no points are complete; 1 – unknown status; 1, 2, 7 – photos by M. Polanská; 3–6 – after *Kaminská/Kozłowski 2011*).

or Moravany-Noviny, there are only a few (*Bárta/Kazior 2000*). The reassessment of the collection from Moravany-Podkovica has not been published yet but according to a conference presentation (*Klaric/Hromadová 2016*), this site appears to be one of the richest of the area for shouldered points.

To summarise the evolution of influences between Eastern and Central Europe: The original idea of shouldered points comes from *S. M. Zamjatnin* (*1934*), defining them as tools made on massive blanks.

In Eastern Europe, regarding the typological research in the second half of the 20th century, several studies of this issue followed, devoted to the more precise definition and typology and drawing attention to the diversity of blanks' modifications and morpho-metric variability (e.g. *Belyaeva 1979*; *2007*; *Bulochnikova 1988*; *Gvozdover 1998*; *Gvozdover/Belyaeva 1988*; *Lev 2005*; *2009*).

In Central Europe, the researchers were influenced by Zamjatnin's original definition for a long time. That is also why we still lack a new, more precise definition of shouldered points, considering their variability in size and modifications of the ventral side or shoulder, as seen on the pieces from the sites of Banka-Horné farské role or Kraków Spadzista (*Wojtal et al. 2019*).

Kostenki knives

In Central Europe, Kostenki knives represent tools that result from the re-sharpening of an unretouched artefact, where part of the edge was used as a knife (*Polanská 2020*). The removals on the blank's dorsal face and retouch of the edge serve for edge re-sharpening. These observations match with the technological definition of analogous tools from the Kostenki-Avdeevo culture (e.g. *Girya/Resino-Léon 2002*; *Lev/Klaric/Girya 2009*; *2011*). However, despite many apparent similarities, artefacts from Central and Eastern Europe show differences in the choice of blank, its size and also in some modifications for edge rejuvenation. These differences will be explained in a forthcoming paper. So far, as an example, we mention that an edge modification can be applied to not only large blades, as seen in Russian sites, but also to flakes, bladelets, and other blades of smaller dimensions.

In former Czechoslovakia, Kostenki knives have been massively identified in the Moravian Middle Gravettian, based on the assemblages from the sites of Předmostí I and Pavlov I within one of the newly defined groups (a group with geometric microliths, after *Polanská 2013*; *2020*). Although since the beginning of the 20th century, they have been indicated in the Late Central European Gravettian (e.g. *Absolon 1947*; *Zamjatnin 1930*), the first revision rather points to their rare occurrence in this chronological stage (*Klaric et al. 2015*). The artefacts previously published as Kostenki knives (e.g. *Klíma 1961*; *Kozłowski 1969*; *Otte 1981*; *Otte/Noiret 2004*) correspond to today's definition only partially, because of probable specimens, various chisels, splintered pieces or burins (*Klaric et al. 2015*).

PERSPECTIVES AND CONCLUSION

Kostenki knives and shouldered points are still considered to be the main traditional and emblematic lithic *fossiles directeurs* of the Central European Gravettian, although their consideration has been gradually changing over the last decade. Undoubtedly, they occur within the Gravettian assemblages from Central Europe, however, their occurrence, as well as their role as a chronological marker, has been overestimated in the last century. They are certainly one of the *fossiles directeurs* for some of the Middle and Late/Final Gravettian groups in this region, but under the conditions of their correct identification. Indeed, one *fossile directeur* can be characteristic for several groups, thus its identification should not be based only on a morphological comparison, but also on an evaluation of its technical state and the artefact status in the context of the whole assemblage in a given site.

The task of further studies is to give a full characterisation of the industries in which these *fossiles directeurs* have been found. It seems that there are also several other tool types within these industries specific to them (Fig. 6), such as various bitruncated elements (Petřkovice I, Trenčianske Bohuslavice-Pod Tureckom), small points modified with marginal retouch (Petřkovice I, Dolní Věstonice III) or

with a damaged tip and another broken-burnt fragment of relatively small size (length ca. 5 cm) with a not very invasive ventral retouch (*Polanská 2009*).

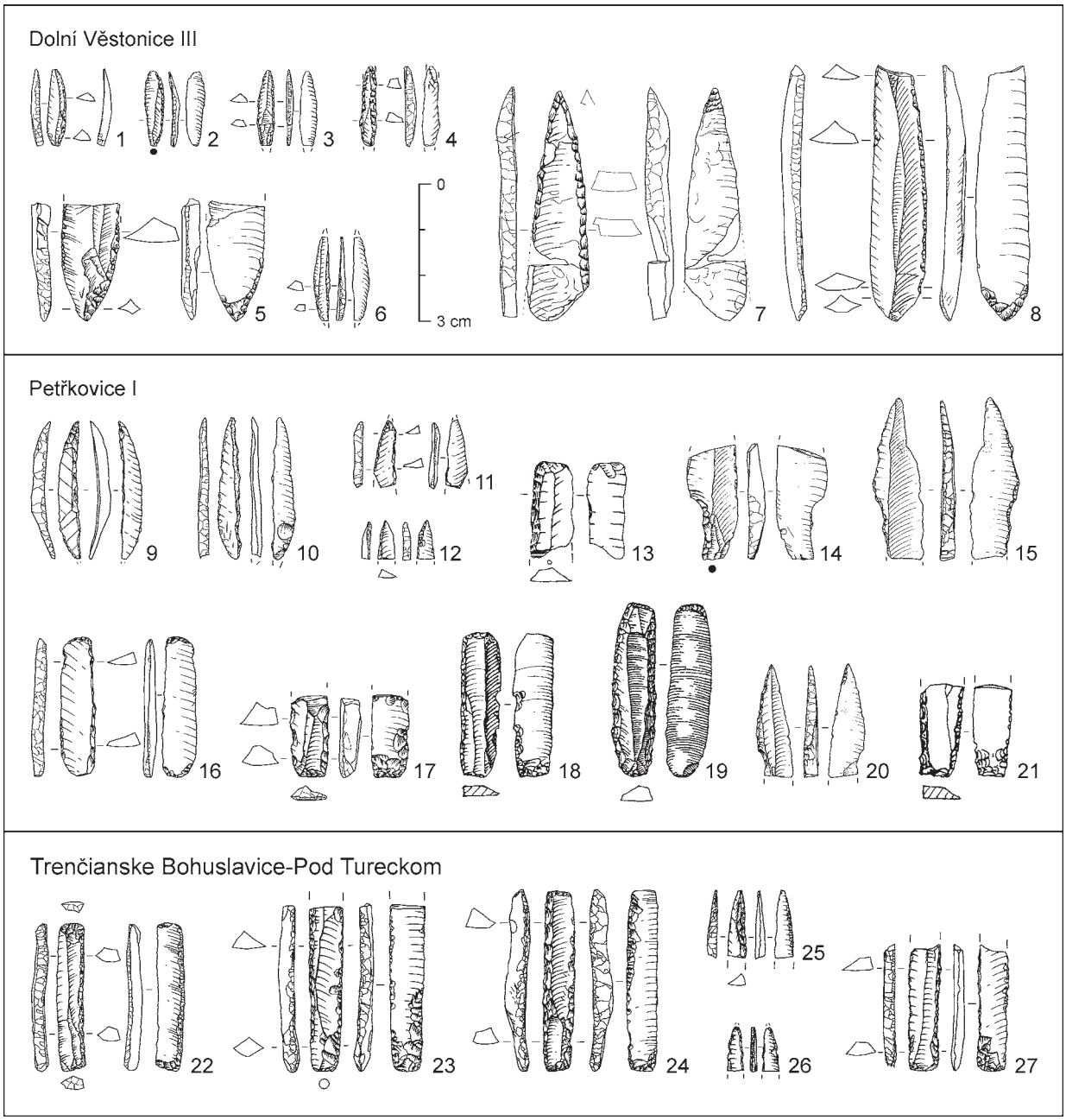


Fig. 6. Some Late and Final Gravettian Central European assemblages with characteristic microliths and armatures. 1–8 – Dolní Věstonice III; 9–21 – Petřkovice I; 22–27 – Trenčianske Bohuslavice-Pod Tureckom (1–12, 14–17, 20 – drawings by M. Polanská; 13 – after *Oliva/Neruda 1999*; 18, 19, 21 – after *Novák 2008*; 22–27 – drawings by M. Polanská).

larger, symmetrical axial backed points with inverse retouch (Dolní Věstonice III). It is evident that during the Middle and Late/Final Gravettian the region of Central Europe was occupied by several groups with their distinctive tool types and industries (Fig. 4). However, in the current state of research, these industries are still not defined in detail, and so we cannot discuss their relationships or chronological significance yet.

In each region of Central Europe, whether in Slovakia, Czech Republic, Poland or Austria, there are several collections suitable for the characterisation of lithic components and the definition of *fossiles directeurs* (e.g. several sites of Lubná and Kraków-Spadzista, Grub-Kranawetberg, Moravany-Žakovská, Petřkovice I). However, they still remain isolated and have been analysed separately. A unified

methodological approach would help a better characterisation and open a meaningful discussion about the Late and Final Gravettian and the beginning of Epigravettian in this area. This first step is the condition to discuss again the analogies between Central and Eastern European sites and the justification of the terms mentioned in the introduction that connect sites hundreds of kilometres distant from one another.

Acknowledgements

The work of M. Polanská was supported by the Czech Academy of Sciences (PPLZ programme) and partially realised during PhD. research (Pantheon-Sorbonne University; UMR 7041-ArScAn). For suggestions and constructive discussion, the authors would like to thank two reviewers, Maria Zheltova, Bibiána Hromadová, Daria Eskova, Sergey Lev, Klára Matulová.

Translated by authors

BIBLIOGRAPHY

Absolon 1947 — K. Absolon: Kamenné paleolitické nástroje z Předmostí ve sbírkách hanáckého městského musea v Holešově. Tvaroslovná analysa na srovnávacím podkladě. *Příroda* 39, 1947, 22–32.

Alexandrowicz et al. 2000 — W. S. Alexandrowicz/Ľ. Kaminská/B. Kazior/J. K. Kozłowski/M. Pawlikowski/K. Sobczyk: Excavations at Banka-Horné farské role site. In: J. K. Kozłowski (ed.): *Complex of Upper Palaeolithic Sites Near Moravany, Western Slovakia. Vol. III. Late Gravettian Shouldered Points Horizon Sites in the Moravany–Banka Area.* Kraków – Nitra 2000, 121–152.

Ambrož/Ložek/Prošek 1952 — V. Ambrož/V. Ložek/F. Prošek: Mladý pleistocén v okolí Moravan u Piešťan nad Váhem (Západní Slovensko). *Anthropozoikum* 1, 1952, 53–142.

Bánesz 1961 — L. Bánesz: Zlomok hlinenej plastiky z paleolitickej stanice v Kašove. *Archeologické rozhledy* 13, 1961, 774–780.

Bárta 1965 — J. Bárta: *Slovensko v staršej a strednej dobe kamennej.* Bratislava 1965.

Bárta 1980 — J. Bárta: Paleolit a mezolit. *Slovenská archeológia* 28, 1980, 119–136.

Bárta 1987a — J. Bárta: Prínos nových poznatkov slovenskej archeológie ku stratigrafii pleistocénu a starého holocénu. *Antropozoikum* 18, 1987, 203–228.

Bárta 1987b — J. Bárta: K problematike listových hrotov z Trenčianských Bohuslavíc. In: *25 let pavilonu Anthropos 1961–1986*. Brno 1987, 91–95.

Bárta/Kazior 2000 — J. Bárta/B. Kazior: Excavations at Moravany-Noviny in 1963. In: J. K. Kozłowski (ed.): *Complex of Upper Palaeolithic sites near Moravany, Western Slovakia. Vol. III. Late Gravettian shouldered point horizon sites in the Moravany-Banka area.* Nitra 2000, 13–30.

Belyaeva 1979 — V. I. Belyaeva: *Kremniovyy inventar' Kostenok 1. Opyt klassifikatsii.* Avtoreferat kandidatskoy dissertacii. Leningrad 1979.

Belyaeva 2007 — V. I. Belyaeva: Nozhi Kostenok 1 iz kollektsii raskopok P. P. Efimenko. In: *Problemy arheologii kamennogo veka (k yubileyu M. D. Gvozdover).* Moskva 2007, 80–99.

Bohmers 1960 — A. Bohmers: Statistiques et graphiques dans l'étude des industries lithiques préhistoriques. V. Considérations générales au sujet du Hambourgien, du Tjongerien, du Magdalénien et de l'Azilien. *Palaeohistoria* 8, 1960, 15–37.

Boriskovsky red. 1984 — P. I. Boriskovskyy (red.): *Paleolit SSSR.* Arheologiya SSSR 1. Nauka. Moskva 1984.

Breuil 1924 — H. Breuil: Notes de voyage paléolithique en Europe centrale II. Les industries paléolithiques du loess de Moravie et Bohême. *L'Anthropologie* 34, 1924, 515–552.

Brézillon 1971 — M. Brézillon: *La dénomination des objets de pierre taillée. Gallia Préhistoire.* Supplementum 4. Paris 1971.

Bulochnikova 1988 — E. V. Bulochnikova: Nakonečniki s bokovoy vyemkoy kak material k izucheniyu verkhnepaleoliticheskikh populyatsiy. In: *Problemy sovremennoy biologii. Trudy 19 konferentsii molodykh uchenykh.* Deponirovannaya rukopis' v VINITI. Moskva 1988, 128–130.

Delporte 1959 — H. Delporte: Notes de voyage leptolithique en Europe centrale I. La Tchécoslovaquie. *Rivista di Scienze preistoriche* 14, 1959, 19–57.

Eickoff 2009 M. Eickhoff: Historie „ukradeného" naleziště Assien Bohmers a vykopávky SS-Ahnenerbe v Dolních Věstonicích. In: M. Eickhoff (ed.): *RegioM. Sborník Regionálního muzea v Mikulově.* Mikulov 2009, 129–146.

Efimenko 1915 P. P. Efimenko: Kostenkovskaya paleoliticheskaya stoyanka. *Ezhegodnik Russkogo antropologicheskogo obshchestva pri S.-Peterburgskom universitete* 5, 1915, 15–25.

Efimenko 1953 P. P. Efimenko: *Primaeval Society, Academy of Sciences of the Ukrainian Soviet Socialist Republic.* Kiev 1953.

Efimenko 1958 P. P. Efimenko: *Kostienki I. Academy of Science of the URSS.* Moskva – Leningrad 1958.

Eigner et al. 2020 J. Eigner/M. Lička/A. Přichystal/S. Vencl/K. Žák: Výzkum gravettského a neolitického sídliště v Řevnicích, okr. Praha-západ. *Archeologie ve středních Čechách* 24, 2020, 33–63.

Felgenhauer 1959 F. Felgenhauer: *Willendorf in der Wachau. Monographie der Palaeolithfundstellen I–VII.* Mitteilungender Prähistorischen Kommission der Österreichischen Akademie der Wissenschaften 8–9. Wien 1959.

Freund 1944 G. Freund: *Pschedmost*. PhD. Thesis. German Charles University in Prague. Prague 1944. Unpublished.

Garrod 1938 D. A. E. Garrod: The Upper Palaeolithic in the light of recent discovery. *Proceedings of the Prehistoric Society* 1, 1938, 155–172.

Girya/Resino-Léon 2002 E. Yu. Girya/A. Resino-Léon: Semenov – Kostionki – Palaeolithic Science. *Arkheologicheskie vesti* 9, 2002, 173–190.

Grigor'ev 1965 G. P. Grigor'ev: *Early Upper paleolithic Sites in Near East and the Problem of Homo sapiens Migration into Europe*. 1965, 96–100.

Grigor'ev 1966 G. P. Grigor'ev: Kremskaya, Willendorfskaya i Pavlovskaya kul'tury v Tsentral'noy Evrope. In: *Arkheologiya Starogo i Novogo Sveta.* Nauka. Moskva 1966, 7–24.

Grigor'ev 1968 G. P. Grigor'ev: *Natchalo verkhnego paleolita i proyskhozhdenie. Homo Sapiens.* Nauka. Leningrad 1968.

Grigor'ev 1970 G. P. Grigor'ev: Verkhniy Paleolit. In: A. A. Formozov (ed.): *Kamennyy vek na territorii SSSR.* Nauka. Moskva 1970, 43–63.

Grigor'ev 1979 G. P. Grigor'ev: Kostenkovskaya kul'tura – metodologicheskie problemy ee vydeleniya. In: *Verhhniy Pleystotsen i razvitie Paleoliticheskoy kul'tury Russhoy ravniny. Tezisy dokladov k vsesoyuznomu soveshchaniyu posvyaschennomu 100-letiyu otkrytiya paleolita v Kostenkakh.* Voronezh 1979, 28–30.

Grigor'ev 1993 G. P. Grigor'ev: The Kostenki-Avdeevo archaeological culture and the Willendorf-Pavlov-Kostenki-Avdeevo cultural unity. In: O. Soffer/N. D. Praslov (eds.): *From Kostenki to Clovis. Upper Paleolithic–Paleo–Indian Adaptations*. Boston 1993, 51–65.

Grigor'ev 1998 G. P. Grigor'ev: Otnoshenie vostochnogo gravetta k Zapadu? In: *Vostochnyy Gravett.* Moskva 1966, 73–80.

Gvozdover 1961 M. D. Gvozdover: Spetsificheskie osobennosti kremnevogo inventarya Avdeevskoy paleoliticheskoy stoyanki. *Kratkie Soobshchenia Instituta Arkheologii* 82, 1961, 112–119.

Gvozdover 1998 M. D. Gvozdover: Kremnevyy inventar' Avdeevskoy verkhnepaleoliticheskoy stoyanki. In: H. A. Amirkhanov (red.): *Vostochnyy gravett. Izdanie finansirovano rossiyskim gumanitarnym nauchnym fondom pri uchastii instituta „Otkrytoe Obshchestvo"*. Moskva 1998, 15–34.

Gvozdover/Belyaeva 1988 M. D. Gvozdover/V. I. Belyaeva: O nozhakh „kostenkovskogo tipa". In: *Zakonomernosti razvitiya paleoliticheskikh kult'ur na territorii Frantsii i Vostochnoy Evropy.* Leningrad 1988, 54–56.

Hawkes 1940 C. F. C. Hawkes: *The Prehistoric Foundations of Europe to the Mycenean Age*. London – Methuen 1940.

Hromada 1998 J. Hromada: Gravettienske sídliská v Moravanoch nad Váhom a ich miesto vo vývoji mladého paleolitu strednej Európy. *Slovenská archeológia* 46, 1998, 145–167.

Hromada/Kozłowski eds. 1995 J. Hromada/J. K. Kozłowski (eds.): *Complex of Upper Palaeolithic sites near Moravany, Western Slovakia I. Moravany-Žakovska (Excavations 1991–1992).* Kraków 1995.

Kaminská zost. 2014 Ľ. Kaminská (zost.): *Staré Slovensko 2. Paleolit a mezolit.* Archaeologica Slovaca Monographae. STASLO 2. Nitra 2014.

Kaminská/Kozłowski 2002 Ľ. Kaminská/J. K. Kozłowski: Gravettian settlement on the south and north side of the Western Carpathians. In: J. Gancarski (ed.): *Starsza i środkowa epoka kamienia w Karpatach polskich.* Krosno 2002, 35–58.

Kaminská/Kozłowski 2011 Ľ. Kaminská/J. K. Kozłowski: Nitra I-Čermáň v rámci štruktúry osídlenia gravettienskej kultúry na Slovensku. *Slovenská archeológia* 59, 2011, 1–85.

Klaric/Hromadová 2016 L. Klaric/B. Hromadová: Moravany-Podkovica debunked, reassessment of an almost unknown Willendorf-Kostienkian collection of Western Slovakia. In: J. Wilczyński/P. Wojtal (eds.): *World of Gravettian Hunters. 16–20 May 2016. Abstract.* Kraków 2016, 42, 43.

Klaric et al. 2015 L. Klaric/S. Lev/E. Ye. Girya/M. Polanská: "Couteaux de Kostienki et lames aménagées par technique de Kostienki": Retour sur un malentendu historique. *Bulletin de la Societé Préhistorique Française* 112, 2015, 421–474. DOI: https://doi.org/10.3406/bspf.2015.14550

Klaric et al., in press L. Klaric/N. Goutas/J. Laccarière/W. Banks: Rayssien? Vous avez dit Rayssien? In: O. Touzé/N. Goutas/P. Noiret/H. Salomon (eds.): *NW Europe during the Gravettian. Contributions of recent research to the understanding of the societies and their environments. Proceedings of Liège symposium, 13–14 april 2018.* ERAUL. Liège, in press.

Klíma 1959 B. Klíma: Zur Problematik des Aurignaciens und Gravettiens in Mittel Europa. *Archaeologia Austriaca* 26, 1959, 35–51.

Klíma 1961 B. Klíma: Současný stav problematiky aurignacienu a gravettienu. *Archeologické rozhledy* 13, 1961, 84–121.

Kozłowski 1969 J. K. Kozłowski: Problem tzw. Kultury Kostienkowsko-Willendorfskiej I. Analiza inwentarzy kamiennych. *Archeologia Polski* 14, 1969, 19–85.

Kozłowski 1976 J. K. Kozłowski: Les industries à pointes à cran en Europe centre-est. In: B. Klíma (dir.): *Périgordien et Gravettien en Europe, Colloque XV du IXe Congrès international de l'UISPP.* Nice 1969, 121–127.

Kozłowski 1986 J. K. Kozłowski: The Gravettian in Central and Eastern Europe. *Advances in World Archeology* 5, 1986, 131–200.

Kozłowski 1996 J. K. Kozłowski: The Danubian Gravettian as seen from the northern perspective. In: J. Svoboda (ed.): *Paleolithic in the Middle Danube region. Anniversary volume to Bohuslav Klíma.* Spisy AÚ AV ČR v Brně 5. Brno 1996, 11–22.

Kozłowski ed. 1998 J. K. Kozłowski (ed.): *Complex of Upper Palaeolithic sites near Moravany, Western Slovakia. Vol. II. Moravany-Lopata II (Excavations 1993–1996).* Kraków 1998.

Kozłowski ed. 2000 J. K. Kozłowski (ed.): *Complex of Upper Palaeolithic Sites near Moravany, Western Slovakia. Vol. III. Late Gravettian Shouldered Point Horizon Sites in the Moravany-Banka area.* Kraków – Nitra 2000.

Kozłowski/Montet-White 2001 J. K. Kozłowski/A. Montet-White: The hunting-butchering tool-kit from Kraków-Spadzista a Gravettian site in Southern Poland. In: *Proceedings of the International Conference on mammoth site studies.* Publications in Anthropology 22. Kansas 2001, 109–116.

Kozłowski/Sobczyk 1987 J. K. Kozłowski/K. Sobczyk: *The Upper Palaeolithic site Kraków-Spadzista Street C2.* Kraków 1987.

Kufel-Diakowska et al. 2016 B. Kufel-Diakowska/J. Wilczyński/P. Wojtal/K. Sobczyk: Mammoth hunting–Impact traces on backed implements from a mammoth bone accumulation at Kraków Spadzista (Southern Poland). *Journal of Archaeological Science* 65, 2016, 122–133.
DOI: https://doi.org/10.1016/j.jas.2015.11.008

Laccore 1960 F. Lacorre: *La Gravette, Le Gravétien et Le Bayacien. Imprimerie Barneoud.* Laval 1960.

Leclerc/Tarrête 2005 J. Leclerc/J. Tarrête: Notice Culture. In: A. Leroi-Gourhan (ed.): *Dictionnaire de la Préhistoire.* Paris 2005, 295.

Lengyel/Mester/Szolyák 2016 G. Lengyel/Z. Mester/P. Szolyák: The Late Gravettian and Szeleta cave, North-East Hungary. *Quaternary International* 406, 2016, 174–183.
DOI: https://doi.org/10.1016/j.quaint.2015.09.014

Lev 2005 S. Yu. Lev: Kostienki knives from the Zaraysk site (typological aspect). In: M. Zhilin (ed.): *The Stone Age of the East European Forest area Europe and the Trans-Urals region.* St. Petersburg 2005, 18–27.

Lev 2009 S. Yu. Lev: Kamennyy inventar' Zarayskoy stoyanki (tipologicheskiy aspect). In: H. Amirkhanov (red.): *Issledovaniya paleolita v Zarayske 1999–2005*. Moskva 2009, 37–186.

Lev/Klaric/Girya 2009 S. Yu. Lev/L. Klaric/E. Yu. Girya: O prichinakh raznoobraziya nozhey kostenkovskogo tipa. *Rossiyskaya arkheologiya* 4, 2009, 81–93.

Lev/Klaric/Girya 2011 S. Yu. Lev/L. Klaric/E. Yu. Girya: Nozhi kostenkovskogo tipa i plastiny s podrabotkoy konca. Fenomen konvergentnogo razvitiya ili rodstvo tekhnologijy? In: K. N. Gavrilov (red.): *Paleolit i Mezolit Vostochnoy Evropy. Taus*. Moskva 2011, 235–279.

Lisitsyn 2019 S. N. Lisitsyn: The Eastern Frontier of the Gravettian in the Kostenki-Borshchevo Palaeolithic Locality, the Don Basin, Russia. *Vestnik of Saint Petersburg University* 64, 2019, 525–554. DOI: https://doi.org/10.21638/11701/spbu02.2019.208

Moreau 2012 L. Moreau: Le Gravettien ancien d'Europe centrale revisité. Mise au point et perspectives. *L'Anthropologie* 116, 2012, 609–638. DOI: https://doi.org/10.1016/j.anthro.2011.10.002

Novák 2008 M. Novák: Flint and Radiolarite Assemblages. Technology and Typology. In: J. Svoboda (ed.): *Petřkovice. On shouldered Points and Female Figurines*. The Dolní Věstonice Studies 15. Brno 2008, 70–142.

Oliva 2007 M. Oliva: *Gravettien na Moravě.* Disertationes archaeologicae brunenses/pragensesque 1. Brno – Praha 2007.

Oliva/Neruda 1999 M. Oliva/P. Neruda: Gravettien severní Moravy a českého Slezska. K otázce horizontu s vrubovými hroty. *Acta Musei Moraviae, Scientiae sociales* 84, 1999, 43–115.

Onoratini 1978 G. Onoratini: Un nouveau type de pointe à cran: la pointe de La Bouverie dans le complexe général des pointes à cran. *Bulletin de la Societé Préhistorique Française* 75/11–12, 1978, 522–542.

Otte 1981 M. Otte: *Le Gravettien en Europe centrale.* Vol. 1–2. De Tempel. Bruges 1981.

Otte 1990 M. Otte: Révision de la séquence du Paléolithique Supérieur de Willendorf (Autriche). Bulletin-Institut royal des sciences naturelles de Belgique. *Sciences de la terre* 60, 1990, 219–228.

Otte/Noiret 2004 M. Otte/P. Noiret: Évolution du Gravettien au moyen Danube. In: J. Svoboda/L. Sedláčková (eds.): *The Gravettian along the Danube. Proceeding of the Mikulov Conference 20–21, November 2002*. The Dolní Věstonice Studies 11. Brno 2004, 8–32.

Pelegrin/O'Farrell 2005 J. Pelegrin/M. O'Farrell: Les lamelles retouchées ou utilisées de Castanet. Les lamelles retouchées ou utilisées de Castanet. In: F. Lebrun-Ricalens/J. G. Bordes/F. Bon (eds.): *Productions lamellaires attribuées à l'Aurignacien: chaînes opératoires et perspectives technoculturelles.* Archéologiques 1. Luxembourg 2005, 103–121.

Polanská 2013 M. Polanská: L'industrie lithique (fouille 2006). Collection d'une importance significative pour la compréhension de la "composante lithique à microlithes géométriques" du Pavlovien morave. In: J. A. Svoboda/J. Mikulík/M. Novák/M. Polanská/Z. Schenk/J. Wilczyński/P. Wojtal: *Předmostí – Building an authentic museum*. The Dolní Věstonice Studies 19. Brno 2013, 44–63.

Polanská 2020 M. Polanská: *Questionnement sur la diversité du Pavlovien par l'étude technologique des gisements moraves.* Spisy AÚ AV ČR 66. Brno 2020.

Polanská/Hromadová 2015 M. Polanská/B. Hromadová: Réflexion autour des industries gravettiennes "post-pavloviennes" de Slovaquie occidentale et de Moravie (25,500/24,500–22,000 BP non calibré). In: S. Sázelová/M. Novák/A. Mizerová (eds.): *Forgotten times and spaces. Anniversary volume dedicated to J. Svoboda.* Brno 2015, 132–154. DOI: https://doi.org/10.5817/CZ.MUNI.M210-7781-2015-12

Polanská/Hromadová/Sázelová 2021 M. Polanská/B. Hromadová/S. Sázelová: The Upper and Final Gravettian in Western Slovakia and Moravia. Different approaches, new questions. *Quaternary International* 581–582, 2021, 205–224. DOI: https://doi.org/10.1016/j.quaint.2020.08.004

Polanská/Novák/Klaric 2019 M. Polanská/M. Novák/L. Klaric: Shouldered point status as the "*fossile directeur*" in the Late Gravettian of Central Europe. In: A. Nemergut/I. Cheben/J. Ruttkayová/K. Pyżewicz (eds.): *16th SKAM Lithic Workshop. "Fossil directeur." A phenomenon over time and space. 21–23 October 2019, Nitra, Slovak Republic.* Abstract book. Nitra 2019, 39.

Prošek/Ložek 1953 F. Prošek/V. Ložek: Sprašový profil v Bance u Piešťan. *Anthropozoikum* 3, 1953, 301–323.

Richthofen 1933 B. Richthofen: AltseinzeitlicheFunde in Weissrussland und dem grossrussischen Nachbargebeit. *Eurasia septentrionalis antique* 8, 1933, 162–174.

Rogachev 1951 A. N. Rogachev: O nizhnem sloye kul'turnykh ostatkov telmanskoy stoyanki v Kostenkakh. *Kratkie soobshcheniya o dokladokh i polevykh issledovaniyakh Instituta istorii material'noy kul'tury* 37, 1951, 23–29.

Rogachev 1953 A. N. Rogachev: lssledovanie ostatkov pervobytno-obshchinnogo poseleniya verkhnepaleoliticheskogo vremeni u s. Avdeevo na r. Srjm v 1959. *Materialy i issledovaniya po Arhheologii SSSR* 39, 1953, 137–191.

Rogachev 1957 A. N. Rogachev: Mnogosloynye stoyanki Kostenkovsko-Borshevskogo rayona na Donu i problema razvitiya kul'tury v epokhu verkhnego paleolita na Russkoy ravnine. *Materialy i issledovaniya po arkheologii SSSR* 59, 1957, 9–134.

Sobczyk 1995 K. Sobczyk: *Osadnictwo wschodniograweckie w dolinie Wisły pod Krakowem.* Kraków 1995.

Sonneville-Bordes/Perrot 1956 D. Sonneville-Bordes/J. Perrot: Lexique typologique du Paléolithique Supérieur. *Bulletin de la Societé Préhistorique Française* 53/9, 1956, 547–560.

Svoboda 1996 J. Svoboda: Gravettian and Epigravettian chronologies in the Middle Danube area. *Přehled výzkumů* 1992, 1996, 9–19.

Svoboda 2007 J. Svoboda: The Gravettian on the Middle Danube. *PALEO* 19, 2007, 203–220.

Šída 2016 P. Šída: Gravettian lithics assemblages from Lubná (Bohemia). *Quaternary International* 406, 2016, 120–128.
DOI: https://doi.org/10.1016/j.quaint.2015.09.008

Tarasov 1979 L. M. Tarasov: *Gagarinskaya stoyanka i ee mesto v paleolite Evropy.* Nauka. Leningrad 1996.

Vasil'ev 2008 S. A. Vasil'ev: *Drevneyshee proshloe chelovechestva: poisk rossiyskikh uchenykh*. St. Petersburg 2008.

Valde-Nowak 2008 P. Valde-Nowak: Paleolityczne zabytki ze stanowiska Marhaň, okr. Bardejov (Słowacja). In: J. Machnik (ed.): *Archeologia i środo-wisko naturalne Beskidu Niskiego w Karpatach II. Kurimská brázda.* Kraków 2008, 139–156.

Valoch 1959 K. Valoch: Lösse und paläolithische Kulturen in der Tschechoslowakei. *Quartär* 8, 1959, 115–149.

Valoch 1986 K. Valoch: Les questions du Pavlovien. *Antiquités nationales* 18–19, 1986, 55–62.

Wilczyński et al. 2015 J. Wilczyński/P. Wojtal/M. Lanczont/P. Mroczek/D. Sobieraj/S. Fedorowicz: Loess, flints and bones. Multidisciplinary research at Jaksice II Gravettian site (Southern Poland). *Quaternary International* 359–360, 2015, 114–130.
DOI: https://doi.org/10.1016/j.quaint.2014.04.002

Wilczyński et al. 2019 J. Wilczyński/P. Wojtal/M. Oliva/K. Sobczyk/G. Haynes/J. Klimowicz/G. Lengyel: Mammoth hunting strategies during the Late Gravettian in Central Europe as determined from case studies of Milovice I (Czech Republic) and Kraków-Spadzista (Poland). *Quaternary Science Reviews* 223, 2019, 105919.
DOI: https://doi.org/10.1016/j.quascirev.2019.105919

Wilczyński et al. 2020 J. Wilczyński/O. Žaár/A. Nemergut/B. Kufel-Diakowska/M. Moskal-del Hoyo/P. Mroczek/B. Páll-Gergely/T. Oberc/G. Lengyel: The Upper Palaeolithic at Trenčianske Bohuslavice. Western Carpathians, Slovakia. *Journal of Field Archaeology* 45, 2020, 270–292.
DOI: https://doi.org/10.1080/00934690.2020.1733334

Wojtal et al. 2019 P. Wojtal/G. Haynes/J. Klimowicz/K. Sobczyk/J. Tarasiuk/S. Wroński/J. Wilczyński: The earliest direct evidence of mammoth hunting in Central Europe – The Kraków Spadzista site (Poland). *Quaternary Science Reviews* 213, 2019, 162–166.
DOI: https://doi.org/10.1016/j.quascirev.2019.04.004

Zamjatnin 1930 S. M. Zamjatnin: Die Ausgrabungen auf demaltsteinzeitlichen Wohnplatzvon Berdiš im Jahre 1927. *Prace archeologickij komisii* 2, 1930, 479–490.

Zamjatnin 1934 S. M. Zamjatnin: *La station Aurignacienne de Gagarino.* Les Editions d'Etat, Bulletin de l'Académie de l'Histoire de la culture matérielle 88. Moskva – Leningrad 1934.

Zotz/Vlk 1939 L. Zotz/V. Vlk: Das Paläolithikum des unteren Waagtales. *Quartär* 2, 1939, 65–101.

Variabilita *fossiles directeurs* v mladom a finálnom gravettiene strednej Európy

Michaela Polanská – Martin Novák – Laurent Klaric

Súhrn

Mladopaleolitické kultúry v strednej Európe sú tradične definované na základe kamenných artefaktov, predovšetkým rôznych typov retušovaných nástrojov, ktoré sa zvyčajne považujú za typické pre danú kultúru. Nie je to inak ani v rámci gravettienu, ktorý je jednou z paneurópskych kultúr mladého paleolitu a od nepamäti priťahuje pozornosť svojou bohatou materiálnou kultúrou aj symbolickými aspektmi. V rámci bývalého Československa sú pre mladú a finálnu fázu gravettienu považované za tradičné *fossiles directeurs* (charakteristické nástroje) hroty s vrubom a kostienkovské nože (typ Kostienki). Na základe identifikácie týchto artefaktov v stredoeurópskych a východoeurópskych kamenných nálezových súboroch boli navrhnuté termíny ako „Willendorf-Kostienki/Willednorf-Kostenkien", „kostenkien", „východný gravettien", čo poukazuje na analógie medzi náleziskami vzdialenými stovky kilometrov od seba (napr. *Grigor'ev 1968*; *1993*; *Gvozdover 1998*; *Hromada 1998*; *Kozłowski 1969*; *Kozłowski/Sobczyk 1987*; *Lisitsyn 2019*; *Svoboda 1996*). Nové výskumy, revízie historických zbierok, ako aj moderné metódy bádania však prinášajú nový pohľad na tieto „typické" artefakty. Aj keď je pravdepodobné, že sa vyskytujú vo viacerých stredoeurópskych súboroch mladého a finálneho gravettienu, ich výskyt je menej častý, ako sa v minulosti predpokladalo (napr. *Klaric et al. 2015*; *Polanská/Hromadová 2015*).

Prvé analógie medzi strednou a východnou Európou sa začali objavovať v prvej polovici 20. storočia (napr. *Breuil 1924*; *Freund 1944*; *Garrod 1938*; *Zamjatnin 1930*). Boli to predovšetkým ruskí bádatelia, ktorí hľadali analógie ku kamenným nástrojom podobným tým z Kostienok I, Gagarina alebo Avdeeva (obr. 1; *Grigor'ev 1965*; *1966*; *Gvozdover 1961*; *Zamjatnin 1930*). Stredoeurópske prístupy (definície charakteristických typov nástrojov) sa však vydali iným nezávislým smerom, čo je priamo viditeľné od druhej polovice 20. storočia na opisoch kostienkovských nožov a hrotov s vrubom (napr. *Kozłowski 1969*; *1986*).

Problematike hrotov s vrubom v mladom a finálnom gravettiene strednej Európy bolo v poslednom období venovaných viacero článkov a konferenčných príspevkov (*Klaric/Hromadová 2016*; *Kufel-Diakowska et al. 2016*; *Polanská/Hromadová 2015*; *Polanská/Hromadová/Sázelová 2021*; *Polanská/Novák/Klaric 2019*; *Wojtal et al. 2019*). V strednej Európe boli pôvodne tieto charakteristické nástroje identifikované podľa východoeurópskych nálezov z Kostienok I a Avdeeva. Podľa definície *S. M. Zamjatina* (*1934*, 51) vo východnej Európe išlo o nástroje s retušovaným vrubom na masívnych čepeliach, ktorých spodná strana bola upravená rozpínavou retušou. Artefakty zo strednej Európy boli upravené na menších polotovaroch s častou absenciou spodnej retuše (napr. niektoré artefakty z Willendorfu I, Předmostí Ia; obr. 2). *J. K. Kozłowski* (*1969*; *1976*) následne definoval niekoľko skupín hrotov s vrubom vychádzajúcich z tvaru úpravy polotovaru.

V bývalom Československu bolo doteraz identifikovaných 20 postpavlovienskych lokalít s hrotmi s vrubom (*Polanská/Hromadová/Sázelová 2021*, tabela 1). Napriek tomu sa v žiadnej zbierke nenachádza dostatok týchto nástrojov, ktoré by umožnili ich úplnú charakterizáciu a popis výrobného procesu (systému produkcie). Okrem toho existuje problém so správnou interpretáciou „vrubu" na artefakte, ktorý môže byť tiež výsledkom rôznych modifikácií polotovaru. Preto je potrebné tieto artefakty hodnotiť v širšom kontexte kamenného nálezového súboru, ich technického stavu a stavu zachovania.

V strednej Európe sú kostienkovské nože (definované ako) výsledkom obnovy hrany neretušovaného polotovaru (čepieľka, čepeľ alebo úštep), kde bola ako nôž používaná hrana nástroja (*Polanská 2020*) a kde odbitia na vrchnej strane spolu s retušovaním okraja slúžili na opätovné doostrenie hrany. Tieto znaky sa zhodujú s technologickou definíciou analogických nástrojov kultúry Kostienki-Avdeevo (napr. *Lev/Klaric/Girya 2009*; *2011*), avšak artefakty zo strednej a východnej Európy sa líšia výberom polotovaru, jeho veľkosťou a tiež v niektorých modifikáciách obnovy hrany.

V bývalom Československu boli kostienkovské nože početne identifikované v moravskom strednom gravettiene na lokalitách Předmostí I a Pavlov I (skupina s geometrickými mikrolitmi; *Polanská 2013*; *2020*). Aj keď od začiatku 20. storočia boli signalizované v mladom stredoeurópskom gravettiene (napr. *Absolon 1947*; *Zamjatnin 1930*), ich prvá revízia skôr poukazuje na sporadický výskyt v tomto chronologickom úseku období (*Klaric et al. 2015*). Artefakty, v minulosti publikované ako kostienkovské nože (napr. *Klíma 1961*; *Kozłowski 1969*; *Otte 1981*; *Otte/Noiret 2004*), zodpovedajú dnešnej definícii iba čiastočne a zahŕňajú pravdepodobné exempláre, odštepovače a rydlá (*Klaric et al. 2015*).

Kostienkovské nože a hroty s vrubom sú dnes naďalej považované za tradičné kamenné charakteristické nástroje, hoci pohľad na nich (ich typo-technologickú definíciu a význam) sa postupne mení (obr. 3). Nepochybne sa vyskytujú v gravettienskych súboroch zo strednej Európy, avšak ich výskyt, ako aj ich štatút chronologického ukazovateľa boli v minulosti precenené. Stále sú bezpochyby jedným z *fossiles directeurs* niektorej/niektorých skupín stredného a mladého gravettienu, ktoré osídľovali územie strednej Európy (obr. 4). Jeden nástroj však môže byť typický aj pre niekoľko skupín, a tak ich správna identifikácia je úlohou ďalších štúdií. Nemala by byť založená na porovnaní tvaru

artefaktu, ale na vyhodnotení ich technického stavu v kontexte celej industrie danej lokality. Ich „technický stav" odráža, či ide o kompletný nástroj bez poškodenia, nedokončený artefakt (nahrubo opracovaný alebo preformu) zlomený počas retušovania, prípadne tvarovania alebo už dokončený finálny produkt zlomený/poškodený vplyvom vykonávanej aktivity (obr. 5).

Úlohou ďalších štúdií je charakterizovať nálezové celky, v ktorých sa tieto tradičné *fossiles directeurs* vyskytujú. Ukazuje sa totiž, že v rámci týchto celkov (industriálnych skupín) existujú aj iné typy nástrojov, ktoré sú pre nich špecifické (obr. 6). Ide napríklad o rôzne obojstranne priečne retušované elementy (Petřkovice I, Trenčianske Bohuslavice-Pod Tureckom), malé hroty upravené marginálnym (okrajovým) otupením (Petřkovice I, Dolní Věstonice III) alebo väčšie, symetrické axiálne hroty upravené spodnou retušou (Dolní Věstonice III). Je zrejmé, že počas stredného, mladého a finálneho gravettienu bolo územie strednej Európy osídľované viacerými skupinami s charakteristickými nástrojmi (obr. 4). Za súčasného stavu výskumu však tieto industriálne celky stále čakajú na definovanie, preto zatiaľ nemôžeme podrobne diskutovať o ich vzťahoch alebo chronologickom význame.

Na území strednej Európy existuje v súčasnosti len niekoľko zbierok vhodných na kompletnú charakterizáciu kamenných industrií a definíciu charakteristických nástrojov. Tie však stále ostávajú izolované. Jednotný metodický prístup a spoločná analýza by pomohli ich lepšiemu poznaniu a obohatili diskusiu o mladom/finálnom gravettiene a počiatku postgravettienu v tejto oblasti. Až po takomto komplexnom prístupe bude možné znova otvoriť diskusiu o analógiách medzi stredo a východoeurópskymi lokalitami a o opodstatnení pojmov ako Willendof-Kostienki, prípadne kostienkien, ktoré spájajú lokality vzdialené stovky kilometrov od seba.

Obr. 1. Najznámejšie stredoeurópske a východoeurópske gravettienske lokality (grafická úprava M. Polanská; www.maps-for-free.com).

Obr. 2. Hroty s vrubom a otázne „hroty s vrubom" tradične identifikované v stredoeurópskych a východoeurópskych lokalitách. 1, 2 – Willendorf I; 3, 4 – Předmostí Ia; 5–8 – Moravany-Podkovica; 9, 10 – Kostienki I (1, 2 – podľa *Onoratini 1978*; 3, 4 – podľa *Valoch 1986*; 5–8 – podľa *Bárta 1965*; 9, 10 – podľa *Efimenko 1958*).

Obr. 3. Kostienkovské nože a otázne „kostienkovské nože" tradičné identifikované v stredoeurópskych a východoeurópskych lokalitách. 1 – Berdyzh; 2 – Předmostí Ia; 3, 4 – Avdeevo; 5, 6 – Kostienki I; 7 – Pavlov I (1, 2 – podľa *Absolon 1947*; 3, 4 – podľa *Gvozdover 1998*; 5, 6 – podľa *Efimenko 1958*; 7 – kresby M. Polanská).

Obr. 4. Historický vývoj termínov v strednej Európe (grafická úprava M. Polanská).

Obr. 5. Fragmenty hrotov a preforiem z Nitry-Čermáňa (nekompletné hroty; 1 – neznámy štatút; 1, 2, 7 – fotky M. Polanská; 3–6 – podľa *Kaminská/Kozłowski 2011*).

Obr. 6. Niektoré mlado a finálne gravettienske súbory s charakteristickými mikrolitmi a *armatures*. 1–8 – Dolní Věstonice III; 9–21 – Petřkovice I; 22–27 – Trenčianske Bohuslavice-Pod Tureckom (1–12, 14–17, 20 – kresby M. Polanská; 13 – podľa *Oliva/Neruda 1999*; 18, 19, 21 – podľa *Novák 2008*; 22–27 – kresby M. Polanská).

Dr. Michaela Polanská
The Czech Academy of Sciences
Institute of Archeology Brno
Centre for Palaeolithic and Paleoanthropology
Čechynská 363/19
CZ – 602 00 Brno

and

UMR 7055 – Préhistoire et Technologie
MSH Mondes
21, Allée de L'Université
FR – 92 023 Nanterre Cedex
michaelapolanska@yahoo.fr

Mgr. Martin Novák, Ph.D.
The Czech Academy of Sciences
Institute of Archeology, Brno
Centre for Palaeolithic and Paleoanthropology
Čechynská 363/19
CZ – 602 00 Brno
novak@arub.cz

Dr. Laurent Klaric
UMR 7055 – Préhistoire et Technologie
MSH Mondes
21, Allée de L'Université
FR – 92 023 Nanterre Cedex
klaric@cnrs.fr

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 163–174

CAN WE IDENTIFY ANY *FOSSILE DIRECTEUR* IN THE EPIGRAVETTIAN?

Zdeňka Nerudová

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.11

Keywords: Epiaurignacian, Epigravettian, Magdalenian, knapping technology, *en éperon*

Abstract: In the last few years, there have been studies showing that the issue of Late Upper Palaeolithic (LUP) industries located in and around Moravia (Czech Republic) are much more complex than previously thought. Focusing on Epigravettian/Epiaurignacian and Magdalenian, one of the possible solutions is the detailed study of knapping technology. Initial studies indicated that Epigravettian units can be distinguished from the Magdalenian collections. By applying the study of knapping technology to unclear collections, their culture can be determined to some extent, if it is not demonstrated in another clearer way. Analogies indicate that the knapping technology defined for Moravian LUP units may have a wider regional validity.

INTRODUCTION

General overview shows, after Willendorf-Kostienki phase (23 ky uncal BP) and before arrival of Magdalenian peoples (18 kyr) Moravia (Czech Republic) was occupied by two groups of peoples: Epiaurignacians and Epigravettians (*Nerudová/Neruda 2015*; *Škrdla et al. 2015a*) with unclear their mutual relation. The visualisation of data showed settlement density of Moravia region during the Last Glacial Maximum (*Nerudová/Neruda 2015*; *Nerudová/Neruda/Hamrozi 2021*) and differentiation in settlement strategies between Epiaurignacian and Epigravettian. The general problem is existence of numerous sites, but only a few of them are well excavated. Both cultures (or techno-complexes) are represent by some similarities in theirs lithic staff, though are obvious also some differences.

According to actual state of our knowledge of Moravian collection(s), Epiaurignacian is generally characterised as a culture with:

- highly reduced cores which are typical;
- bipolar anvil core for Sagaidak-Muralov microliths;
- Aurignacian tool types (polyhedral and multiple burins prevail; endscrapers and carenoidal endscraper-like cores, Sagaidak-Muralovka microliths);
- by prevalence of erratic flint, occasionally is supplemented by local quartz and rock crystal;
- sites are concentrated on the eastern slopes of Drahany, longer to the water courses;
- fauna generally contain reindeers and horses;
- chronologically Epiaurignacian slightly precedes Epigravettian (22–18 ka uncal BP);
- the technology of knapping include bipolar anvil core applied for quartz and rock crystal and soft stone hammer applied for erratic flint;
- the character of butts is plain, punctiform, dihedral and linear (*Škrdla et al. 2015b*).

Epigravettian in Moravia is characterised by following details:

- typical are unipolar blade cores;
- the lithic staff have no Aurignacian-like tools and no microliths, frequent are different types of burins, the presence of backed tools is sparse;
- use different raw materials;

- settlement strategy is characterised by open-air sites, usually refugia near (small) water courses;
- in fauna mammoths significantly prevails, reindeers (mammoth-fauna species);
- ^{14}C data 18–15 ka uncal BP;
- technology of knapping use soft stone (mineral) hammer;
- typical is punctiform butt (*Nerudová/Moník 2019*).

Details mentioned above showed not only technological and typological differences between Epiaurignacian and Epigravettian. In the wider chronological context, concrete differences between the technology of the Magdalenian, Gravettian and Epigravettian were already mentioned by *J. Mozola* (*2013*). The differences lay in the exploitation of local cherts, absence of striking platform abrasion and the presence of punctiform and plain butts in the Epigravettian (*Mozola 2013*, 57), as opposed to Gravettian and Magdalenian ones. This trend has been evidenced in the broader geographical context of Late Upper Palaeolithic industries where soft hammers (wood, antler, bone, ivory…) were complemented with soft hammerstones, related to changes in knapping technique.

In the past, we successfully tried to re-analysed part of lithic collection from the Kůlna Cave, seemingly according to ^{14}C date associated with the Epigravettian (*Nerudová/Moník 2019*). Our analysis based on technology of knapping and presence of *en éperon* technology confirmed Magdalenian association entire collection from Layer 5 and 6 in the Kůlna Cave (*Nerudová/Moník 2019*).

In this study, we focus on a previously less presented aspect of butts on blanks (flakes and blades) from the site Brno-Štýřice IIIa and unanalysed butts from the Švédův stůl Cave (Magdalenian layer) to test our hypothesis. As additional sites for analyses, we selected Bratčice III open-air Epigravettian site and Rozdrojovice. Brno-Štýřice IIIa open-air site was generally omitted from the wider comparisons due to its unclear cultural classification. The neighbouring site Brno-Štýřice III is associated with the Epigravettian (*Nerudová 2016*), the detail cultural classification of Brno-Štýřice IIIa remains unclear, although there are evidence for Magdalenian rather than other LUP complex (*Nerudová et al. 2012*). Švédův stůl Cave represents multi-layer cave occupation, archaeologically excavated in the mid-20th century. The modern excavation was carried out in 2019 (*Nejman et al. 2020*). We analysed small collection of artefacts stored in Moravian Museum, excavated by archaeologist *B. Klíma* (*1962*).

MATERIALS

Bratčice III site is located in a small village situated less than 20 km south-south-west of Brno, in the proximity of the eastern slopes of the Krumlovský les (Krumlov Forest) Area. Numerous Palaeolithic sites are known from the cadastre of Bratčice, especially sites from the EUP period – the Szeletian culture (*Belcredi et al. 1989*). One of these – Bratčice III – is situated on the right bank of the small stream of Šatava, 1.5 km to the south-east of the village centre. The open-air site faced north-north-east at an elevation of 224 m above sea level, 18 m above the valley floor. The materials from the Bratčice III site contains 8 lithic artefacts, 14 bones and 23 fragments of mammoth molars. The detail publication and evaluation of finds from Bratčice III is in preparation.

Brno-Štýřice IIIa site is situated approx. 60 m toward west from the well-known site Brno-Štýřice III. The site was unearthed during the rescue archaeological excavation in 2009. The archaeological layer with lithic artefacts was preserved only in the area of 94–95/M-N m with maximal concentration of finds in squares 94/M and 94/N. Probably significant (northern) part of the site was disturbed in the past by the construction of house Kamenná 184/11. In the eastern direction was the site disturbed by solifluction and by sub-recent horticulture (?) activities. The lithic industry was situated in the same stratigraphic position as in site Brno-Štýřice III. Under the B-horizon, in the upper part of the orange loess-like sediment. The artefacts were *in situ* position, without significant re-orientation (*Nerudová et al. 2012*, fig. 5). Raw material is composed of erratic flint (97%), occasionally supplemented by cretaceous chert (spongolite; 1%), chert of type Olomučany (0.2%), Moravian jurassic chert (1%), burnt (0.3%) and undetermined material (0.5%).

Rozdrojovice I (Brno-venkov district) lies northwest of Brno, not far from the Brno Dam recreational area. K. Valoch carried out research here with R. Musil in 1953. Only a few retouched palaeolithic artefacts were found despite several probes. The artefacts were found at a depth of 50–60 cm below the

surface in the B-Horizon formed during the Holocene. Some of the findings can be reliably associated with Szeletian, the remaining part of the artefacts are associated with the Gravettian or Epigravettian (*Nerudová 2016*).

Švédův stůl Cave is situated in the southern part of the Moravian Karst, near the village of Ochoz u Brna (10 km north-east of the Brno). Cave is situated 11 m above the valley of Říčka Creek and 334 m a. s. l. Švédův stůl Cave has been excavated by many archaeologists and amateurs several times. The first excavation started here in 1886, later in 1905 a student found part of a human (Neanderthal) mandible in the rear part of the cave. B. Klíma classified lithic industry obtained during the excavations as Mousterian, Aurignacian and Magdalenian (*Klíma 1962*), together he excavated (in 1953–1955) a rests of *in situ* sediments inside the cave (for detail overview see *Nejman et al. 2020*).

METHODS

The technology of knapping and type of hammer used were determined on the basis of authors experience and with the help of known literature (*Pelegrin 2002*; *2012*; *Pelegrin/Texier 2004*). The type of hammer used in site Brno-Štýřice III was described by traceologist during the use-wear analyses (*Pyżewicz/Nerudová 2020*). The butts were observed by naked eye and by stereo microscope Nikon SMZ645 using 8x–50x magnification. The collections from Brno-Štýřice IIIa (Epigravettian?, Magdalenian?), Bratčice III (Epigravettian), Rozdrojovice (Epigravettian?) and Švédův stůl Cave (Magdalenian) were used for comparison. A number of criteria for distinguishing the technique and manner of knapping were used in the analysis. Knapping techniques include percussion and pressure (direct percussion using a stone hammer, direct percussion using an antler billet, indirect percussion by antler punch or wooden billet, indirect percussion by counterblow, pressure with a short pelvic crutch and pressure in hand). The strike should be realized with either a soft (mineral or organic) or hard (stone) hammer (*Andrefsky Jr. 1998*, 11; *Inizan et al. 1995*, 30; *1999*, 30). Characteristic traces on butts of blanks or even cores can distinguish between the various ways of striking the core and detachment of blanks (*Andrefsky Jr. 1998*, 137; *Inizan et al. 1995*, 74 ff.; *1999*, 73 ff.). For example, a soft stone hammer usually creates thin pointed butts, which are impossible to measure precisely (*Klaric 2003*). Contrary to soft stone hammer, an organic hammer (like wood – boxwood – or antler) penetrates the material and active point of contact between the hammer and the striking platform lies several millimetres behind the point of impact (*Pelegrin 2002*). The resulting butts have an elliptical shape and thickness of 2–3 mm. The use of soft hammers is generally expected for the Upper Palaeolithic in Europe (*Inizan et al. 1995*, 75; *Lengyel/Chu 2016*). For blanks removed by a soft hammer is characteristic morphological marker described as the lip (*Inizan et al. 1999*, 144). During the Late Upper Palaeolithic organic soft hammers and soft stone hammers were used for different types of blade products (*Pelegrin 2002*).

DEFINITION OF A BUTT AND DIFFERENT BUTT TYPES

The butt is a part of a core striking platform and is detached through a strike or pressure. Its morphology and dimensions depend upon the knapping technique used (direct, indirect), the type of hammer used and whether a striking platform was prepared. According to *M.-L. Inizan et al.* (*1995*, 163; *1999*, 136), ten basic butt types can be distinguished: 1. cortical, 2. plain (prepared with one strike), 3. dihedral, 4. facetted (with more detachments) 5. *chapeau de gendarme* type (characteristic for Levallois products), 6. winged, 7. pecked, 8. spur (*en éperon*), 9. linear and 10. punctiform.

Should the Magdalenian staff from Švédův stůl Cave, it should comprise of butts typical for this culture, i.e. *en éperon* type (*Barton 1990*; *Cheynier 1956*; *Karlin 1972*). These originate as follows: an isolated point is prepared with a series (2–3) of small elaborate strikes on the surface of – and stemming from – a core striking platform, aiming at more precise blade detachment (*Inizan et al. 1995*, 163; *Surmely/Alix 2005*). The resulting beak on the blade's butt appears as a peculiar curved shape resembling the keel of ancient ships (*en éperon*).

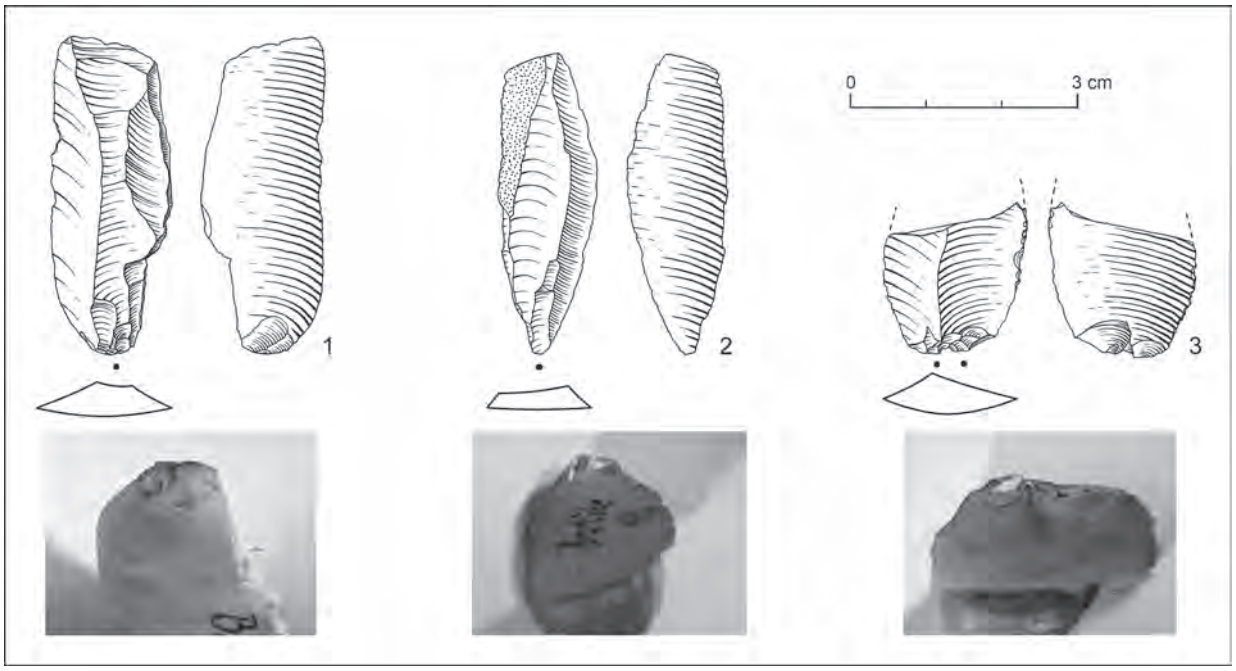


Fig. 1. Bratčice III. Characteristics punctiform butts (drawing by T. Janků, micro photo by M. Kmošek).

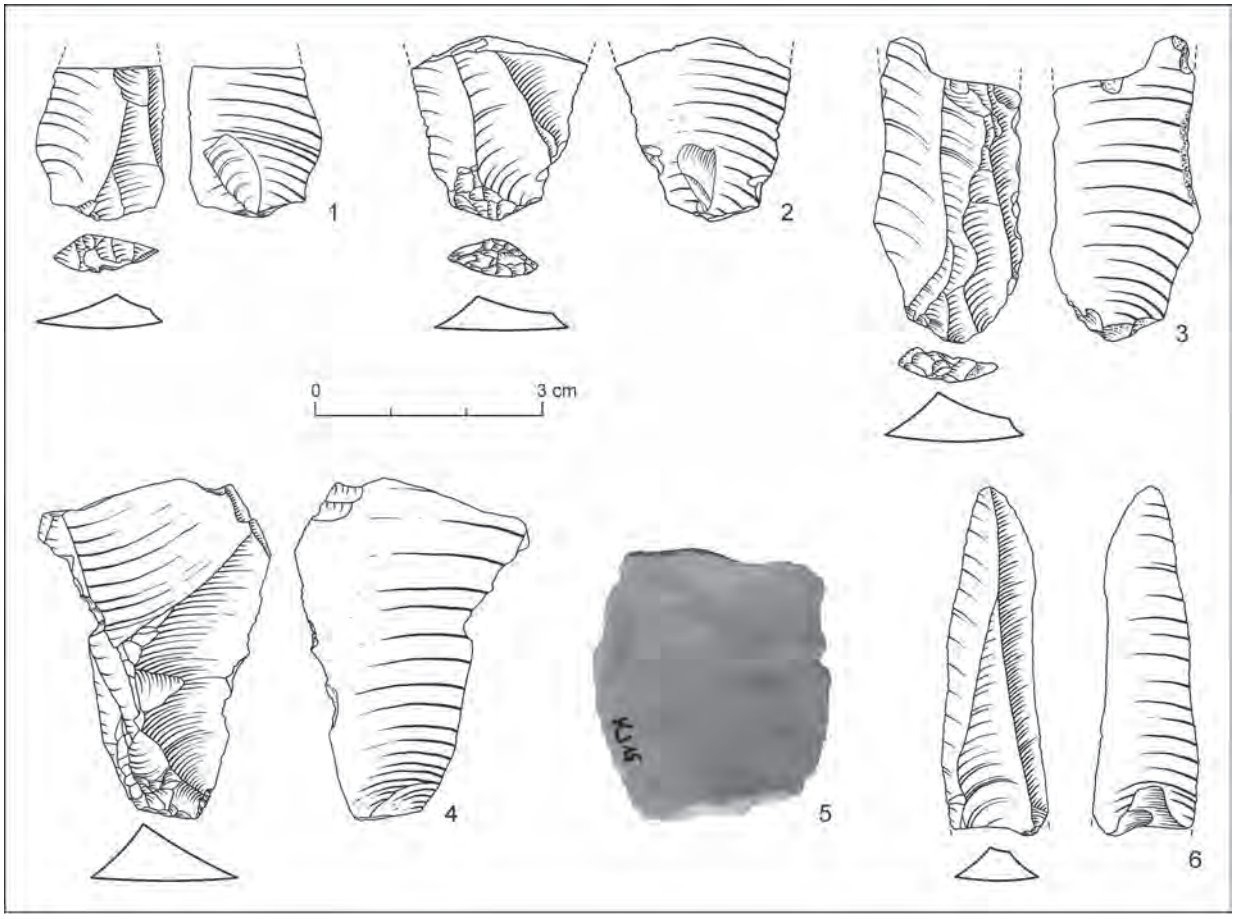


Fig. 2. 1, 2 – Brno-Štýřice IIIa; 3, 4, 6 – Rozdrojovice; 5 – Stadice (drawing by T. Janků, micro photo by M. Kmošek).

Table 1. Studied sites and types of butts (Σ in pcs). Legend: Nat. surf – with natural surface; Punc. – punctiform; Und. – undiagnostic/not preserved; * – not monitored.

Site	Datation	Cortical	Dihedral	Nat.surf.	Linear	Plain	Facetted	Punc.	Und.	*En éperon*	Σ	References
Bratčice III	EPIGR	1	0	0	0	1	0	3	3	0	8	this issue
Brno-Štýřice III	EPIGR	98	258	132	172	448	59	577	899	0	2643	*Nerudová 2016*
Brno-Štýřice IIIa	EPIGR	8	23	14	*	76	6	72	394	0	597	this issue
Rozdrojovice	EPIGR	3	5	3	0	10	2	10	11	0	44	this issue
Stadice	EPIGR	39	99	38	64	146	33	333	*	0*	752	*Nerudová/Moník 2019*
Kůlna Cave, Layer 5	MAGD	8	9	1	1	36	5	27	99	1	187	*Nerudová/Moník 2019*
Kůlna Cave, Layer 6	MAGD	5	14	3	1	25	3	56	146	3	256	*Nerudová/Moník 2019*
Loštice I	MAGD	9	42	10	21	43	2	139	1379	18	1663	*Neruda/Nerudová 2008*
Balcarka Cave	MAGD	3	26	6	3	38	5	81	8	6	176	*Nerudová/Neruda 2010*
Švédův stůl Cave	MAGD	1	2	0	5	8	0	21	22	3	62	this issue
Kůlna Cave, Layer 3	EPIMAG	14	4	0	*	72	3	80	180	*	353	*Moník 2004*
Kůlna Cave, Layer 4	EPIMAG	11	9	0	*	100	11	168	210	*	509	*Moník 2004*

RESULTS – REDUCTION STRATEGY AND TYPES OF BUTTS

Bratčice III is too small a collection for detailed technology studies. There are no retouched tools, knapping technology (punctiform butts) or soft mineral hammers usually connected with the Epigravettian industry (Fig. 1). The classification corresponds to the stratigraphic distribution of the artefacts and the radiocarbon date.

The method of knapping in Brno-Štýřice IIIa focused on obtaining long, regular blades, which are mostly not preserved on the site. The primary core preparation had to be carried out in other places, outside the actual locality, as indicated by the preserved types of butts among the blanks. The most common types of butts in Brno-Štýřice IIIa are plain and punctiform butts; dihedral butts appear much less frequently (Table 1). Dorsal abrasion of artefacts is present. Certainly, some artefacts were knapped with a soft mineral hammer, as seen on the butts of the artefacts and the presence of characteristic splinters on their ventral area. The cores cannot be described because they have been preserved only in either a fragmented form or a greatly reduced form in this collection. The negatives of the blades, however, indicate a unipolar method of knapping. At least two artefacts from Brno-Štýřice IIIa are similar to butts of the *en éperon* type (Fig. 2: 3), however, on closer examination, they don't fully meet the criteria. The only specific artefact is a fragment of the bladelet (probably dynamically broken) with a blunted side, which could be classified as a microlithic point with à dos (*Nerudová 2016*, fig. 30). Although the butt edges of some artefacts do not exclude the possibility that they were knapped with a soft hammer, the knapping technology does not correspond to the Magdalenian, but rather the Epigravettian.

The collection from Rozdrojovice I is very small, only 45 pieces were analysed (Table 1). It is dominated by three unipolar cores made of imported Silicite from the Kraków-Częstochowa Jura (*Nerudová 2016*, fig. 53). Their bases are prepared in one stroke (the typical preparation for knapping with the *en éperon* technique is missing). The angle between the base of the core and the tensile surface of the core is very sharp. However, the corresponding products for these cores are missing on the site. On the other hand, fragments of several blades from radiolarite are noteworthy in the silicite component (Fig. 2: 6). In addition to the mineral hammer, in Rozdrojovice roughly the same number is represented by an organic hammer and at least two or three butts of the type cf. *en éperon* (Fig. 2: 1, 2). In the collection, there is a striking short endscraper and one fragment of the blade morphologically

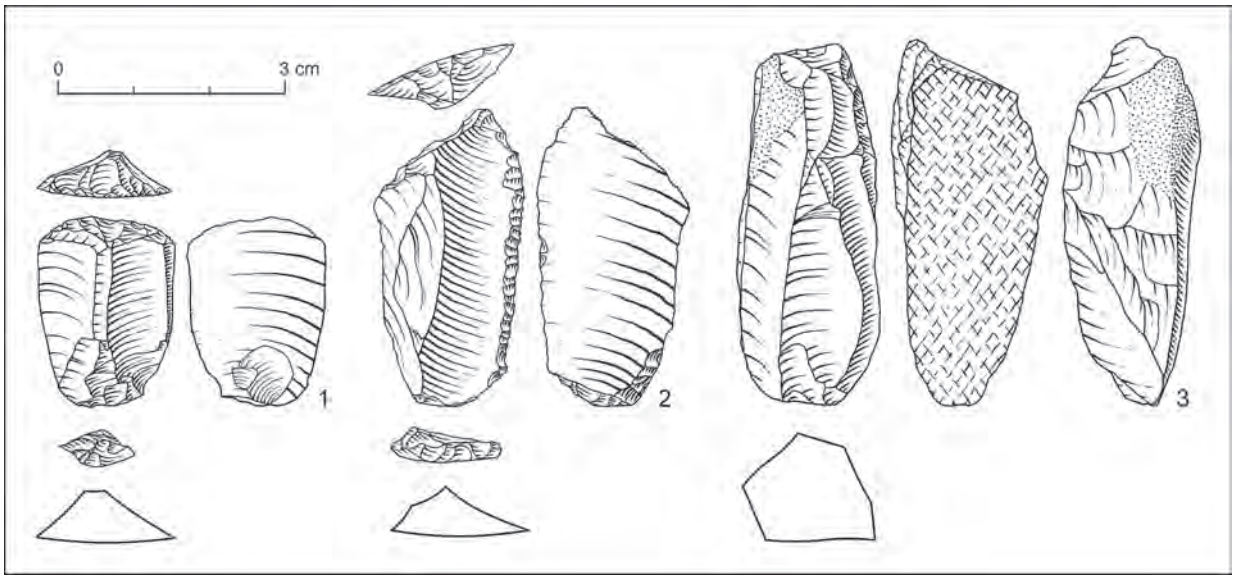


Fig. 3. Švédův stůl Cave (drawing by T. Janků).

very similar to the endscraper (however, the typical retouch is missing). However, microliths or other elements typical of Magdalene are not present. The raw material and technological collection is more like the Gravettian/Epigravettian.

ŠVÉDŮV STŮL CAVE

Since a detailed techno-typological analysis will be the content of another study, we will limit ourselves here only to the characteristics of the knapping. The analysed stratified collection from Švédův stůl Cave contains 62 pieces of flakes and blades and three cores (Fig. 3: 3). Among the butts, the most common type was punctiform butts, less commonly plain butts and linear butts (Table 1). If we follow the knapping methods, there are signs of a soft mineral hammer with punctiform butts (very rarely with dorsal preparation), eventually ventral flakes, and features typical for an organic hammer. An organic hammer was observed in a total of 11 cases. In five products, the butt was straight, wide (thick) with dorsal preparation of the proximal part, six products had the butt slightly concave, the broad and dorsal preparation of the proximal part of the artefact was not visible. Nevertheless, both options correspond to the results of direct knapping with an organic hammer (*Inizan et al. 1995*). At the same time, however, it is necessary to take into account that none of the specified objects, with some exceptions, correspond to the archaeological definition of the "final" product. The collection mostly contains preparatory flakes and blades and not many retouched types. In three cases, in the collection from the Švédův stůl cave, there are *en éperon* type butts, always on a regular retouched blade (formal tool; Fig. 3: 1, 2).

DISCUSSION

Distinguishing between Magdalenian and Epigravettian industries lies in the identification of knapping technique, preparation of striking platforms, and the presence or absence of butts of *en éperon* type, the preparation of dorsal surface of blanks, the presence of long regular blades, and the angle between the butts and ventral surfaces of artefacts (*Maier 2015*, 33; *Wiśniewski 2015*). These criteria, however, have to be applied with care and, if possible, in combination with one another. Most authors, however, consider the *en éperon* butts to be indicative of direct percussion from elaborately prepared cores, using an organic (or soft stone) hammer (above all in the Central European area; *Floss/Weber 2012*,

Table 2. Technological characteristics of the Magdalenian, Epigravettian and Epiaurignacian regarding the sites referred in the text.

Magdalenian	Technological feature	Epiaurignacian	Epigravettian
+	Preparation of core striking plattform	–	–
+	Dorsal abrasion proximal part of blank	Not frequent	Not frequent
+	Long regular blades	Not frequent	+/Not frequent
+	Butts *en éperon*	–	–
+	Mineral (soft stone) hammer	+	+
+	Organic (antler) hammer	–/Albendorf?	–
+	Direct percussion	+	+
–	Specific reduction strategy focused on microliths	+	–

235; *Maier 2015*, 33; *Pelegrin 2002*; *2012*; *Pigeot 2004*; *Valentin/Pigeot 2000*). According to A. Maier, butts of the *en éperon* type are most common between 16 and 14 thousand years cal BP where they represent 12–69% of the total in assemblages from Bohemia, Poland and Thuringia. This period is marked by relative techno-typological uniformity in these regions. Later, between 14 and 13 thousands years cal BP, *en éperon* butts decrease in number. Mineral percussions are now used instead of organic ones, and different tool types begin to predominate (mostly projectiles; *Maier 2015*, 158). Apart from the chronological aspect, regional differences are observable in the intensity of the application of *en éperon* butts throughout the Magdalenian world.

Although the technology of knapping is usually not precisely described and analogies are rather scattered, when we compare Magdalenian knapping technique with the Epigravettian technique (or LUP in generall) some striking differences are obvious (Table 2).

In Brno-Štýřice III, most of the butts show signs of knapping with a soft mineral hammer, i.e. dorsal abrasion of artefacts and punctiform butt (*Nerudová 2016*), whereas *en éperon* butt types are missing completely, which is concordant with the preparation of preserved cores. Similar situation can be observed in the Epigravettian site at Stadice where punctiform and plain butts predominate significantly (Fig. 2: 5; Table 1) and the technology used is characteristic of a soft mineral hammer. No evidence of *en éperon* butts is present there; among the faceted butts three pieces remind one of *en éperon* butts, but they are by no means typical (*Nerudová/Moník 2019*). In Mohelno-Plevovce KSA was also applied soft stone hammer and butts are plain, punctiform, dihedral and linear (*Škrdla et al. 2015b*).

The material from Rosenburg am Kamp (Austria) was analysed in detail by I. Ott. The author noticed plain and punctiform butts, the not numerous cores are unipolar as well as bipolar. Between sporadic tools, backed bladelet significantly prevails (*Ott 1996*). A very specific situation can be observed in the Grubgraben site and there was a question about whether to include this site. The collection is so unique that it has no analogy in the narrower Central European space. The knapping is significantly influenced by the input size of the raw material, which is rather smaller in size. Much of the production was carried out off-site, with specific production of microliths and carenoidal endscrapers (*Montet-White 1990*; *Neugebauer-Maresch et al. 2016*).

The site Albendorf (Germany) provided typical and atypical carinated tool-types, bladelets and microliths. Cores for formal blanks are reduced in unidirectional way; many of blanks have a very small butts (punctiform) and traces of dorsal reduction. The second reduction strategy was focused on the microlithic bladelets. For theirs production the carinated tools were used as cores. None of them has other forms of platform preparation like edge rounding or faceting. Contrary to the character of lithic staff, in Albendorf was identified according significant traces of use at the distal edge, one fragment of ivory as a soft hammer for flint-knapping (*Steguweit 2010*).

Nitra III (Slovakia) provided mostly unipolar blade cores before bipolar ones. The butts of blanks are often unprepared, linear or punctiform. Between the tools, short endscrapers prevail over burins, truncated blades and backed tools (*Kaminská/Nemergut 2014*).

From Sowin 7 in Poland are unipolar blade cores with simple preparation of cores striking platform. The products have flat butts, blades are short, between the tools burins and backed pieces prevail

(*Wiśniewski et al. 2012*). Detailed examination of the lower layer from Sowin 7 has shown technological differences from Magdalenian layers. The striking platform of cores was oval and prepared with one strike. The edges of striking platforms are abraded, similar to Gravettian ones. The blades have plain butts and are curved in their distal parts (*Wiśniewski et al. 2012*). In Targowisko slightly prevail double platform cores over single platform ones. Both flakes and blades have the butts usually plain or cortical, dihedral (edge) and punctiform butts are less common. On blanks is occasionally present dorsal abrasion and a characteristic lip. Between the tools, endscrapers and burins prevail over other types, like are backed bladelets (*Wilczyński 2009*). Very similarly is described the character of lithics and technology in the site Święte 9 in South-East Poland (*Łanczont et al., in press*).

Technology of knapping in Esztergom–Gyurgyalag (Hungary) was focused on the direct soft hammer percussion. The single blade core is reduced in unidirectional way. On the blanks significantly prevail plain butts. As a specific feature of the collection from Esztergom–Gyurgyalag is unusual proportion of backed tools (altogether more than 60%; *Lengyel 2014*). For bladelets unfortunately is not describe mode of reduction strategy. Similar situation in blade production is present also in Arka, Bodrogkeresztúr, Hidasnémeti, Sajószentpét or Ságvár (for more details see *Lengyel 2018*).

Piastra Neamţ open-air site (Romania) is associated with the Gravettian and Epigravettian occupation. From the Epigravettian Layer 2, dated between 17,000–19,000 BP are documented unipolar blade cores, with surface prepared by one (single) strike. The cores were used for exploitation of large blades. The second reduction strategy is focused on micro-blades, which are knapped from unipolar "burin-shaped" cores. In the collection endscapers and burins significantly prevails, numerous are also cf. Dufour bladelets, carenoidal elements and microliths. The faunal assemblage contains mostly reindeers, less horse. Among unique finds is a human bone (*Cârciumaru et al. 2006*; *2010*). According the lithic composition this staff can be associate rather with Epiaurignacian than Epigravettian, nevertheless this classification was not accepted (E. Ch. Nitu, pers. com).

In Šandalja II (Croatia), the early Epigravettian Layer C/d dated 20,750 ±400 years have the industry with the blades with often lipped butts. Use is direct soft-hammer percussion technique and blade core (one is present in the assemblage) is large and prismatic with a single striking platform. Between the tools are frequent endscrapers, backed bladelet and micro-Gravettes (*Karavanić et al. 2013*).

Blades from the Epigravettian site Sant-Antoine in Italy possessed plain or abraded butts in 49% of cases, knapped with soft mineral hammer (*Bracco et al. 1997*).

Rather distant analogy are known from Russia. Eliseevitchi 1 open-air site, dated between 17–12 ky uncal BP provided blades and bladellets with dorsal preparation. According to analyses, for knapping both soft mineral and hard hammer were used. In second site, Eliseevitchi 2, dated around 15 ky uncal BP were short blades knapped from bipolar cores by soft mineral hammer. At the site are frequent burins and backed bladelets. In the Eliseevitchi 2 also organic hammer for knapping was probably used (*Eskova 2019*). According to oral presentation of D. Eskova, in Late Gravettian site Khotylevo 2 is not clear continuity between Gravettian, the lithic staff and technology is more similar to the Moravian Epigravettian collections (*Eskova 2019*).

CONCLUSION

Despite the seeming heterogeneity of the late Palaeolithic collections, it is possible to observe some unifying elements in a wider regional context, particularly evident in the methods of knapping (technology) of stone chipped industry. According to actual state of knowledge, we can characterise the technological *fossile directeur* for LUP (Epiaurignacian, Epigravettian) collections as soft mineral hammer for knapping (Table 2). Typical are unipolar, less bipolar blade cores; in some of the sites is specific bipolar anvil technique as alternative way how to obtain micro-blades, in same of the sites are alternatively for production of micro-blades used "burin-shaped" or "endscrapers" cores (Albendorf, Eliseevichi, Mohelno-Plevovce, Piastra Neamţ). Contrary to the Magdalenian, there is no evidence for antler hammer (excluding direct evidence in Albendorf) and no evidence for *en éperon* butts. Cores' striking platforms are without preparation or are only simply prepared by one strike. Dorsal preparation of blanks is not frequent and typical are punctiform butts (excluding the sites in Hungary, where are generally typical plain butts). For a number of collections it's clear that a large part of the knapping took place off-site. Various stone materials are frequent, indicating broad territorial contacts, often over long distances.

Similar technological characteristics are described from wider area of Slovakia, Austria, Germany, Poland, Hungary, Romania, Croatia or Russia.

After some technological stability presented by Magdalenian, the trend to abandon techno-typological stability and turn towards mineral hammers is evident in the trend to abandon techno-typological stability and turn towards mineral hammers (*Maier 2015*). This trend is also observable in the Late Palaeolithic layers 4 and 3 of Kůlna Cave. Plain and punctiform butts predominate, particularly in layer 4.

Acknowledgements

This article has been prepared with the financial support of the Ministry of Culture through institutional funding for the long-term conceptual development of the Moravian Museum research organisation (DRKVO, MK000094862) 2019–2023. The author is grateful to Adrián Nemergut and Kaszia Pyżewicz for their kind invitation to the SKAM workshop and possibility to participate on this special issue.

Translated by author and Alexander Robin Smith

BIBLIOGRAPHY

Andrefsky Jr. 1998 — W. Andrefsky Jr.: *Lithics. Macroscopic approaches to analysis.* Cambridge 1998.

Barton 1990 — C. Barton: Beyond style and function – a view from the Middle Paleolithic. *American Anthropologist* 92, 1990, 57–72.

Belcredi et al. 1989 — L. Belcredi/M. Čižmář/P. Koštuřík/M. Oliva/M. Salaš: *Archeologické lokality a nálezy okresu Brno-venkov.* Brno 1989.

Bracco et al. 1997 — J.-P. Bracco/J. Gagnepain/C. Stouvenot/P. Bidart/S. Vigier: L'industrie lithique épigravettienne de Saint-Antoine – Locus 2 (Vitrolles, Hautes-Alpes). Première analyse. *Paléo* 9, 1997, 221–243.

Cârciumaru et al. 2006 — M. Cârciumaru/M. Anghelinu/L. Steguweit/L. Niţă/L. Fontana/A. Brugère/U. Hambach/M. Mărgărit/V. Dumitraşcu/M. Cosac/F. Dumitru/O. Cârstina: The Upper Palaeolithic site of Poiana Cireşului (Piatra Neamţ, Nort-eastern Romania) – recent results. *Archäologische Korrespondenzblatt* 36, 2006, 319–331.

Cârciumaru et al. 2010 — M. Cârciumaru/M. Anghelinu/L. Steguweit/G. Lucas/L. Niţă/L. Fontana/A. Brugère/U. Hambach/M. Mărgărit/V. Dumitraşcu/M. Cosac/F. Dumitru/O. Carstina: Recent Results from the Upper Paleolithic Site of Poiana Ciresului. Piatra Neamţ (Northeastern Romania). In: C. Neugebaeur-Maresch/L. R. Owen (eds.): *New Aspects of the Central and Eastern European Upper Palaeolithic. Methods, chronology, technology and subsistence.* Osterreichischen Akademi der Wissenschaften. Wien 2010, 209–219.

Eskova 2019 — D. K. Eskova: *Epigravettian of the Desna region. A Variety of Technological Traditions. Oral Presentation, The cultural geography of the Palaeolithic in the East-European Plain. From the Micoquian to the Epigravettian. Conference, 10th–16th September 2019.* Bryansk 2019.

Floss/Weber 2012 — H. Floss/M.-J. Weber: Schlagtechniken. In: H. Floss (ed.): *Steinartefakte vom Altpaläolithikum bis in die Neuzeit.* Tübingen 2012, 133–136.

Cheynier 1956 — A. Cheynier: Les Gros Monts à Nemours (Seine-et-Mame). Congrés préhistoriques de France. 15e session. *Poitiers-Angoulême*, 1956, 344–365.

Inizan et al. 1995 — M.-L. Inizan/M. Reduron/H. Roche/J. Tixier: *Technologie de la pierre taillée.* Préhistoire de la Pierre Taillée. Tome 4. Meudon 1995.

Inizan et al. 1999 — M.-L. Inizan/M. Reduron/H. Roche/J. Tixier: *Technology and Terminology of Knapped Stone 5.* Meudon 1999.

Kaminská/Nemergut 2014 — Ľ. Kaminská/A. Nemergut: The Epigravettian Chipped Stone Industry from the Nitra III Site (Slovakia). In: K. T. Biró/A. Markó/K. P. Bajnok (eds.): *Aeolian Scripts New Ideas on the Lithic World Studies in Honour of Viola T. Dobosi.* Budapest 2014, 93–120.

Karavanić et al. 2013 — I. Karavanić/N. Vukosavljević/R. Šošić Klindžić/D. Kurtanjek/J. Zupanič: The lithic and bone industries of the Epigravettian layers from Šandalja II near Pula. *Vjesnik za arheologiju i povijest dalmatinsku* 106, 2013, 7–73.

Karlin 1972 — C. Karlin: Le débitage. In: A. Leroi-Gourhan/M. Brézillon (eds.): *Fouilles de Pincevent: Essai d'analyse ethnographique d'un habitat Magdalénien VIIe supplément.* Gallia Préhistoire. Paris 1972, 263–278.

Klaric 2003 L. Klaric: *L'unite technique des industrie a burins du raysse dans leur contexte diachronique. Reflexion sur la diversité culturelle au Gravettien a partir des donées da la Picardie. D'Arcy-sur-Cure, de Brassempouy et du Cirque de la Patrie.* PhD. Thesis. Université de Paris I. Pantheon-Sorbonne. Paris 2003. Unpublished.

Klíma 1962 B. Klíma: Die archäologische Erforschung der Höhle Švédův stůl. In: B. Klíma/R. Musil/J. Jelínek/J. Pelíšek (eds.): *Die Erforschung der Höhle Švédův stůl 1953–1955.* Brno 1962, 9–96.

Łanczont et al., in press M. Łanczont/M. Połtowicz-Boka/D. Bobak/P. Mroczek/A. Nowak/M. Komar/K. Standzikowski: On the edge of eastern and western culture zones in the early Late Pleistocene. Święte 9 – A new epigravettian site in the south-east of Poland. *Quaternary International*, in press.

Lengyel 2014 G. Lengyel: Backed tool technology at Esztergom-Gyurgyalag Epigravettian site in Hungary. In: K. T. Biró/A. Markó/K. P. Bajnok (eds.): *Aeolian scripts. New ideas on the lithic world. Studies in honour of Viola T. Dobosi.* Budapest 2014, 121–130.

Lengyel 2018 G. Lengyel: Lithic analysis of the Middle and Late Upper Palaeolithic in Hungary. *Folia Quaternaria* 86, 2018, 5–157.

Lengyel/Chu 2016 G. Lengyel/W. Chu: Long thin blade production and Late Gravettian hunter-gatherer mobility in Eastern Central Europe. *Quaternary International* 406, 2016, 166–173.

Maier 2015 A. Maier: *The Central European Magdalenian. Regional Diversity and Internal Variability.* New York 2015.

Moník 2004 M. Moník: *Pozdní paleolit v Čechách a na Moravě*. PhD. Thesis. Faculty of Arts. Charles University. Praha 2004. Unpublished.

Montet-White 1990 A. Montet-White: *The Epigravettian site of Grubgraben. Lower Austria: the 1986–1987 excavations.* ERAUL 40. Liège 1990.

Mozola 2013 J. Mozola: *Rozlišení mladopaleolitických kultur na podkladě technologické analýzy sbíjení kamenných polotovarů.* BC. Thesis. Faculty of Arts. Masaryk University. Brno 2013. Unpublished.

Nejman et al. 2020 L. Nejman/S. Hughes/L. P. Sullivan/D. Wright/A. Mosig/N. Nismene/O. Mlejnek/P. Škrdla/L. Lisá/M. Kmošek/M. Nývltová-Fišáková/M. Králík/P. Neruda/Z. Nerudová/A. Přichystal: Preliminary Report of the 2019 Excavation at Švédův Stůl Cave in the Moravian Karst. *Přehled výzkumů* 61, 2020, 11–19.

Neruda/Nerudová 2008 P. Neruda/Z. Nerudová: Loštice I. Výzkum nové magdalénienské stanice na střední Moravě. *Archeologické rozhledy* 60, 2008, 509–628.

Nerudová 2016 Z. Nerudová: *Lovci posledních mamutů na Moravě.* Brno 2016.

Nerudová/Moník 2019 Z. Nerudová/M. Moník: The Epigravettian of Kůlna Cave a revision of artefacts. *Archeologické rozhledy* 71, 2019, 567–586.

Nerudová/Neruda 2010 Z. Nerudová/P. Neruda: Technologický a typologický rozbor kamenné štípané industrie z jeskyně Balcarky. In. Z. Nerudová (ed.): *Jeskyně Balcarka v Moravském krasu. Interdisciplinární studie.* Anthropos 31 (N. S. 23). Brno 2010, 67–82.

Nerudová/Neruda 2015 Z. Nerudová/P. Neruda: Moravia between Gravettian and Magdalenian. In: S. Sázelová/M. Novák/A. Mizerová (eds.): *Forgotten times and spaces. New perspectives in paleoanthropological, paleoetnological and archeological studies.* Brno 2015, 378–394.

Nerudová/Neruda/Hamrozi 2021 Z. Nerudová/P. Neruda/P. Hamrozi: Statistical and geographical modelling of Moravian (Czech Republic) Late Upper Palaeolithic occupation. *Quaternary International* 581–582, 2021, 175–189.

Nerudová et al. 2012 Z. Nerudová/P. Neruda/L. Lisá/M. Roblíčková: Záchranný výzkum mladopaleolitických lokalit v Brně-Štýřicích v kontextu osídlení Brněnska. *Archeologické rozhledy* 64, 2012, 591–627.

Neugebauer-Maresch et al. 2016 C. Neugebauer-Maresch/T. Einwögerer/J. Richter/A. Maier/S. T. Hussain: Kammern-Grubgraben. Neue Erkenntnisse zu den Grabungen 1985–1994. *Archaeologica Austriaca* 100, 2016, 225–254.

Ott 1996 I. Ott: Die Artefakte der jungpaläolithischen Fundstelle von Rosenburg am Kamp, Niederösterreich. *Archeologica Austriaca* 80, 1996, 43–114.

Pelegrin 2002 J. Pelegrin: Les techniques de débitage laminaires au Tardiglaciare: criteres de diagnose et quelques réflexions. In: B. Valentin/P. Bodu/M. Christensen (eds.): *L'Europe Centrale et Septentrionale au Tardiglaciare. Confrontation des modeles régionaux du peoplement.* Table-ronde de Nemours, 13–16 mai 1997. Mémoires du Musée de Préhistoire d'Ille de France 7. Nemours 2002, 73–86.

Pelegrin 2012 J. Pelegrin: Sur les débitages laminaires du Paléolithique supérieur. In: J. Jaubert/F. Delpech (eds.): *François Bordes et la préhistoire.* Édition du CTHS. Paris 2012, 141–152.

Pelegrin/Texier 2004 J. Pelegrin/J.-P. Texier: Les techniques de tailles de la pierre préhistorique. *Dossiers d´archélogie* 290, 2004, 26–33.

Pigeot 2004 N. Pigeot: *Les derniers magdaleniens d´Etiolles. Perspectives culturelles et paleohistoriques.* Gallia Préhistoire. Suplement 37. Paris 2004.

Pyżewicz/Nerudová 2020 K. Pyżewicz/Z. Nerudová: A microwear study regarding the function of lithic tools in Moravian Epigravettian. *Quaternary International* 536, 2020, 60–74.

Steguweit 2010 L. Steguweit: New Insights into the Inventory of Alberndorf (Lower Austria) and Some Remarks on the "Epi-Aurignacian" Controversy. In: C. Neugebauer-Maresch/L. R. Owen (eds.): *New Aspects of the Central and Eastern European Upper Palaeolithic – Methods, Chronology, Technology and Subsistence.* Mitteilungen der Prähistorischen Kommission. Herausgegeben von Herwig Friesinger 72. Wien 2010, 221–229.

Surmely/Alix 2005 F. Surmely/P. Alix: Note sur les talons en éperon du Protomagdalénien. *Paléo* 17, 2005, 157–176.

Škrdla et al. 2015a P. Škrdla/L. Nejman/J. Bartík/T. Rychtaříková: Human occupation of central Europe during the Last Glacial Maximum: new evidence from Moravia, Czech Republic. *Antiquity (The Project Gallery)* 89, 2015. http://www.antiquity.ac.uk/projgall/nejman347 [29. 03. 2021]

Škrdla et al. 2015b P. Škrdla/L. Nejman/J. Bartík/T. Rychtaříková/P. Nikolajev/J. Eigner/M. Nývltová Fišáková: Terminal LGM dwelling structure from Mohelno in the Czech-Moravian Highlands. In: S. Sázelová/M. Novák/A. Mizerová (eds.): *Forgotten times and spaces: New perspectives in paleoanthropological, paleoetnological and archeological studies.* Brno 2015, 395–409.

Valentin/Pigeot 2000 B. Valentin/N. Pigeot: Éléments pour une chronologie des occupations magdaléniennes dans le Bassin parisienn. In: B. Valentin/P. Bodu/M. Christensen (eds.): *L´Europe centrale et septentrionale au Tardiglaciarire. Confrontation des modéles régiounaux du peuplement. Table-Ronde internationale de Nemours, 13–16 may 1997.* Mémoires du Musée de préhistoire d´Ille de France 7. Paris 2000, 73–86.

Wilczyński 2009 J. Wilczyński: Targowisko. A new Late Glacial site in Southern Poland. *Eurasian Prehistory* 6, 2009, 95–118.

Wiśniewski 2015 T. Wiśniewski: Magdalenian settlement in Klementowice. In: T. Wiśniewski (ed.): *Klementowice. A Magdalenian site in Eastern Poland.* Lublin 2015, 15–179.

Wiśniewski et al. 2012 A. Wiśniewski/M. Furmanek/M. Borowski/K. Kadziolka/A. Rapiñski/K. Winnicka: Lithic raw material and Late Palaeolithic strategies of mobility. A case study from Sowin 7. *Anthropologie* 50, 2012, 391–409.

Je možné nalézt *fossile directeur* pro epigravettien?

Zdeňka Nerudová

Souhrn

Jednou z možností, jak studovat a případně rozlišit pozdně mladopaleolitické soubory (LUP) epigravettienu, epiaurignacienu a případně magdalénienu, je prostřednictvím technologie jejich sbíjení. První práce naznačily, že lze takto poměrně spolehlivě odlišit celky epigravettienu od souborů magdalénienu. Aplikací studia technologie sbíjení na nejisté soubory lze do určité míry determinovat jejich kulturní příslušnost, pakliže ji není možné prokázat signifikantnějším způsobem a pokud dochází k překryvu radiokarbonových dat (epigravettien a magdalénien). Jako klíčové se do budoucna jeví rozlišení epiaurignacienu od epigravettienu, neboť obě kultury mají velmi podobné složení kamenné industrie.

V současnosti je epiaurignacien na Moravě reprezentován značně redukovanými jádry, aurignacienskými typy nástrojů, mikrolity typu Sagaid-Muralovka a převahou eratických silicitů. Lokality v oblasti Drahanské vysočiny jsou situovány dále od vodních toků, v lovené fauně dominují koně a sobi. Technologie sbíjení zahrnuje i dvoupodstavová jádra těžená na kovadlině a měkký minerální otloukač. Patky produktů jsou nejčastěji bodové, hladké nebo lomené (*Škrdla et al. 2015*).

Zcela jinak je charakterizován epigravettien na Moravě. Pro něj jsou typická jednopodstavová čepelová jádra, absence aurignacienských elementů mezi nástroji, absence mikrolitů, naopak jsou velmi početná různá rydla; elementy s otupeným bokem jsou spíše vzácné. Lokality jsou situovány v refugiích nejčastěji u vodních toků. V lovené fauně dominuje mamut, pro sbíjení je užíván měkký minerální otloukač a na produktech dominuje bodová patka (*Nerudová/Moník 2019*).

Zmíněné rozdíly lze pozorovat i v širším geografickém a chronologickém kontextu (gravettien, epiaurignacien, epigravettien, magdalénien; *Mozola 2013*). Analýza technologie sbíjení byla úspěšně aplikována na soubor artefaktů jeskyně Kůlna, které mohly být na podkladě radiokarbonového data spojovány s epigravettienem. Technologie sbíjení a přítomnost patek typu *en éperon* ale přesvědčivě doložila jejich spojitost s magdalénienem (*Nerudová/Moník 2019*). V této studii byly testovány další, v některých případech ne zcela jednoznačně kulturně klasifikované soubory (obr. 1).

Technologie sbíjení a použitý otloukač byly identifikovány na základě autorčiných zkušeností a za použití dostupné literatury (*Pelegrin 2002*; *2012*; *Pelegrin/Texier 2004*), použitý otloukač na lokalitě Brno-Štýřice III byl identifikován trasologem (*Pyżewicz/Nerudová 2019*). K pozorování byl použit také stereo mikroskop Nikon SMZ645 za použití 8x–50x zvětšení. Analýzami bylo zjištěno, že soubory z Bratčic III a Brna-Štýřic IIIa lze spojovat s epigravettienem, Rozdrojovice I surovinově a technologicky odpovídají spíše gravettienu/epigravettienu, příslušnost artefaktů ze Švédova stolu k magdalénienu nebylo nutné zpochybnit (obr. 2; 3). Širší srovnání potvrdilo podobné znaky u kulturně identických souborů (tabela 1).

Technologie sbíjení v magdalénienu, která je odlišná od výše zmíněných kultur epigravettienu a epiaurignacienu, byla velmi podrobně popsána (*Maier 2015*, 33; *Wiśniewski 2015*). Za chronologicky významné může být považováno sbíjení způsobem *en éperon*, které je nejčastější v období mezi 16. a 14. tis. lety kalibrovaně BP, kdy je zastoupeno 12–69 % v kolekcích v Čechách, Polsku a Duryňsku, zatím co o tisíciletí později přítomnost patek *en éperon* v souborech rapidně klesá (*Maier 2015*, 158).

Zatím co rozdíly v technologii sbíjení mezi magdalénienem a epigravettinem jsou uvedené v tabelách 1 a 2, lze naopak v širším geografickém rámci lze pro epigravetien a epiaurignacien pozorovat některé shodné rysy. Ty jsou zjevné zejména ve způsobech sbíjení (technologii) kamenné štípané industrie. Ke zevšeobecnění byla použita řada analogií (Albendorf, Grubgraben, Nitra III, Rosenburg, Sowin 7, Stadice, Arka, Bodrogkeresztúr, Eliseevitchi 1, Eliseevitchi 2, Esztergom-Gyurgyalag, Hidasnémeti, Khotylevo 2, Piastra Neamţ, Sajószentpét nebor Ságvár, Sant-Antoine, Šandalja II, Targowisko), na jejichž podkladě můžeme definovat technologický *fossile directeur* pro pozdně mladopaleolitické (LUP) soubory epiaurignacienu a epigravetienu (tabela 2).

Pro sbíjení je typický měkký minerální otloukač, typická jsou jednopodstavová čepelová jádra, dvoupodstavová jsou méně běžná. Na některých lokalitách je užito sbíjení na kovadlině pro získávání mikročepelí nebo jsou mikročepele získávány z kýlovitých rydel či kýlovitých škrabadel (Albendorf, Eliseevichi, Mohelno-Plevovce, Piastra Neamţ). Na rozdíl od magdalénienu zatím není žádný doklad pro parohový otloukač (výjimka je Albendorf) a důležitá je absence patek typu *en éperon*. Podstavy jader jsou preparovány jedním úderem, produkty (čepele) obvykle nemají dorzální preparaci a typická je pro ně bodová patka (s výjimkou souborů v Maďarsku). U mnohých souborů je uváděno, že výrazná část sbíjení probíhala mimo vlastní lokalitu. Časté jsou různorodé suroviny, naznačující široké územní kontakty, mnohdy i na velké vzdálenosti. Podobné technologické charakteristiky lze pozorovat v širší oblasti Česka, Moravy, Slovenska, Rakouska, Německa, Polska, Maďarska, Rumunska nebo Ruska.

Obr. 1. Bratčice III. Charakteristické bodové patky (kresba T. Janků, mikrofoto M. Kmošek).
Obr. 2. 1, 2 – Brno-Štýřice IIIa; 3, 4, 6 – Rozdrojovice; 5 – Stadice (kresba T. Janků, mikrofoto M. Kmošek).
Obr. 3. Jeskyně Švédův stůl (kresba T. Janků).

Tabela 1. Studované lokality a typy patek (Σ v kusech). Legenda: Nat. surf. – s přirozeným povrchem; Punc. – bodová; Und – nediagnostická/nedochovaná; * – nebylo sledováno.
Tabela 2. Technologické charakteristiky magdalénienu, epigravettienu a epiaurignacienu s ohledem na lokality zmiňované v textu.

doc. Mgr. Zdeňka Nerudová Ph.D.
Centrum kulturní antropologie MZM
Zelný trh 6
CZ – 659 37 Brno
znerudova@mzm.cz

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 175–198

ANALYSIS OF CHIPPED INDUSTRY FROM THE SETTLEMENT OF THE ŽELIEZOVCE GROUP IN BAJČ[1]

Ivan Cheben – Michal Cheben

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.12

Keywords: Želiezovce group, Southwestern Slovakia, settlement, lithics, silicites, knappable raw materials, typology

Abstract: A rich collection of chipped stone industry, chronologically falling to the final stage of the Želiezovce group, was obtained from the area of the settlement in Bajč. Two aspects were taken into consideration when analysing the assemblage of finds – typological-technological point of view and proportion of knappable raw materials at the site. The assemblage of chipped industry from Bajč comprises of items representing all phases of production process. The initial phase of raw silicite modification (including obsidian) is indicated by primary blades and flakes. The following stage, a primary exploitation, is documented by the presence of crest and subcrest blades. The final phase of the production process is represented mainly by the finished artefacts. Even though the collection contains also production waste, such as blades and their fragments, it mainly comprises tools – the final products of the knapping process. The analysed collection comprises of a wide range of various kinds of silicites and volcanic glass. It is currently the most diverse assemblage of knappable material obtained from the settlements of the Želiezovce group in Southwestern Slovakia. Local silicite raw material – limnosilicite – clearly prevails in the assemblage, but obsidian was also common. Radiolarite of the Szentgál type, chalk flint of the Tevel type, radiolarites of the Bakonycsernye, Gercse and Hárskút types were also identified, although they were fewer. The least frequent raw materials include felsitic porphyry, Volhynian flint, radiolarite from the Klippen Belt of the White Carpathians, silicite of the Kraków-Częstochowa Jurassic period, erratic flint, wood opal and nummulite silicite. A new, previously undescribed raw material has been recorded. It was identified as a siliceous substance of volcanic origin whose primary sources are located within the territory of neovolcanites in central Slovakia.

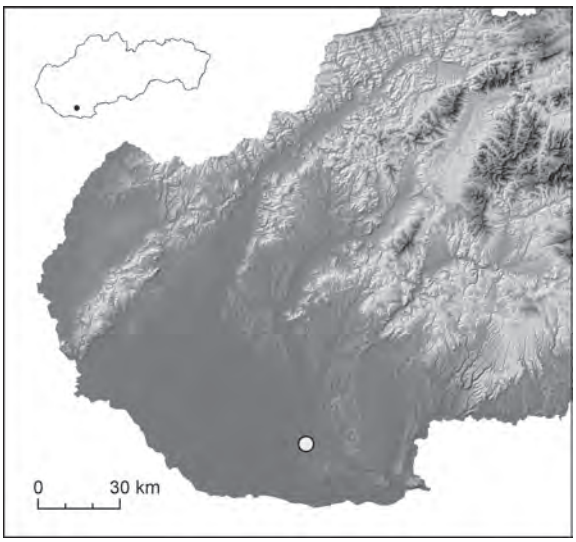


Fig. 1. Location of Želiezovce group settlement in Bajč-Medzi kanálmi.

THE SETTLEMENT AREA

During several seasons (1987–1990 and 1992–1993), a large settlement area was excavated in the cadastral area of the village of Bajč (Komárno dist.), located on a sand dune, at the Medzi kanálmi site (Fig. 1). Several chronological horizons were detected. The site was most intensely settled in the end of the cultural development of the Želiezovce group, especially in its third development stage. The site was not re-settled until as late as the Early Middle Ages, since when it was again intensely occupied. Only few traces of occupancy of the sand dune have been documented within the excavated area, for instance, an object containing pottery of the Kosihy-Čaka culture (*Cheben I. 1998*, fig. 4). Traces of habitation in the late Hallstatt and the LaTène periods were also detected (*Čaplovič/Cheben I./Ruttkay 1988*; *1990*; *Cheben I./Ruttkay 1991*; *1992*; *1993*; *1995*).

[1] This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-20-0521 and projects VEGA 2/0101/19, 2/0075/21.

Numerous and typologically diverse finds were obtained from more than 500 settlement features and four inhumation burials (*Cheben I. 2000*, appendix 1) related to the Želiezovce group. Pottery represented the most numerous group of finds. Based on a detailed analysis of pottery, development of the Želiezovce group in its final stage was outlined (*Cheben I. 2000*). In comparison to other artefacts found within the settlement, polished and chipped lithic industry were extremely frequent. Such a numerous collection of stone industry has not been obtained from any other settlement of the Linear Pottery culture and the Želiezovce group in Southwestern Slovakia. The collection of polished lithic industry (*Méres/Hovorka/Cheben I. 2001*) consisting of more than 200 artefacts was processed from the aspects of raw materials as well as typology.

Chipped industry, represented by 734 specimens from the settlement at Bajč, remains unpublished. From the typological-technological point of view, as well as from the aspect of representations of knappable raw materials, the assemblage had been processed as a part of a dissertation dealing with chipped lithic industry from the Early Neolithic in the territory of Southwestern Slovakia (*Cheben M. 2020*). The presented article thus provides a more complex view on this type of material culture. The results of typological and technological analyses, as well as the diversity of raw materials, are presented in this paper. However, what needs to be considered is that it is a closed complex, culturally associated with a relatively short stage of the Želiezovce group (stage III).

RAW MATERIAL COMPOSITION AND TYPOLOGICAL-TECHNOLOGICAL EVALUATION OF ARTEFACTS

The collection of chipped industry from the investigated settlement contains a wide range of various types of silicites and volcanic glass. It is currently the most numerous and most diverse collection of knappable raw materials obtained from a settlement of the Želiezovce group in Southwestern Slovakia.

Local silicite – limnosilicite – is clearly predominant in the collection; it is represented by 308 specimens (Fig. 2). One artefact was probably also made of limnosilicite, however, determination of this type of silicite raw material was very difficult. The second widely used silicite is radiolarite of Szentgál type, imported from Hungary (188 specimens). In addition, more silicites imported from the territory of Hunary occurred at the site, chalk flint of the Tevel type being the most frequently represented type (55 specimens). Also, Bakonycsernye, Gerecse, and Hárskút types of radiolarite were detected (Fig. 2). Two specimens of felsitic porphyry, whose sources are located in Northeastern Hungary, was represented in the assemblage as well. This type of raw material was used e.g. during the Early Upper Palaeolithic at the Moravany nad Váhom-Dlhá site (*Nemergut/Cheben M./Gregor 2012*). Another rather frequent raw material from the category of volcanic glass, detected in the collection, was obsidian (73 specimens). Volhynian flint (4 specimens) was probably brought to the settlement together with obsidian. The source of this type of flint is situated in the territory of Western Ukraine. The collection also contained 41 specimens of radiolarite. Its origin can be sought in the Klippen Belt, in the area of the White Carpathians in Western Slovakia. A raw material imported from the territory of Poland – silicite of the Kraków-Częstochowa Jurassic period – was also represented in the collection, represented by 25 specimens. In one case, its G variety was identified. Finding of four artefacts made of erratic flint was an important discovery, because this type of silicite occurs only exceptionally in the collections of chipped industry of the Želiezovce group. The collection from Bajč comprised of three artefacts containing a new, previously undescribed type of raw material, identified as a "siliceous substance of volcanic origin". It has not yet been identified in any of the previously analysed collections obtained from Neolithic or Eneolithic sites or in any Palaeolithic collections. It is a silicite whose primary sources are located in the territory of the neovolcanites in central Slovakia, where it is found together with rhyolites (*Cheben M. 2020*). In the case of rhyolites, it creates several-centimetres thick layers which can be several meters long. During an intense survey, the authors identified one of the primary sources of this raw material near Hliník nad Hronom. As for other knappable raw materials, wood opal occurred (2 specimens) and one artefact was made of nummulite silicite whose sources are the gravels of the Ipeľ River. In one case, it was not possible to identify the raw material. Fourteen artefacts bore traces of intense burning, making the identification of the exact type of silicite impossible. The same applies to four specimens whose surface was covered with patina.

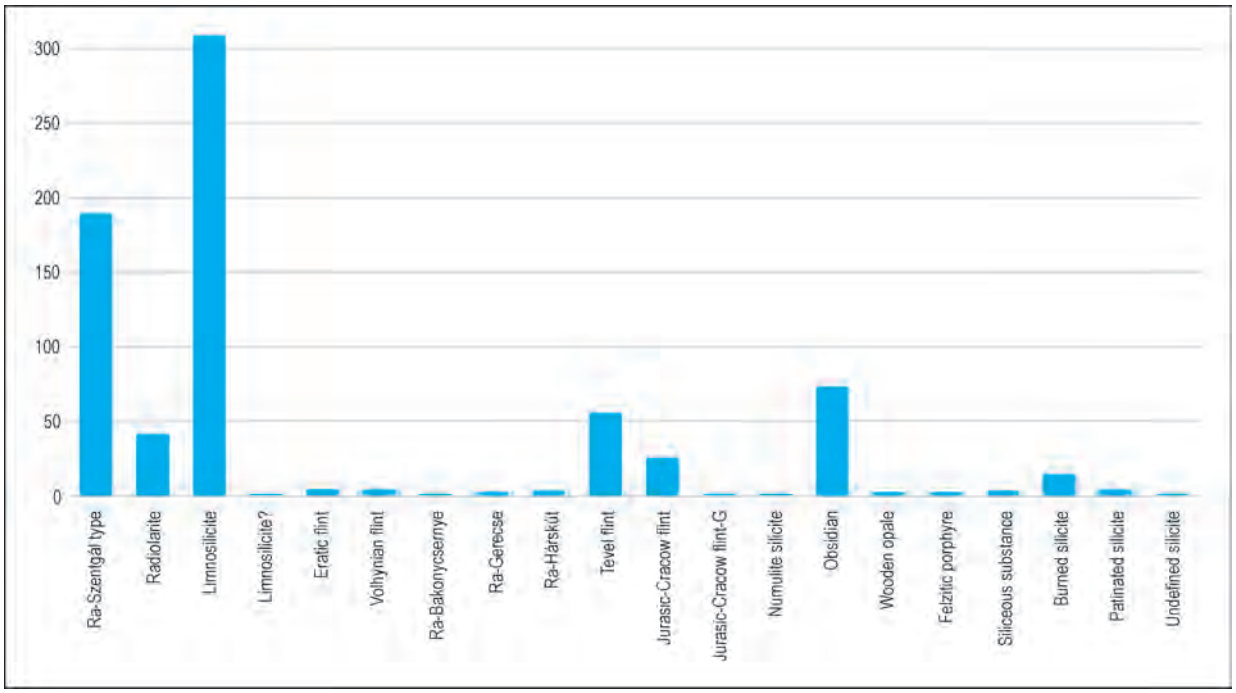


Fig. 2. Bajč-Medzi kanálmi. Proportion of individual types of raw materials present on the settlement.

Petrographic analysis of material composition of the chipped industry obtained from the settlements of the Želiezovce group clearly suggests that a wide range of used knappable raw materials from different areas of Slovakia or its neighbouring countries – Poland, Bohemia, Hungary, or Ukraine were used.

Petrographic determination of silicite used for the production of chipped tools definitely revealed important findings about the chipped industry from Bajč. It also conributed to identification of primary or secondary sources from which the material was transported to the settlement. This type of analysis also provides important information on the contacts of contemporary cultures, indicating the existence of trade routes in the territory of central Europe in the Neolithic and Eneolithic. The detailed analysis determining proportions of raw materials documented at individual sites can, similarly to the settlement in Bajč, suggest whether a similar trend could have been present also at other settlements in Southwestern Slovakia.

As revealed by the petrographic analysis, one of the most frequently used silicites in the collection was the local silicite – limnosilicite. One of the important primary sources of this raw material is in the Žiarska dolina basin (Fig. 3), in the region of neovulcanites located in central Slovakia. Besides limnosilicite, other silicites represented in Bajč chipped industry collection can also be found in this territory, even though the intensity of their use varied, as confirmed by the analysed collection. They include, for instance, chalcedonies (jasper), opals (wood opal), silicified tuff and the siliceous mineral of volcanic origin. The sources of these silicites are approx. 80 km far from the settlement. However, as shown by the analysis of the chipped industry, their secondary sources, the gravels of the Hron River, were also intensely used. In this case, the distance between the source of the raw material and the settlement is significantly shorter, being only a few tens of km. Another local raw material richly represented in the collection is radiolarite from the Klippen Belt (Fig. 4). The transportation route from the primary and secondary sources (the gravels of the Váh River) to the settlement was approx. 130 km long. The assumed secondary sources are 60–80 km far from the settlement. Volcanic glass – obsidian (Fig. 3), whose sources are located in Southeastern Slovakia (Zemplínske vrchy Hills) and Northeastern Hungary (Tokaj-Zemplén Hills), had to be brought to the site from the distance of more than 250 km. An important raw material – the silicite of the Kraków-Częstochowa Jurassic period – was imported from the territory of Southern Poland, from the Kraków-Częstochowa Upland 350 km far (Fig. 3). Volhynian flint was imported from the region of the Dnieper River (Ukraine), from a distance of 800 km (Fig. 3). As suggested by the analysis, important raw materials used in Southwestern Slovakia included Hungarian

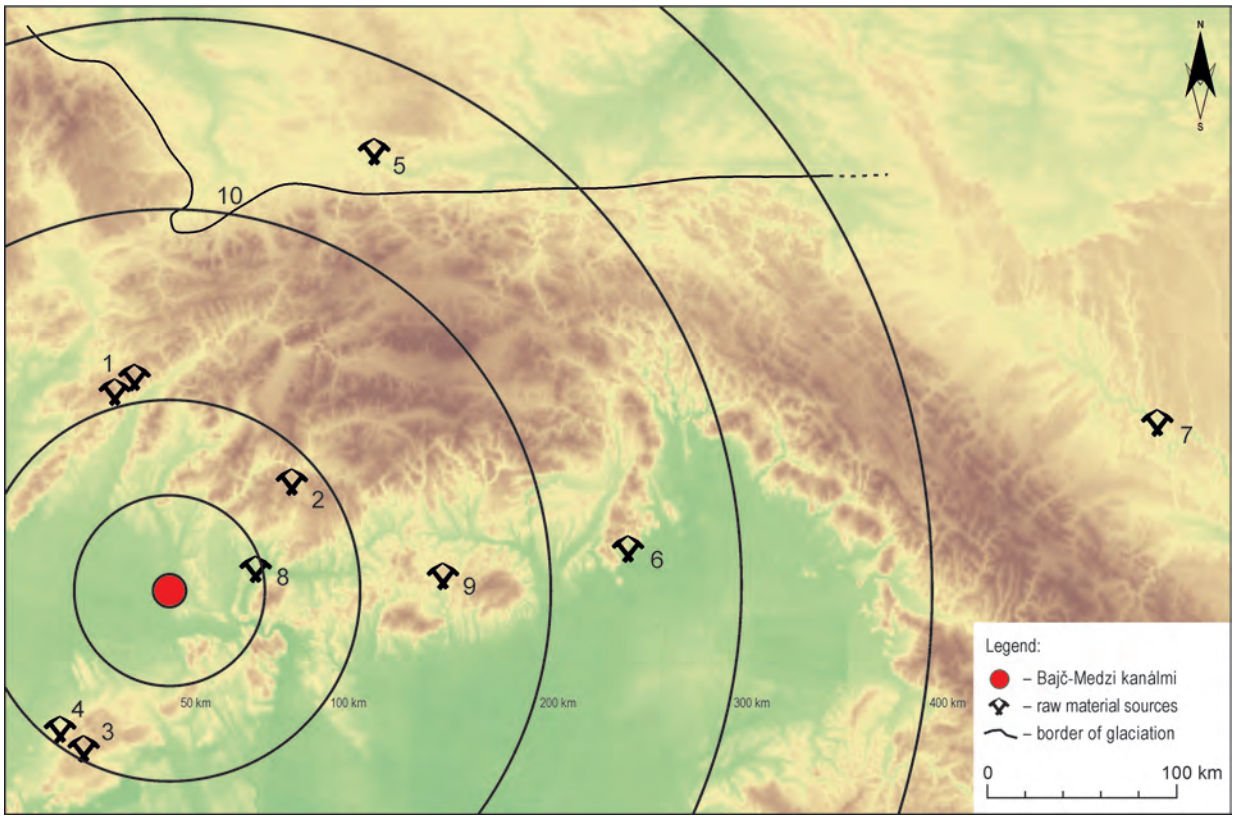


Fig. 3. Map of sources of the siliceous raw materials and volcanic glass, and their distance to the analysed settlement. 1 – radiolarite (Pieniny Klippen Belt); 2 – limnosilicite; 3 – Szentgál-type radiolarite; 4 – Tevel flint; 5 – Jurasic flint, Kraków-Częstochowa Upland; 6 – obsidian; 7 – Volhynian flint; 8 – numulite silicite; 9 – limnosilicite (N Hungary); 10 – erratic flint.

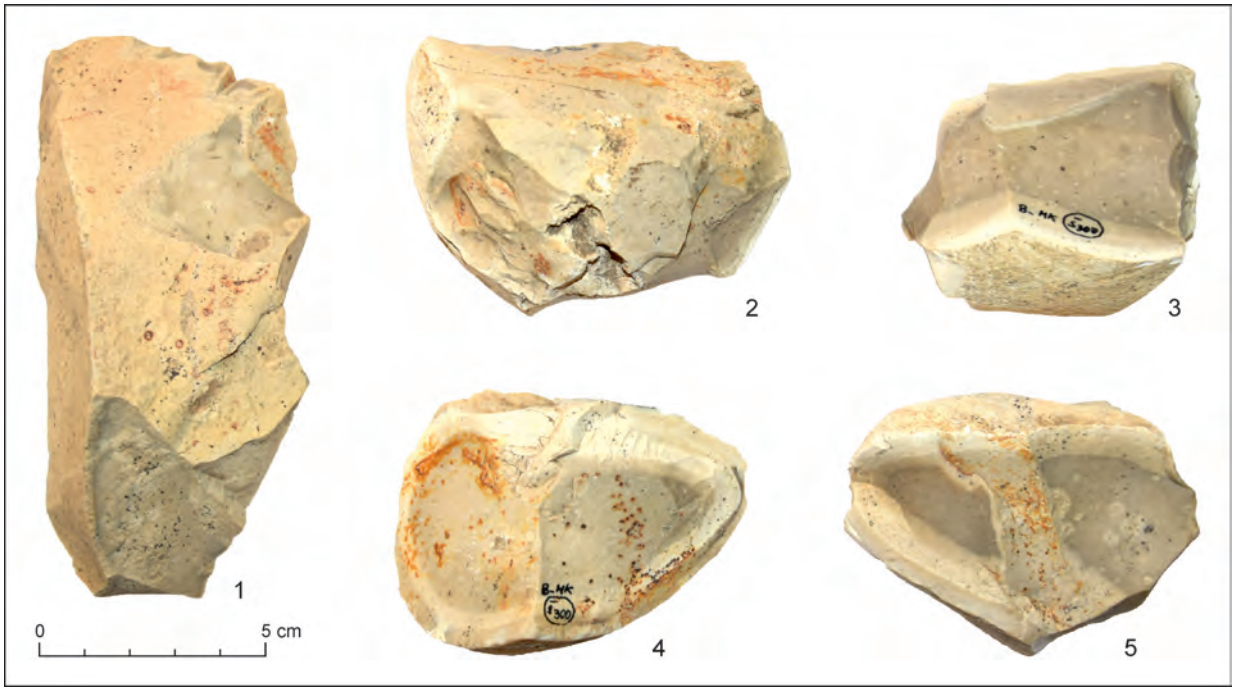


Fig. 4. Bajč-Medzi kanálmi. Hoard of silicite raw material from the pit 550 (Tevel flint).

Table 1. Bajč-Medzi kanálmi. Level of preservation of the original surface on blades and flakes.

Surface	Ra-Szentgál	Radiolarite	Limnosilicite	SGS	Volhynian flint	Ra-Bakonycsernye	Ra-Gerecse	Ra-Hárskút	Flint-Tevel	SKCJ	SKCJ-G	Nummulite silicite	Obsidian	Siliceous substance	In total
Blade with original surface	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Blade with partial cotex	–	–	3	–	–	–	2	–	6	2	1	–	4	–	18
Blade with negative	96	9	112	1	4	–	–	1	32	14	–	–	32	3	312
Flake with original surface	–	2	3	–	–	–	–	–	2	–	–	–	–	–	7
Flake with partial cortex	2	1	2	2	–	–	–	–	2	3	–	–	2	–	14
Flake with negative	48	10	130	1	–	1	–	1	5	4	–	–	26	–	230
Total	146	22	250	4	4	1	2	2	47	23	1	0	64	3	581

silicites, especially radiolarite of the Szentgál type and chalk flint of the Tevel type, whose primary sources are located in the Bakony Mountains. The transportation route was approx. 130 km (Fig. 3). In the collection, erratic flint was represented by several specimens. This material was most probably imported from a distance of 200 km, from the region of Northern Moravia and Silesia (Fig. 3).

Analysis of the surface of the silicites and obsidian can determine whether individual raw materials were transported to individual settlements from primary/secondary sources and in what state. For such a numerous collection as the one obtained from the settlement in Bajč, it is rather surprising that the blades with preserved original surface (cortex) are absolutely absent. Similar situation was observed when it comes to flakes, with only seven specimen present (Table 1). Considering blades and flakes with partly preserved cortex (Table 1), similar trend can be observed when in case of specimen made of limnosilicite, flint of the Tevel type, silicite of the Kraków-Częstochowa Jurassic period, and obsidian. In case of flakes with partly preserved cortex, silicites such as radiolarite of the Szentgál type, radiolarite from the Klippen Belt, and erratic flint occurred together with the above mentioned silicite raw materials (Table 1). In the whole assemblage, several pieces of silicite raw material with original surface and traces of manipulation occurred, represented mainly by the Tevel type flint, radiolarite, limnosilicite, and nummilite silicite.

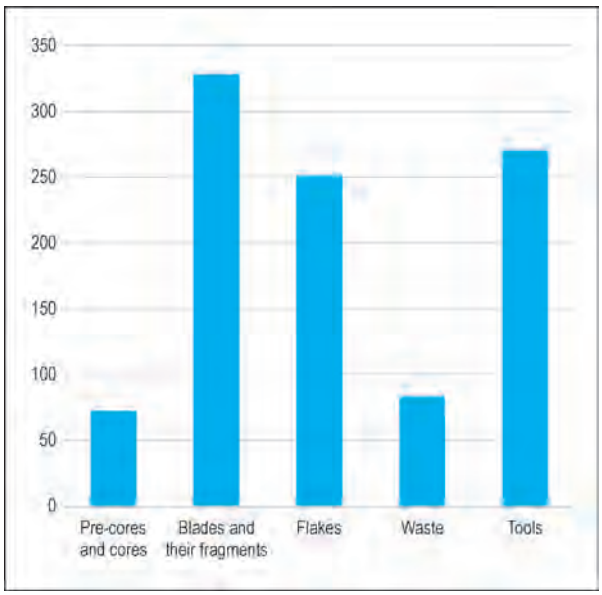


Fig. 5. Bajč-Medzi kanálmi. Quantity of chipped industry in the main groups.

The minimum number of artefacts with the original surface (cortex) might suggest that the silicites, such as the Szentgál type radiolarite, erratic flint, Volhynian flint, silicite of the Kraków-Częstochowa Jurassic period, siliceous substance of volcanic origin, and felsitic porphyry, were most probably imported to the settlement in the form of modified cores, possibily with the remnants of cortex. Raw materials such as obsidian, the Tevel type flint, radiolarite, nummulite silicite and limnosilicite were transported to the settlement in Bajč in their unmodified or only roughly processed form. The finds with the preserved pebble surface indicate that the gravels of the Hron River were the secondary source of limnosilicite material. Two types of original surface were detected on the radiolarites (from the Klippen Belt). In one case, a radiolarite layer with chert cortex was detected, the second specimen was

a radiolarite pebble. These finds suggest that radiolarite was obtained not only from its primary sources located in the Klippen Belt, but also from secondary sources – the gravels of the Váh River.

The analysed chipped industry comprises of the elements of all phases of the production process. Initial phase of silicite raw material modification (including obsidian) is represented by the presence of primary blades and flakes. Material exploitation phase is represented by crest and sub-crest blades. The assemblage contains predominantly the artefacts from the final phase. Cores amended because of improper exploitation or damaged raw material (cracks, hollows) are represented by a numerous reparation blades and flakes, indicating rejuvenation of the striking or exploited surface of the core. The assemblage also contains numerous exemplars of waste as well as final products – tools (Fig. 5). The most dominant in the collection are blades and their fragments, followed by flakes. Tools represent another considerable part of the inventory (Fig. 5).

Pre-cores and cores

72 artefacts have been evaluated within this group (Table 2; Pl. I). Thirteen specimens were identified as raw material without any traces of manipulation. On the same number of artefacts in this category, traces of manipulation have been found. These were mainly nodules or pebbles with preserved negatives of several debitages which may have been a result of testing of the quality of raw material.

As many as 45 individuals identified as cores in various stages of exploitation were identified in the analysed collection. Three massive rejuvenation flakes (removed by a direct strike with a hard hammering tool) were secondarily used for core production. One of such cores was identified as a single-platform disc-shaped core with a platform trimmed by several blows. The edge of the core between the platform and the reduced surface bore traces of dorsal preparation. According to the preserved negatives on the reduced surface of the core, we can say that only flakes were removed. The second core was identified as a fragment from which blades were obtained. Third specimen is a flat single-platform core with the striking surface modified by several blows. The edge was modified by removing the overhangs. Blades and flakes were being chipped off from the core. In the collection, one flake used as a double-platform flat microcore was detected. The platforms were made up by lines with dorsal preparation identified on their edges. The microcore was rejected probably due to a technical fault. It was used only for chipping off flakes.

One specimen indicating initial phase of exploitation also occurred in the collection. It was a single-platform prismatic core with the platform modified by several blows. The reason for rejection was impossible to define.

As for the core shapes, the collection contained mostly prismatic (7 specimens), conical (6 specimens), pyramidal (5 specimens) and boat-shaped (4 specimens) cores. Among the prismatic shapes, double platform cores with striking surfaces modified by multiple blows were predominant. Only one core had both platforms modified by a single blow. Changed orientation was detected on two cores. The edge between the reduced and striking surfaces on two specimens bore traces of overhangs removal. Mainly blades and flakes were made from the cores, however, there are unique documents of bladelets reduction. Conical cores had – except of one specimen – platforms modified by multiple blows. On their edges, between the striking and reduced surfaces, exclusively traces of removed overhangs were identified. It was mainly blades and bladelets that were reduced from the conical cores. Other frequently occurring shapes of cores in the collections were pyramids. Three of them had changed orientation and there was also one single-platform and one double-platform core. All striking surfaces were modified by multiple blows. The edge of one specimen was modified by means of dorsal preparation. Mainly flakes were made of these cores, in one case it was also blades. Only bladelets were chipped off of another specimen. Boat-shaped, single-platform cores occurred in the collection as well. Changed orientation was detected in one of them. Striking surfaces on all individuals were modified by multiple blows. Edges of two cores were modified by removal of overhangs. The analysed cores were rejected mostly due to technological fault. From the boat-shaped cores, mostly blades and bladelets were removed, sometimes it was blades and flakes. Three specimens represent irregular cores with changed orientation. Their striking surfaces were modified either by single or multiple blows. On one specimen, traces of removal of the overhangs from the core's edge were detected. Irregular cores were probably used for reduction of flakes only. The collection of cores also includes one disc-shaped core and one flat core. The double-platform flat core had its platforms modified by single blows. The single-platform disc-shaped core had its striking surfaces modified by multiple blows. Only flakes were reduced from both cores.

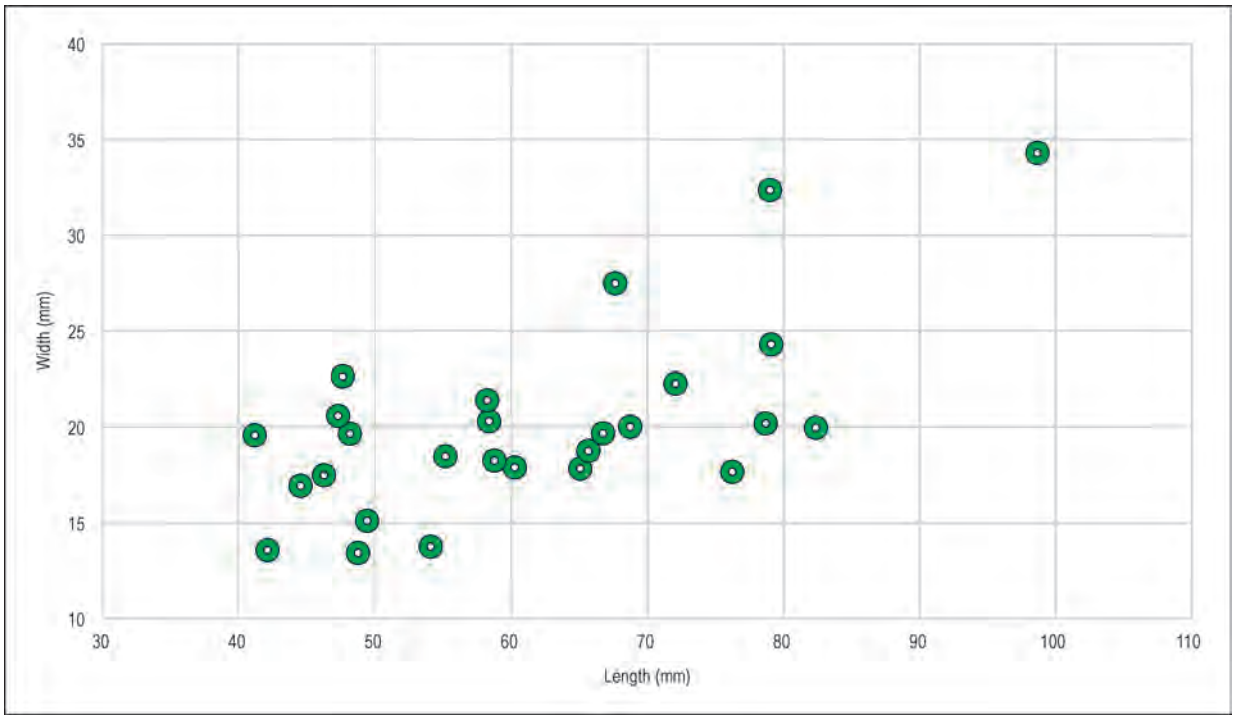


Fig. 6. Bajč-Medzi kanálmi. The width-to-lenght ratio of the whole target blades.

Eleven residues of cores (exploited) from which only flakes were reduced in the final phase were detected in the inventory of the chipped industry. They were mainly cores with changed orientation, but single-platform and double-platform cores occurred as well. Their striking areas were mainly modified by multiple blows and only several specimens were modified by single blows.

Three specimens were identified as core fragments. They all came from single-platform cores whose striking areas were modified either by single or multiple blows. On the edge of one core fragment, removal of the overhangs was detected. Blades, bladelets and flakes were made from the cores. One fragment came from a thin single-platform pyramidal core with the platform modified by a single blow. Blades were made only from a part of the core. The reduced surface was U-shaped. The platform and the striking area were in an acute angle. Identical or very similar cores (shape, modification and reduction method) were discovered also at a polycultural site of Sedmerovec, at the Podjamie site (*Cheben I./Cheben M./Nemergut 2017*).

A hoard of chipped industry was discovered at the settlement in Bajč, in feature 550. It is currently the second such find from the territory of Southwestern Slovakia. The other hoard of chipped industry comes from the settlement of Želiezovce group in Borovce, Staré hliníky site, discovered in 1950's (*Kolník/Paulík 1957*). At the studied settlement, five pieces of raw material with traces of manipulation were found in the above-mentioned feature. They were nodules of chalk flint of the Tevel type, on which original surface was partly preserved (Fig. 4). The nodules' lengths varied between 6.0 and 12.7 cm. Their widths reached 4.7–6.64 cm, and their thicknesses was between 3.3 and 5.9 cm.

Blades and their fragments

328 artefacts were classified as blades and/or their fragments (Fig. 6; Table 2; Pl. II; III). 68 complete final blades occurred in the inventory. They included one complete blade with core pole in its distal portion – so called *outrepassé*. Only eight complete blades were detected in the collection. A cosiderable part of the collection was fragmentary; proximal-mesial and mesial portions of blades were clearly predominant (Table 3). Mesial-distal fragments of blades were represented by 26 specimens. Seventeen specimens from proximal parts of blades were identified, as for distal portions, nine specimens were found. Similar trend can be observed also in blades (Table 3), among which mesial (8 specimens) and proximal-mesial portions (7 specimens) prevail. The collection also includes two examples of mesial-distal portions of bladelets.

Table 2. Bajč-Medzi kanálmi. Representation of individual raw materials in individual groups.

	Ra-Szentgál	Radiolarite	Limnosilicite	Limnosilicite?	SGS	Volhynian flint	Ra-Gerecse	Ra-Bakonycsernye	Ra-Hárskút	Flint-Tevel	SKCJ	SKCJ-G	Obsidian	Siliceous substance	Nummulite silicite	Wood opal	Felsitic porphyry	Burned silicite	Patinated silicite	Undetermined silicite
Pre-cores and cores	17	9	28	–	–	–	–	1	1	9	1	–	–	–	1	1	–	1	–	1
Blades and their fragments	96	9	114	–	1	4	2	–	1	37	16	1	36	3	–	–	–	6	2	–
Flakes	51	13	134	1	3	–	–	–	1	9	–	–	28	–	–	–	–	3	1	–
Waste	25	10	32	–	–	–	–	–	–	–	1	–	7	–	–	1	2	4	1	–
Tools	84	10	95	–	2	3	1	–	1	31	18	1	14	3	–	–	–	5	1	–
Total	273	51	403	1	6	7	3	1	4	86	43	2	87	6	1	2	2	19	5	1

Table 3. Bajč-Medzi kanálmi. Fragmentary state of final blades and bladelets in the inventory.

	Blades	%	Bladelets	%
Complete	68	25	8	32
Proximal part	17	6	–	0
Proximal-mesial part	81	30	7	28
Mesial part	68	25	8	32
Mesial-distal part	26	10	2	8
Distal part	9	4	–	0
Total	269	100	25	100

Fifteen blades from the preparation phase, suggesting primary processing of transported raw materials, were discovered in the collection from the settlement in Bajč. On preparation blades, plain butts were predominant, found on five specimens. Presence of lips was detected on two specimens. Other two had two poles on their edges (bipoled). As for other types of butts, one punctiform and one faceted butt (two poles found on the edge – bipoled) occurred. Specimens from the final exploitation phase are most frequently represented in the assemblage (295 specimens). From the initial phase of exploitation, one crest and eleven subcrest blades occurred. Several types of butts have been recorded on the final blades and bladelets. Faceted and plain butts are predominant. 60 faceted and 58 plain butts were identified. Lips were recognized on 23 faceted and 21 plain butts. Two poles on edges (bipoled) were preserved on twelve faceted and eight plain butts. As for other frequently occurring types of butts, 26 dihedral butts were found; fifteen of them had lips, and on four edges two poles occurred (bipoled). Five specimens represented linear (with lips on two of them) and three punctiform butts. As for cortical (with lip) and winged faceted butts, one specimen of each was present. Fifteen butts were modified by secondary retouch. Rejuvenation of cores due to technological faults is documented by rejuvenating blades and bladelets (15 specimens) which were reduced mainly to repair the reduction surface. In three cases, blades reduced from core edges occurred (in dorsal portion, a part of the striking and reduction areas were preserved). Plain (5 specimens) and punctiform butts prevailed among the butt types. On two plain butts, lips were recognized, and two poles on the edge of one but was found (bipoled). As for other types, there were two linear and faceted (one with a present lip) butts. The collection also included a dihedral butt with two poles on its edge (bipoled).

On fifteen blades, modification of the core edge, between the platform and the reduced surface by means of dorsal preparation, has been documented. In as many as 60 specimens in the collection, modification of core edges by removal of overhangs was identified. Two specimens from the preparation phase were reduced by a direct blow of a soft anorganic as well as organic percussors. Indirect reduction, using a punch, was identified in one case. On another blade, use of the same technique can only be assumed. Another specimen was probably also reduced indirectly (by a punch) or directly by a soft organic percussor. Specimens from the final reduction phase were reduced mainly from single-platform cores. Only two blades were reduced from double-platform cores. To reduce

final blades and bladelets, direct blow using an organic percussor was most frequently used (54 specimens). On three others, it is only assumed. As for the soft techniques, indirect reduction, by means of a punch, was used in 34 specimens. It was impossible to decide exactly whether indirect (a punch) or direct reduction by an antler/bone was used in the case of 23 blades. On eleven blades, possible indirect reduction by a punch was detected. Apart from soft unaggressive techniques, hard aggressive reductions occurred on final items. In eighteen cases, direct reduction by a soft percussor and five cases of the use of hard anorganic percussor were identified. On other eight specimens, use of direct blows by a soft stone is assumed. When reducing rejuvenating flakes, mainly hard techniques were used. On seven individuals, direct blows by a hard anorganic hammer were detected. In one case, a direct blow of a soft hammerstone was used. Three rejuvenating blades were reduced directly using an organic hammer and one was removed inderectly by a punch. On one specimen, it was impossible to determine whether there was a direct (by an organic hammer) or indirect (by a punch) blow.

Flakes

251 specimens of the chipped industry were flakes (Table 2). 21 cases with partly preserved original surface of the silicite were detected in the assemblage. Rejuventaing flakes, as well as rejuvenating blades document primary processing of transported raw materials at the settlement. Among them, four spherical segments (one probably chipped off a hammer) and three massive flakes with cortex were detected. Plain butts dominated on these flakes (9 specimens). On three of them, lip was detected, and on as many as five edges of butts two poles occurred (bipoled). As for other types, there were three punctiform and two dihedral butts. In one case, a combination of cortical and linear butt was found. One flake had a secondarily retouched butt. Flakes of specimens from the rejuvenating phase were most numerous in this group. In the collection, flakes were identified in 115 cases. Five of them were massive flakes on which two plain, one punctiform, and one secondarily retouched butt were detected. On the plain butt, a lip was present, and on the edge of another one, two poles occurred (bipoled). Plain butts clearly dominated on the flakes. On eleven specimens, lips were found, and five edges had two preserved poles (bipoled). Six linear (edges on three butts had two poles – bipoled) and five punctiform butts were detected on flakes. Two butts were secondarily retouched. On some flakes, combinations of two different butts were detected. In two cases, a winged faceted (one with a lip) and a winged dihedral butt with a lip were found. One combination of plain and linear butts and one combination of plain and cortical butts occurred. Two poles (bipoled) were detected on the edges of both of these butts. As stated above, the individuals from the rejuvenating phase also represented a numerous group (115 specimens). In the collection, flakes rejuvenating the striking surface were represented by 19 specimens, and flakes rejuvenating the reduction surface of the core were represented by 96 specimens. One massive flake created from a core platform – a core tablet with a plain butt – was detected in the collection. On other core tablets, five plain (three with lips and three edges with two poles – bipoled), four punctiform and one dihedral butt with bi-polar edge were determined. A combination of two butts – a plain and a linear with two poles on one edge (bipoled) – occurred on one core tablet. Sixteen massive rejuvenating flakes were included in the inventory. Plain (6 specimens) and linear (5 specimens) butts dominated. Two poles (bipoled) were found on two edges of linear butts. As for other butt types, there were three punctiform butts and one dihedral specimens. Plain butts were the most frequent (23 specimens) on rejuvenating flakes, 80 of which were identified in the inventory. Lips occurred on five of them and two poles were detected on eight edges (bipoled). As for other types, thirteen punctiform (one butt edge had two poles – bipoled), eleven linear (four butt edges had two poles – bipoled), nine faceted (three butt edges had two poles – bipoled) and eight dihedral (two butt edges had two poles – bipoled) butts were identified. Lips were discovered in five cases of faceted and in two dihedral butts. Faulty first blows were detected on several rejuvenating flakes. Two striking points were found on four such flakes. The first blow (direct, with a hard stone) did not remove the flake, so the core was then turned either by 90 degrees (in three cases) or by only a few degrees (one case), so that the second blow could remove the desired flake. Softer unaggressive techniques were used for second attempts – either an indirect blow (by a punch) or a direct blow by a soft stone – probably to have more control over the reduction process.

Dorsal preparation was used to modify core edges between the platforms and the reduced surfaces of twelve flakes. Removal of overhangs, used for modifying core edges, was detected on fifteen specimen.

Mainly hard aggressive techniques were used for reduction of preparation flakes. Direct blow using a hard anorganic hammer was predominant; it was detected in seven cases. Four flakes were reduced by direct blow using a soft anorganic hammerstone. All spherical segments were removed by direct blow using either a hard or a soft hammer. On two flakes, direct blows by a soft organic percussor occurred, on other two, indirect blows by a punch were probably used. Two massive flakes were reduced by a direct blow with a hard anorganic hammer. On one flake, direct reduction with a use of an organic material was applied. Flakes were most often reduced using soft unaggressive techniques. In seventeen cases, indirect blows by a punch were detected, and they can be expected to have been used on other eight individuals. Fourteen flakes were removed by using organic hammers. The same can be assumed in the case of two other specimens. The use of either indirect blows with a punch or direct blows with organic materials are assumed to have been used on six specimens. To remove the flakes in the collection, harder techniques were used as well. The use of direct blows was detected on 21 specimens, eleven of which were chipped off by a soft and ten by a hard percussor. In five cases, we can estimate reduction by anorganic percussors.

Waste

83 specimens of chipped industry obtained from the settlement in Bajč were identified as waste (Table 2). These were mainly small flakes, fragments of blades and flakes as well as fragments of tools.

Tools

The group of tools contains 270 items (Table 2). Besides the retouched specimens, artefacts with sickle gloss and those with traces of a use-wear (so-called use-wear retouch) were classified as tools. Especially blades, and bladelets and their fragments were used for tool production (177 specimens). Flakes were used in 53 cases. Together with final blanks, specimens from core preparation and rejuvenation phases were used for tool production (25 specimens).

Retouched blades and bladelets and their fragments – 38 specimens in total – were prevailing types of tools in the collection (Fig. 7; Table 4). Apart from them, fourteen pieces of flakes, modified by retouch, were detected in the collection. The most common types of retouched blades and bladelets in the inventory were the blades with distal end truncation. There were eight such specimen, including one bladelet. A notch was recorded on the distal end of one blade. Another specimen with bilateral retouch also had a truncation on the body. Three specimens were the blades with diagonal distal-end retouch. Diagonal retouch was slightly arcuate on one blade. Another blade was probably made from what had originally been a sickle blade. Two blades had their distal ends modified by means of convex retouch. One of the above-mentioned specimens also had diagonal corner retouch at its distal part. One more blade with a corner retouch of the distal end occurred in the collection. Only three specimens had both ends (proximal and distal) or lateral edges modified by retouch. One of them was a blade with proximal and distal truncation. The second blade had its proximal part modified by truncation and its distal part was modified by diagonal convex retouch. Another specimen had steep bilateral retouch, its distal portion modified by arcuate retouch, and its proximal portion trimmed by diagonal convex retouch.

The collection of such modified blades and bladelets is complemented with specimens with lateral (2 specimens) and bilateral (5 specimens) retouch. On three bilaterally retouched blades (one with truncated distal end) and on one bladelet, retouch of single lateral edge on the dorsal and another lateral edge of the ventral side was detected. Such modified blades are rather frequent in the inventories of Neolithic chipped industry.

Besides complete or semi-complete blades (their proximal-mesial and mesial-distal portions), the group of tools included eight specimens representing mesial portions of blades modified by retouch. In four cases, modification of distal portion (no specimens with trimmed proximal portion) were detected – either with diagonal-corner (2 specimens), diagonal (1 specimen) or convex (1 specimen) retouch. On one of the mesial portions with distal end corner retouch, a burin blow leading from the side of the artefact (distal portion) occurred. Lateral (2 specimens) and bilateral (2 specimens) retouch was detected on other four mesial portions of the blades. Steep retouch occurred on one lateral and one bilateral blade with such modification.

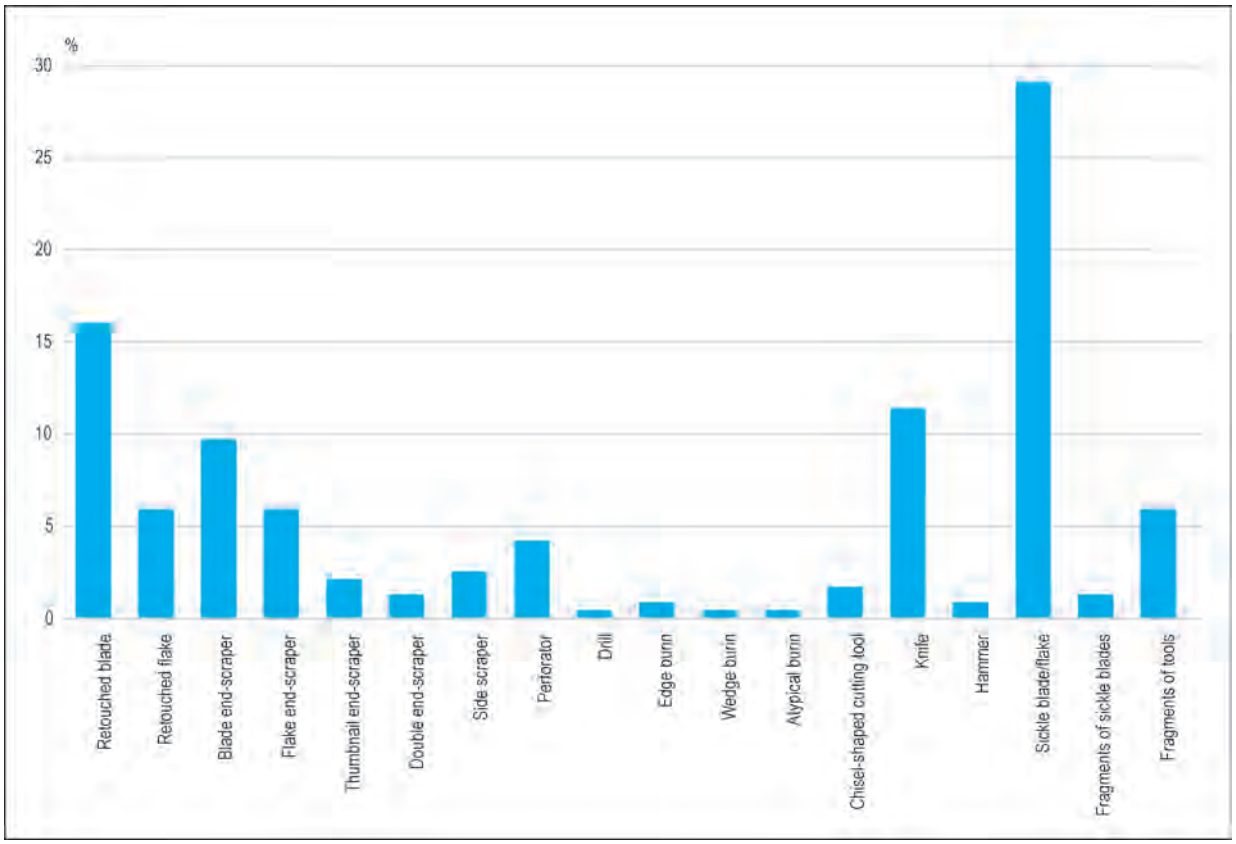


Fig. 7. Bajč-Medzi kanálmi. Quantity of individual tools.

Five blades and one bladelet with notches were detected in the assemblage. One blade had a notch created on the proximal end. The specimen whose both lateral edges bore traces of use-wear was interesting. On the right edge, there were traces on the dorsal side, on the left edge, the traces were on its ventral side (as far as one edge was blunted, the blade must have been turned by 180 degrees along its longer axis and further used).

As for the retouched flakes, fourteen specimens were recorded in the collection (Fig. 7; Table 4). Besides final flakes, specimens from the preparation as well as rejuvenation phases were used for tool production. Lateral edges (both edges in one case) were retouched – either on the dorsal or ventral sides – on eight specimens. The retouch was usually transverse, on two flakes convex retouch was detected. Two specimens had their lateral edges modified by steep retouch – looking like having a blunted side. Modified distal-end portions with diagonal (3 specimens), straight (2 specimens), and convex (1 specimen) retouch were recorded on six other flakes.

Endscrapers represent second dominant group of tools in the collection (Fig. 7; Table 4; Pl. IV). From typological point of view, several types of endscrapers occurred. The most numerous type, counting 23 specimens, is blade endscraper (Table 4). Massive endscrapers were represented by one specimen. Several specimens were modified by lateral convex retouch, proximal end truncation, and diagonal corner retouch. One blade had a notch on its lateral edge. The notch might have been associated with being attached to a shaft. Five blade endscrapers were secondarily made from blades originally used as sickles. This phenomenon occurs very frequently in the collections of Neolithic chipped industry. Fourteen specimens of flake endscrapers, including one massive specimen, were recorded (Table 4). Lateral (on the ventral side) and bilateral retouch (right edge retouched on the ventral, left edge retouched on the dorsal side) was identified on two specimens. Diagonal corner retouch was detected in one endscraper's proximal portion. Thumbnail endscrapers, represented by five specimens, are another type of endscrapers identified in the collection (Table 4). Distal as well as proximal portion of one of the specimens (double thumbnail endscraper) were retouched. Three specimens of double endscrapers were also present in the assemblage (Table 4).

Table 4. Bajč-Medzi kanálmi. Numbers of individual types of tools and raw materials they were made of.

	RaSzentgál	Radiolarite	Limnosilicite	SGS	Volhynian flint	Ra-Gerecse	Ra-Hárskút	Tevel flint	SKCJ	SKCJ-G	Obsidian	Siliceous substance	Burned silicite	Patinated silicite	Total
Retouched blade	13	2	9	–	1	1	–	3	–	–	6	1	1	1	38
Retouched flake	2	2	7	1	–	–	–	1	–	–	1	–	–	–	14
Blade end-scraper	9	–	4	–	–	–	–	7	3	–	–	–	–	–	23
Flake end-scraper	7	–	3	1	–	–	–	–	3	–	–	–	–	–	14
Thumbnail end-scraper	3	–	1	–	–	–	–	–	1	–	–	–	–	–	5
Double end-scraper	1	–	2	–	–	–	–	–	–	–	–	–	–	–	3
Side scraper	–	–	5	–	–	–	–	–	–	–	–	–	–	–	5
Perforator	4	–	5	–	1	–	–	–	–	–	–	–	–	–	10
Drill	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Edge burin	1	–	–	–	–	–	–	–	–	–	1	–	–	–	2
Wedge burin	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Atypical burin	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Chisel-shaped cutting tool	3	–	–	–	–	–	–	–	–	–	1	–	–	–	4
Knife	5	–	11	–	–	–	–	6	3	–	1	1	–	–	27
Hammer	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2
Sickle blade/flake	12	2	33	–	–	–	1	12	4	1	–	1	3	–	69
Fragments of sickle blades	–	–	2	–	–	–	–	–	1	–	–	–	–	–	3
Fragments of tools	7	1	3	–	–	–	–	–	2	–	–	–	1	–	14
Total	69	7	87	2	2	1	1	29	18	1	10	3	5	1	236

The set of tools contained also six side scrapers (Fig. 7; Table 4). All of them were made from flakes. In two cases, rejuvenating flakes – tablets – were used for their production. Distal-end portion of three specimen – besides arcuately retouched lateral edge – was also retouched. One massive flake with slightly arcuate lateral retouch was present in the collection.

The set of perforators comprised of ten specimen (Fig. 7; Table 4; Pl. VI: 1–3; 5; 6) among which slender perforators with non-offset basal portions dominated. There were six specimens. One of them had its proximal portion removed by a side blow. One wide perforator with non-offset basal portion also occurred. Two massive and one slender perforator had slightly offset basal portions.

One artefact, identified as a drill, was reported in the inventory (Pl. VI: 4). It was a wide tool with slightly offset basal portion made of radiolarite of the Szentgál type.

As for other tools, the collection contained several types of burins (Fig. 7; Table 4). Two specimens represent edge burins (Pl. VI: 7). Distal portion of one of them was truncated. One lateral wedge-shaped burin was also present. Atypical burin blow was detected on the proximal-mesial portion of a blade. From the distal portion of the blade, the blow was aimed at its edge and it probably went wrong, which is why the debited burin splinter slipped to the dorsal side.

Four specimens of chisel-shaped cutting tools made from two flakes and blades were recorded in the group of tools. As for raw materials, only radiolarite of the Szentgál type and obsidian were used.

27 blades were detected in the collection of chipped industry from the settlement in Bajč (Fig. 7; Table 4). They were interpreted as knives made either from complete blades or their proximal-mesial portions. The proportion of the blades' lengths and widths is shown in Graph 3. We can see from the graph that mainly complete blades longer than 5 cm were used as knives. Nine blades classified into this group are between 4 and 5 cm long. They are mainly proximal-mesial portions of blades. We can ask whether they were broken on purpose (better attachment to a shaft) or while being used. Traces of work-wear (use-wear retouch) were observed on the edges of almost all specimens. A traseological analysis would confirm whether they are really knives. Retouch occurred on two blades identified as knives. One with distal truncation and the second massive blade which was bilaterally retouched.

Two pieces of limnosilicite were used as hammers. One of them was a pebble, from the second one only a fragment was preserved.

Fourteen damaged (broken) tools were identified in the analysed collection (Fig. 7; Table 4). Fragments of the retouched blades and flakes, as well as fragments of endscrapers and perforators, prevailed.

Artefacts with sickle gloss represent numerous set of tools within the whole analysed assemblage (Fig. 7; Table 4; Pl. V). Not only blades, bladelets and their fragments were used as sickle tools, there were also flakes. Seven specimen with sickle gloss were classified as flakes. Two specimens were modified by retouch, one with truncated distal portion, the second with retouched lateral edge in the proximal portion. As many as 62 artefacts with sickle gloss were made from blades, bladelets and their fragments. Most often, complete blades or their proximal-mesial and mesial portions were used. 41 sickle blades unmodified by additional retouch were detected in the collection. In one case, a blade endscraper was used as a sickle blade. In two cases, sickle blades had their proximal portions modified by series of blows on the ventral sides. Several sickle blades were modified by retouch. Individuals with distal truncation (nine cases) were predominant. Distal portions of other three specimens were modified by arcuate retouch, one was modified by partial diagonal retouch. Only two specimens with detected corner retouch were with modified proximal portions. Besides modified end portions, lateral retouch also occurred. It was observed on four specimens – two of which were the bladelets with steep retouch (backed). Two specimens represented segments made from mesial portions of blades. Both ends (proximal and distal) of one specimen were modified by irregular diagonal retouch. An interesting fact about this specimen is that it was rejuvenated. Originally, it might have been a complete blade used as sickle (gloss on its right side). Probably after it had been broken or damaged, its proximal and distal portions were broken off and its mesial portion was modified by retouch on both ends. There is no sickle gloss on the retouched surfaces; on the left side, it is visible along the whole length (on retouched surfaces as well). We can deduce that first the right edge was used as a sickle, and later, after the specimen's modification, its left edge was used. It is also suggested by the traces of use-wear on both edges. Both ends (proximal as well as distal) of the second specimen were also diagonally retouched. Sickle gloss was detected on both its edges. Besides modified end portions, the segments were also laterally retouched.

The set of tools also included 33 specimens with traces of the so-called use-wear retouch on their lateral edges.

ANALYSIS OF CHIPPED INDUSTRY FROM BURIAL COMPLEXES

Besides numerous archaeological features, four inhumation burials were uncovered in the settlement area of Želiezovce group in Bajč. Together with pottery, they yielded artefacts made of bones, antlers, stone and gastropod shells (*Cheben I. 2000*, fig. 13). Chipped industry used as grave goods (offerings) occurred only in graves 1/88 and 3/90, dated to the very end of stage III of Želiezovce group or to the beginning of the Pre-Lengyel horizon.

Grave 1/88

In this burial complex with rich grave goods, one specimen of chipped industry was arranged next to the skeleton's hands (Fig. 8), together with eight vessels, polished industry, antler and bone artefacts and a stone mat. The artefact was made of limnosilicite. It is the proximal-mesial portion of a blade (Pl. VI: 8) with diagonal retouch of the distal end. Traces of intense use (so-called use-wear retouch – tiny

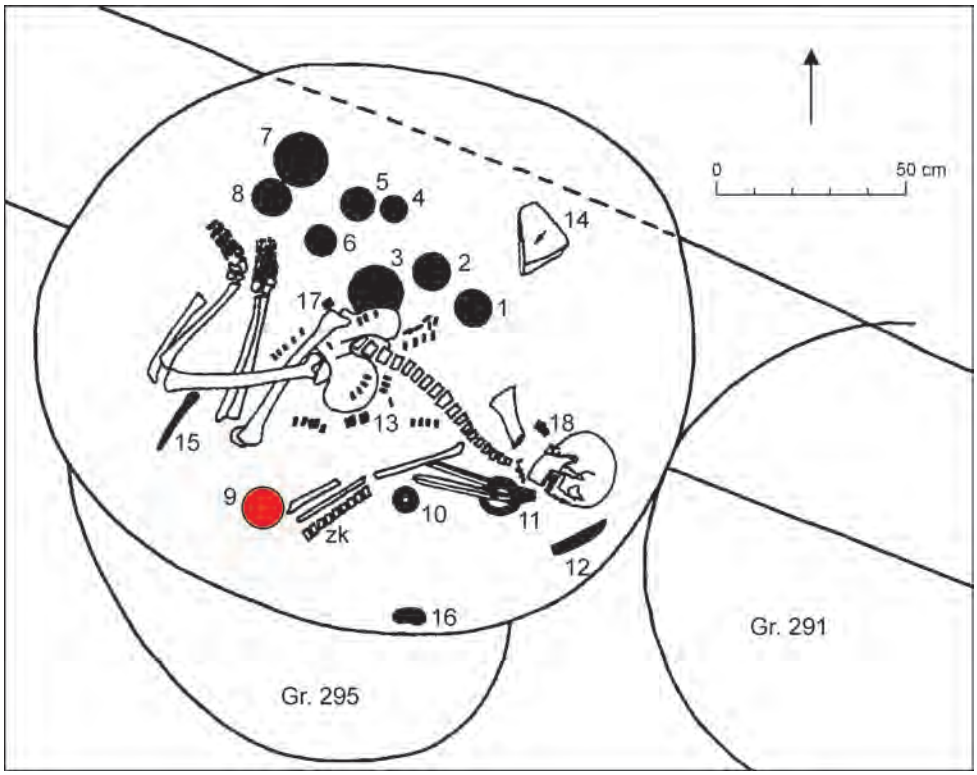


Fig. 8. Bajč-Medzi kanálmi. Plan of the grave 1/88 with the location of the stone chipped industry (modified after *Cheben I. 2000*).

incontinuous retouch visible with a naked eye, caused by the use of the artefact) are visible on both edges of the tool.

From the aspect of technology, the artefact was removed from a single-platform core, either indirectly with a punch, or by a direct blow using an organic percussor (probably an antler). A faceted butt with a lip was found on the blade. Traces of modification of the reduced core edge, caused by a removal of an overhang, were detected on the blade.

Grave 3/90

One specimen was found in the grave pit. The artefact was made of chalk flint of the Tevel type. It is a complete preparation blade with partly preserved original surface (Pl. VI: 9). The blade was used for production of a sickle blade with lateral retouch. Sickle gloss occurred on the left edge of the blade.

From the aspect of technology, the artefact was made from a single-platform core, probably indirectly with a punch. A plain butt was detected on the blade.

Only four burial complexes of the Želiezovce group containing grave goods made of some type of knappable raw material are known from the territory of Southwestern Slovakia. There were two specimens of chipped industry in a grave at the settlement in Bajč, and two come from the settlement in Vráble. They are the above-described graves – 1/88 with a retouched blade located on the fingers of an adult woman, and 3/90, where a preparation blade was deposited. In the enclosed settlement area I in Vráble–Veľké Lehenby, three artefacts were found in two graves of adult men (a sickle blade, a comb blade and a complete blade). They were placed in the chest area (*Furholt et al. 2020*, fig. 3.2.9; 3.2.13). Chipped industry was also discovered in grave pits in other settlements of the Želiezovce group, for instance Patince, Blatné and Štúrovo. Even though we cannot say that they were grave goods, the chipped industry was found in the fill of the pits.

A totally opposite trend can be observed in the countries of Western Europe. At the studied burial grounds and in burials deposited in settlement features in the Czech Republic (Vedrovice), Austria (Kleinhadersdorf) or Germany (Müddersheim, Schwanfeld), chipped industry is much more frequently represented.

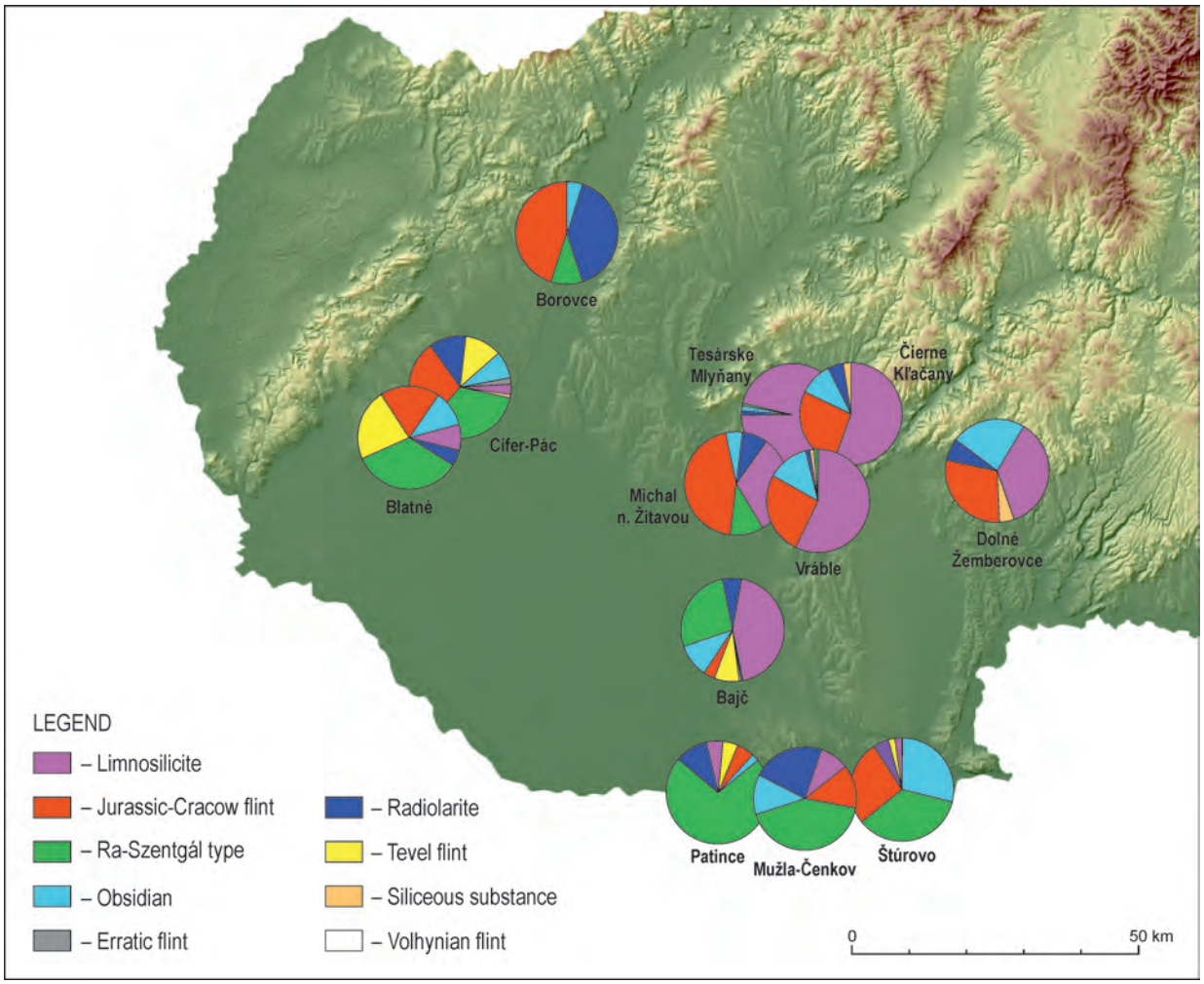


Fig. 9. Representation of main raw materials found on settlements of the Želiezovce group in Southwestern Slovakia (*Cheben M. 2020*).

From small amount of data obtained so far, we can hardly guess the reason why chipped industry was added to children's, male or female burials. We cannot say either whether a specific type of tool was added to male or female graves only. It seems that this kind of material culture was added to male graves more often. However, male graves did not contain artefacts which could be interpreted as exclusively male attributes (e.g. weapon, arrowhead, etc.).

CONCLUSION

A wide range of silicite, including volcanic glass, was used in Southwestern Slovakia in Želiezovce group period. Among the used raw materials, in addition to traditionally dominant silicites such as various types of radiolarites and flints, limnosilicites or obsidian occur as well. Rare or even exotic silicite is represented as well – opal, jasper, streaky silicite, felsitic porphyry or siliceous substance of volcanic origin. Individual raw materials detected in assemblages come from various orographic as well as geological territories of central Europe. Their occurrence at the settlements of the Želiezovce group gives us some idea of their transportation (in what form they might have been imported to the settlement) as well as possible communication routes.

The silicite of the Kraków-Częstochowa Jurassic, imported from Poland, was very important in this period. It is documented by its presence in several collections of chipped industry (Fig. 9). However,

compared to previous periods, a considerable decrease can be observed. It was caused by its replacement by Hungarian raw materials, mainly the Szentgál radiolarite and the Tevel flint (Fig. 9). Besides these, other Hungarian types of radiolarite occur less frequently (Gerecse, Hárskút, Tata and Bakonysernye). In the period of the Želiezovce group in Southwestern Slovakia, a considerable increase in use of local raw materials – limnosilicte and obsidian – is visible (Fig. 9). This increasing trend is observable as early as the Late Linear Pottery culture. The occurrence of radiolarite (originally from the Klippen Belt) at the settlements of the Želiezovce group is poorer compared to earlier Neolithic periods. Nevertheless, it still maintains its irreplaceable role in the assemblages of chipped industry.

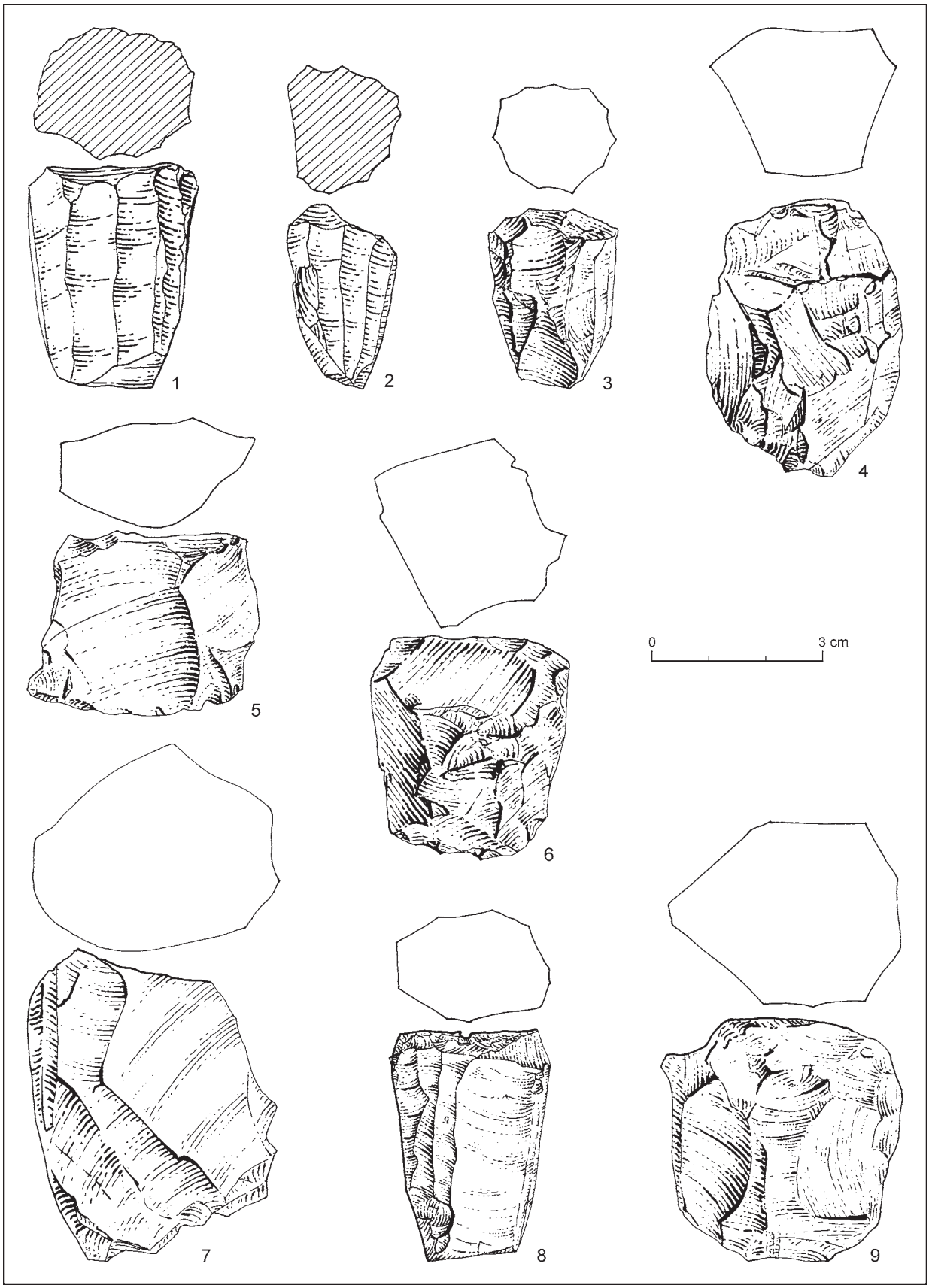
Double-platform prismatic and single-platform pyramidal, conical and boat-shaped cores are most frequent in the collections of chipped industry obtained from the settlements of the Želiezovce group. The same trend is observed in the analysed assemblage from the settlement in Bajč. Cores' platforms of almost all specimens were modified by multiple blows. Cores with striking surfaces modified by single blows are rare. Modification of core edges by removing the overhangs is a frequent phenomenon. The use of massive preparation or rejuvenating flakes in order to prepare cores is a typical phenomenon in the collections of the Želiezovce group, compared to earlier Neolithic periods.

Blades, and bladelets and their fragments are undoubtedly the most frequently represented items of Želiezovce group lithic collections. In the assemblages, including the analysed site, complete, proximal-mesial and mesial portions of blades are predominant. If we look at the numbers of butt types in individual phases of exploitation, plain and faceted butts on blades from the preparation phase prevail. On final blades, mainly faceted, plain and dihedral butts were detected. Plain and punctiform butts are most commonly seen on the blades from the rejuvenating phase. For reduction of blades within the preparation phase, soft techniques were most commonly used – indirect blows and direct blows with organic percussors. A few specimens bore traces of direct blows with hard or soft hammerstones. Debitage of final blades was carried out mainly by using indirect blows with a punch and direct blows with organic percussors. As for rejuvenating blades, aggressive reduction techniques using direct blows with hard and soft hammerstones were applied.

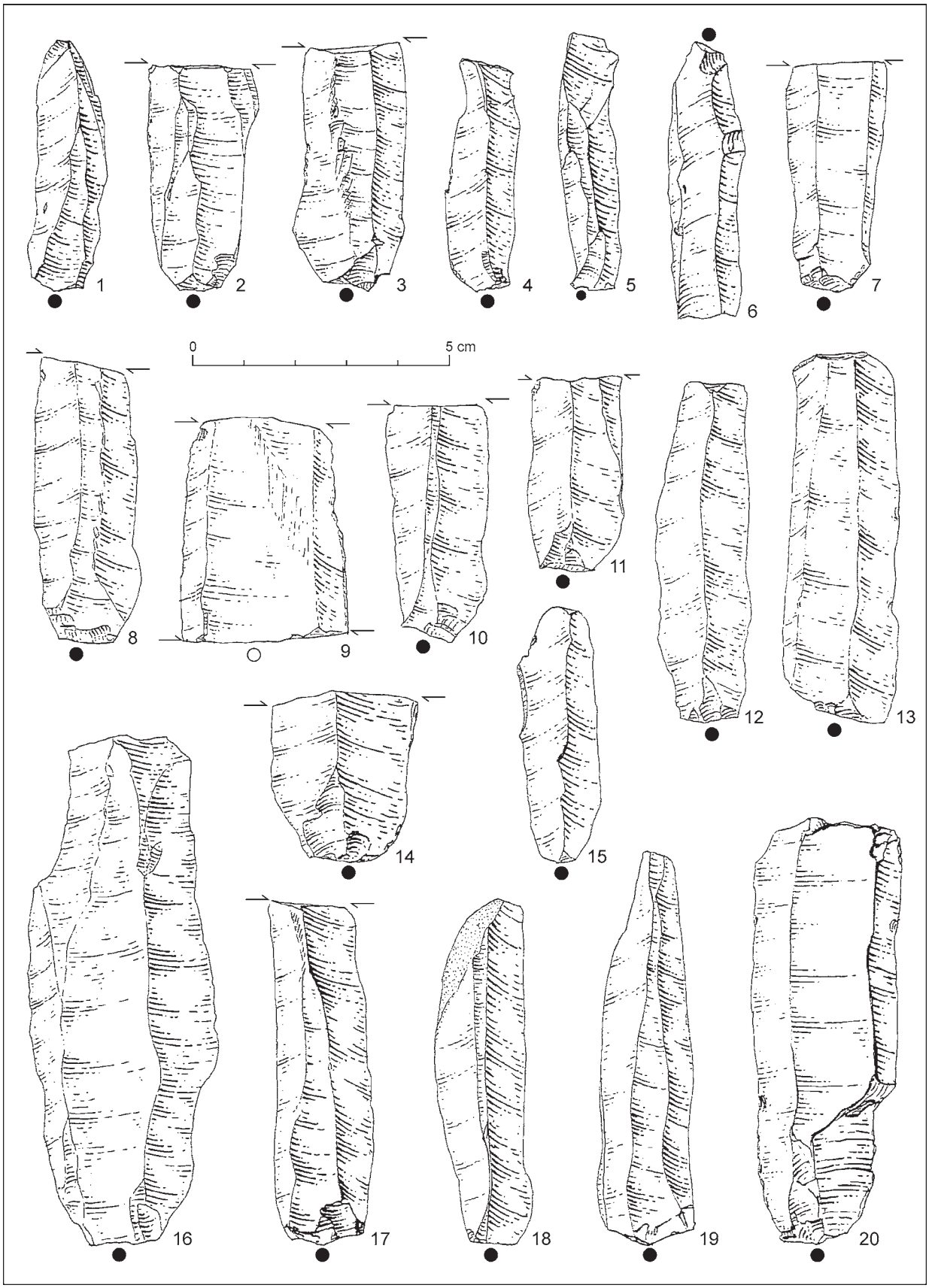
As many as 270 individuals identified as tools were found in the analysed assemblage. As for the typological composition, the analysed collection is no different from other collections of chipped industry from the Želiezovce group settlements. Mainly retouched blades and bladelets as well as flakes are predominant there as well. Other groups of frequently occurring tools include various types of endscrapers, chisel-like cutting tools, knives, drills and perforators. The number of artefacts with sickle gloss is also high. The discovery of five side scrapers at the settlement in Bajč is interesting, since the number is double compared to all other settlements.

Based on the analysis of the chipped industry from the settlement of the final stage of the Želiezovce group in Bajč, we can assume that it was one of the processing areas (in the modern world it would be an industrial park) of the Želiezovce group in the Žitava River Basin. It is indirectly also suggested by the absence of groundplans of any stake-indicating structures, but also by abundant polished industry, as well as artefacts made of clay, bones and antlers that come from the settlement pits. Compared to other studied sites of the Linear Pottery culture and Želiezovce group from Southwestern Slovakia, where structures with stake construction were documented, in Bajč there are extremely high numbers of all types of artefacts.

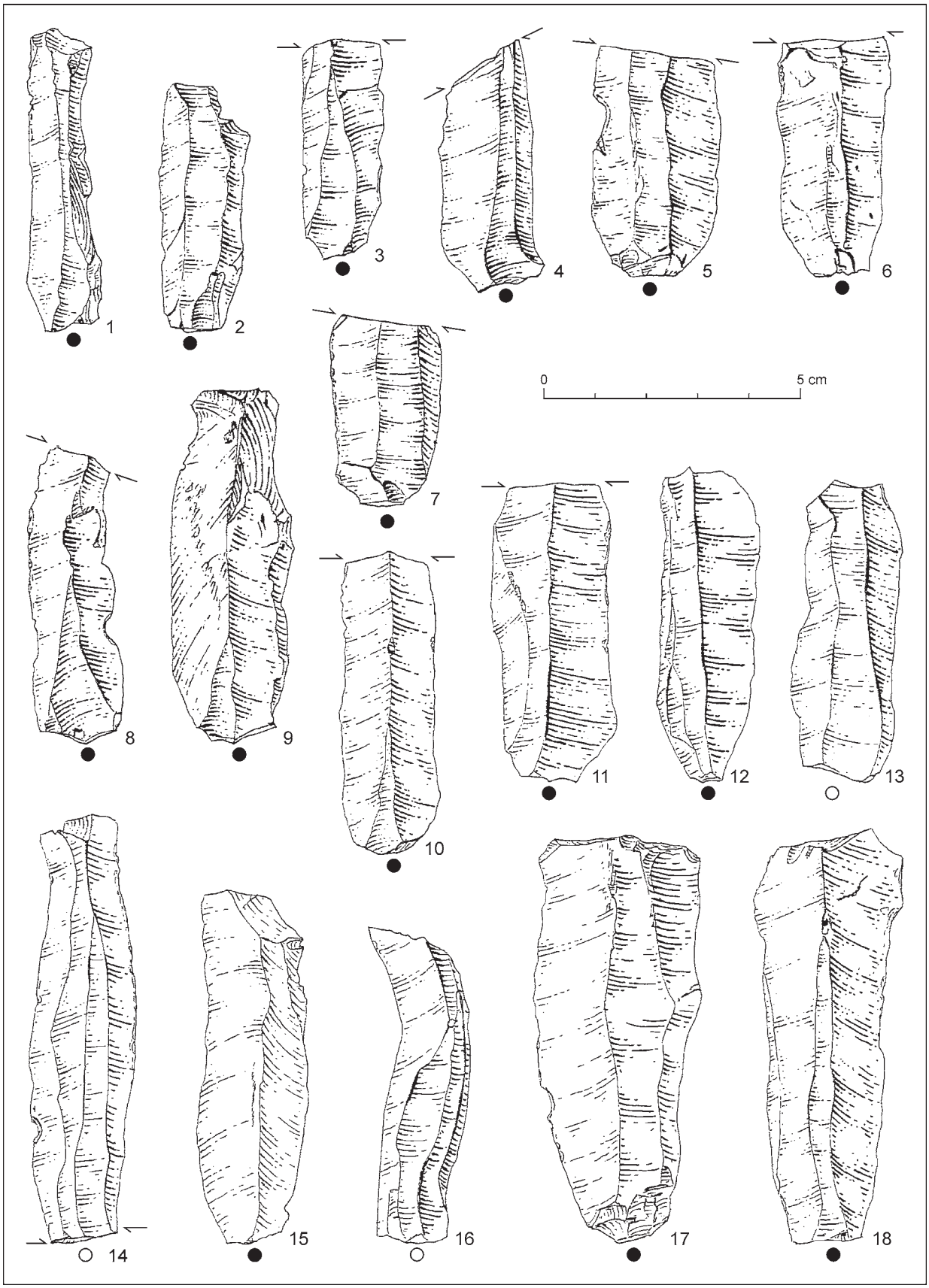
Translated by Viera Tejbusová



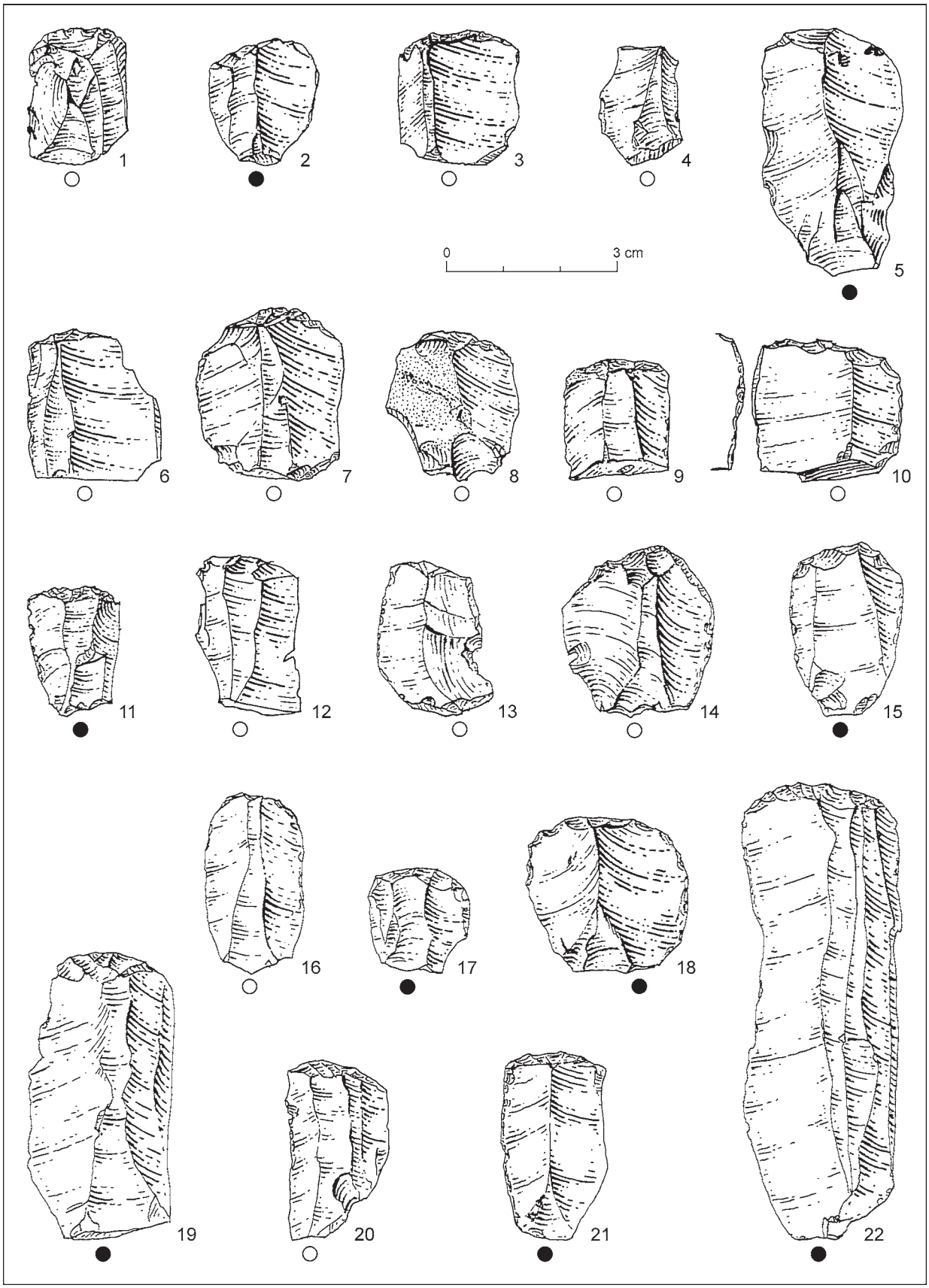
Pl. I. Bajč-Medzi kanálmi. Selection of cores.



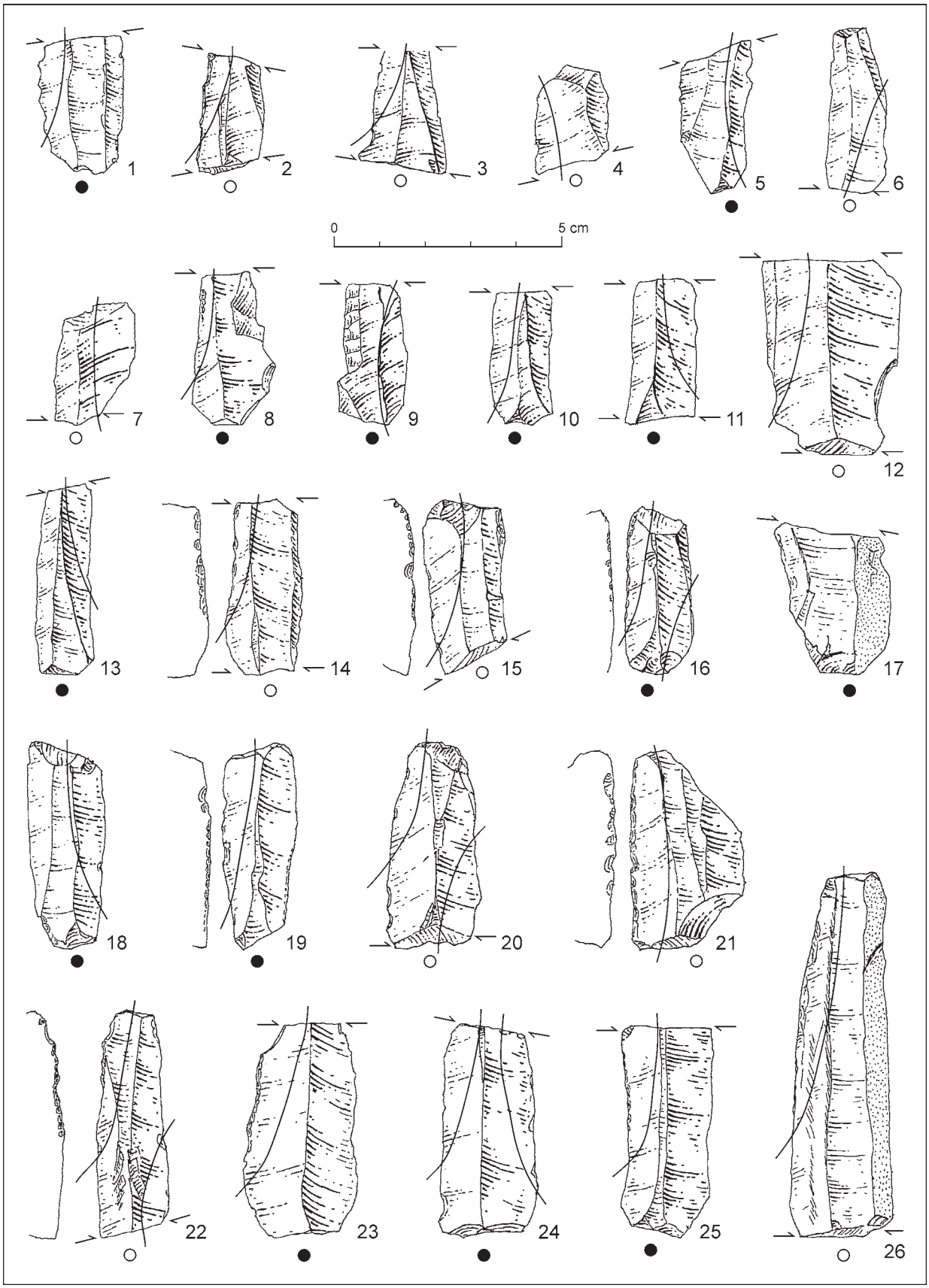
Pl. II. Bajč-Medzi kanálmi. Selection of chipped stone industry, blades and their fragments.



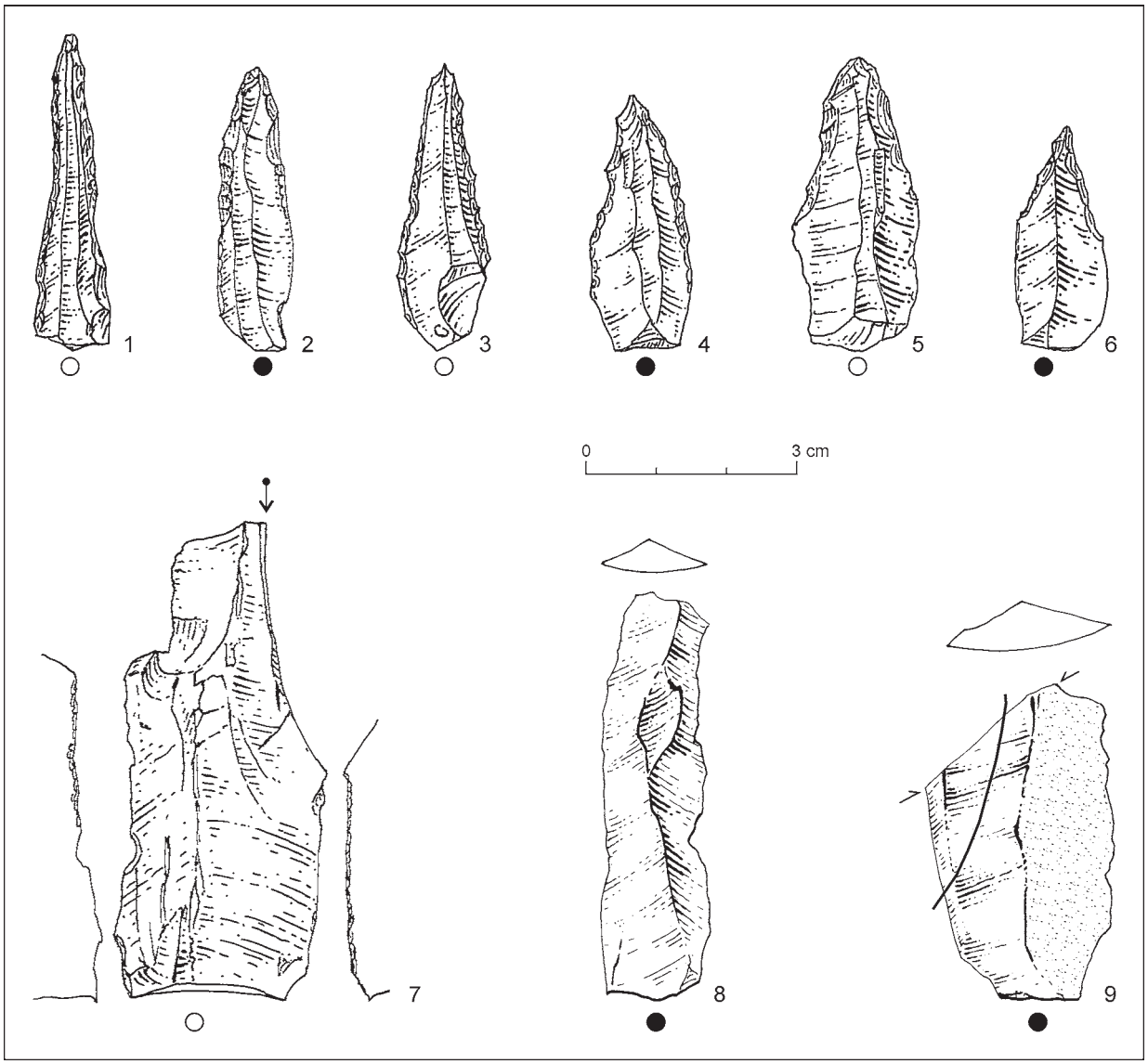
Pl. III. Bajč-Medzi kanálmi. Selection of chipped stone industry, blades and their fragments.



Pl. IV. Bajč-Medzi kanálmi. Selection of chipped stone industry, blades and flakes scrapers.



Pl. V. Bajč-Medzi kanálmi. Selection of chipped stone industry, artefacts with sickle gloss.



Pl. VI. Bajč-Medzi kanálmi. Selection of chipped stone industry. 1–3, 5, 6 – perforators; 4 – drill; 7 – edge burin; 8 – retouched blade (Grave 1/88); 9 – sickle blade (Grave 3/90).

BIBLIOGRAPHY

Čaplovič/Cheben I./Ruttkay 1988 D. Čaplovič/I. Cheben/M. Ruttkay: Rozsiahly záchranný výskum pravekého a stredovekého osídlenia v Bajči. *AVANS 1987*, 1988, 39–41.

Čaplovič/Cheben I./Ruttkay 1990 D. Čaplovič/I. Cheben/M. Ruttkay: Pokračovanie výskumu v Bajči. *AVANS 1988*, 1990, 47–49.

Furholt et al. 2020 M. Furholt/I. Cheben/J. Müller/A. Bistáková/M. Wunderlich/N. Müller-Scheessel: *Archaeology in the Žitava Valley I. The LBK and Želiezovce settlement site of Vráble.* Leiden 2020.

Cheben I. 1998 I. Cheben: Nálezy kultúry Kosihy-Čaka z juhozápadného Slovenska. In: J. Prostředník/V. Vokolek (eds.): *Otázky neolitu a eneolitu našich zemí. Sborník referátů z 16. pracovního zasedání badatelů pro výzkum neolitu a eneolitu Čech, Moravy a Slovenska. Lázně Sedmihorky 23.–25. září 1997.* Turnov 1998, 149–154.

Cheben I. 2000 I. Cheben: *Bajč – eine Siedlung der Želiezovce-Gruppe.* Bonn 2000.

Cheben M. 2020 M. Cheben: *Surovinová základňa a typologický vývoj štiepanej industrie v kultúre lineárnej a želiezovskej skupine na juhozápadnom Slovensku.* PhD. Thesis. Faculty of Arts CU – Institute of Archeology SAS. Bratislava – Nitra 2020. Unpublished.

Cheben I./Cheben M./Nemergut 2017 I. Cheben/M. Cheben/A. Nemergut: Preliminary results of the recent excavation of a radiolarite mine area and its surroundings in Sedmerovec. *Litikum* 5, 2017, 5–11.

Cheben I./Ruttkay 1991 I. Cheben/M. Ruttkay: Ukončenie výskumu pieskovej duny v Bajči. *AVANS 1989*, 1991, 41, 42.

Cheben I./Ruttkay 1992 I. Cheben/M. Ruttkay: Neolitická a stredoveká osada v Bajči. *AVANS 1990*, 1992, 49, 50.

Cheben I./Ruttkay 1993 I. Cheben/M. Ruttkay: Sídlisko želiezovskej skupiny a osada zo 7.–12. storočia v Bajči. *AVANS 1992*, 1993, 59, 60.

Cheben I./Ruttkay 1995 I. Cheben/M. Ruttkay: Šiesta sezóna záchranného výskumu v Bajči-Medzi kanálmi. *AVANS 1993*, 1995, 66, 67.

Kolník/Paulík 1957 T. Kolník/J. Paulík: Záchranný výskum na neolitickom sídlisku v Borovciach pri Piešťanoch. *Slovenská archeológia* 2, 1957, 271–299.

Méres/Hovorka/Cheben I. 2001 Š. Méres/D. Hovorka/I. Cheben: Provenience of polished stone artefacts raw materials from the site Bajč-Medzi kanálmi (Neolithic, Slovakia). *Slovak geological magazine* 7, 2001, 369–379.

Nemergut/Cheben M./Gregor 2012 A. Nemergut/M. Cheben/M. Gregor: Lithic raw material use at the palaeolithic site of Moravany nad Váhom-Dlhá. *Anthropologie* 50, 2012, 379–390.

Analýza štiepanej kamennej industrie z lokality želiezovskej skupiny v Bajči

Ivan Cheben – Michal Cheben

Súhrn

V priebehu viacerých výskumných sezón v rokoch 1987–1990 a 1992–1993 sa v katastri obce Bajč (okr. Komárno), na pieskovej dune v polohe Medzi kanálmi, preskúmal rozsiahly sídliskový areál, na ktorom sa našlo osídlenie z viacerých časových horizontov. Najintenzívnejšie bola poloha osídlená v závere kultúrneho vývoja želiezovskej skupiny, a to v jej III. vývojovom stupni (*Čaplovič/Cheben I./Ruttkay 1988*; *1990*; *Cheben I./Ruttkay 1991*; *1992*; *1993*; *1995*). Z viac ako 500 sídliskových objektov a štyroch kostrových hrobov (*Cheben I. 2000*, príloha 1), prislúchajúcich želiezovskej skupine, sa získal početný a typologicky rôznorodý nálezový inventár. Okrem objavených početných nálezov keramického materiálu je dôležité zdôrazniť, že v porovnaní s inými inventármi, získanými na sídliskách želiezovskej skupiny, patrila kamenná brúsená a štiepaná industria k mimoriadne frekventovaným nálezom. V takom obrovskom množstve sa doposiaľ nezískala zo žiadneho sídliska kultúry lineárnej a želiezovskej skupiny skúmaného na juhozápadnom Slovensku.

Doteraz nepublikovaným nálezovým súborom zostáva štiepaná industria, ktorá je na sídlisku v Bajči zastúpená 734 exemplármi. Po stránke typologicko-technologickej, ako i v rámci zastúpenia štiepateľných surovín, bol nálezový celok spracovaný v dizertačnej práci, ktorá bola zameraná na kamennú štiepanú industriu z obdobia staršieho neolitu z územia juhozápadného Slovenska (*Cheben M. 2020*). Predložený príspevok vypĺňa biele miesto a dopĺňa komplexnejší pohľad na hmotnú kultúru. Pri tomto súbore je potrebné uvedomiť si skutočnosť, že ide o uzatvorený celok, ktorý kultúrne patrí relatívne krátkemu vývojovému stupňu želiezovskej skupiny (stupeň III).

V období želiezovskej skupiny na juhozápadnom Slovensku sa využívalo široké spektrum silicitových surovín, vrátane vulkanického skla. Z použitých surovín sa neobjavujú len tradičné dominantne zastúpené silicity, akými sú rôzne typy rádiolaritov a pazúrikov, limnosilicity alebo obsidián, ale aj ojedinelo zastúpené, môžeme povedať až exotické silicity, napríklad opál, jaspis, žilný kremeň, felzitický porfýr alebo kremičitá hmota vulkanického pôvodu. Jednotlivé suroviny v súboroch pochádzajú z rôznych orografických a geologických oblastí strednej Európy. Ich výskyt na sídliskách želiezovskej skupiny nám podáva určitý pohľad o ich transporte (v akej forme mohli byť na sídlisko donášané), ako aj o ich prípadných komunikačných cestách.

Z Poľska importovaný silicit krakovsko-čenstochovskej jury mal aj v tomto období pre spoločnosť veľký význam. Dokladá to jeho zastúpenie vo viacerých kolekciách štiepanej industrie. Avšak je tu badať výrazný pokles oproti starším obdobiam, spôsobený vytláčaním a nahradením za maďarské suroviny, predovšetkým rádiolaritom typu Szentgál a pazúrikom typu Tevel. Okrem nich sa v menšej miere objavujú aj ďalšie maďarské typy rádiolaritov (Gerecse, Hárskút, Tata a Bakonysernye). V období želiezovskej skupiny na juhozápadnom Slovensku je v kolekciách štiepanej industrie výrazný nárast využívania lokálnej miestnej suroviny, limnosilicitu a obsidiánu. Tento narastajúci trend je patrný už v období mladšej kultúry lineárnej. Výskyt rádiolaritu (pôvodom z bradlového pásma) na sídliskách

želiezovskej skupiny je oproti starším obdobiam neolitu menej početný, avšak stále si udržal svoje nenahraditeľné zastúpenie v súboroch štiepanej industrie.

Najčastejšie sa v kolekciách štiepanej industrie, získaných na sídliskách želiezovskej skupiny, objavujú dvojpodstavové hranolové a jednopodstavové ihlanové, kužeľové a loďkovité jadrá. Tento trend je rovnaký aj na analyzovanom sídlisku v Bajči. Podstava jadier bola skoro u všetkých jedincov upravená viacerými údermi. V malej miere sa objavili jadrá s úderovou plochou, ktorá bola upravená jedným úderom. Častým javom je úprava hrany jadier odstránením previsov. Typickým javom v kolekciách želiezovskej skupiny oproti starším obdobiam neolitu je, že na prípravu jadier boli využívané masívne preparačné alebo reparačné úštepy.

K najpočetnejšie zastúpenému inventáru želiezovskej skupiny patria čepele, čepieľky a ich fragmenty. V kolekciách, nevynímajúc analyzovanú lokalitu, dominujú celé proximálno-meziálne a meziálne časti čepelí. Ak by sme sa pozreli na zastúpenie typov pätiek v jednotlivých fázach ťažby, tak na čepeliach z preparačnej fázy dominujú hladké a facetované pätky. Na cieľových čepeliach sa zistili hlavne facetované, hladké a strieškovité pätky. U čepeliach z reparačnej fázy dominujú pätky hladké a bodové. Na odbíjanie čepelí z preparačnej fázy sa najčastejšie využili mäkké techniky, a to nepriamy úder a priamy úder organickým otĺkačom. Pár kusov malo stopy po použití priameho úderu tvrdým alebo aj mäkkým kameňom. Odbíjanie cieľových čepelí prebiehalo predovšetkým za využitia nepriameho úderu prostredníkom a priamym úderom organickým otĺkačom. U reparačných čepelí bolo zachytené použitie techník za využitia priameho úderu tvrdým a mäkkým kameňom.

V analyzovanom súbore sa identifikovalo až 270 jedincov určených ako nástroje. Z typologickej skladby sa analyzovaný súbor výrazne nelíši od iných kolekcií štiepanej industrie zo sídlisk želiezovskej skupiny. Aj tu dominujú predovšetkým retušou modifikované čepele a čepieľky, ale aj úštepy. Ďalšími skupinami často sa objavujúcich nástrojov sú rôzne typy škrabadiel, dlátovitých pretínacích nástrojov, nožíkov, vrtákov a dierkovačov. Početne zastúpené sú aj artefakty s kosákovým leskom. Zaujímavým zistením bolo, že na sídlisku v Bajči sa našlo až päť kusov driapadiel, čo je dvojnásobne viac ako v kolekcii zo všetkých ostatných sídlisk.

Z analýzy štiepanej industrie môžeme skonštatovať, že ako sídlisko v Bajči, tak aj ostatné sídliská želiezovskej skupiny na juhozápadnom Slovensku boli výlučne spracovateľské.

Obr. 1. Situovanie želiezovského sídliska v Bajči-Medzi kanálmi.
Obr. 2. Bajč-Medzi kanálmi. Podiel jednotlivých druhov surovín zastúpených na sídlisku.
Obr. 3. Mapa so zdrojmi silicitových surovín a vulkanického skla a ich vzdialenosti na analyzované sídlisko. 1 – rádiolarity (bradlové pásmo); 2 – limnosilicity; 3 – rádiolarit typu Szentgál; 4 – pazúrik typu Tevel; 5 – silicit krakovsko-čenstochovskej jury; 6 – obsidián; 7 – Volýnsky pazúrik; 8 – numulitový silicit; 9 – limnosilicity (S Maďarsko); 10 – silicit z glacigénnych sedimentov.
Obr. 4. Bajč-Medzi kanálmi. Hromadný nález suroviny z objektu 550 (pazúrik typu Tevel).
Obr. 5. Bajč-Medzi kanálmi. Podiel industrie v hlavných skupinách.
Obr. 6. Bajč-Medzi kanálmi. Pomer šírky a dĺžky celých cieľových čepelí.
Obr. 7. Bajč-Medzi kanálmi. Percentuálne zastúpenie typov nástrojov.
Obr. 8. Bajč-Medzi kanálmi. Plán hrobu 1/88 s umiestnením kamennej štiepanej industrie (upravené podľa *Cheben I. 2000*).
Obr. 9. Zastúpenie hlavných surovín na sídliskách želiezovskej skupiny na juhozápadnom Slovensku (*Cheben M. 2020*).

Tabela 1. Bajč-Medzi kanálmi. Zachovanie pôvodného povrchu na čepeliach a úštepoch.
Tabela 2. Bajč-Medzi kanálmi. Zastúpenie surovín v jednotlivých skupinách.
Tabela 3. Bajč-Medzi kanálmi. Fragmentácia čepelí a čepieľok.
Tabela 4. Bajč-Medzi kanálmi. Zastúpenie nástrojov a surovín, z ktorých boli vyrobené.

Tab. I. Bajč-Medzi kanálmi. Výber jadier.
Tab. II. Bajč-Medzi kanálmi. Výber štiepanej industrie, čepelí a ich fragmentov.
Tab. III. Bajč-Medzi kanálmi. Výber štiepanej industrie, čepelí a ich fragmentov.
Tab. IV. Bajč-Medzi kanálmi. Výber štiepanej industrie, čepeľových a úštepových škrabadiel.
Tab. V. Bajč-Medzi kanálmi. Výber štiepanej industrie, artefakty s kosákovým leskom.
Tab. VI. Bajč-Medzi kanálmi. Výber štiepanej industrie. 1–3, 5, 6 – dierkovače; 4 – vrták; 7 – hranové rydlo; 8 – retušovaná čepeľ (hrob 1/88); 9 – kosáková čepeľ (hrob 3/90).

PhDr. Ivan Cheben, CSc.
Archeologický ústav SAV
Akademická 2
SK – 949 21 Nitra
ivan.cheben@savba.sk

Mgr. Michal Cheben, PhD.
Archeologický ústav SAV
Akademická 2
SK – 949 21 Nitra
michal.cheben@savba.sk

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 199–211

SINKERS AND COMPOSITE FISHING HOOKS IN THE NEOLITHIC OF EASTERN BALTIC

Slate artefacts from Berezovo 2 (Karelian Isthmus, North-West Russia)

Roman I. Muravev – Evgenia S. Tkach – Dmitriy V. Gerasimov

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.13

Keywords: Neolithic, North-West Russia, Berezovo 2, slate industry, fishing tools

Abstract: Representative collection of slate fishing inventory was obtained from Beresovo 2 archaeological site in the Karelian Isthmus, North-West Russia. This material is attributed to the Middle-Late Neolithic, 4th ka BC. Series of typologically pronounced tools display variety of fishing equipment and imply diversified methods of fishing. Technological context allows discussing advantages of soft and foliated slate for making fishing and hunting equipment, and connections between bone and slate processing technologies.

Slate artefacts were well-presented in the Eastern Fennoscandia, including the Karelian Isthmus, during the whole Stone Age. They also were in use later, in the Middle Ages and up to the Early Modern period. Such a long-term technological tradition was based on availability of this raw material in the regions with lack of local flint outcrops; and also on its physical characteristics that made slate good for processing using knapping, flaking, sawing and finally grinding (polishing) techniques. Different kinds of slate raw material were used within the industry, and they could be used for making implements of different categories.

Slate sinkers and fishing hook parts are known in the Neolithic archaeological contexts of the Eastern part of the Gulf of Finland and particularly on the Karelian Isthmus for more than a century. Julius Ailio described a fishing rod sinker from the former Finnish municipality Kaukola on the Karelian Isthmus which he called "Angelsenker" (*Ailio 1909*, fig. 41–43; pl. I: 50). Sakari Pälsi published six beautifully crafted stems of various types, found in the same area, including one with a drilled hole (*Pälsi 1915*, pl. XI: 1–6). Similar artefacts were found in the Neolithic sites that were excavated and studied in Finland in the first half of the 20th century in Finnish provinces Northern and Southern Karelia, including the Karelian Isthmus. Rapid increasing of amount of slate artefacts including fishing hooks and line-sinkers in Finland and Karelia associates with Middle Neolithic Typical Comb Ware culture, the 1st half of the 4th ka BC (*Núñez 1998*, 112).

Fishing tools were rather often discussed in archaeological literature within the general problematic concerning prehistoric subsistence strategies, in relation with fishing methods and osteological collections from archaeological sites (e.g. *Äyräpää 1950*; *Carpelan 1999*; *Mökkönen 2001*; *Nurminen 2007*; *Núñez 2009*; *Pälsi 1915*; *Ukkonen 2004*). But until the beginning of the 21st century there were no special studies on slate fishing tools. Typology of slate fishing tools for the territory of the Karelian Isthmus and entire Finland was developed by Eero Naskali in the MA. Thesis at the Department of Archaeology, University of Helsinki (*Naskali 2004*).

A large collection of slate artefacts was obtained from a multiperiod archaeological site Berezovo 2 that has been completely studied in 2018 with 1700 sq.m excavation area (*Gerasimov/Tkach/Goncharova 2018*). It is situated in the Karelian Isthmus, at the North-West shore of the Ladoga Lake, close to the famous archaeological sites in Kaukola parish, nowadays Sevastyanovo village in the Leningrad region, Russia (Fig. 1). Archaeological finds of typologically pronounced types indicate that several cultural contexts were represented at the site (Late Mesolithic – 7–6 ka BC; Middle to Late Neolithic and Eneolithic – 4–beginning of the 3 ka BC), single artefacts of later eras up to the Modern time were also found.

Fig. 1. Berezovo 2. Location of settlement and workshop.

The site was located on a sandy terrace 25 m a.s.l. at the southern slope of a fluvial-glacial hill. According to the local shoreline chronology (e.g. *Saarnisto 2008*) the terrace could be formed during the ancient Ancylus Lake transgression maximum about 8500 cal BC. After that time the terrace was available and attracting for settling, as the Ladoga Lake shoreline was in several meters from the terrace edge till the Neva River breakthrough about 1200 cal BC, and the site location was at the southern shore of an island 1 x 1 km in size. In the most part of the site area the finds were obtained from the sandy-gravel fluvial-glacial sediments, where they penetrated from the habitation surface in the past. There were several structures (ancient pits, hearths, remains of one dwelling) in the central part of the terrace with a lens of sorted sand. They mainly contained Middle and Late Neolithic contexts.

It is worthwhile to clarify the differences in the regional periodization systems that are used within the discussing territory. In the Finnish periodization the Late Neolithic covers the third millennium BC, while in the North-West Russia the same time relates to the Eneolithic or the Early Metal Age (*Nordqvist 2018*, 51, fig. 11).

Representative series of slate fishing tools from the site can be considered as a part of the Late Neolithic archaeological context basing on the reference material; and allow discussing typology and technology of this specific category of artefacts.

The slate assemblage contains more than 1100 artefacts, total weight over 4 kg. It consists of series of projectile points, chopping tools (adzes, shaft hole axe, different kinds of miniature adzes), and also piercers, knife-like tools, pendants and some other categories. Fishing tools – sinkers and composite fishing hooks – make a significant category of artefacts. Besides the ready-made tools, numerous preforms, fragments of unfinished blanks and raw bars were found – they make about one half of the whole slate assemblage from the site.

Finds were documented with a laser total station, which allowed to determine accurately location coordinates for 391 slate artefacts found *in situ*. In addition, during the field work, after parsing the layer with a small digging tool, whole soil was sifted through a sieve with a 3.5 mm mesh according to units 1 x 1 m (in some cases 0.5 x 0.5 m) and to arbitrary layers. The soil from the defined artificial structures was sifted separately. Sifting added 770 pieces of slate finds – mainly small fragments.

Slate finds were stratigraphically distributed through four arbitrary layers in a decreasing order, while the thickness of the cultural layer was up to 40 cm. The thickness of an arbitrary layer was 5–7 cm and could vary when followed a surface of a distinguished lithological layer. The most of the finds were concentrated in the first (534 pieces) and the second (363 pieces) arbitrary layers. The third layer included only 78 slate finds, and just 24 were found in the fourth.

ONE HUNDRED YEARS OF TYPOLOGY AND CLASSIFICATION

General criteria for classification of slate fishing tools are mainly convinced, but defining the function of an artefact may vary depending on a stage of treatment and on different morphological characteristics. Frequent fragmentation of artefacts, as well as variety in shape, size and morphological elements make difficult their typological definition and interpretation.

Also preservation of organic materials in the Stone Age assemblages of the studied region – unburnt bone, wood, resin, threads – is very bad, which minimizes the opportunity to find a complete composite fishing hook or fishing gear. Nevertheless the 10.5 thousand years old fishing net with floats and sinkers was found in the former Antrea parish in Karelian Isthmus (*Pälsi 1920*).

The first steps to classify slate fishing hooks from Finland and Karelia, including the Karelian Isthmus, were taken by the famous Finnish archaeologist *S. Pälsi* (*1915*, 134). This typology described all the kinds of Neolithic fishing hooks known to the time, including composite tools. According to Pälsi, slate stems of composite hooks belonged to continuous typological series. Basing on analysis of morphology of stems with elongated and pointed upper end Pälsi suggested that the shape of the slate tools repeated the shape of those made of wood and bone in the earlier times (*Pälsi 1915*, 135).

Five types of stems from the Latvian Neolithic contexts were defined by Ilga A. Zagorska basing on crossection shape and morphology of the lower part of the objects (*Zagorska 1991*, 54). This classification included not only slate artefacts, but fishing tools of other different materials (bone, antler, animal teeth) – all together 205 stems of composite fishing hooks (*Zagorska 1991*, 55, fig. 5). Stems of composite fishing hooks were found as surface finds on the shores of the Lubāns Lake and the Big Ludza Lake, as well as in the Zvejnieki burial ground, at the settlements Zvejnieki II, Riņņukalns and Abora I. Also spines were found in the same contexts but more rear. Spines are of small size, they often have sloped or extended lower part. A number of them bear traces of binding, which indicates that these points were not independent tools, but made parts of a composite hooks (*Zagorska 1991*, 56).

Classification by *E. Naskali* (*2004*) was developed basing on collections of surface finds and excavations made in Finland in the beginning of the 20th century. The work remained unpublished and, therefore, little known. Besides the Naskali's classification is the most recent one, it also considers the largest amount of material from a big territory. 91 stems and 222 sinkers were analysed in the study, about a half of the items originate from the Southern Finland and from the Karelian Isthmus (former Finnish, nowadays Russian territory). Thus the classification was based on the materials that are the most relevant for comparing with Berezovo 2 collection in geographical, chronological and cultural sense.

E. Naskali distinguished three types of sinkers, each of them was divided in two subtypes; and four types of composite hook stems. Slate spines for composite fishing hooks were not considered in the typology:

- Sinkers:
  - Type P1 (a and b) – sinker with notched heads at both ends;
  - Type P2 (a and b) – sinker with grooves at both ends;
  - Type P3 (a and b) – sinker with drilled holes at both ends.

- Composite fishing hook stems:
  - Type A1 – stem of uniform thickness, straight or slightly curved, with grooves on the upper end;
  - Type B1 – stem with an expansion in the middle part, straight or slightly curved, with grooves on the upper end;
  - Type B2 – stem with a strong expansion in the middle part, grooves are located between the center and the upper end of an artefact ("fish-shaped" upper part, with grooves or drilled hole);
  - Type C1 – conical shaped stem.

IN DARK WATERS – BEREZOVO 2 FISHING EQUIPMENT

The assemblage of slate fishing implements from Berezovo 2 consists of 54 items. 23 of them are ready-made tools (Table 1). There are series of sinkers on rather large and mainly poorly polished slate bars (Fig. 2), as well as spines (Fig. 3) and stems (Fig. 4) of composite fishing hooks.

Sinkers are presented in Berezovo 2 collection by seven complete and 20 fragmented items made of soft slate. They can be related to types P1a, P2a and P3a by E. Naskali (Fig. 2: 1–13).

Type P1a is represented by one fragmented polished slate sinker with a flattened crossection and with only one extant notched head (Fig. 2: 11). The closest analogies to this artefact are finds from Kaukola, Johannes and Inkoo (*Naskali 2004*, 60). Sinkers with a similar "notched" way of tying are also known in the Eneolithic of the Republic of Karelia, for example, at Voinavolok XXVII settlement (*Zhulnikov 1999*, fig. 58: 3).

Type P2a is the most numerous; it is represented by seven complete and 17 fragmented finds (Fig. 2: 1–10). Most of the completed items are sinkers made of untreated or poorly polished elongated slate bars with sub-triangular or subrectangular crossection. Analogies to this type of finds are known among the artefacts from Neolithic sites in the former Finnish Kaukola and Viipuri parishes; which are kept nowadays in the Finnish National Museum (*Naskali 2004*, 70). Similar artefacts are also widely presented at the sites of the Republic of Karelia – Besovy Sledki, Sulgu III, Malaya Suna I and others (*Savvateev 1991*, fig. 2: 1–22).

Type P3a is represented by two fragmented artefacts (Fig. 2: 12, 13). The lower parts of the sinkers are broken off. One of these sinkers is well polished, flattened in the upper part and rounded in the crossection, and has a biconical drilled hole (Fig. 2: 12). Preservation of the second item does not allow to understand the whole shape of the artefact, but it had a drilled hole in the upper part (Fig. 2: 13). Analogies to this type are known among the artefacts from Finnish parishes Kaukola, Kurkijoki and Mynämäki (*Naskali 2004*, 81).

Spines of composite fishing hooks (nine complete items) are also represented in the Berezovo 2 slate assemblage as a separate category of finds (Fig. 3: 1–6). Their sizes vary from 26 to 56 mm. The spines are made of soft slate, have a wide beveled base and sharped at

Table 1. Berezovo 2. Size and weight of slate fishing tools.

Type	Item №	Measurements (mm)	Weight (g)
Sinkers			
Type P1a	Fig. 2: 11	45 x 19 x 4	5.8
Type P2a	Fig. 2: 1	75 x 12 x 7	9.1
	Fig. 2: 2	76 x 12 x 9	11.8
	Fig. 2: 3	62 x 10 x 6	5.9
	Fig. 2: 4	74 x 7 x 5	3.5
	Fig. 2: 5	61 x 11 x 5	5.0
	Fig. 2: 6	58 x 10 x 6	4.3
	Fig. 2: 7	58 x 9 x 4	2.7
	Fig. 2: 8	52 x 7 x 4	1.9
	Fig. 2: 9	47 x 13 x 5	4.1
	Fig. 2: 10	40 x 10 x 5	2.1
Type P3a	Fig. 2: 12	37 x 8 x 5	2.0
	Fig. 2: 13	36 x 7 x 4	1.0
	+ 14 unidentified fragments		
Fishing hook spines	Fig. 3: 1	54 x 9 x 4	2.6
	Fig. 3: 2	54 x 7 x 3	1.5
	Fig. 3: 3	45 x 6 x 4	1.1
	Fig. 3: 4	41 x 5 x 4	1.2
	Fig. 3: 5	26 x 6 x 2	0.5
	Fig. 3: 6	56 x 8 x 5	2.8
	+ 3 fragments		
Fishing hook stems			
Type A1	Fig. 4: 1	60 x 6 x 5	3.3
	Fig. 4: 2	58 x 4 x 4	1.5
	Fig. 4: 3	44 x 5 x 4	1.7
	Fig. 4: 4	34 x 7 x 5	1.5
Type B1	Fig. 4: 6	62 x 9 x 6	3.8
	Fig. 4: 7	52 x 7 x 6	2.1
	Fig. 4: 8	49 x 9 x 5	2.7
	Fig. 4: 9	48 x 6 x 5	2.0
	Fig. 4: 10	46 x 7 x 5	2.4
	Fig. 4: 11	44 x 7 x 6	2.3
Type B2	Fig. 4: 5	36 x 12 x 5	2.4
	+ 7 unidentified fragments		

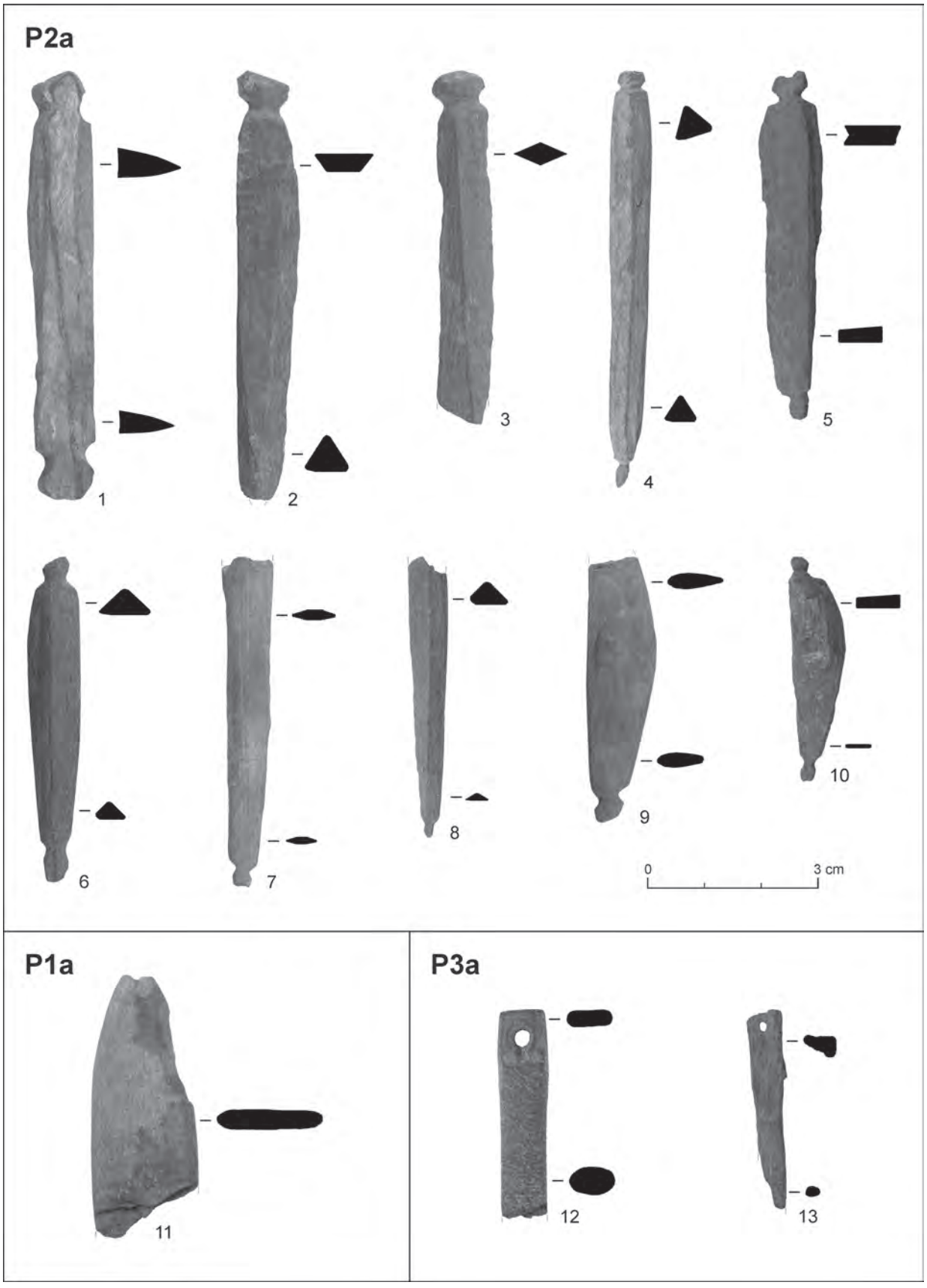


Fig. 2. Berezovo 2. Slate sinkers (photo by S. B. Shapiro).

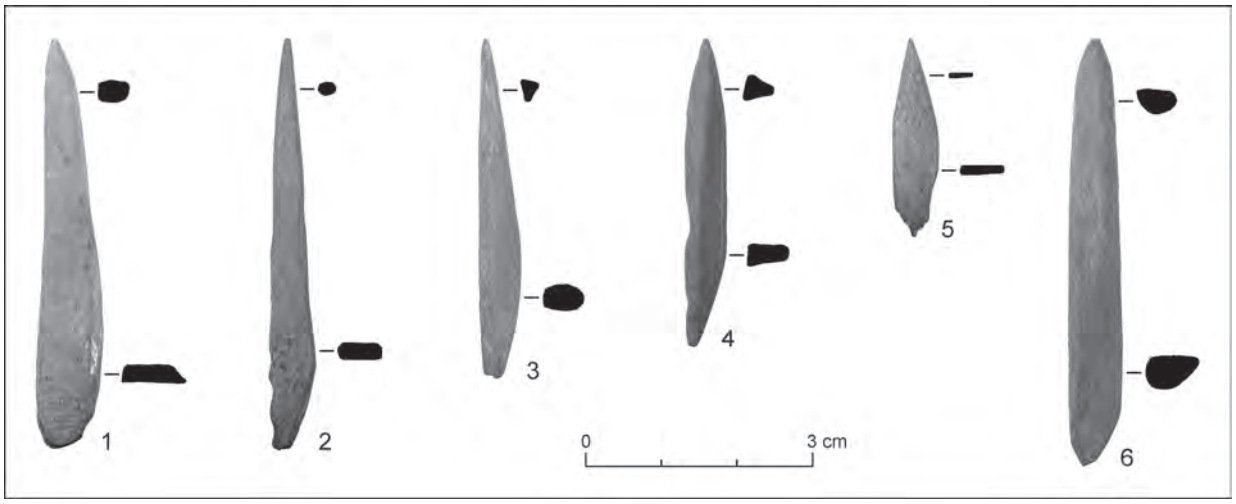


Fig. 3. Berezovo 2. Slate fishing hook spines (photo by S. B. Shapiro).

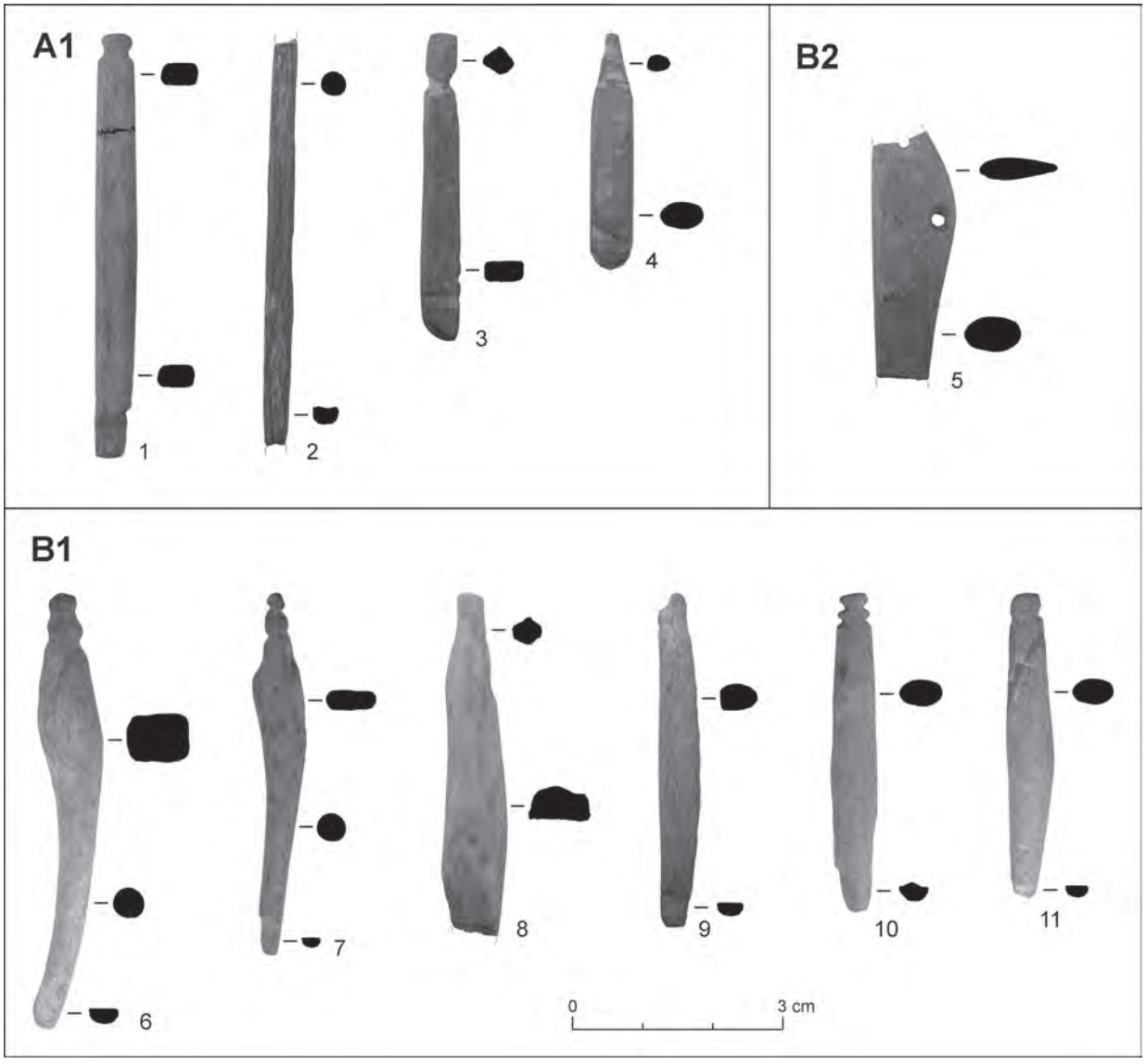


Fig. 4. Berezovo 2. Slate fishing hook stems (photo by S. B. Shapiro).

the end. Some items (e.g. Fig. 3: 2) have notches at the base opposite the beveled part. They probably served to tie a spine to a hook stem. The spines crossections are subcircular or sub-triangular, the smallest item has a flattened crossection. Large items (e.g. Fig. 3: 1) probably could serve for catching very big fish. One of the finds can be considered as an unfinished spine with a treated lower part (Fig. 3: 6). The number of spines found on the site is less than the number of stems, which can be indirect evidence that spines (as well as other fishing tools) were made more often of organic materials (bone, antler, wood, etc.), and have not preserved in archaeological contexts (*Koivisto 2017*, 26; *Núñez 1998*, 123).

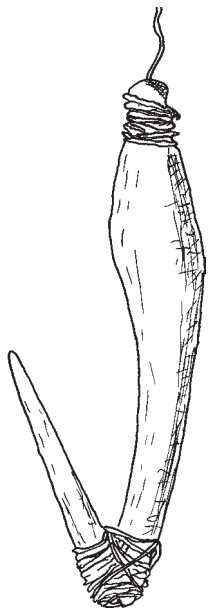


Fig. 5. Graphic reconstruction of a composite fishing hook (drawing by M. A. Kholkina).

The stems of composite fishing hooks (eight complete items, 10 fragments) are represented by several recognizable shapes. The assemblage from Berezovo 2 contains types A1, B1, B2 by E. Naskali. Artefacts were made of soft slate. The common feature in their design is presence of an attachment place in the upper (head for tying) and lower (notch) parts of an artefact. Sometimes a notch was supplemented with scratches made on purpose for better binding when attaching to a spine. According to reconstructions (also based on complete composite fishing hooks found in other regions) a stem and a spine could be tied together with plant fiber or tendons and fish glue or tar and wax mixture (Fig. 5; for other similar reconstructions see: *Krutikova/Tsoi 2018*, 27; *Pälsi 1915*, 134).

Type A1 is represented by three complete items and six fragments (Fig. 4: 1–4). The first one (Fig. 4: 1) was found in fragments in different parts of the excavation area and refitted. It is 60 mm long, elongated in shape, sub-rectangular in a crossection. The second item (Fig. 4: 2) was found with both ends broken; it seems to be similar to the first one, but subcircular in a crossection. The third stem (Fig. 4: 3) is 44 mm long, of elongated shape, sub-rectangular in a crossection. Its head was separated by circular cuts, and there is a notch for attaching a spine in the lower part. The fourth stem (Fig. 4: 4) of the A1 type is the smallest in the group (34 mm long), rounded in a crossection, its head is narrowed upwards. The closest analogies to these tools are presented in materials from Kaukola and Evijärvi (*Naskali 2004*, 27).

Type B1 is represented by five complete items and three fragments (Fig. 4: 6–11). They also can be divided in two subtypes. The first is presented by two well-treated large stems 52 and 62 mm long, curved in profile, with a head for tying that was formed by two circular grooves in the upper part with a subcircular crossection, and a steep extension in the middle part that has a rectangular crossection (Fig. 4: 6, 7). Further down the stems were gradually getting narrow and obtain a subcircular crossection; there is a notch for attaching a hook spine at one side of each of the stems.

The items of the second subtype within B1 type are of cylindrical shape with an extension in the middle part, and have relatively small size – 44, 46 and 48 mm long. Heads of these stems were marked out by one (Fig. 4: 9, 11) or two (Fig. 4: 10) cuts. In the lower part there is a notch for a hook spine that directed straight (Fig. 4: 9, 11) or with a slight angle upward (Fig. 4: 10). The closest analogies to the finds of the type B1 can be found in materials from Kaukola, Viipuri, Kuusjärvi (*Naskali 2004*, 34).

Type B2 is represented by one fragmented find (Fig. 4: 5). It is a fragment of a stem with both ends broken off, with a lenticular section in the upper part, an oval section in the lower part and an asymmetrical extension. Two biconical holes have been drilled in the upper part and on the extension of the tool. This find can be attributed as a rather rare "fish-shaped" fishing hook stem type. One of the most perfectly designed examples is a large one (about 9 x 12 cm) from the assemblage of Typical Comb Ware site Leppävirta Moninmäki Holopainen in the Eastern Finland (*Koivisto 2017*, 28, fig. 6; *Luho 1966*). On the Russian territory complete artefacts of this type are known from materials of the Karelian Late Neolithic sites with Comb Ware: Chernaya Guba IV, IX and Suna IV in the Onega Lake region (*Vitenkova 2002*, 124,

fig. 51: 5). Similar fragment was found in the field of Juho Paavilaisen (Juho Paavilaisen Rantapelto) in Kaukola (*Pälsi 1915*, pl. XI: 1). A fragment of similar tool was found at Tudozero VIII site at the south-eastern shore of the Onega Lake (*Ivanischeva M. V./Ivanischeva E. A. 2018*, 135, fig. 1: 4). The last two items have only one drilled hole in the extension. The same feature differ the Berezovo 2 "fish-shaped" hook from the finds from Räisälä, Kurkijoki and Rääkkylä parishes (*Naskali 2004*, 42), as well as from the stem from Viipuri Häyrinmäki site (*Erä-Esko 1995*, 16).

It was suggested (*Zagorska 1991*, 57) that stems could be used not only just as parts of fishing hooks, but also as sinkers; extended (fish-shaped) stems could serve as spoon-baits or trolls and could be used without bait, as they might glitter in water. This may also imply the existence of various individual fishing methods, such as catching on a float, as well as luring and trolling, when fishing lines were drawn through the water. The last could be carried out from a static position as well as from a boat.

SLATE FOR WOOD AND SLATE FOR FOOD – DIFFERENCES IN RAW MATERIAL

The slate assemblage from Berezovo 2 site can be divided in two main groups basing on hardness and foliation of the raw material. The first and the larger one unites pieces of relatively soft and highly foliated slate (824 pieces). High foliation is a pronounceable characteristic of this group, well-observed on the broken surfaces. Another group (338 pieces) is presented by artefacts of hard slate, including metatuff from the western shore of the Onega Lake (so-called green Onega slate).

J. Ailio (*1909*, pl. I: 44) defined soft foliated slate as Schiefer. In comparison with hard Onega slate soft slate is worth (or almost incompatible) for processing by knapping technology because of low fracture stability. Softness and high foliation also limits its use for manufacturing of a number of categories of tools, like adzes and other chopping macrotools, as well as the use of traditional methods of processing slate such as flaking and pecking (*Shakhnovich 2007*). This is probably why use of these techniques for slate processing was minimally represented at the Berezovo 2 site. This also explains the fact that tools of soft slate mainly were not intended for processing materials like wood, and served as hunting projectile points, fishing tools or belonged to the spiritual sphere (*Tarasov 2001*, 144). However, this raw material clearly had a number of advantages. It is easy to obtain thin bars by deliberately delaminating slate blocks with stone flake wedges and a hammerstone or a mallet. Frequently these bars were found as semi-finished forms. Due to its softness, this raw material requires less labor for processing and is easily amenable to abrasive techniques – grinding and sawing (*Tarasov 2001*, 142). This makes processing technology for the soft slate similar to bone processing technology (*Zhilin 1993*). Also, this raw material has relatively low weight, which could be important for production of arrowheads and certain categories of fishing equipment.

WHAT'S THE SLATE FISHING TOOLS DISTRIBUTION IN SPACE AND TIME?

Chronology of slate fishing tools is rather wide and covers the entire Neolithic period, also runs beyond its borders. Fishing tools, interpreted as sinkers, are known in materials of the Early Neolithic Sperrings culture (*Vitenkova 1996*, 75). Slate parts of composite fishing hooks are presented in the Middle Neolithic and later sites in Karelia (*Savvateev 1991*). Finnish researchers generally date slate hooks to the Neolithic, but admit the Mesolithic age of sinkers used with bone or wooden hooks for fishing (*Minkkinen 2000*; *Naskali 2004*). Sinkers of several different types with varying degrees of processing, from rough bars with notches to well-polished tools, are associated with Typical Comb Ware culture, however, some artefacts have later dating in the Finnish Late Neolithic (*Naskali 2004*, 63–84).

Geography of slate fishing tools distribution is quite wide – these are the Baltic states, Finland and North-Western Russia including the Karelian Isthmus, Karelia, as well as a number of sites in the Vologda, Arkhangelsk regions and the Republic of Komi.

There are many finds of slate artefacts associated with fishing at the Stone Age sites in Karelia (*Savvateev 1991*, 188, 190, fig. 2). Items with circular grooves on upper and lower ends and flattened parts

for attaching a spine, mainly grinded or polished over the entire surface, were considered as stems of composite fishing hooks. These features are distinguished as distinctive in comparison to sinkers with lateral notches on raw or almost unprocessed elongated slate bars (*Savvateev 1991*, 190). It has been suggested that stems with transverse cuts and a narrow polished end could be punches for making pit ornamentation on Neolithic ceramics (*Lobanova 1994*; *Shakhnovich 1995*; *Tarasov 2001*, 144).

An excellent series of polished sinkers, more than 60 artefacts, were obtained from excavation of the Okhta I site in the territory of Saint-Petersburg (*Gusentsova/Sorokin 2018*, 126). These are flat or volumetric well-polished tools, expanded to the middle part, with notches and heads for tying.

Stems of composite fishing hooks of slate are presented in Neolithic collections from the North-East of the European Russia, but in smaller amount (*Kozyreva 1991*). In particular, two stems were found at Andozero II site in the Vologda Region (*Oshibkina 1978*, 46). Two fragments of stems and one complete item with square, lenticular and rounded crossections came from surface finds at Tudozero VIII settlement (*Ivanischeva M. V./Ivanischeva E. A. 2018*, 136). 12 bone stems with two notches for tying at the ends that could be used as parts for composite hooks or as what nowadays we call spinners were found at the peat-bog site Karavaikha IV, which was interpreted as a fishing place (*Kosorukova 2018*, 129, 131, fig. 1–10). Stems with rounded crossections and with heads at both ends were found at Kubenino site (*Foss 1952*, 107). Researchers have repeatedly suggested that one of such head (probably a large one) or a notch were used to tie a fishing line, and the other served to attach a spine (*Kozyreva 1991*, 227; *Krainov 1991*, 138). Finds of similar shapes are known in Volosovo culture contexts on the Upper Volga – Sakhtysh I, Strelka I, etc. (*Krainov 1991*, 138). These stems were made not only of slate, but also of bone. The most eastern finds of such stems are probably tools from the Vis II peat-bog, where stems with notches at the ends were found (*Burov 1966*), and the Vis III peat-bog, where a small polished stone stem with head in the upper part was found (*Burov 1968*).

As for the distant analogies, the Kitoysky type of composite fishing hook deserves mention. Artefacts of this type were found first in 1881 in a burial context and in the early stages of the study were considered as pendants and symbolic fish images. This category of artefacts is widely represented primarily in the Neolithic funerary sites of the Baikal region, in particular, in the Kitoysky burial ground and in other sites of the Angara basin (*Goryunova 2002*; *Okladnikov 1974*). The same stems are presented among the finds from the second cultural layer of the Shrakshura III site at the Baikal Lake. This layer is dated by the radiocarbon method to the Early Neolithic, 7420–7290 cal BC (*Novikov/Mamontov/Goryunova 2018*). Despite constructive similarities, this type of composite fishing hooks is quite different from the Fennoscandian composite hooks in a number of morphological characteristics (*Gurina 1991*, 22). There was an experiment to make a fishing hook of the Kitoysky type using prehistoric technologies. It has taken about three hours to make a fishing hook stem and about seven hours to make a complete composite tool that withstands up to 13 kg of static load (*Krutikova/Tsoi 2018*). As direct relations of such remote areas as Fennoscandia or North-West Russia and Trans-Baikal region are hardly possible, it seems more probable that morpholology of composite fishing hooks in those areas was elaborated independently because it fits well to the function of those artefacts.

CONCLUSIONS

Slate assemblage from Berezovo 2 is a valuable source for studying the variety of fishing equipment within the same Neolithic tradition, and technological approaches including raw-material strategy for production of such inventory.

Certain categories of slate finds at Berezovo 2 were made directly on the site, as evidenced by presence of blanks and fragmented or defective pieces. Soft and highly foliated local slate was used for making fishing and hunting equipment. This material is relatively light and easy to process by abrasive techniques. In contrary, the chopping tools were made of hard metatuff from the Onega Lake and presumably were mostly imported as ready-made objects.

Variety of the fishing inventory supposes developed and diversified methods of fishing, including using individual equipment for catching rather big fish.

Spreading of the same types of fishing inventory in a large territory of the Karelian Isthmus, the Republic of Karelia and Finland is another evidence of a stable system of contacts and an exchange within the Neolithic Comb Ware community.

Acknowledgments

The study was performed within the project "Phenomenon of Asbestos Ware in pottery traditions of Eastern Europe: making and use technology, structure of interregional contacts" supported by the Russian Science Foundation, #19-18-00375.
Authors are grateful to Stanislav B. Shapiro for taking pictures of slate artefacts and to Margarita A. Kholkina for graphic reconstruction, as well as to the two referees for their commenting the manuscript.

Translated by authors

BIBLIOGRAPHY

Ailio 1909 — J. Ailio: *Die steinzeitlichen Wohnplatzfunde in Finland.* Helsingfors 1909.

Äyräpää 1950 — A. Äyräpää: Ältesten steinzeitlichen Funde aus Finnland. *Acta Archaeologica* 21, 1950, 1–43.

Burov 1966 — G. M. Burov: Arkheologicheskie nakhodki v starichnykh torfyanikakh basseyna Vychegdy. *Sovetskaya Arkheologiya* 1, 1966, 155–173.

Burov 1968 — G. M. Burov: Rezul´taty raskopok Visskikh torfyanikov v 1963–1964 gg. *Uchenye zapiski Permskogo gosudarstvennogo universiteta* 191, 1968, 193–209.

Carpelan 1999 — C. Carpelan: Käännekohtia Suomen esihistoriassa aikavälillä 5100–1000 eKr. In: P. Fogelberg (ed.): *Pohjan poluilla: Suomalaisten juuret nykytutkimuksen mukaan. Bidrag till kännedom av Finlands natur och folk.* Helsinki 1999, 249–280.

Foss 1952 — M. E. Foss: *Drevneyshaya istoriya severa Evropeyskoy chasti SSSR*. Materialy i issledovaniya po arkheologii SSSR 29. Moskva 1952.

Gerasimov/Tkach/Goncharova 2018 — D. V. Gerasimov/E. S. Tkach/E. N. Goncharova: Raskopki neoliticheskoy stoyanki Berezovo 2 v Severo-Zapadnom Priladozh´e (polevye nablyudeniya i predvaritel´nye interpretatsii). In: *Byulleten IIMK RAN (okhrannaya arkheologiya)* 8. Sankt-Peterburg 2018, 9–20.

Goryunova 2002 — O. I. Goryunova: *Drevnie mogil´niki Pribaykal´ya (neolit – bronzovyy vek).* Irkutsk 2002.

Gurina 1991 — N. N. Gurina: Nekotorye obshchie voprosy izucheniya drevnego rybolovnogo i morskogo promysla na territorii SSSR. In: *Gurina red. 1991*, 5–24.

Gurina red. 1991 — N. N. Gurina (red.): *Rybolovstvo i morskoy promysel v epokhu mezolita – rannego metalla v lesnoy i lesostepnoy zone Vostochnoy Evropy*. Leningrad 1991.

Gusentsova/Sorokin 2018 — T. M. Gusentsova/P. E. Sorokin: Rybolovnye konstruktsii i orudiya lova neolita – rannego metalla pamyatnika Okhta I v Sankt-Peterburge. In: *Lozovskaya/Vybornov/Dolbunova red. 2018*, 124–127.

Ivanischeva M. V./Ivanischeva E. A. 2018 — M. V. Ivanishcheva/E. A. Ivanishcheva: Arkheologicheskie ob´´ekty i orudiya rybolovstva na poseleniyakh kamennogo veka na Tudozere v Yuzhnom Prionezh´e. In: *Lozovskaya/Vybornov/Dolbunova red. 2018*, 135–140.

Koivisto 2017 — S. Koivisto: *Archaeology of Finnish wetlands: With special reference to studies of Stone Age stationary wooden fishing structures.* Helsinki 2017.

Kosorukova 2018 — N. V. Kosorukova: Rybolovnyy inventar´ na stoyanke Karavaikha 4 v basseyne ozera Vozhe. In: *Lozovskaya/Vybornov/Dolbunova red. 2018*, 128–131.

Kozyreva 1991 — R. V. Kozyreva: Rybolovstvo i morskoy promysel na Severo-Vostoke evropeyskoy chasti SSSR. In: *Gurina red. 1991*, 218–232.

Krainov 1991 — D. A. Krainov: Rybolovstvo u neoliticheskikh plemen Verkhnego Povolzh´ya. In: *Gurina red. 1991*, 129–152.

Krutikova/Tsoi 2018 — K. A. Krutikova/N. V. Tsoi: Opyt rekonstruktsii ranneneoliticheskogo rybolovnogo kryuchka kitoyskogo tipa (Baykalo-Eniseyskaya Sibir). *Izvestiya Irkutskogo gosudarstvennogo universiteta. Seriya Geoarkheologiya, Etnologiya, Antropologiya* 25, 2018, 19–35.

Lobanova 1994 — N. V. Lobanova: Ornamental´nye shtampy neoliticheskikh poseleniy vostochnogo berega Onezhskogo ozera. *Vestnik Karel´skogo kraevedcheskogo muzeya* 2, 1994, 13–16.

Lozovskaya/Vybornov/Dolbunova red. 2018 — O. V. Lozovskaya/A. A. Vybornov/E. V. Dolbunova (red.): *Strategii zhizneobespecheniya v kamennom veke, pryamye i kosvennye svidetel´stva rybolovstva i sobiratel´stva. Materialy mezhdunarodnoy konferentsii, posvyashchennoy 50-letiyu V. M. Lozovskogo.* Sankt-Peterburg 2018.

Luho 1966 V. Luho: *Leppävirta Moninmäki Holopainen. Fil.tri. Ville Luhon virka-matkallaan kaivauttamat kivikautiset asuinpaikkalöydöt.* Helsinki 1966.

Minkkinen 2000 V. Minkkinen: *Kalastusvälineiden levintä Suomessa maalöytöjen perusteella.* Helsinki 2000.

Mökkönen 2001 T. Mökkönen: Hauki on kala: Saimaan vesistöalueen kivi- ja varhaismetallikauden osteologinen aineisto. *Muinaistutkija* 3, 2001, 2–13.

Naskali 2004 E. Naskali: *Koukkupyydyksiä Suomen kivikaudelta*. MA. Thesis. Department of Archaeology. University of Helsinki. Helsinki 2004. Unpublished.

Nordqvist 2018 K. Nordqvist: *The Stone Age of North-Eastern Europe 5500–1800 cal BC. Bridging the gap between the East and the West. Acta Universitatis Ouluensis*. Series B 160. Humaniora. Tampere 2018.

Novikov/Mamontov/Goryunova 2018 A. G. Novikov/A. M. Mamontov/O. I. Goryunova: Orudiya rybnogo lova i ikhtiofauna iz kompleksa rannego neolita Shrakshura III na Malom more ozera Baykal. *Izvestiya Irkutskogo gosudarstvennogo universiteta. Seriya Geoarkheologiya, Etnologiya, Antropologiya* 24, 2018, 61–73.

Núñez 1998 M. Núñez: Slates, the "Plastics" of Stone Age Finland. In: L. Holm/K. Knutsson (eds.): *Proceedings from the Third Flint Alternatives Conference at Uppsala, Sweden, October 18–20, 1996*. Occasional Papers in Archaeology 16. Uppsala 1998, 105–124.

Núñez 2009 M. Núñez: The sea giveth, the sea taketh: the Role of marine resources in Northern Ostrobotnia, Finland, 4000–2000 BC. *Arctic Anthropology* 46, 2009, 167–175.
DOI: https://doi.org/10.1353/arc.0.0021

Nurminen 2007 K. Nurminen: Kalanluulöytöjä Suomen neoliittisilta asuinpaikoilta. *Muinaistutkija* 1, 2007, 2–17.

Okladnikov 1974 A. P. Okladnikov: *Neoliticheskie pamyatniki Angary (ot Shchukino do Bureti).* Novosibirsk 1974.

Oshibkina 1978 S. V. Oshibkina: *Neolit Vostochnogo Prionezia*. Moskva 1978.

Pälsi 1915 S. Pälsi: Riukjärven ja Piiskunsalmen kivikautiset asuinpaikat Kaukolassa. *Suomen Muinaismuistoyhdistyksen Aikakauskirja* 28, 1915, 7–181.

Pälsi 1920 S. Pälsi: Ein steinzeitlicher Moorfund bei Korpilahti im Kirchspiel Antrea. Län Viborg. *Suomen Muinaismuistoyhdistyksen Aikakauskirja* 28, 1920, 1–19.

Saarnisto 2008 M. Saarnisto: Emergence history of the Karelian Isthmus. In: M. Lavento/K. Nordqvist (eds.): *Karelian Isthmus – Stone Age Studies in 1998–2003.* Iskos 16. Helsinki 2008, 128–139.

Savvateev 1991 Yu. A. Savvateev: Rybolovstvo i morskoy promysel v Karelii. In: *Gurina red. 1991*, 164–181.

Shakhnovich 1995 M. M. Shakhnovich: Nakhodki neoliticheskikh ornamental´nykh shtampov na territorii Karelii. *Vestnik Karel´skogo kraevedcheskogo muzeya* 5, 1995, 80–87.

Shakhnovich 2007 M. M. Shakhnovich: Mezoliticheskoe poselenie Kirkkolakhti 1 v Severnom Priladozh´e. In: M. G. Zhilin (red.): *Svoeobrazie i osobennosti adaptatsii kul´tur lesnoy zony Severnoy Evrazii v final´nom pleistotsene – rannem golotsene.* Moskva 2007, 163–181.

Erä-Esko 1995 L. Erä-Esko: *Suomen esihistoria: Suomen kansallismuseon näyttelyluettelo.* Helsinki 1995.

Tarasov 2001 A. Iu. Tarasov*: Izmenchivost kamennogo inventaria na territorii Karelii v neolite – rannem zheleznom veke.* PhD. Thesis. Dissertatsiia na soiskanie uchenoi stepeni kandidata istoricheskikh nauk. Institute of Linguistics, Literature and History of Karelian Research Centre Russian Academy of Science. Petrozavodsk 2001. Unpublished.

Ukkonen 2004 P. Ukkonen: Early in the north: utilization of animal resources in Northern Finland during prehistory. *Iskos* 13, 2004, 103–130.

Vitenkova 1996 I. F. Vitenkova: Kul´tura sperrings. In: M. G. Kosmenko/S. I. Kochkurkina (red.): *Arkheologiya Karelii.* Petrozavodsk 1996, 65–81.

Vitenkova 2002 I. F. Vitenkova: *Pamyatniki pozdnego neolita na territorii Karelii.* Petrozavodsk 2002.

Zagorska 1991 I. A. Zagorska: Rybolovstvo i morskoy promysel v kamennom veke na territorii Latvii. In: *Gurina red. 1991*, 39–64.

Zhilin 1993 M. G. Zhilin: *Kostyanoe vooruzhenie drevneyshego naseleniya Verkhnego Povolzh´ya.* Moskva 1993.

Zhulnikov 1999 A. M. Zhulnikov: *Eneolit Karelii. Pamyatniki s poristoy i asbestovoy keramikoy.* Petrozavodsk 1999. Petrozavodsk 1999.

Závažia a zložené rybárske háčiky z neolitu vo východnom Pobaltí

Bridlicové artefakty z lokality Berezovo 2 (Karelská šija, severozápadné Rusko)

Roman I. Muravev – Evgenia S. Tkach – Dmitriy V. Gerasimov

Súhrn

Bridlicové artefakty boli v oblasti východnej Fennoškandinávii často využívané počas doby kamennej, ako aj neskôr. Takáto dlhodobá technologická tradícia bola založená na dostupnosti a fyzikálnych vlastnostiach bridlice, ktorá bola vhodná na spracovanie otĺkaním, štiepaním, pílením a napokon brúsením (leštením). Rôzne druhy bridlicovej suroviny mohli byť využívané na výrobu nástrojov rôznych kategórií.

Bridlicové závažia a časti rybárskych háčikov sú známe v neolitických archeologických kontextoch už viac ako storočie. Územie ich rozšírenia je pomerne veľké. Patria sem pobaltské štáty ako Fínsko a severozápadné Rusko. Rybárske nástroje boli pomerne často opísané v archeologickej literatúre ako súčasť hlavnej problematiky, ale až do začiatku 21. storočia chýbali štúdie zamerané na bridlicové rybárske závažia.

Veľkú kolekciu bridlicových artefaktov (viac ako 1100 predmetov) sa podarilo získať z archeologickej lokality Berezovo 2, s osídlením z viacerých období. V roku 2018 bola preskúmaná plocha s rozlohou 1700 m^2. Nálezisko sa nachádza na Karelskej šiji, na severozápadnom brehu Ladožského jazera. Archeologické nálezy typologicky výrazných typov indikujú prítomnosť viacerých kultúrnych komplexov (podľa regionálnej archeologickej periodizácie: neskorý mezolit – 7.–6. tisícročie p. n. l; stredný až neskorý neolit a enolit – 4. až začiatok 3. tisícročia pred n. l.). Reprezentatívne série bridlicových rybárskych nástrojov z lokality môžeme na základe referenčného materiálu zaradiť do neskorého neolitu. Na základe tvrdosti a vrstevnatosti suroviny môžeme tento súbor rozdeliť na dve hlavné skupiny. Prvá a väčšia skupina zjednocuje kusy relatívne mäkkej a výrazne vrstevnatej bridlice. Mäkkosť a výrazná vrstevnatosť obmedzujú použitie suroviny na výrobu mnohých kategórií nástrojov, ako sú sekery s krížovým ostrím a iné sekacie nástroje, podobne ako aj pri výrobe štiepanej industrie. Tento materiál však má aj mnohé výhody. Vyžaduje menej námahy pri spracovaní, dá sa ľahko brúsiť a je relatívne ľahký, čo mohlo byť kľúčové pri výrobe hrotov a niektorých typov rybárskych nástrojov. Niektoré kategórie bridlicových nálezov z Berezova 2 boli vyrobené priamo na lokalite, čo dokladá prítomnosť polotovarov, fragmentov alebo poškodených kusov.

Ďalšia skupina artefaktov je z tvrdej bridlice, vrátane metatufu zo západného brehu Onežského jazera (tzv. zelenej onežskej bridlice). Tieto predmety boli pravdepodobne importované ako hotové výrobky.

Súbor bridlicových rybárskych nástrojov z Berezova 2 obsahuje 54 predmetov, pričom 23 z nich sú hotové nástroje. Sú to série závaží na pomerne veľkých a najmä slabo obrúsených bridlicových tyčinkách (obr. 2), ako aj tŕňoch (obr. 3) a stopkách (obr. 4) zložených rybárskych háčikoch. Artefakty boli vyrobené z mäkkej bridlice.

Všeobecné kritériá pre klasifikáciu bridlicových rybárskych nástrojov sú pomerne dostatočne definované, no určenie funkcie predmetu sa môže líšiť v závislosti od štádia opracovania a od rôznych morfologických vlastností. Predpokladá sa, že stopka háčika mohla slúžiť nielen ako časť rybárskeho háčika, ale aj ako závažie. Stopky v tvare ryby mohli slúžiť ako lyžičkové návnady alebo nástrahy na prívlač. Dali sa použiť aj bez návnady, čo môže naznačovať existenciu rôznych individuálnych spôsobov rybolovu. Prvé kroky ku klasifikácii bridlicových rybárskych háčikov z Fínska a Karelska urobil *S. Pälsi* (*1915*) začiatkom 20. stor. a ďalšie generácie vedcov ju ďalej rozpracovali. Najnovší systematický výskum typológie bridlicových rybárskych nástrojov v skúmanej oblasti urobil *E. Naskali* (*2004*) na začiatku 21. stor. Táto klasifikácia bola založená na materiáloch, ktoré boli najrelevantnejšie pre porovnanie s kolekciou z Berezova 2 v geografickom, chronologickom a kultúrnom kontexte. Závažia sú v súbore z Berezova 2 zastúpené siedmimi celými a 20 fragmentárnymi exemplármi. Mohli by súvisieť s typmi P1a (jeden neúplný exemplár), P2a (najpočetnejší – sedem celých a 17 neúplných exemplárov) a P3a (dva neúplné exempláre) definovaných E. Naskalim. Analógie k týmto nálezom sú známe medzi predmetmi z neolitických lokalít v Karelsku a Fínsku.

Tŕne zložených rybárskych háčikov (9 úplných exemplárov) sú tiež prítomné aj v bridlicovom súbore z Berezova 2 ako samostatná kategória nálezov. Majú širokú skosenú základňu, na konci zaostrenú. Niektoré predmety majú vruby, ktoré pravdepodobne slúžili na priviazanie tŕňa k stopke háčika.

Stopky zložených rybárskych háčikov (osem úplných exemplárov, 10 fragmentov) predstavujú niekoľko rozpoznaných tvarov podľa E. Naskaliho – typy A1 (tri úplné exempláre a šesť fragmentov), B1 (päť kompletných exemplárov a tri fragmenty), B2 (jeden neúplný nález). Ich spoločným znakom je prítomnosť úchytu v hornej (hlavica

na uviazanie) a dolnej (vrub) časti predmetu. Bridlicový súbor z Berezova 2 je kľúčovým prameňom pre štúdium variability rybárskych nástrojov v rámci neolitickej tradície a technologických prístupov, vrátane materiálovej stratégie pre výrobu takéhoto inventára.

Rozmanitosť rybárskeho inventára predpokladá rozvinuté a diverzifikované metódy rybolovu, vrátane používania jednotlivých nástrojov na chytanie pomerne veľkých rýb. Rozšírenie rovnakých rybárskych nástrojov na veľkom území Karelskej šije, Karelskej republiky a Fínska je ďalším dôkazom stabilného systému kontaktov a výmeny v rámci neolitickej komunity, tzv. kultúry hrebeňovej keramiky.

Obr. 1. Berezovo 2. Situovanie sídliska a dielní na mape.
Obr. 2. Berezovo 2. Bridlicové závažia (foto S. B. Shapiro).
Obr. 3. Berezovo 2. Tŕne bridlicových rybárskych háčikov (foto S. B. Shapiro).
Obr. 4. Berezovo 2. Stopky bridlicových rybárskych háčikov (foto S. B. Shapiro).
Obr. 5. Grafická rekonštrukcia zloženého rybárskeho háčika (kresba M. A. Kholkina).

Tabela 1. Berezovo 2. Veľkosť a hmotnosť bridlicových rybárskych nástrojov.

Preložila Viera Tejbusová

Roman I. Muravev
Saint-Petersburg State University
University Embankment 7/9
Mendeleevskaya Liniya 5
RU – 199034 Saint-Petersburg

and

Peter the Great Museum of Anthropology
and Ethnography (the Kunstkamera) RAS
University Embankment 3
RU – 199034 Saint-Petersburg
alcesalces243@gmail.com

Dmitriy V. Gerasimov, PhD.
Peter the Great Museum of Anthropology
and Ethnography (the Kunstkamera) RAS
University Embankment 3
RU – 199034 Saint-Petersburg
dger@kunstkamera.ru

Evgenia S. Tkach, PhD.
Institute for the History of Material Culture RAS
Dvortsovaya Embankment 18
RU – 191186 Saint-Petersburg

and

Peter the Great Museum of Anthropology
and Ethnography (the Kunstkamera) RAS
University Embankment 3
RU – 199034 Saint-Petersburg
evgeniia.tkach@gmail.com

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 213–230

RAW MATERIAL AS *FOSSILE DIRECTEUR*?

A case study of the use of Stránská skála-type chert

Jaroslav Bartík – Petr Škrdla

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.14

Keywords: Moravia, Stránská skála, chert exploitation, raw material networks, *fossile directeur*

Abstract: The Stránská skála-type chert is a local Moravian chert of Jurassic age, which is available only within a limited area restricted to the Stránská skála rock outcrop and secondary sources in nearby gravels. As this raw material has been well-studied petrographically, its distribution is easy to trace. Its use and proportions within individual archaeological assemblages in particular vary over time – ranging from the dominant raw material during several chrono-cultural periods to a complete absence of this raw material in other periods. Periods of significant use include the Initial and Early Upper Palaeolithic, Late Neolithic and Early Eneolithic. Less pronounced evidence of distribution is also known from the Late/Final Eneolithic and from the Early Bronze Age. Periods of no use include the Middle to Late Upper Palaeolithic, Early – Middle Neolithic and Middle Eneolithic. This raw material was mostly used locally with a limited distribution – the maximum extent of its occurrence is a few tens of kilometres from the source outcrop. The Stránská skála-type chert should be accepted as a *fossile directeur sensu lato* thanks to its easy determination and the isolation of the outcrop in combination with the techno-typological analysis.

INTRODUCTION

Stránská skála (Fig. 1) is an isolated raw material (the Stránská skála-type chert) outcrop on the eastern edge of the Brno Basin has been well-studied petrographically (*Přichystal 2009*; *2019*), so its distribution is easy to trace (cf. *Bartík et al. 2019*; *Škrdla 2017*). Although there are other occurrences of limestones of Jurassic age with petrographically almost identical cherts (e.g. Bílá hora, Hády, or Švédské šance) and similar cherts appear in gravels in the vicinity of Stránská skála (with characteristic pebble cortex), the prevailing volume of cherts of that type in the Palaeolithic assemblages unequivocally came directly from the Stránská skála outcrop.

The Stránská skála-type chert represents a local raw material that was utilized during the entire Stone Age with peaks at the beginning of the Upper Palaeolithic (*Přichystal/Svoboda/Škrdla 2003*) and during the Late Neolithic – Early Eneolithic periods (*Bartík et al. 2019*). In contrast, its marginal use was documented during the Late Upper Palaeolithic (*Přichystal 2002*; *Svoboda et al. 2020*), Late Eneolithic (*Kopacz ed. 2019*) and Early Bronze Age (*Kopacz/Šebela 2006*). This raw material (and the Brno Basin itself) went almost completely unnoticed during the Mid Upper Palaeolithic (Gravettian), Late Upper Palaeolithic, Mesolithic and Early/Middle Neolithic (LBK, STK; Fig. 2).

MATERIALS AND METHODS

As mentioned above, the Stránská skála-type chert comprises characteristic features within its texture, including whitish enclosures (fragments of microfossiles), dark sponge spicules, rectangular cavities after dissolved crinoidal segments and banding. Although some of the features mentioned above allow the identification of this material on the macroscopic level, stereomicroscopy using immersion liquid provides an even more precise diagnosis (e.g. *Přichystal 2009*).

Fig. 1. Stránská skála near Brno from NE.

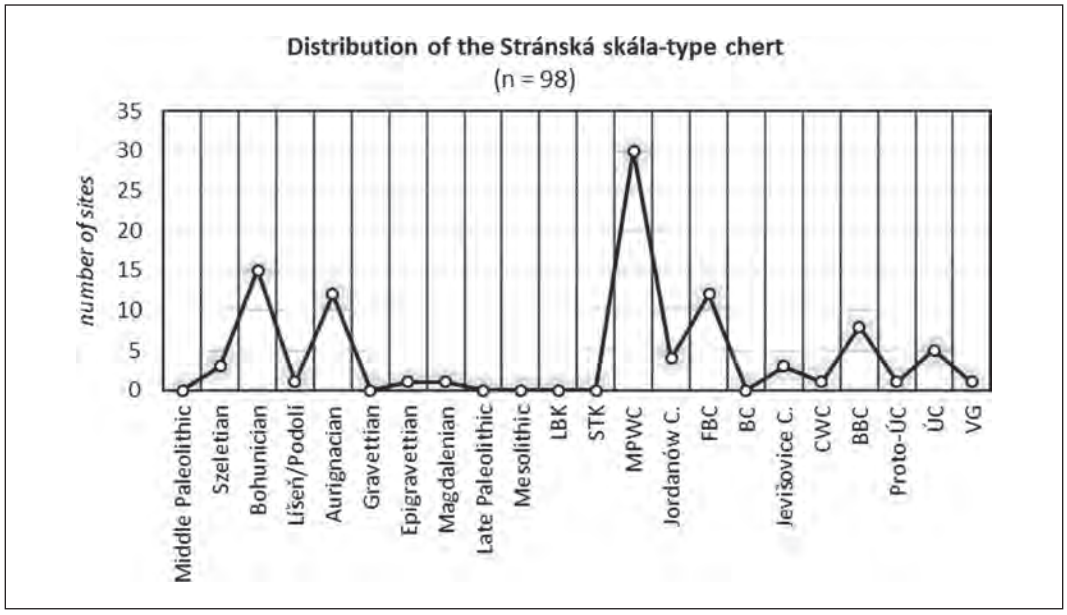


Fig. 2. Review of sites with evidence of Stránská skála-type chert according to individual periods.

In this study we would like to explore the extent of export (distance and volume) and test to what extent the presence of the Stránská skála-type chert within individual assemblages is diagnostic as type fossil (inside and outside of the Brno Basin area), which allows cultural classification of archaeological assemblages. To avoid identification discrepancies, we added only assemblages where raw materials were identified by A. Přichystal or our team.

In addition, we tested whether the presence or absence of the Stránská skála-type chert together with specific technological and typological features within individual assemblages can serve as a cultural identification marker – i.e. *fossile directeur sensu lato* (the term borrowed form palaeontology where it identifies a type fossil for a certain period).

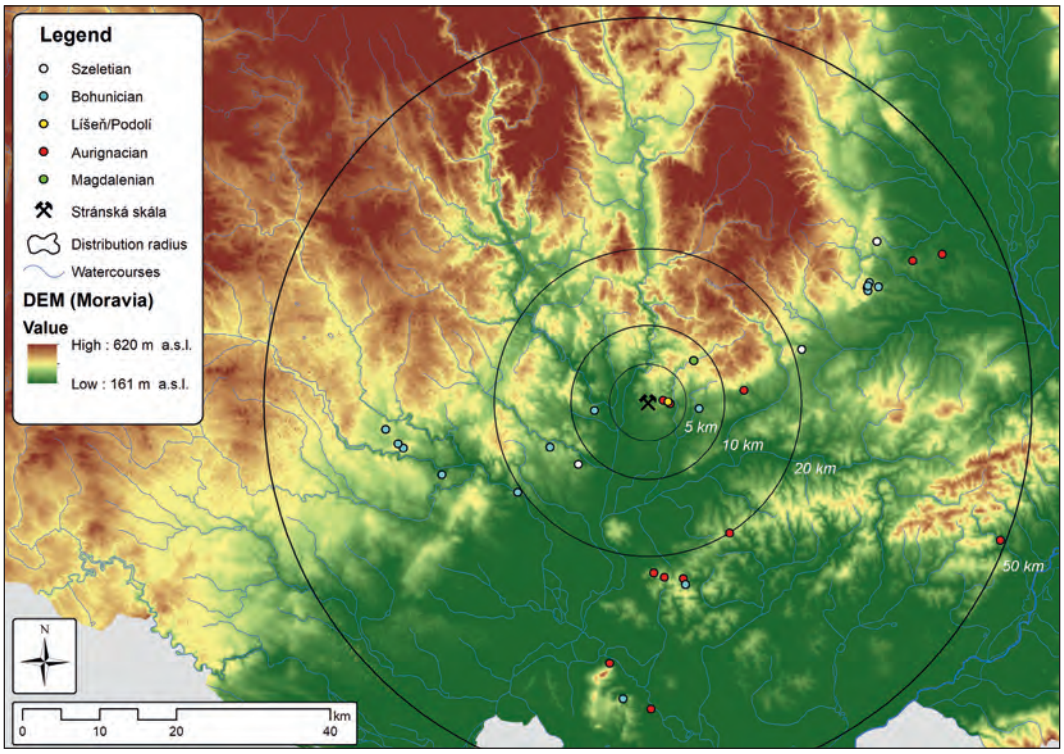


Fig. 3. Stránská skála-type chert distribution in Palaeolithic.

RESULTS

Palaeolithic

Cherts of the Stránská skála type have been used to various extents since the Palaeolithic.

Early and Middle Palaeolithic

Unequivocally Early and Middle Palaeolithic sites within the Brno area are scarce. The only possible Early Palaeolithic site was excavated within Cromerian slope sediments below the northwestern cliff of the Stránská skála rock (*Valoch 2003*, with ref.). The most recent excavation of the site was carried out by *K. Valoch* (*2003*) who presented a collection of lithic artefacts (the artificiality of which is, however, disputable) and documented fire traces on bones. Rare stratified Middle Palaeolithic sites (*Svoboda 1985*) have not yielded artefacts made from the Stránská skála-type cherts. On the top of the Stránská skála rock, sediments related to the Middle Palaeolithic age are absent, possibly eroded during MIS-4 (as indicated by the Bohunician soil lying directly on the limestone scree and Middle Pleistocene soils).

Middle to Upper Palaeolithic transition and Initial Upper Palaeolithic

The Bohunician and the Szeletian techno-complexes were documented in Moravia on the notional boundary (ca. 50–40 ka cal BP) separating the Middle Palaeolithic from the Upper Palaeolithic. While the Bohunician economy is based on the use of the Stránská skála-type chert (almost exclusively within the Brno Basin), the Szeletian used the Stránská skála-type cherts to a significantly lesser degree (isolated artefacts made from this rock were documented only in a stratified assemblage from Želešice III; Fig. 3; *Škrdla et al. 2014*; other finds are known from surface assemblages in the areas of the River Bobrava; *Škrdla et al. 2011b*; and Vyškov Gate; *Mlejnek 2015*). Large Bohunician workshop sites are known from the top of Stránská skála (*Svoboda/Valoch 2003*, with ref.). In addition, several surface artefact clusters were documented in the eastern vicinity of Stránská skála in the Líšeň cadastre (*Svoboda 1987*). Another important stratified site cluster is situated on the opposite side of the Brno Basin, in the city quarter Bohunice (*Škrdla/Tostevin 2005*; *Valoch 1976*). The Bohunician settlement extended along the Bobrava River upstream

to the west, where the excavated site Ořechov IV is. The proportion of the Stránská skála-type chert in Ořechov IV is still high (69% in surface collection: *Škrdla et al. 2016*; 80% in the stratified collection; *Škrdla 2017*). Other Bohunician-like assemblages were collected from surface sites in the cadastre of Ořechov (*Škrdla et al. 2011b*), and upstream of the Jihlava River, in the cadastre of Dolní Kounice (*Nerudová 2014*), and more to the west in Mohelno (the Boleniska field) and Lhánice (sites I and II), where the proportion of the Stránská skála-type cherts was less than 5% (*Škrdla et al. 2012*; *Škrdla/Rychtaříková 2012*). To the east from the Brno Basin, in the direction of Prostějov (via the Vyškov Gate), there is the excavated site of Tvarožná X, where these cherts constitute 70% of the assemblage (*Škrdla et al. 2009*). To the northeast, in the Prostějov region, there is the surface collection from the site Ondratice/Želeč I, in which the share of the Stránská skála-type chert amounts only to 9% (*Mlejnek/Škrdla/Přichystal 2012*). In addition, isolated artefacts have been found on several surface sites in the cadastres of Ondratice (sites denoted III and IV) and Drysice (sites labeled I, III, V; *Mlejnek 2015*). Finally, isolated finds of artefacts made from the cherts in question have been found to the south of the Brno Basin (Fig. 3); isolated artefact constitute the surface assemblage from Diváky-Borovinka (*Havlíček/Škrdla 2010*), Řeznovice-Horní pole (*Škrdla et al. 2012*), and a stratified assemblage from Milovice I (*Oliva 2009*).

While an evolved Levallois technology (serial production of often elongated Levallois points and blades with a finely faceted striking platform removed from bidirectional cores) characterise the Bohunician technology, bifacial reduction and irregular cores characterise the Szeletian technology (e.g. *Škrdla 2017*). The Levallois artefacts made from the Stránská skála-type chert (but not exclusively from this material) can be therefore reliably linked with the Bohunician technocomplex and to its extensive exploitation and workshops on the top of Stránská skála. Contrary, the leaf points, as a product characteristic of the Szeletian bifacial thinning technology, were often made from other raw materials than the Stránská skála-type chert, specifically within stratified assemblages. However, many leaf points found on the eastern boundary of the Brno Basin (surface finds with unclear cultural affinity) were made from this raw material, which indicates no technological limitation related to this raw material (*Nerudová/Přichystal 2001*; *Svoboda 1987*, table 9). In addition, leaf points (made from other rocks than the Stránská skála-type chert) are present within the Bohunician type-site assemblage (but only there), where their possible meaning was discussed in detail by *G. Tostevin* and *P. Škrdla* (*2006*). The leaf points made from the Stránská skála-type chert can be attributed only when new stratified assemblages containing such points are excavated.

Early Upper Palaeolithic

Two industrial types have been documented on the Moravian territories at the beginning of the Upper Palaeolithic – the earlier Líšeň/Podolí I, followed by the Aurignacian (*Škrdla 2017*, with ref.). The recently described Líšeň/Podolí I type industry (so far known only from the Líšeň/Podolí I site), chronologically overlaps with Greenland Interstadial 11, with the Stránská skála-type cherts as the prevailing raw material used (89.2%; *Škrdla 2017*).

The first Upper Palaeolithic techno-complex on the Moravian territory undoubtedly created by Anatomically Modern Humans (as confirmed by the skeletal remains discovered in the Mladeč caves) was the Aurignacian. The currently available Moravian radiocarbon dates postdate the HE-4 cold event and overlap with Greenland Interstadial 8, i.e. falls into the time range between 39–33 ka cal BP (*Demidenko/Škrdla/Nejman 2017*, with ref.). The Aurignacian sites described as workshops are known directly from the top of Stránská skála (*Svoboda 1987*; *Valoch 1954*). Other sites have been excavated in the eastern vicinity of Stránská skála, on the cadastres of Líšeň and Podolí (*Škrdla et al. 2010*; *2011a*). All assemblages from these sites are characterised by the dominance of the Stránská skála-type chert in their raw material spectra – over 95% (cf. *Přichystal/Svoboda/Škrdla 2003*).

The surface collections indicate limited export of the Stránská skála-type chert in the northeastern direction (Fig. 3), towards the Prostějov area (ca. 40–45 km in a direct line), where it was identified at Vítovice (*Mlejnek 2015*) and Skalka (*Mlejnek/Škrdla 2014*) and on the Předina elevation at Dobrochov (*Svoboda/Přichystal 1990*). Export in the southern direction is indicated by isolated finds discovered in the Kloboucko region (ca. 20–25 km in a direct line; e.g. Diváky, Křepice, Nikolčice, Bošovice; *Havlíček/Škrdla 2010*; *Škrdla/Havlíček/Rychtaříková 2010a*; *2010b*; *Škrdla/Kuča 2012*), and further in the direction of the Pavlov Hills (ca. 35–40 km in a direct line; e.g. Bulhary, Dolní Věstonice III; *Škrdla/Cílek/Přichystal 1996*; *Škrdla/Přichystal 1999*). Export in the eastern direction has been documented in Boršice/Buchlovice, at the 331 m elevation marker (ca. 50 km in a direct line; *Škrdla 2005*).

Carinated endscrapers are characteristic of the Aurignacian tool kit found at the Stránská skála hilltop sites as well as a small stratified assemblage from Líšeň VIII (e.g. *Demidenko/Škrdla/Nejman 2017*; *Svoboda 1987*; *1991*). Although it should be easy to trace the distribution of carinated endscrapers made from the Stránská skála-type chert, this raw material is often present in typologically undiagnostic artefacts (e.g. flakes). The Moravian Jurassic cherts were reported from Stratzing in Lower Austria (*Brandl et al. 2015*), however, it is also possible that they were collected from secondary deposits distributed throughout Southern Moravia/Lower Austria.

The Líšeň/Podolí I type industry is known only from a stratified assemblage from an eponymous site and the industry, although it includes important technological and typological features, it cannot be spatially traced at the moment.

Mid Upper Palaeolithic

In Moravia, this period is represented by the Gravettian (more precisely, the Pavlovian) culture (*Klíma 1959*). Major sites containing such units are located at the main Moravian communication routes along major rivers (i.e. the Morava, Dyje, and Odra). Although an isolated upper Gravettian burial is known from Brno, Francouzská Street (*Oliva 1996*; *Pettit/Trinkaus 2000*), and one isolated point, possibly Gravettian, was found at Maloměřice (*Valoch 1979*), the Brno Basin area was probably beyond the reach of the Pavlovian people. Consequently, the Stránská skála-type chert was completely ignored during the Gravettian. Surprisingly, the raw material from which the famous Upper Gravettian Venus of Willendorf II was made was determined as oolitic limestone, which most probably comes from Stránská skála (*Binsteiner et al. 2008*). In addition, a possible presence of the Moravian Jurassic cherts was reported from early Gravettian layer AH5 in Willendorf II (*Moreau/Brandl/Nigst 2016*).

Late Upper Palaeolithic

This period geologically covers the Last Glacial Maximum and the following Late Glacial, or – in archaeological terms – the Epigravettian (including a non-homogeneous group of industry types dated between the Gravettian and the Magdalenian), and Magdalenian. Only two Epigravettian sites (Stránská skála IV and Brno – Vídeňská Street) and one Magdalenian site (Maloměřice-Borky) are known from the Brno Basin area.

The Last Glacial Maximum site Stránská skála IV is located on the slope below the northeastern foot of the Stránská skála cliff (Fig. 1). An analysis of the raw material used by the Epigravettian hunters shows a high proportion of imported rocks. However, the use of the local chert was also documented (*Svoboda 1991*; *Svoboda et al. 2020*). A. Přichystal, who analysed this assemblage, noticed the pebble cortex on some artefacts identified as "the Stránská skála chert" and suggested that they might come from local gravels rather than from the primary outcrops directly on Stránská skála. It is in accordance with the preliminary analyses of recently collected materials from Stránská skála IV, which indicate that most of the cherts used at this site were collected from gravels rather than from the Stránská skála hilltop outcrops, although occasional use of the latter cannot be completely excluded.

The Stránská skála IV assemblage is poor both technologically and typologically (cf. *Svoboda 1991*; *Svoboda et al. 2020*). The local rocks were probably used as expedient rather than curated tools, however, *A. Markó* (*2019*) described a raw material from an Epigravettian site at Magyorosbány, which is macroscopically similar to the Stránská skála chert (stereomicroscopy is needed here to exclude possible confusion with the Upper Cretaceous Tevel flint from the Bákony Mountains).

Although the use of the local cherts has been documented at the Late Glacial site in Brno – Vídeňská Street (which included several isolated clusters), no artefacts made from the Stránská skála cherts have been reported (*Nerudová 2016*). Based on *K. Valoch* (*1960*) – as no more recent information is available – there is no available information on the use of the Stránská skála-type chert at the Magdalenian site of Maloměřice-Borky I. However, isolated finds that were possibly made from the Stránská skála cherts were present in an assemblage from the plateau in front of the Ochozská jeskyně cave (Fig. 3; *Přichystal 2002*).

Late Neolithic and Early Eneolithic

An analysis of the proofs of the distribution of the Stránská skála-type chert in the post-Palaeolithic periods showed its occurrence at over sixty archaeological sites (*Bartík 2020*). Chronologically, most of them (46%) belong to the Lengyel culture (Fig. 2). The greatest number of documented components is directly correlated with the widest range of the raw material's distribution. In the case of the Moravian

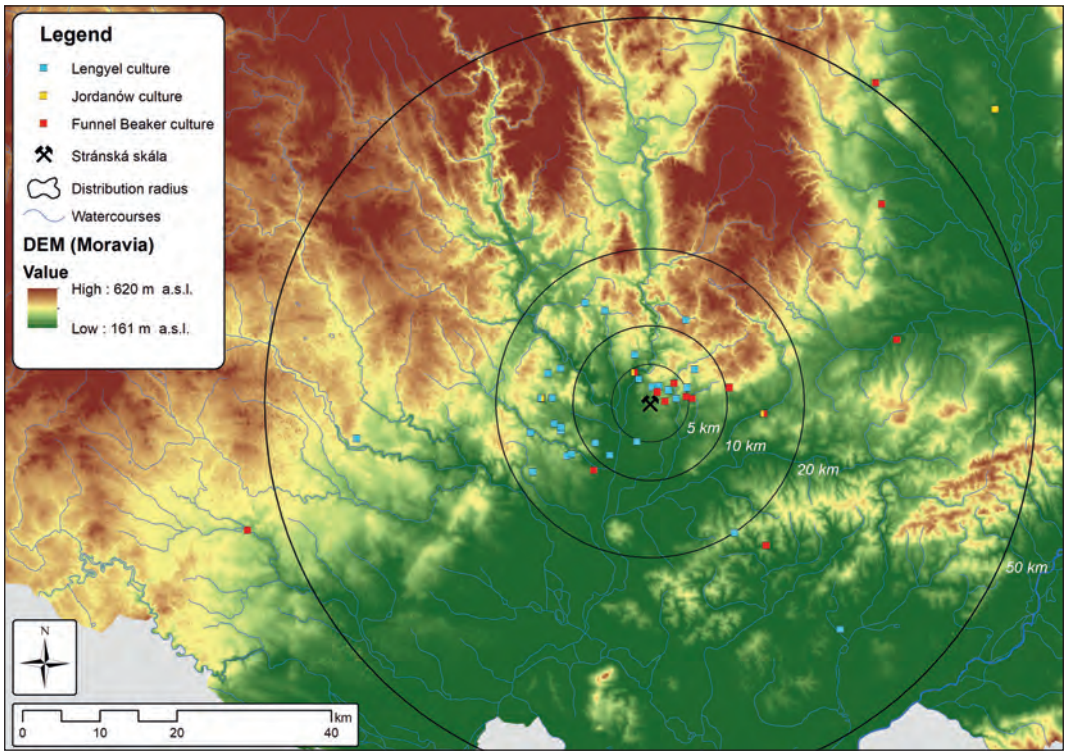


Fig. 4. Stránská skála-type chert distribution in Late Neolithic and Early Eneolithic.

Painted Ware Culture (MPWC) a distribution of the raw material in all directions has been observed. The direction in which the Stránská skála-type chert was moved most often is to the SW of the source site (Fig. 4; *Bartík et al. 2019*). Interestingly, in the Early Neolithic (LBK) and Middle Neolithic (STK), this raw material was ignored completely, probably due to the tradition of the exploitation and use of the Krumlovský les-type chert (cf. *Oliva 2015*) and the Olomučany-type chert in the Brno area since the Mesolithic.

During the early Eneolithic (Jordanów culture), the use of the Stránská skála-type chert was preserved (e.g. *Jelínek 2019*; *Kaňáková/Hladíková 2018*), but the number of sites where it occurred decreased significantly, which was probably related to the overall reduction of population in settlements compared with the previous period (Fig. 3; cf. *Šmíd 2017*). Another peak in the distribution of the Stránská skála-type chert is linked with the developments at the times of the Funnel Beaker Culture (FBC). However, at this time the distribution was not that intense. Unlike in the previous period, there was an increase in the distribution of the raw material to more remote places – up to several tens of kilometres – the prevailing direction of the distribution being east to northeast (Fig. 4; *Bartík et al. 2019*).

If we look at this period using other criteria, such as technology and typology, we must primarily look at the assemblages that come directly from Stránská skála and that have been analysed best. Like the assemblages from initial Early Palaeolithic, the assemblages of chipped industry made from the local chert have a workshop character. Thanks to a recent comprehensive analysis of all available post-Palaeolithic assemblages it was possible to reconstruct the *chaîne opératoire* of the local produce (*Bartík 2020*). The results show that within the exploitation and workshop complex of Stránská skála, advanced blade making techniques were applied to the local chert during the Late Neolithic (MPWC). The blades were knapped from well prepared, mostly unipolar cores with a removed cortex. This advanced blade making technology reached its peak at the beginning of the Eneolithic, when the Stránská skála-type chert was intensively exploited by the people of the Funnel Beaker Culture (Fig. 5). In the Final Eneolithic and Early Bronze Age, that followed, blades were exceptional and the production of flakes from low quality cores was dominant. A change in the knapping technique of blanks was proven: in the period in question, the Late Neolithic to Early Eneolithic, the producing of blades by means of indirect percussion was proven, while later, in times when people resigned on the gaining of regularly shaped blanks, the technology of direct percussion with a hard hammer (*Bartík 2020*). From the perspective of technology and applied techniques, the technique of core reduction does not constitute a *fossile directeur* for a single archaeological

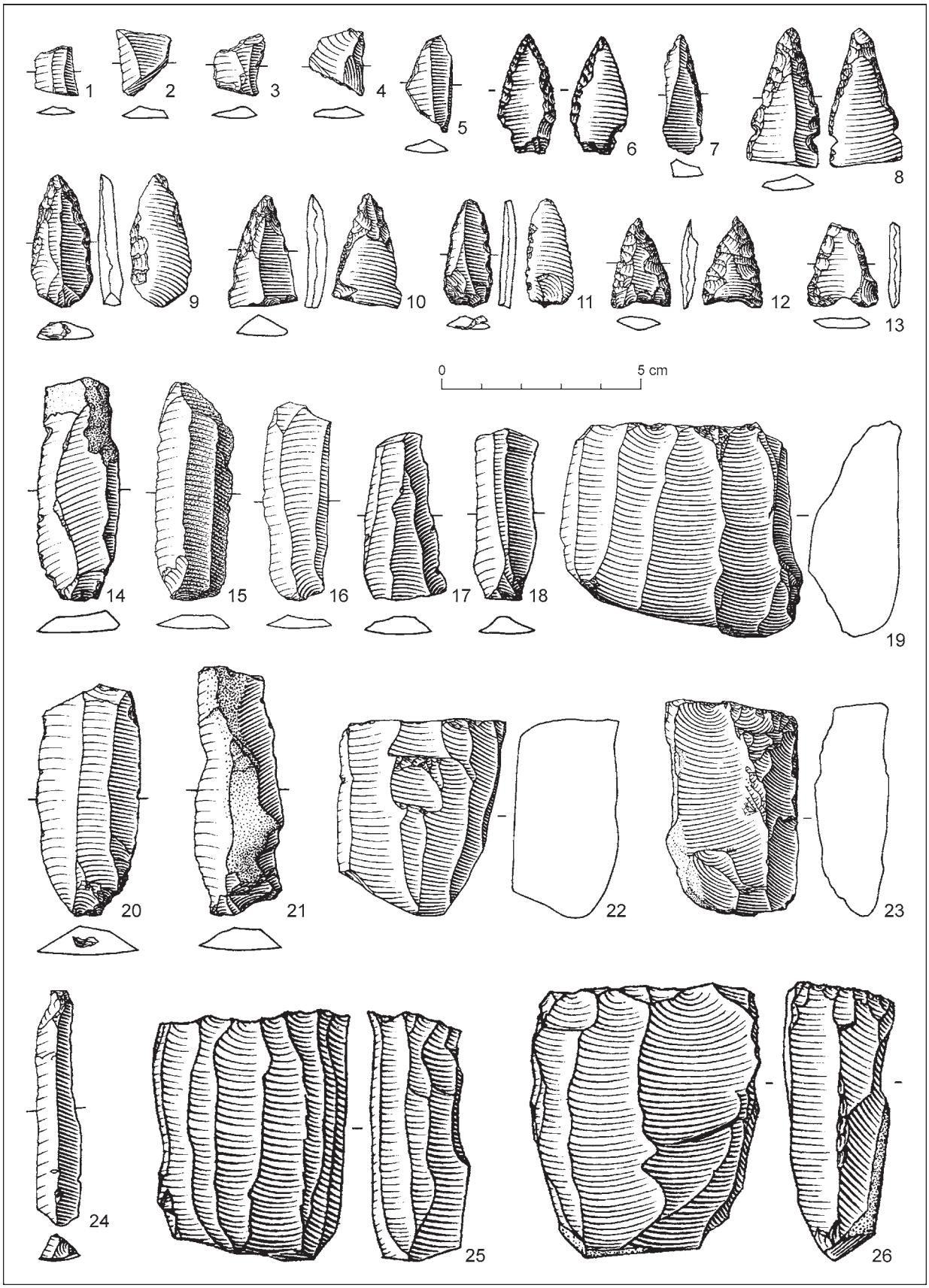


Fig. 5. Selected Funnel Beaker Culture blade products and tools from Stránská skála-type chert. 1–7, 9–26 – Stránská skála III; 8 – Brno-Líšeň, Čtvrtě.

culture. However, it is relatively reliable in predicting a relatively well-defined chronological horizon, when the production of the blades from the Stránská skála-type cherts was most popular, not only at the eponymous workshop site, but also in the settlements in the environs (cf. *Bartík et al. 2019*, 402–406).

While the typological spectrum of tools datable to the MPWC is very low in Stránské skála, probably due to the fact they were carried outside of the exploitation/workshop area, a variety of tools was produced here in the FBC period (*Bartík 2020*, 163–168; *Svoboda/Šmíd 1996*, 94), a large part of which then remained at the site (with or without traces of use). Together with the raw material studied here, some of the clearly defined standardised FBC tools may then be considered *fossile directeur*. These include mainly some microlites, which have been dated to the FBC context thanks to the systematic flotation of the backfill of excavated features. Surprisingly, along with small trapezoids (Fig. 5: 1–3) also two characteristic and one slightly atypical triangle (Fig. 5: 4, 5) were found. This type of tool had not yet been known from the Funnel Beaker Culture. This is probably why the only similar item, which was found at the Hlinsko hillfort – where the FBC settlement horizon has also been documented – was tentatively dated to the Mesolithic (*Šebela/Škrdla/Schenk 2007*, 359–361, fig. 7: 4). However, in the Mesolithic, this raw material was not used, which allows us to hypothesise that possible further finds of triangles made from the Stránská skála-type chert will be associated with the Early Eneolithic. A similar hypothesis can be made about the occurrence of the microlithic triangles, which were most abundant in Central Europe in the Late Mesolithic and Early Neolithic (*Eigner/Řezáč 2014*; *Mateiciucová 1998*; *2008*), again – in times when the Stránská skála chert was unknown or deliberately ignored. The last group of tools – a minor one, but technologically and typologically significant – on which the hypothesis of *fossile directeur* could be applied includes points. From the perspective of the find context at Stránská skála, they have been discovered both by surface collection and stratified features dated to the FBC by pottery. Typologically, 5 forms of arrowheads/points have been determined (*Bartík 2020*, 167, 168).

The most important for the issue in question are the most standardised points denoted as the Štramberk type (cf. *Diviš 2001*; *Klíma 1960*; *Struhár 2014*). Three finds of this type of point have been made, one of them preserved completely (Fig. 5: 6) and two fragmentary (Fig. 5: 7, 10). There is a distinctive retouch on the ventral side of the point of one of these artefacts. A Štramberk-type point made from the Stránská skála-type chert (Fig. 5: 8) was discovered several hundred metres from the researched exploitation/workshop area at the site Čtvrtě in Brno-Líšeň and another one was found at what is now a surface site with evidence of FBC at Želešice I-Za lesem (*Bartík et al. 2019*, 406). The finds of Štramberk-type points are dated to a broader chronological horizon: from the Late Neolithic to Middle or Late Eneolithic. However, the production of this type of points from the Stránská skála-type chert has not been confirmed in any of the cultures within this period. The Štramberk points have been discovered over a relatively wide geographical area and were produced using different types of raw materials (cf. *Struhár 2014*). In any case, when the raw material was determined as the Stránská skála-type chert, the finds of points were always linked with the activities of the Funnel Beaker Culture. In the future, it will be necessary to further verify this pattern in order to confirm whether it is a case of distortion caused by the current state of research or a case of a *fossile directeur* linked to a specific raw material.

Middle and Late Eneolithic

There is no archaeological evidence of the use of the Stránská skála-type chert in the Middle Eneolithic; the demise of the distribution network of this raw material is supported by its petrochemically proven absence at central Moravian hillforts where it was imported during the FBC (cf. *Přichystal 2007*; *2010*; *Šmíd/Přichystal 2015*). Only sporadic proofs of the distribution of this material are available in the form of isolated flakes and raw material from three hillfort sites of the Jevišovice Culture in the hills in the N-NE outskirts of Brno (Fig. 6; *Bartík/Šebela 2019a*). The low number of finds does not allow a reliable testing of the *fossile directeur* hypothesis.

Final Eneolithic

A limited use of the Stránská skála-type chert survived to the Final Eneolithic. While we have only a single component from a grave context dated to the Corded Ware Culture, both burial and settlement contexts have been proven for the Bell Beaker Culture (BBC). In the BBC period, a settlement area directly on Stránská skála, at site SS IV, where an intensive processing of the local cherts – among which the sub-

standard variety C prevailed – was proven along with common settlement activities (*Bartík et al. 2018*). Although there are several thousand artefacts associated with the production of chipped industry, there are relatively few proofs of the distribution of the Stránská skála-type chert to the surrounding BBC sites. Apart from the Stránská skála, artefacts made from the Stránská skála-type chert have been documented at five sites in the cadastre of the Brno city and its surroundings (Fig. 6; *Bartík/Šebela 2019b*). Spatially, the distribution of the raw material was considerably limited and, in cases of a larger proportion of the raw material, the distribution radius does not exceed 15 km. Outside the Brno area, this raw material was petrographically proven in isolated artefacts only in the cluster of burial grounds around Hoštice and Ivanovice in Haná (Vyškov District; about 30 km from Stránská skála; *Přichystal/Všianský 2012*, 304–311). In unique cases, the presence of the Stránská skála-type chert was proved outside Moravia. Examples of the Stránská skála-type chert include individual finds from the BBC cemetery and settlement (find group I/II) at Skalice in Southwest Slovakia (*Cheben/Drahošová 2004*) and a flake from the BBC burial ground in Tuněchody (Chrudim District; find group II/III; *Tichý et al. 2008*).

Technologically, the chipped industry as rendered by the BBC peoples from Stránská skála is the complete opposite of the previous developments. Flakes became the main products of the reduction of cores, which corresponds with the type of the cores (Fig. 7: 1–16). Limited attention has been paid to the primary fashioning of rocks prior to reducing; direct detaching of final products without any prior preparation of the striking platform cannot be ruled out. Only a small number of blades have been found and it is a question from what cores they were struck from (*Bartík 2020*, 205–214). Compared to the previous development, the knapping technique changed as well. Most of the industry was knapped by a direct percussion with hard hammerstones; part of the production is supposed to have been made by the bipolar anvil core technique. A reconstruction of the *chaîne opératoire* (*Bartík 2020*, 283, fig. 135) shows a striking dichotomy: a difference between the technological developments of the finished retouched tools. While most production from low-quality material was linked with flakes that were not further used or tools for direct consumption (whose real use was verified by trasological analysis), a small part of the assemblage, made from better quality chert varieties, contains more advanced forms of artefacts with complete retouching. Here, finer techniques are supposed, including pressure retouching, applicable for instance in the bifacial reduction of artefacts (in the case of the Stránská skála-type chert this includes a segment and several arrowheads). Interestingly, no arrowheads made from the Stránská skála-type chert – which are generally considered the *fossile directeur* of the knapped stone industry of the BBC in East Central Europe and beyond (*Furestier 2007*; *Kopacz/Přichystal/Šebela 2009*) – have been recorded outside of the Stránská skála area. It is not excluded that the qualities of the Stránská skála-type chert were not suitable for the making of such artefacts-scald cornea, with its quality properties, they did not intend to produce these artefacts. However, we still know examples directly from Stránská skála, where bifacial reduction was applied to the local cherts. An interesting issue here is the imitation of the prestige artefacts, such as daggers, but we are limited by the state of the only documented artefact. To sum up the result, there is a dominant part of the assemblage with a low technological quality and very limited use in toolmaking, where the raw material used was not important, and a minor part where a better technology was used, and which had higher demands on the toolstone – it had to be a raw material that allowed the production of bifacially reduced standardised tools. Lower quality chert and the primary character of flakes have been documented in industries from the surrounding settlements. However, there is a lack of finds with completely retouched tools of better quality. The activities of the bearers of the BBC date into find group II/III. The future finds of bifacially thinned artefacts from the Stránská skála-type chert will most probably be dated to this chronological phase.

Early Bronze Age

Sporadic evidence of the use of the Stránská skála-type chert is dated to the turn of the Final Eneolithic and Early Bronze Age: two pieces of chert appeared in the grave goods of grave no. 12 in Bedřichovice, dated to the Proto-Únětice Culture (Brno-Country District; *Kopacz/Šebela 1998*, fig. 2: 15, 16). There are several cases in which the use of the Stránská skála-type chert was documented as the late phases of the Únětice Culture. In the Brno suburbs and its vicinity, the Stránská skála-type and Švédské valy-type cherts were found in the chipped industry assemblages from the settlements in Černá Pole, Slatina, Tuřany, and at the settlement and burial ground in the nearby Podolí (*Bartík 2020*; *Šebela 2019*). The analysis of the distribution of the Stránská skála-type chert in the Early Bronze Age showed that the raw material was mainly of local importance and its distribution radius usually did not exceed 5 km (Fig. 6). Outside this area, the Stránská

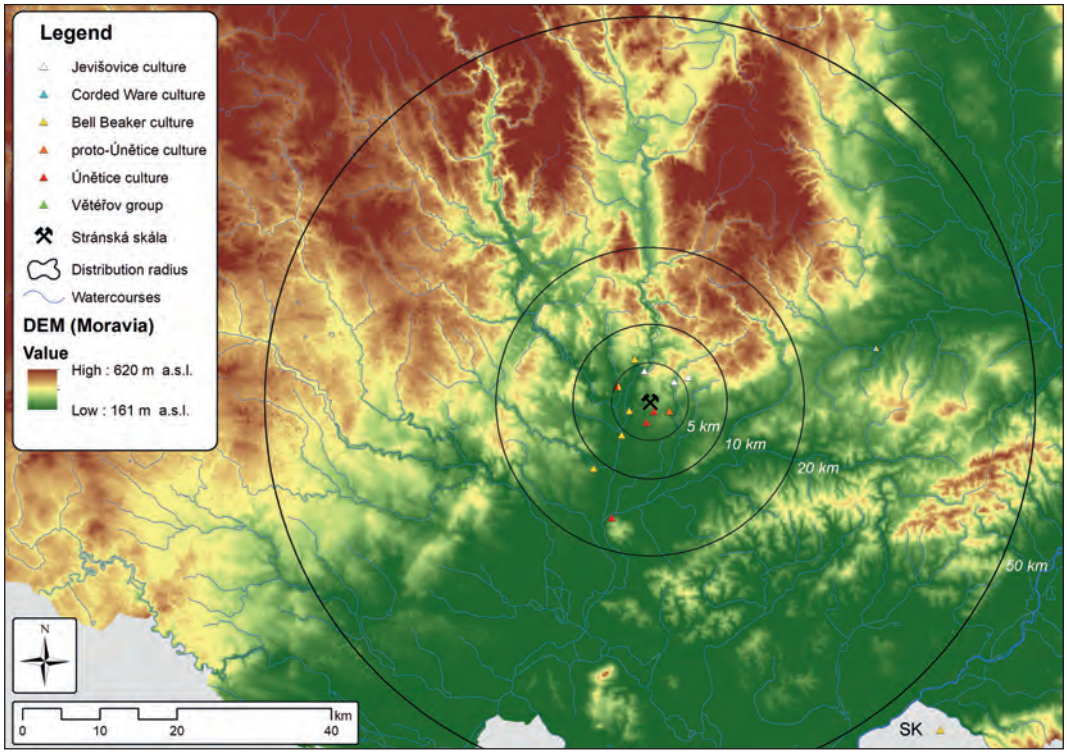


Fig. 6. Stránská skála-type chert distribution in Final Eneolithic and Early Bronze Age.

skála-type chert has been represented by a mere two pieces at the Blučina-Cezavy hillfort site (about 14 km from Stránská skála; *Kaňáková Hladíková/Parma 2015*, 523). In the later phases of the Early Bronze Age, the Stránská skála-type chert no longer played a significant role among the raw materials used for chipped industry. The only evidence of use in the environment of the Věteřov group comes from the Budkovice hillfort (Brno-Country District; about 30 km from Stránská skála), where two artefacts found and another one, in which the raw material used is spurious (SSC/KLC; *Kopacz/Šebela 2006*, table 1).

Based on typologically characterististic isolated finds, the latest prehistoric activities associated with the exploitation of the Stránská skála-type cherts are dated to the Early Bronze Age (*Bartík 2020*). Like in the case of the Jevišovice Culture, the only direct evidence of the use of the raw material is the evidence of its distribution to neighbouring settlements.

The technology of Early Bronze Age chipped industry draws on the previous development in the Late Eneolithic and it almost exclusively consists of flakes, like the industries using the studied raw material. The relatively frequent occurrence of the "janus" flakes is also worth mentioning. Their typical feature is a frequent use of preparation flakes with the remains of cortex for tool production (*Kaňáková Hladíková 2013*; *Kopacz/Šebela 2006*). The most important assemblage where the Stránská skála-type chert was represented significantly includes the sites of Slatina-Jihomoravské Square (*Salaš 1987*), Tuřany-Švédské valy (*Kos 2006*) and Podolí-Příčný (*Kala/Parma 2011*; *2013*). A collection of 208 pieces was obtained from the "Jihomoravské Square", of which 153 were made from the Stránská skála-type chert (*Kopacz/Šebela 2006*, pl. I). Technologically/typologically, this material was used in cores with different stages of reduction (33 pcs), flakes (101 pcs), blades (2 pcs) and blades with utilisation retouch (2 pcs). The rest of the assemblage consists of pieces of raw material (*Kopacz/Šebela 2006*, 98–100). The industry from feature 10 with a rich collection of chipped industry is supposed to have workshop character (*Kaňáková Hladíková/Parma 2015*, 523). In the assemblage from Tuřany (106 pcs) the Stránská skála-type chert is dominant. This site also turned up proofs of the mining of the local Švédské šance-type cherts (*Kos/Parma 2007*), which are geologically similar to the Stránská skála-type chert (see *Přichystal 2009*; *2019a*).

A number of interesting findings was provided by rescue excavations at the site of Příčný (cadastre of Podolí, Brno-Country District, which followed up on each other. A settlement and a burial ground with 44 graves from the classical phase of the Únětice Culture were excavated here (*Kala/Parma 2011*; *2013*). This was the very first time that the Stránská skála-type chert appeared in a funerary context. Importantly, links

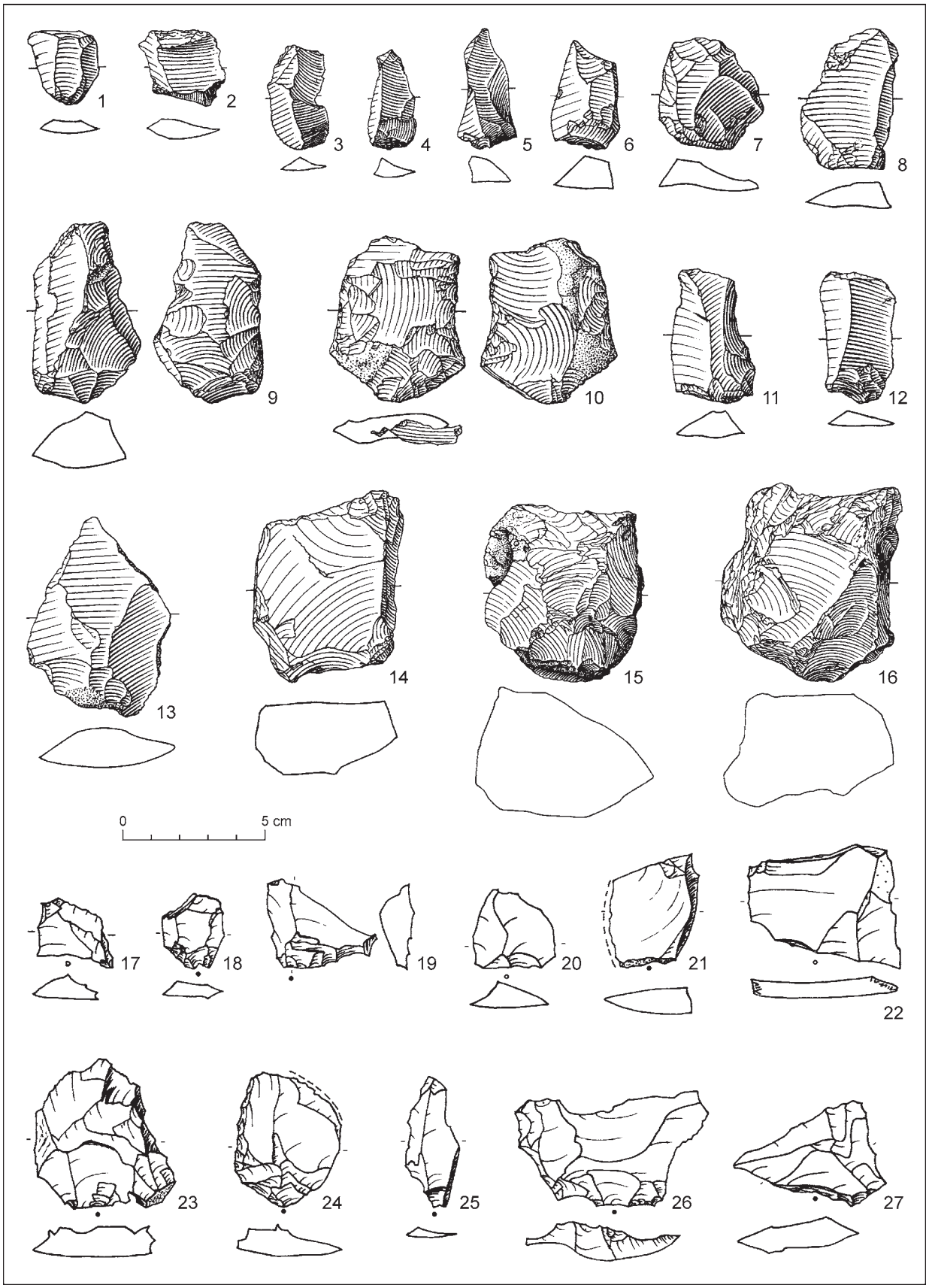


Fig. 7. Selected flake products from Stránská skála-type chert. 1–16 – Stránská skála IV, Final Eneolithic; 17–27 – Podolí-Příčný, Early Bronze Age (after *Kaňáková Hladíková/Parma 2015*).

between material type and the age and sex of the buried was determined, which were by no means coincidental (*Kaňáková Hladíková/Parma 2015*, 530–533). The Podolí assemblage (Fig. 7: 17–27) gives us an idea of the typological spectrum of instruments made from the Stránská skála-type chert. Among the identified artefacts were saws, chisels and knives with unretouched blades and backed or cortex edges, which are characteristic of the Early Bronze Age in Moravia (cf. *Kaňáková Hladíková 2013*). Interestingly, no artefacts with sickle-gloss made from the Stránská skála-type chert have been discovered (*Kaňáková Hladíková/Parma 2015*, 527, 528).

DISCUSSION

The *fossile directeur* (type fossil) approach has been commonly used by archaeologists in typological and technological studies. The typical examples include the Levallois point as a characteristic tool of the Bohunician, the leaf point for the Szeletian, the carinated endscraper or burin and Dufour bladelets for the Aurignacian and the backed bladelet for the Gravettian and Magdalenian. In this case study, we tested the possibility of using also a type of raw material – here the Stránská skála-type chert – as a *fossile directeur*. Therefore, the present article discusses the extent to which the presence of the Stránská skála-type chert can be used as a *fossile directeur* within Initial Upper Palaeolithic/Early Bronze assemblages, within and outside of the Brno Basin. All chronological horizons were tested from the perspective of technology, typology and distribution networks.

There are no available data for this type of analysis for Middle Palaeolithic sites.

The raw material economy of the Bohunician sites in the Brno Basin was primarily based on the Stránská skála-type cherts obtained directly from their outcrops on the top of Stránská skála rock. The proportion of these rocks in individual assemblages decreased (down the line) with the increasing distance from Stránská skála: 90% of the SSC were at sites directly in the Brno Basin, ca. 70% within 15 km, and only a minor amount (below 10%) were found in assemblages up to 30 km and only isolated items were found further than 30 km from Stránská skála. Unlike in the Bohunician, Szeletian sites have not been documented directly in the Brno Basin. However, at Želešice III a surprising find of several artefacts of the Stránská type chert was made (*Škrdla et al. 2014*). The Early Upper Palaeolithic technocomplexes share the pattern of the Bohunician. Both Aurignacian and Líšeň/Podolí I-type raw industry economies linked with the sites in the Brno Basin were primarily based on the Stránská skála-type cherts, while the export of this raw material outside the Brno Basin was limited (however, this finding can be affected by a low number of analysed stratified assemblages beyond the Brno Basin). Generally, the Stránská skála-type chert was intensively used by the Bohunician and both the above-mentioned Early Upper Palaeolithic technocomplexes in the Brno Basin and its export to the surrounding area was limited. The significant proportion of the Stránská skála chert within the Palaeolithic assemblages from the Brno Basin and its nearest vicinity (up to ca. 15 km) indicate their dating to the initial or early Upper Palecolitic. When the raw material data are combined with technological and typological data, the Levallois artefacts made from the Stránská skála-type chert are a *fossile directeur* for the Bohunician and the carinated end scrapers are a *fossile directeur* for the Aurignacian. There are no available data on the tracing of the Líšeň/Podolí I industry. The Szeletian used the Stránská skála-type chert in differently than the industries mentioned above. Although isolated artefacts made from the Stránská skála-type chert were identified in the Želešice III assemblage, the high proportion of this raw material within any particular assemblage excludes its classification as Szeletian.

Local raw materials including the Stránská skála type chert were almost completely replaced by imported erratic flints from the glacio-fluvial deposits in Northern Moravia/Southern Poland, and other imported rocks (the most important being the White Carpathian radiolarites, followed by the silicites from the Kraków-Częstochowa Jurassic Upland, and sporadically other rocks) in the Gravettian (Pavlovian). A similar trend in the use of the Stránská skála-type chert continued in the Epigravettian (where it was documented only in an assemblage from Stránská skála IV) and the Magdalenian. The only important exception is the possible presence of the Stránská skála-type chert at Magyorosbányia – a site in the Carpathian Basin of similar dating as Stránská skála IV (*Markó 2019*). If the presence of the Stránská skála chert is microscopically confirmed, then it will be a *fossile directeur* also in the case of Late Upper Palaeolithic.

In the case of the post-Palaeolithic industries made from the Stránská skála-type chert, a future testing of hypotheses concerning their typological aspects will be necessary. In most cases, the validity of the above patterns is limited by a low number of identified tools. Provided that their numbers rise thanks to further excavations, some types of the standardised tools made from the Stránská skála-type chert might be accepted as *fossile directeur*.

CONCLUSION

During the Initial and Early Upper Palaeolithic (including the Bohunician, Líšeň/Podolí I type industry, and the Aurignacian) the raw material economy of all the sites in the Brno Basin and its nearest vicinity was based primarily on cherts of the Stránská skála type and this raw material, in combination with technological and typological data, can be used as *fossile directeur*. In contrast, the bearers of the Szeletian Culture did not settle in the Brno Basin and almost totally ignored this raw material. Similarly, the Gravettian (Pavlovian) culture almost completely ignored the Brno Basin and the Stránská skála-type chert was absent in its assemblages, which can be interpreted as a cultural or technological choice. Similarly, the same pattern can be observed during the subsequent periods: the Epigravettian and Magdalenian. We can conclude that the Stránská skála-type chert cannot be considered a *fossile directeur* for Mid and Late Upper Palaeolithic assemblages.

Chronologically and technologically, the post-Palaeolithic chipped industries made from the Stránská skála-type chert do not exhibit a clear pattern that would allow them to be linked with a single archaeological culture in the sense of *fossile directeur*. However, when this chert is present in significant quantities at sites within lower tens of kilometres from Stránská skála, its connection with a settlement dated from the Late Neolithic to Early Eneolithic can be assumed – in case of technologically developed blade industries – or from the Final Eneolithic to Early Bronze Age in the case of flake industries. As for the typological testing of *fossile directeur*, there are some links, so far hypothetical, to specific types of standardised tools, which will have to be tested and verified considering the low numbers of finds. As regards the Early Eneolithic, they include microliths (triangles, short trapezoids) and some forms of arrowheads (mainly the Štramberk type). Final Eneolithic industries include arrowheads with wings and segments; Early Bronze Age artefacts include tools with saw retouch and different forms of knives. Some of these tools (especially in the Bell Beaker and Únětice Cultures) are *fossiles directeurs* for the cultures as such, but in connection with the raw material they offer further valuable dating potential that enables a distinction of more detailed chronological phases or the determination of provenance and/or socio-economic context.

Translated by authors

BIBLIOGRAPHY

Bartík 2020 — J. Bartík: *Těžební a dílenský areál na Stránské skále u Brna v neolitu až straší době bronzové*. Ph.D. Thesis. Masaryk University. Faculty of Arts. Department of Archaeology and Museology. Brno 2020. Unpublished.

Bartík et al. 2018 — J. Bartík/J. Kopacz/M. Nývltová Fišáková/A. Přichystal/L. Šebela/P. Škrdla: Question of chert exploiting on the Stránská skála Hill (Brno-Slatina, Czech Republic) by the Bell Beaker People. *Journal of Neolithic Archaeology* 20, 2018, 185–202.
DOI: https://doi.org/10.12766/jna.2018S.10

Bartík et al. 2019 — J. Bartík/P. Škrdla/L. Šebela/A. Přichystal/L. Nejman: Mining and processing of the Stránská skála-type chert during Late Neolithic and Early Eneolithic periods. *Archeologické rozhledy* 71, 2019, 373–417.

Bartík/Šebela 2019a — J. Bartík/L. Šebela: Use of cherts of the Stránská skála type in the prehistoric times – The Jevišovice culture. In: *Kopacz ed. 2019*, 72–77.

Bartík/Šebela 2019b — J. Bartík/L. Šebela: Use of cherts of the Stránská skála type in the prehistoric times – Late Eneolithic. In: *Kopacz ed. 2019*, 77–81.

Binsteiner et al. 2008 — A. Binsteiner/A. Přichystal/G. Wessely/W. Antl Weiser/A. Kern: Neue Untersuchungen zum Kalkoolith der Venus von Willendorf. Mitteilungen der Anthropologischen Gesellschaft in Wien. *Anthropologische Gesellschaft in Wien* 138, 2008, 23–35.

Brandl et al. 2015 — M. Brandl/L. Moreau/O. Schmitsberger/Ch. Neugebauer-Maresch: The Southern Moravian Cherts at the Aurignacian Site of Stratzing-Galgenberg, Austria. *Anthropologie* 53, 2015, 181–202.

Demidenko/Škrdla/Nejman 2017 — Y. E. Demidenko/P. Škrdla/L. Nejman: Aurignacian in Moravia. New geochronological, lithic and settlement data. *Památky archeologické* 108, 2017, 5–38.

Diviš 2001 — J. Diviš: Nová nalezitě hrotů typu Štramberk-Krnov v okolí Příbora a Kopřivnice. *Archeologie Moravy a Slezska* 1, 2001, 53–58.

Eigner/Řezáč 2014 J. Eigner/M. Řezáč: Chronologická hodnota trapézů v českém mezolitu. *Archeologie ve středních Čechách* 18, 2014, 471–488.

Furestier 2007 R. Furestier: *Les industries lithiques campaniformes du sud-est de la France*. BAR International Series 1684. Oxford 2007.

Havlíček/Škrdla 2010 F. Havlíček/P. Škrdla: Diváky (okr. Břeclav). *Přehled výzkumů* 51, 2010, 279.

Cheben/Drahošová 2004 I. Cheben/V. Drahošová: Nálezy kultúry zvoncovitých pohárov zo Skalice. In: M. Lutovský (ed.): *Otázky neolitu a eneolitu 2003. Sborník referátů z 22. pracovního setkání badateů zaměřených na výzkum neolitu a eneolitu. Český Brod – Kounice, 23.–26. září 2003.* Praha 2004, 355–375.

Jelínek 2019 T. Jelínek: Štípaná industrie jordanovské kultury na Olomoucku. In: *Ročenka AC Olomouc 2018*. Olomouc 2019, 86–96.

Kala/Parma 2011 J. Kala/D. Parma: Podolí u Brna (okr. Brno-venkov). *Přehled výzkumů* 52, 2011, 195, 196.

Kala/Parma 2013 J. Kala/D. Parma: Podolí u Brna (okr. Brno-venkov). *Přehled výzkumů* 54, 2013, 186, 187.

Kaňáková Hladíková 2013 L. Kaňáková Hladíková: *Posteneolitická štípaná industrie na Moravě.* Dissertationes archaeologicae Brunenses/Pragensesque 15. Brno 2013.

Kaňáková Hladíková 2018 L. Kaňáková Hladíková: Soubor štípané industrie časného a staršího eneolitu ze sídliště Rousínovec – Přední lány. *Studia archaeologica Brunensia* 23, 2018, 39–64.

Kaňáková Hladíková/Parma 2015 L. Kaňáková Hladíková/D. Parma: Štípaná industrie z pohřebiště únětické kultury v Podolí-Příčný (okr. Brno-venkov) jako indikátor sociálních jevů. *Archeologické rozhledy* 67, 2015, 515–546.

Klíma 1959 B. Klíma: Zur Problematik des Aurignacien und Gravettien in Mittel-Europa. *Archaeologia Austriaca* 26, 1959, 35–51.

Klíma 1960 B. Klíma: Pozdně paleolitická stanice na Kotouči ve Štramberku. *Anthropozoikum* 10, 1960, 93–112.

Kopacz ed. 2019 J. Kopacz (ed.): *The end of the Stone Age on the Stránská skála hill in Brno – Lithic production or "Optimalization"?* Rzeszów – Brno 2019.

Kopacz/Přichystal/Šebela 2009 J. Kopacz/A. Přichystal/L. Šebela: *Lithic Chipped Industry of the Bell Beaker culture in Moravia and its East-Central European Context.* Kraków – Brno 2009.

Kopacz/Šebela 1998 J. Kopacz/L. Šebela: Chipped Stone Material of the Moravian Proto-únětice Culture. *Przeglad Archeologiczny* 46, 1998, 37–57.

Kopacz/Šebela 2006 J. Kopacz/L. Šebela: *Kultura unietycka i grupa wieterzowska na Morawach na podstawie materiałów krzemiennych.* Kraków – Brno 2006.

Kos 2006 P. Kos: *"Černovická terasa" CTP B1.2*. Research report. Institute for Archaeological Heritage Brno. Brno 2006. Unpublished.

Kos/Parma 2007 P. Kos/D. Parma: Archeologický výzkum Švédských valů. *Brněnský metropolitan*, leden 2007, 15.

Markó 2019 A. Markó: Árvéső: eszköz vagy magkő – megfigyelések a mogyorósbányai kavicsgravetti leletanyagon. In: M. Vicze/G. Kovács (eds.): *Momosz X. Őskoros Kutatók X. Összejövetele, Százhalombatta, 2017. Április 6–8*. Őskori technikák, őskori technológiák. Százhalombatta 2019, 211–230.

Mateiciucová 1998 I. Mateiciucová: Štípaná industrie na pohřebišti kultury s LnK ve Vedrovicích. *Pravěk NŘ 7*, 1998, 77–103.

Mateiciucová 2008 I. Mateiciucová: *Talking Stones: The Chipped Stone Industry in Lower Austria and Moravia and the Beginnings of the Neolithic in Central Europe (LBK), 5700–4900 BC*. Dissertationes Archaeologicae Brunenses/Pragesesque. Brno 2008.

Mlejnek 2015 O. Mlejnek: *Paleolit východních svahů Drahanské vrchoviny*. Dissertationes Archaeologicae Brunenses/Pragensesque 18. Brno 2015.

Mlejnek/Škrdla 2014 O. Mlejnek/P. Škrdla: Paleolitická lokalita Skalka u Prostějova I – Na skalkách. *Acta Musei Moraviae*, *Scientiae sociales* 99, 2014, 159–167.

Mlejnek/Škrdla/Přichystal 2012 O. Mlejnek/P. Škrdla/A. Přichystal: Ondratice I/Želeč – an Early Upper Palaeolithic site in central Moravia. *Archäologiesches Korrespondenzblatt* 42, 2012, 295–314.
DOI: https://doi.org/10.11588/ak.2012.3.18620

Moreau/Brandl/Nigst 2016 L. Moreau/M. Brandl/P. R. Nigst: Did prehistoric foragers behave in an economically irrational manner? Raw material availability and technological organisation at the early Gravettian site of Willendorf II (Austria). *Quaternary International* 406A, 2016, 84–94.
DOI: https://doi.org/10.1016/j.quaint.2015.11.123

Nerudová 2014 Z. Nerudová: Paleolitická industrie z lokality Dolní Kounice XVIII – „U židovského hřbitova". *Acta Musei Moraviae*, *Scientiae sociales* 99, 2014, 141–157.

Nerudová 2016 Z. Nerudová: *Lovci posledních mamutů na Moravě*. Studie Centra kulturní antropologie 2. Brno 2016.

Nerudová/Přichystal 2001 Z. Nerudová/A. Přichystal: Nálezy ojedinělých listovitých hrotů z Moravy a Čech. *Archeologické rozhledy* 53, 2001, 343–347.

Oliva 1996 M. Oliva: Mladopaleolitický hrob Brno II jako příspěvek k počátkům šamanismu. *Archeologické rozhledy* 48, 1996, 353–383.

Oliva 2009 M. Oliva: Štípaná industrie ze severních sektorů. In: M. Oliva (ed.): *Sídliště mamutích lidí v Milovicích pod Pálavou*. Anthropos 27. Brno 2009, 229–256.

Oliva 2015 M. Oliva: Mezolitická těžba rohovce v Krumlovském lese (jižní Morava) v kontextu neolitizace střední Evropy. *Památky archeologické* 106, 2015, 5–42.

Pettit/Trinkaus 2000 P. B. Pettit/E. Trinkaus: Direct AMS radiocarbon dating of the Brno 2 Gravettian human remains. *Anthropologie* 38, 2000, 149–150.

Přichystal 2002 A. Přichystal: Výzkum surovin štípaných artefaktů magdalénského osídlení z Ochozské jeskyně. In. J. Svoboda (ed.): *Prehistorické jeskyně*. Dolnověstonické studie 7. Brno 2007, 226–228.

Přichystal 2007 A. Přichystal: Kamenná štípaná industrie. In: L. Šebela et al.: *Hlinsko. Výšinná osada lidu badenské kultury*. Spisy Archeologického ústavu AV ČR Brno 32. Brno 2007, 241–253.

Přichystal 2009 A. Přichystal: *Kamenné suroviny v pravěku východní části střední Evropy*. Brno 2009.

Přichystal 2010 A. Přichystal: Kamenná štípaná industrie. In: M. Šmíd et al.: *Hrad u Bílovic. Eneolitické hradisko na Prostějovsku*. Pravěk. Supplementum 21. Brno 2010, 107–109.

Přichystal 2019 A. Přichystal: Petrographic characteristics of cherts from Stránská skála. In: *Kopacz ed. 2019*, 30–42.

Přichystal/Svoboda/Škrdla 2003 A. Přichystal/J. A. Svoboda/P. Škrdla: Lithic Raw Materials Used by Humans at Stránská skála. In: J. A. Svoboda/O. Bar-Yosef (eds.): *Stránská skála. Origins of the Upper Paleolithic in the Brno Basin, Moravia, Czech Republic*. American School of Prehistoric Research Bulletin 47. Dolní Věstonice Studies 10. Cambridge 2003, 59–64.

Přichystal/Všianský 2012 A. Přichystal/D. Všianský: Petroarcheologický výzkum kamenné industrie z Hoštic I, Hoštic IV a Ivanovic VI. In: A. Matějíčková/P. Dvořák (eds.): *Pohřebiště z období zvoncovitých pohárů na trase dálnice D1 Vyškov-Mořice*. Pravěk. Suplementum 24. Brno 2012, 303–322.

Salaš 1987 M. Salaš: Záchranný archeologický výzkum na sídlišti z doby bronzové v Brně-Slatině. *Acta Musei Moraviae, Scientiae sociales* 72, 1987, 53–73.

Struhár 2014 V. Struhár: Contrubution to the problems of occurrence of erratic Side Notched Arrowheads ("Kerbespitze") in Eneolithic cultures. In: J. Kovárník (ed.): *International Symposium "Centenary of Jaroslav Palliardi's Neolithic and Aeneolithic Relative Chronology" and XXXIIIrd Conference on the Neolithic and Eeneolithic our countries. Moravské Budějovice, Monday 15th – Thursday 18th September 2014. Book of abstracts*. Moravské Budějovice – Hradec Králové 2014, 26, 27.

Svoboda 1985 J. A. Svoboda: Průzkum v okolí Stránské skály. *Přehled výzkumů* 1983, 1985, 21, 22.

Svoboda 1987 J. A. Svoboda: *Stránská skála. Bohunický typ v brněnské kotlině*. Studie Archeologického ústavu ČSAV v Brně 14. Praha 1987.

Svoboda 1991 J. A. Svoboda: Stránská skála. Výsledky výzkumu v letech 1985–1987. *Památky archeologické* 82, 1991, 5–47.

Svoboda et al. 2020 J. A. Svoboda/S. Boriová/G. Lengyel/P. Pokorný/A. Přichystal/S. Sázelová/J. Wilczyński: Last Glacial Maximum landscape and Epigravettian horse hunting strategy in Central Europe. The case of Stránská skála IV. *Přehled výzkumů* 61, 2020, 59–70.

Svoboda/Přichystal 1990 J. A. Svoboda/A. Přichystal: Aurignacká industrie z Přediny u Dobrochova (okr. Prostějov). *Archeologické rozhledy* 42, 1990, 475–491.

Svoboda/Šmíd 1996 J. A. Svoboda/M. Šmíd: Dílenský objekt kultury nálevkovitých pohárů na Stránské skále. *Pravěk NŘ* 4, 1996, 79–125.

Svoboda/Valoch 2003 J. A. Svoboda/K. Valoch: History and Strategy of Research at Stránská skála. In: J. A. Svoboda/O. Bar-Yosef (eds.): *Stránská skála. Origins of the Upper Paleolithic in the Brno Basin, Moravia, Czech Republic*. American School of Prehistoric Research Bulletin 47. Dolní Věstonice Studies 10. Cambridge 2003, 1–14.

Šebela 2019 L. Šebela: Use of cherts of the Stránská skála type in the prehistoric times – The Únětice culture. In: *Kopacz ed. 2019*, 81–84.

Šebela/Škrdla/Schenk 2007 L. Šebela/P. Škrdla/Z. Schenk: Hlinsko (okr. Přerov). *Přehled výzkumů* 49, 2007, 359–362.

Škrdla 2005 P. Škrdla: *The Upper Paleolithic on the Middle Course of the Morava River.* Dolní Věstonice Studies 13. Brno 2005.

Škrdla 2017 P. Škrdla: *Moravia at the onset of the Upper Paleolithic.* The Dolní Věstonice Studies 23. Brno 2017.

Škrdla et al. 2009 P. Škrdla/G. Tostevin/D. Nývlt/L. Lisá/O. Mlejnek/A. Přichystal/D. Richter: Tvarožná–Za školou. The results of 2008 excavation season. *Přehled výzkumů* 50, 2009, 11–24.

Škrdla et al. 2010 P. Škrdla/G. Tostevin/P. Matějec/D. Nývlt/Š. Hladilová/J. Kovanda/O. Mlejnek/L. Nejman: Brno (k. ú. Líšeň, okr. Brno-město). *Přehled výzkumů* 51, 2010, 269–274.

Škrdla et al. 2011a P. Škrdla/P. Matějec/G. Tostevin/T. Rychtaříková/Š. Hladilová: Brno (k. ú. Líšeň, okr. Brno-město). *Přehled výzkumů* 52/1, 2011, 140–143.

Škrdla et al. 2011b P. Škrdla/T. Rychtaříková/L. Nejman/M. Kuča: Revize paleolitického osídlení na dolním toku Bobravy. Hledání nových stratifikovaných EUP lokalit s podporou GPS a dat z dálkového průzkumu Země. *Přehled výzkumů* 52/1, 2011, 9–36.

Škrdla et al. 2012 P. Škrdla/J. Vokáčová/P. Knotek/T. Rychtaříková: Mohelenský mikroregion na počátku mladého paleolitu. *Přehled výzkumů* 53/1, 2012, 9–32.

Škrdla et al. 2014 P. Škrdla/L. Nejman/T. Rychtaříková/P. Nikolajev/L. Lisá: New observations concerning the Szeletian in Moravia. *Quartär* 61, 2014, 87–101. DOI: https://doi.org/10.7485/QU61_04

Škrdla et al. 2016 P. Škrdla/T. Rychtaříková/L. Nejman/J. Bartík/A. Hrušková/J. Krása: Ořechov IV: Nová lokalita bohunicienu nad údolím Bobravy. *Přehled výzkumů* 57/1, 2016, 11–31.

Škrdla/Cílek/Přichystal 1996 P. Škrdla/V. Cílek/A. Přichystal: Dolní Věstonice III, excavations 1993–1995. In: J. A. Svoboda (ed.): *Paleolithic in the Middle Danube region*. Spisy AÚ Brno 5. Brno 1996, 421–435.

Škrdla/Havlíček/Rychtaříková 2010a P. Škrdla/F. Havlíček/T. Rychtaříková: Křepice (okr. Břeclav). *Přehled výzkumů* 51, 2010, 282, 283.

Škrdla/Havlíček/Rychtaříková 2010b P. Škrdla/F. Havlíček/T. Rychtaříková: Nikolčice (okr. Břeclav). *Přehled výzkumů* 51, 2010, 289, 290.

Škrdla/Kuča 2012 P. Škrdla/M. Kuča: Bošovice (okr. Vyškov). *Přehled výzkumů* 53/1, 2012, 103.

Škrdla/Přichystal 1999 P. Škrdla/A. Přichystal: Bulhary (okr. Břeclav). *Přehled výzkumů* 40 (1997–1998), 1999, 149–156.

Škrdla/Rychtaříková 2012 P. Škrdla/T. Rychtaříková: Levallois Point or Blade – Which Blank was the Target Artifact of the Bohunician Technology? In: A. Pastoors/M. Peresani (eds.): *Flakes not Blades. The Role of Flake Productionat the Onset of the Upper Paleaeolithic in Europe*. Wissenschaftliche Schriften des Neanderthal Museum 5. Mettmann 2012, 199–214.

Škrdla/Tostevin 2005 P. Škrdla/G. Tostevin: Brno-Bohunice. Analýza materiálu z výzkumu v roce 2002. *Přehled výzkumů* 46, 2005, 35–61.

Šmíd 2017 M. Šmíd: *Nálevkovité poháry na Moravě*. Pravěk – Supplementum 33. Brno 2017.

Šmíd/Přichystal 2015 M. Šmíd/A. Přichystal: *Eneolitická hradiska na Prostějovsku. Ohrozim-Čubernice a Prostějov-Čechovice – Čechovsko*. Pravěk. Supplementum 29. Brno 2015.

Tichý et al. 2008 R. Tichý/J. Turek/I. Dohnálková/H. Dohnálková/R. Thér: Birituální pohřebiště kultury zvoncovitých pohárů v cihelně Tuněchody u Chrudimy. Předběžná zpráva o výzkumu pohřebiště I. *Acta archaeologica Opaviensia* 3, 2008, 45–60.

Tostevin/Škrdla 2006 G. B. Tostevin/P. Škrdla: New excavations at Bohunice and the question of the uniqueness of the type-site for the Bohunician industrial type. *Anthropologie* 44, 2006, 31–48.

Valoch 1954 K. Valoch: Paleolitická stanice na Stránské skále u Brna. *Acta Musei Moraviae, Scientiae sociales* 39, 1954, 5–30.

Valoch 1960 K. Valoch: *Magdalénien na Moravě*. Anthropos 12. Brno 1960.

Valoch 1976 K. Valoch: *Die altsteinzeitliche Fundstelle in Brno-Bohunice*. Studie Archeologického ústavu ČSAV v Brně 4. Praha 1976.

Valoch 1979 K. Valoch: Paleolitický nález z Brna-Maloměřic. *Archeologické rozhledy* 31, 1979, 290, 291.

Valoch 2003 K. Valoch: Výzkum staropaleolitické lokality Stránská skála I v Brně-Slatině. *Acta Musei Moraviae, Scientiae sociales* 88, 2003, 3–65.

Surovina jako *fossile directeur*?

Případová studie využívání rohovce typu Stránská skála

Jaroslav Bartík – Petr Škrdla

Souhrn

Stránská skála (obr. 1) představuje významnou geologickou a archeologickou lokalitu známou také jako bohatý zdroj jurských rohovců, které byly různou měrou využívány po velkou část moravského pravěku. Studie přináší základní přehled doposud známých dokladů využívání rohovce typu Stránská skála v jednotlivých obdobích (obr. 2). Jedním z hlavních cílů bylo rovněž testovat využitelnost předmětné suroviny jako významného datačního prvku ve smyslu *fossile directeur* (termín vypůjčený z paleontologie, kde identifikuje typickou fosilii určitého období). Za tímto účelem jsou zde proto analyzovány všechny chronologické horizonty, ve kterých byl doložen výskyt rohovce typu Stránská skála jak z pohledu rozsahu distribuční sítě, tak po stránce technologických a typologických aspektů kamenných industrií.

Rohovec typu Stránská skála v paleolitu

V průběhu staršího a středního paleolitu byly lidmi zdroje rohovců na Stránské skále ignorovány. K významnému využívání rohovce typu Stránská skála docházelo až od bohunicienu, ve které tvořil podstatnou část surovinové základny v brněnské kotlině a jejím okolí. Přímo na lokalitách v prostoru brněnské kotliny dosahuje podíl této suroviny přibližně 90 %, ve vzdálenosti do 15 km od brněnské kotliny stále ještě kolem 70 %, do vzdálenosti 30 km už klesá k asi 10 % a ve vzdálenosti více než 30 km je pak zastoupena již jen ojedinělými kusy. Szeletské lokality oproti bohunicienu v brněnské kotlině chybí a rohovec typu Stránská skála je zastoupen pouze několika kusy na nedaleké lokalitě Želešice III (obr. 3). Naopak surovinové základny industrie typu Líšeň/Podolí I a aurignacienu v brněnské kotlině odpovídají bohunicienu – rohovec typu Stránská skála představuje hlavní využívanou surovinu k produkci štípané industrie. V následujících obdobích paleolitu bylo využívání této suroviny výrazně odlišné. V gravettienu byla zcela ignorována. V epigravettinu byl rohovec typu Stránská skála okrajově využíván na lokalitě Stránská skála IV. Jelikož ale zdejší stratifikovaný soubor byl hodnocen spolu s artefakty z narušených poloh, není jisté, do jaké míry byl lokální rohovec využíván (v místě lokality se nacházel i pozdně eneolitický objekt s industrií dílenského charakteru). U tohoto období bude třeba petrograficky ověřit také údaj o možné přítomnosti této suroviny na maďarské lokalitě Magyorosbányia. Poněkud nejisté je díky nízké početnosti artefaktů štípání rohovce typu Stránská skála v magdalénienu, který je reprezentován pouze industrií z prostoru před Ochozskou jeskyní v Moravském krasu. V industriích z pozdního paleolitu a mezolitu nebyl rohovec typu Stránská skála doposud spolehlivě identifikován.

Z uvedeného přehledu tedy vyplývá, že v období iniciální a časné fáze mladého paleolitu (zahrnuje bohunicien, industrie typu Líšeň/Podolí I a aurignacien) byly lokality brněnské kotliny a jejího nejbližšího okolí založeny na využívání rohovce typu Stránská skála a tento materiál, v kombinaci s technologickými a typologickými charakteristikami industrií, může být považován za *fossile directeur*. Tomu kontrastuje skutečnost, že tato surovina byla zcela na okraji zájmu v szeletienu. V následujícím gravettienu byla oblast brněnské kotliny na okraji osídleného území a surovina byla kompletně ignorována, což může být interpretováno jako kulturní ale i technologická volba. Podobný nezájem o využití rohovce typu Stránská skála je i v následujících obdobích (epigravettien a magdalénien), tudíž pro období střední a pozdní fáze mladého paleolitu rozhodně nelze tento rohovec považovat za *fossile directeur*.

Rohovec typu Stránská skála v kulturách zemědělského pravěku

Analýza dokladů distribuce rohovce typu Stránská skála v postapaleolitických obdobích odhalila jeho výskyt na více jak šesti desítkách archeologických lokalit (obr. 2). Po chronologické stránce náleží největší část z nich k lengyelské kultuře (46 %). Zajímavé je, že v průběhu staršího (LnK) a středního (VpK) neolitu byla surovina zcela ignorována patrně v důsledku již od mezolitu zažitých tradic spojených s exploatací a využíváním rohovce typu Krumlovský les a na Brněnsku také rohovce typu Olomučany. V průběhu časného eneolitu (jordanovská kultura) sice využívání rohovce typu Stránská skála přežívá, ale počet lokalit s jeho výskytem značně klesá, což zřejmě souvisí i s celkovou demografickou regulací osídlení oproti předchozímu období. Druhý z výrazných vrcholů distribuce rohovce typu Stránská skála se váže na období vývoje kultury nálevkovitých pohárů. V této době však již nedosáhla distribuce takové intenzity jako v případě kultury s MMK. Na rozdíl od předešlého období přibylo vzdálenějších dokladů distribuce až na několik desítek (40–50) kilometrů (obr. 4).

Pro střední eneolit zatím nedisponujeme přímými doklady využívání rohovce typu Stránská skála a o zániku distribuční sítě zájmové suroviny svědčí i její petroarcheologicky potvrzená absence na hradiskách střední Moravy, kam v průběhu trvání KNP proudila.

Z období mladého eneolitu disponujeme jen sporadickými doklady distribuce ve formě ojedinělých úštěpů a suroviny ze tří výšinných lokalit jevišovické kultury, které se váží na kopcovitý terén na S až SV okraji Brna a jeho okolí. V tomto období tedy nemůže být prozatím *fossile directeur* pro nízkou početnost artefaktů spolehlivě testován.

Využívání rohovce typu Stránská skála pokračovalo v omezené míře také v pozdním eneolitu. Zatímco v případě kultury se šňůrovou keramikou disponujeme pouze jedinou komponentou z hrobového kontextu, u nositelů kultury zvoncovitých pohárů byl doložen jak kontext sídlištní, tak kontext funerální. V období KZP máme doloženu existenci sídlištního areálu přímo na Stránské skále v poloze SS IV, kde bylo kromě běžných sídlištních aktivit prokázáno také intenzivní zpracovávání místních rohovců. Přestože odtud evidujeme několik tisíců artefaktů spojitelných s výrobou štípané industrie, dokladů distribuce rohovce typu Stránská skála na okolní lokality KZP máme doposud poměrně málo. Pokud nepočítáme Stránskou skálu, tak atefakty z rohovce typu Stránská skála jsou prozatím známy z dalších pěti lokalit rozprostírajících se na katastrech města Brna a okolí. Z prostorového hlediska byla tedy distribuce suroviny značně limitovaná a v případě většího zastoupení suroviny nepřekračuje distribuční rádius 15 km (obr. 6). Mimo oblast Brněnska byla surovina petrograficky doložena ojedinělými artefakty pouze v rámci klastru pohřebišť v okolí Hoštic a Ivanovic na Hané a ve zcela ojedinělých případech byl prokázán výskyt rohovce typu Stránská skála i mimo území Moravy (Tuněchody ve V Čechách a Skalice na JZ Slovensku).

Sporadické doklady využívání rohovce typu Stránská skála pocházejí i ze samotného přelomu pozdního eneolitu a starší doby bronzové, kdy se dva kusy rohovce projevily ve výbavě hrobu protoúnětické kultury v Bedřichovicích. Ve více případech je doloženo využívání rohovce typu Stránská skála až v mladších vývojových fázích únětické kultury. Na území příměstských částí Brna a jeho blízkého okolí se rohovec původem ze Stránské skály či nedalekých Švédských valů vyskytl v kolekcích štípané industrie na sídlišti v Černých Polích, Slatině, Tuřanech a na sídlišti i pohřebišti v nedalekém Podolí u Brna. Z analýzy distribuce rohovce typu Stránská skála ve starší době bronzové tedy vyplývá, že surovina měla převážně lokální význam a její distribuční rádius zpravidla nepřesáhl hodnotu 5 km (obr. 6). Mimo tuto oblast byl rohovec typu Stránská skála zaregistrován pouze ojedinělými kusy na výšinné lokalitě Blučina-Cezavy. V případě mladšího úseku starší doby bronzové už rohovec typu Stránská skála nesehrál v surovinových spektrech štípaných industrií významnější roli. Jediný doklad využití v prostředí věteřovské skupiny pochází z hradiska v Budkovicích.

V případě post-paleolitických štípaných industrií můžeme z chronologického a technologického hlediska konstatovat, že rohovec typu Stránská skála nevykazuje jasně ohraničenou strukturu spojitelnou pouze s jednou konkrétní archeologickou kulturou ve smyslu pojetí *fossile directeur*. Pokud je však tento rohohovec významněji přítomen na lokalitě vzdálené do několika málo desítek kilometrů od Stránské skály, můžeme zde oprávněně předpokládat jeho vazbu s osídlením z období spadajícího do rozmezí mladého neolitu až staršího eneolitu v případě, že jde o technologicky vyspělé čepelové industrie (obr. 5), nebo z pozdního eneolitu až starší doby bronzové, v případě industrií úštěpových (obr. 7). Pokud jde o testování *fossile directeur* z typologického hlediska, můžeme pozorovat některé prozatím hypotetické vazby na konkrétní typ standardizovaných nástrojů, které bude nutno s ohledem na jejich nízkou početnost dále testovat a verifikovat. V případě staršího eneolitu se jedná například o mikrolity (trojúhelníky, krátké trapézy) a některé formy hrotů (zejména hroty typu Štramberk). U industrií pozdního eneolitu se pak jedná o šipky s křidélky či segmenty a v případě straší doby bronzové o nástroje s pilkovitou retuší a různé formy nožů. Některé z uvedených nástrojů (zejména pokud se zaměříme na kulturu zvoncovitých pohárů a únětickou kulturu) představují *fossile directeur* pro jednotlivé kultury samy o sobě, ve spojení se surovinou však mohou získat další cenný datační potenciál pro zařazení do jemnějších chronologických fází nebo k určení regionální provenience či socioekonomického kontextu.

Obr. 1. Stránská skála u Brna (pohled od SV).
Obr. 2. Přehled lokalit s doklady výskytu rohovce typu Stránská skála v jednotlivých obdobích.
Obr. 3. Distribuce rohovce typu Stránská skála v paleolitu.
Obr. 4. Distribuce rohovce typu Stránská skála v mladém neolitu až starším eneolitu.
Obr. 5. Ukázka čepelové produkce a vybraných nástrojů kultury nálevkovitých pohárů z rohovce typu Stránská skála. 1–7, 9–26 – Stránská skála III; 8 – Brno-Líšeň, Čtvrtě.
Obr. 6. Distribuce rohovce typu Stránská skála v mladém eneolitu až starší době bronzové.
Obr. 7. Ukázka úštěpové produkce. 1–16 – Stránská skála IV, pozdní eneolit; 17–27 – Podolí-Příčný, starší doba bronzová (podle *Kaňáková Hladíková/Parma 2015*).

Mgr. Jaroslav Bartík, Ph.D.
The Czech Academy of Sciences
Institute of Archaeology in Brno
Čechyňska 363/19
CZ – 602 00 Brno
bartik@arub.cz

Ing. Petr Škrdla, Ph.D., DSc.
The Czech Academy of Sciences
Institute of Archaeology in Brno
Čechyňska 363/19
CZ – 602 00 Brno
ps8a@seznam.cz

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 231–250

USE OF OBSIDIAN IN SLOVAK PREHISTORY[1]

Ľubomíra Kaminská

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.15

Keywords: prehistory, Slovakia, sources of obsidian, archaeological cultures, raw material use

Abstract: Obsidian near the Zemplín Hills comes from primary (Viničky) and secondary (Brehov and Cejkov) sources. In Viničky, primary sources of obsidian come from two phases of rhyolite volcanism. The older phase is represented by perlite breccias with obsidian found underneath rhyolite extrusive body, younger phase consists of obsidian and perlite bonded with intrusive dyke bodies.

The Brehov site is a primary source of secondary obsidian accumulations in Quaternary deluvial/fluvial deposits, partially covered by eolian sands in the area of Brehov and Cejkov. These allochthonous obsidian nodule occurrences with surface relief were the principal source of obsidian industry found at Palaeolithic – Neolithic archaeological sites.

Obsidian was mostly used by the cultures settled in Eastern Slovakia, in the vicinity of its sources. In the Palaeolithic, the cultures of Gravettian and Epigravettian prefered this raw material. In Spiš, it occurs in the Świderian culture and in other Late Palaeolithic and Mesolithic cultures. Mesolithic industry in Košice-Barca was made exclusively of obsidian. In the Neolithic, it was the most prevalent raw material in Eastern Linear Potter culture in the Eastern Slovak Lowland and in Bükk culture. In other parts of Slovakia, obsidian was most favoured during the existence of Želiezovce group and Lengyel culture. In Eastern Slovakia, obsidian was used also in the Late Neolithic and the Eneolithic, and partly also in the Early Bronze Age.

INTRODUCTION

Apart from climate and environmental conditions, information on used lithic raw materials is an important aspect when evaluating life and activities of people of the Stone Age. It can reveal much about the mobility of both hunter and farmer societies as well as the extent of their contacts on the local and inter-regional levels. Therefore, it is important to be aware of what kinds of lithic raw materials were used and from what sources they came.

Slovakia's sources of high-quality lithic raw materials are scarce. It was mostly radiolarites from the Klippen Belt and limnosilicites from various regions that were used, in Eastern Slovakia it was mainly obsidian (*Kaminská 1991*; *2013*; *Mišík 1969*; *1975*).

OBSIDIAN SOURCES

Abundant finds of obsidian tools of various ages, found within the area of the Zemplín Hills (Fig. 1) several years ago, suggested that a source of obsidian can be expected in the area (*Janšák 1935*). Official geological maps with scale of 1 : 50 000 point to the occurrence of obsidians in the southern part of the Zemplín Hills (*Baňacký et al. 1988*), in association with acid volcanism. The appearance of vineyards

[1] This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-20-0521 and project VEGA 2/0084/18.

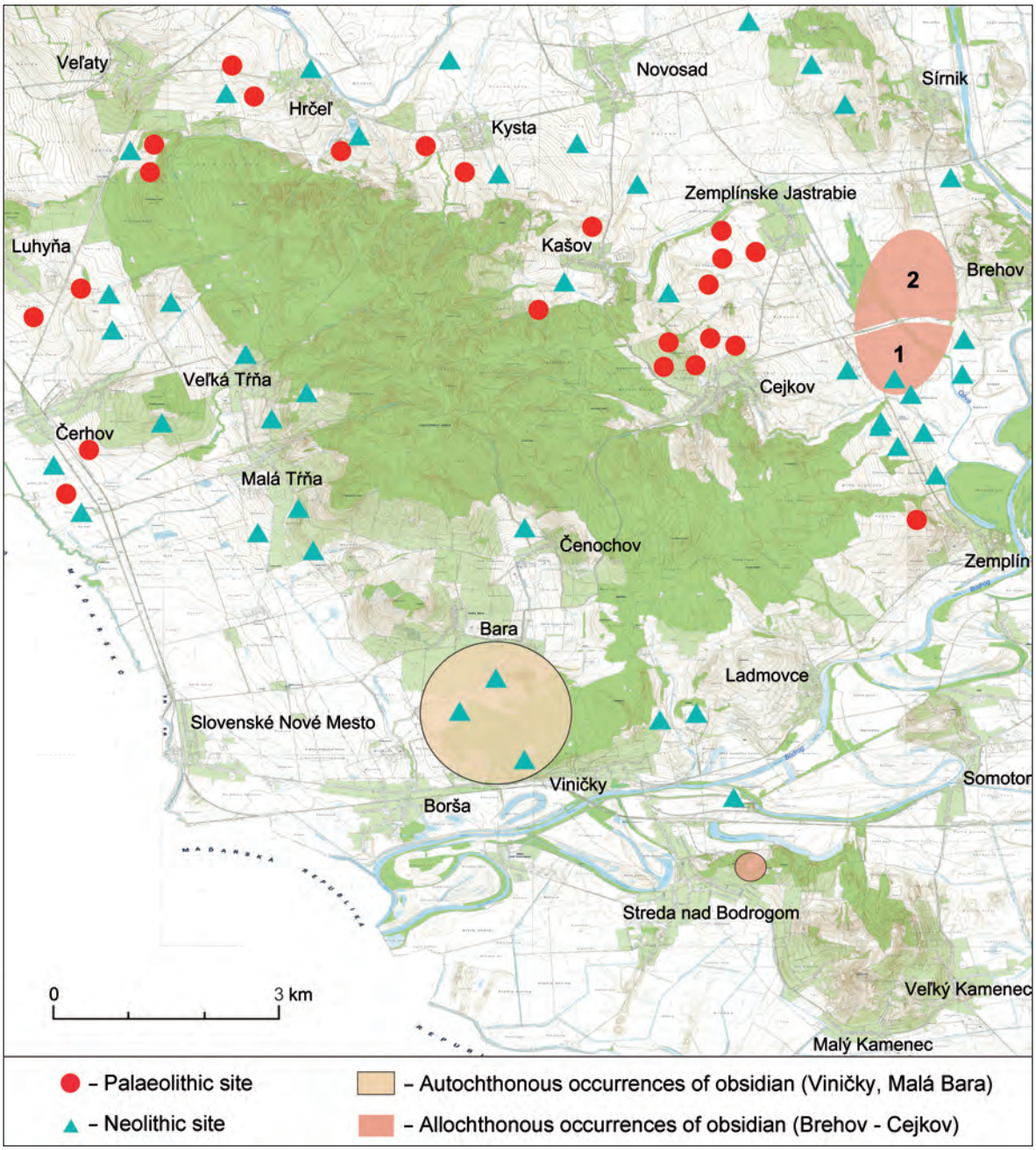


Fig. 1. Map of the area of the Zemplín Hills with autochthonous and allochthonous sources of obsidian, with sites from the Palaeolithic and Neolithic. Allochthonous sources from Brehov and Cejkov: 1 – Cejkov-Žihľavník; 2 – Brehov-Za alejou (Brehov 2).

and wine cellars in the southern part of the Zemplín Hills also indicates that the products of rhyolitic volcanism in the vineyards of Viničky are the primary sources of obsidian (*Ivan 1962*; *1964*; *Kaminská/Ďuďa 1985*; *Šalát/Ončáková 1964*).

Other sources of obsidian are located in the area of the Tokaj Hills in Northeastern Hungary. The geochemical differences in the composition of the obsidians allowed for the division of the sources into Carpathian group C1, associated with the Zemplín Hills, and Carpathian group C2 (subgroups C2a and C2b) linked to the Tokaj Region in Hungary (*Williams Thorpe/Warren/Nandris 1984*). Such a division was confirmed by later analyses (*Biró 1984*), leading to further division of group C1 into subgroups C1a and C1b. Subgroup C1a contains finds from the archaeological sites of Kašov and Cejkov, primary source located in Viničky was classified as subgroup C1b (*Biró/Kasztovszky 2013*; *Kasztovszky/Biró/Kis 2014*).

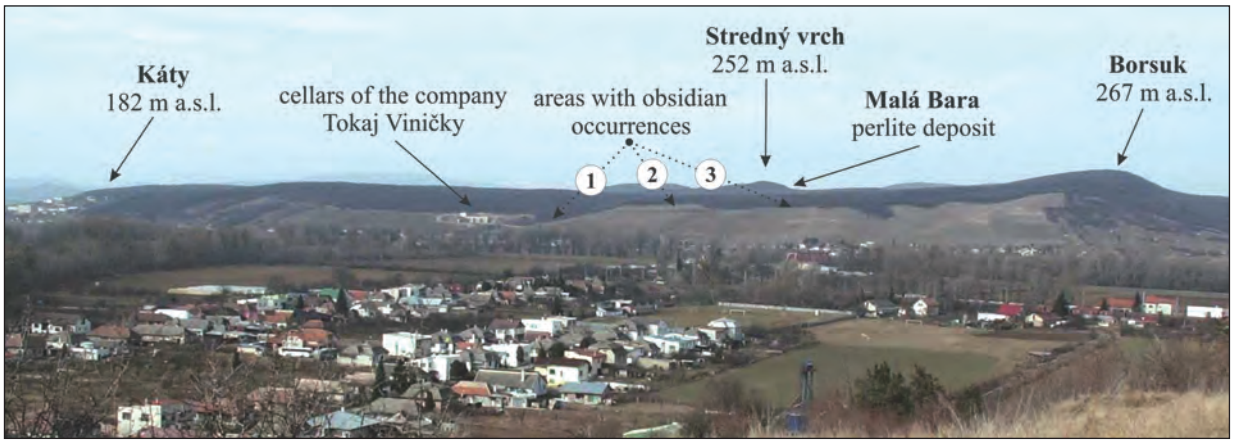


Fig. 2. Panorama of the SW side of the Borsuk rhyolite dome/flow next to the village Viničky with obsidian and perlite occurences, including the Tokaj Viničky Ltd. Winecellars; 1–3 – obsidian occurrences. View from the southeast (photo by P. Bačo; after *Bačo et al. 2017*).

Viničky

Primary sources of obsidian occur in the peripheral parts of the extrusive rhyolite body near Malá Bara and in several places in the cadastral area of Viničky (Fig. 1; 2). In relation to these occurrences, more detailed results of investigation and dating by K/Ar method were published (*Bačo et al. 2017*). From the aspect of availability of the obsidian in the Stone Age, we consider the following findings and interpretations essential.

Obsidian in forms of nodules always occurs along with perlite, usually as obsidian nodules in perlite environment. In the area of Viničky, obsidian is associated with two types of geological/lithological settings corresponding with two phases of rhyolite volcanism.

The first type of geological/lithological setting discovered in new cellars (Tokaj Viničky Ltd./PROMACO Winecellars) is perlitized dyke body or bodies. Obsidian is found in their perlitized glassy parts. From them, they eroded to eluvial/deluvial sediments (*Bačo et al. 2017*, 215, fig. 9). Multiple redisposition of obsidian after its creation (the period of Upper Sarmat to Pannon) leading to secondary cumulation of obsidian cannot be definitely excluded (*Bačo et al. 2017*, fig. 21). Obsidian from the same environment is located also in the vineyards near the cellars (*Bačo et al. 2017*, fig. 7: 2–3; 8).

Sizes of the collected obsidian nodules vary from 10 to 14 cm, although smaller ones are the most frequent. The surface of the nodules is usually smooth, however, initial sculpture in form of coarse surface and small dimples occurs on some of them (*Bačo et al. 2017*, fig. 10; 11c). Distinct sculpture of the surface of obsidian known from archaeological sites was not detected. On thin chips of obsidian from Viničky, fluidal texture can be seen (*Bačo et al. 2017*, 216; *Kaminská/Ďuďa 1985*, 122).

The second setting with the outcrops of obsidian are perlite breccias. Their occurrence is directly verified also in the new cellars (Tokaj Viničky LTD/PROMACO Winecellars). These perlite breccias are interpreted as bedrock breccias of an extrusive body (Borsuk) which has a form of a massive lava stream in this part (*Bačo et al. 2011*). Their dating falls to the Middle Baden-Pannon (*Bačo et al. 2017*, fig. 21). Obsidian in these breccias makes fragments of 10–15 cm, however, smaller on average, with surface without a distinct sculpture (*Bačo et al. 2017*, 216–218, fig. 12; 13). Geological settings in Malá Bara is similar to the settings in the neighbouring Viničky.

Streda nad Bodrogom

Perlite with obsidian is also known from Streda nad Bodrogom. The name "marekanite" is used for the obsidian from this source. It occurs in the settings of redeposited rhyolite and rhyodacite volcaniclastic rocks and its primary source is unknown. Dating of obsidian by K/Ar method pointed to a different – older – age than that of the obsidians from the territory of Viničky (*Bačo et al. 2017*, fig. 21; table 1). Sizes of the obsidians varied between 0.5–5 cm, being mainly about 2.5 cm big. Large nodules were rare. Irisation visible on trommels is typical for the obsidian from this location. Geological position of horizons

containing obsidian, discovered in the quarry, gave rise to natural outcrops of the material in the past, which was thus could have been freely collected in the Stone Ages.

Brehov

Allochthonous locations of obsidian with surface with sculpture as known from the obsidian from archaeological sites were discovered in the territory of Brehov and the neighbouring village of Cejkov. Originally assumed source of obsidian might have been a site with common occurrence of strong glass rhyodacite with local perlitic evolution. The site was detected by exploring the underneath of an andesite extrusive body of Veľký vrch, north of Brehov (Fig. 1). Obsidian might have eroded from the site and transported to secondary sites in the vicinity (*Bacsó et al. 1995a*; *1995b*; *Bačo et al. 2003*).

One of the secondary sites is Brehov-Za alejou (*Bacsó et al. 1995b*; *Bačo et al. 2003*). Obsidian was preserved within the loamy weathered rhyodacites and their breccias (Fig. 1). They are covered with eolian sands of thickness up to 2 m. Obsidian was found in the form of nodules, with no traces of modification. The size of the obsidian fragments varies from 5 mm to 10 cm. Their surface relief frequently varies, sometimes rather indistinct (*Bačo et al. 2017*, 219, 220, fig. 18; 19). The area west of Brehov with the occurrence of obsidian is called Brehov 2 (the sites of Ošva, Trávnický kopec, Kereškeň) and it overlaps the site of Brehov-Za alejou.

Other numerous finds of obsidian fragments with sculpture are located in the fields southeast of the Zemplín – Cejkov – Brehov crossroads, as far as the Ošva River, and are identical with the finds from the sites with frequent occurrence of obsidian, presented by *Š. Janšák* (*1935*, 56). The site southwest of Brehov, in the cadastral area of Cejkov, called Cejkov-Žihľavník (*Přichystal/Škrdla 2014*, 219) or Cejkov – Malé lúky-Žihľavník (*Bačo et al. 2017*, 219), are particularly important. Trenches have confirmed the occurrence of fragmentarily preserved red or white clays that are considered to be transformed volcaniclastic rocks in these two locations (*Přichystal/Škrdla 2014*, 219). Today, they are partly covered by eolian sands or clay (*Přichystal/Škrdla 2014*, 217). It is assumed that the obsidian was brought in this territory from its primary source, as deluviofluvial sediments, or comes from gravel-sand deposits of the local rivers.

Obsidian fragments with average size of 5–10 cm are found at the studied secondary sites, however, a core of 2.59 kg was also discovered (*Přichystal/Škrdla 2014*, 221). The obsidian surface was secondarily shaped by water, in the time when of deposition in permeable rocks, most probably tuffs (*Přichystal/Škrdla 2014*, 217). Besides obsidian nodules, partly modified raw material such as flakes and rarely tools suggest at least primary testing of raw material or preparation of cores in the studied area. Secondary sources of obsidian in the territory of Brehov – Cejkov – Zemplín spread over an area of 6 km^2 (*Přichystal/Škrdla 2014*, 224). They represent a newly discovered source of the raw material used for production of obsidian industry whose primary location was probably situated underneath the andesite horizon at Veľký vrch near Brehov (*Bačo et al. 2003*; *2017*, 224; *Přichystal/Škrdla 2014*, 217).

DATING OF OBSIDIAN

Geological position and radiometric dating of products of rhyolite volcanism in Eastern Slovakia, which are associated with the creation of obsidian, classify this type of volcanism into the period of Upper Sarmat/Lower Pannon (*Lexa/Kaličiak 2000*). Obsidians from Viničky was dated to the previous period, using the fission track dating method which identified their age to 11.1 ±0.8 MA years (*Repčok 1977*). The age of the obsidian from the archaeological site of Hraň near Brehov was set to 14.2 ±0.5 MA years (*Repčok/Kaličiak/Bacsó 1988*). Further dating (*Bigazzi et al. 1990*) showed differences in the ages of primary sources of obsidian from Tokaj in Northeastern Hungay (10 million years) and those from the Zemplín Hills including most obsidian artefacts from the Tokaj region (15 million years).

We can currently work with several K/Ar datings of obsidian from primary sources as well as from archaeological sites (*Bačo et al. 2017,* fig. 21; table 1). Based on the dating, we can determine the age of obsidian from primary and secondary sources, as well as from archaeological sites (Fig. 3). Primary sources of obsidians in Viničky can be divided into two phases of rhyolitic volcanism with defined geological position. The older phase is represented by perlite breccias with obsidian in the bedrock of the rhyolite extrusive body within 13.52 ±0.81–11.58 ±0.46 MA years. The younger phase consists of obsidian and perlite integrated within the intrusive bodies of dyke type – 11.19 ±0.53–11.04 ±0.34 MA

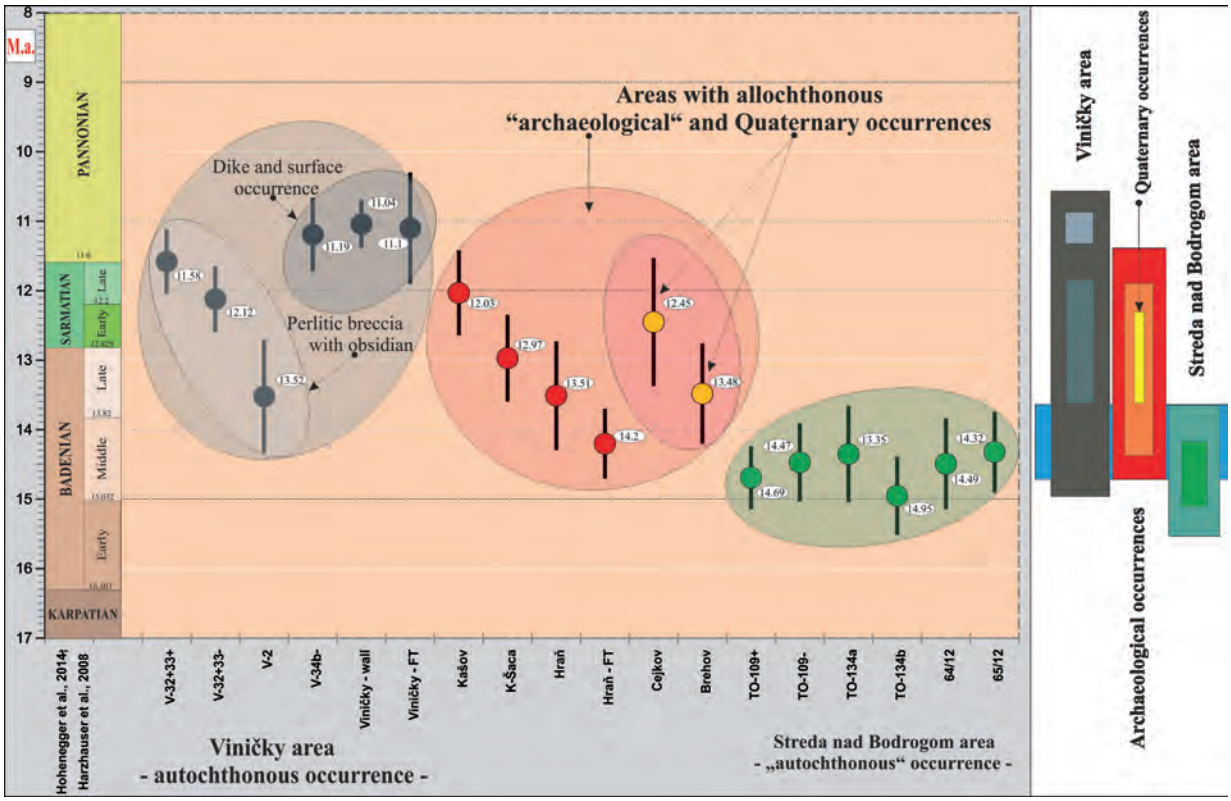


Fig. 3. Results of isotope dating of volcanic glasses in the Zemplín Hills region grouped in accordance with localities and the type of occurrence (after *Bačo et al. 2017*).

years. Obsidian – marekanite from Streda nad Bodrogom comes from a currently unknown source and it is older – 14.95 ±0.56–14.32 ±0.58 MA years.

Several obsidian fragments from secondary positions and archaeological sites have been dated as follows: Cejkov – 12.45 ±0.92 MA years, Brehov – 13.48 ±0.72 MA years, Hraň – 13.51 ±0.78 MA years and 14.02 ±0.50 MA years, Kašov – 12.03 ±0.61 MA years and Košice-Šaca – 12.97 ±0.62 MA years. Most recently, obsidian from Hraň was dated by the fission-track dating method (12.45 ±0.40 Ma) so was the obsidian from Brehov (11.62 ±0.24 Ma) and Viničky (12.19 ±0.21 Ma; *Kohút et al. 2021*). The span of data of these obsidian fragments is rather wide, but the dating overlaps the dating of the known primary and secondary sources of obsidian originating in Eastern Slovakia.

USE OF OBSIDIAN SOURCES

As a high-quality raw material for production of chipped tools, obsidian was used mainly by the cultures settled in the region of the Zemplín Hills, where its natural sources are located (Fig. 1). By the means of contacts with other cultures, obsidian occurrs also in more distant territories. The best-known work dealing with the occurrence of obsidian industry at the sites near the Zemplín Hills was written by *Š. Janšák* (*1935*). Since then, new information on the importance of obsidian for prehistoric societies has been obtained. The extent of use of obsidian by individual archaeological cultures in the lithic periods varied. The use of obsidian decreased with increasing distance from its natural source. Other local rocks were also used; they were of more or less similar quality, including, e.g., radiolarite, limnosilicite, chert, silified sandstone, and andesite (*Kaminská 1991*; *2001*; *2013*). The presence of raw materials originating in distant sources has been confirmed at individual sites (flint from the territory of Poland, Volhynian flint, limnosilicite and quartz porphyry from Northeastern Hungary, etc.).

Until now, no special attention was paid to the sculpture of obsidian nodules, artefacts and flakes when studying obsidian industry in Slovakia. Only the presence of sculpture without detailed charac-

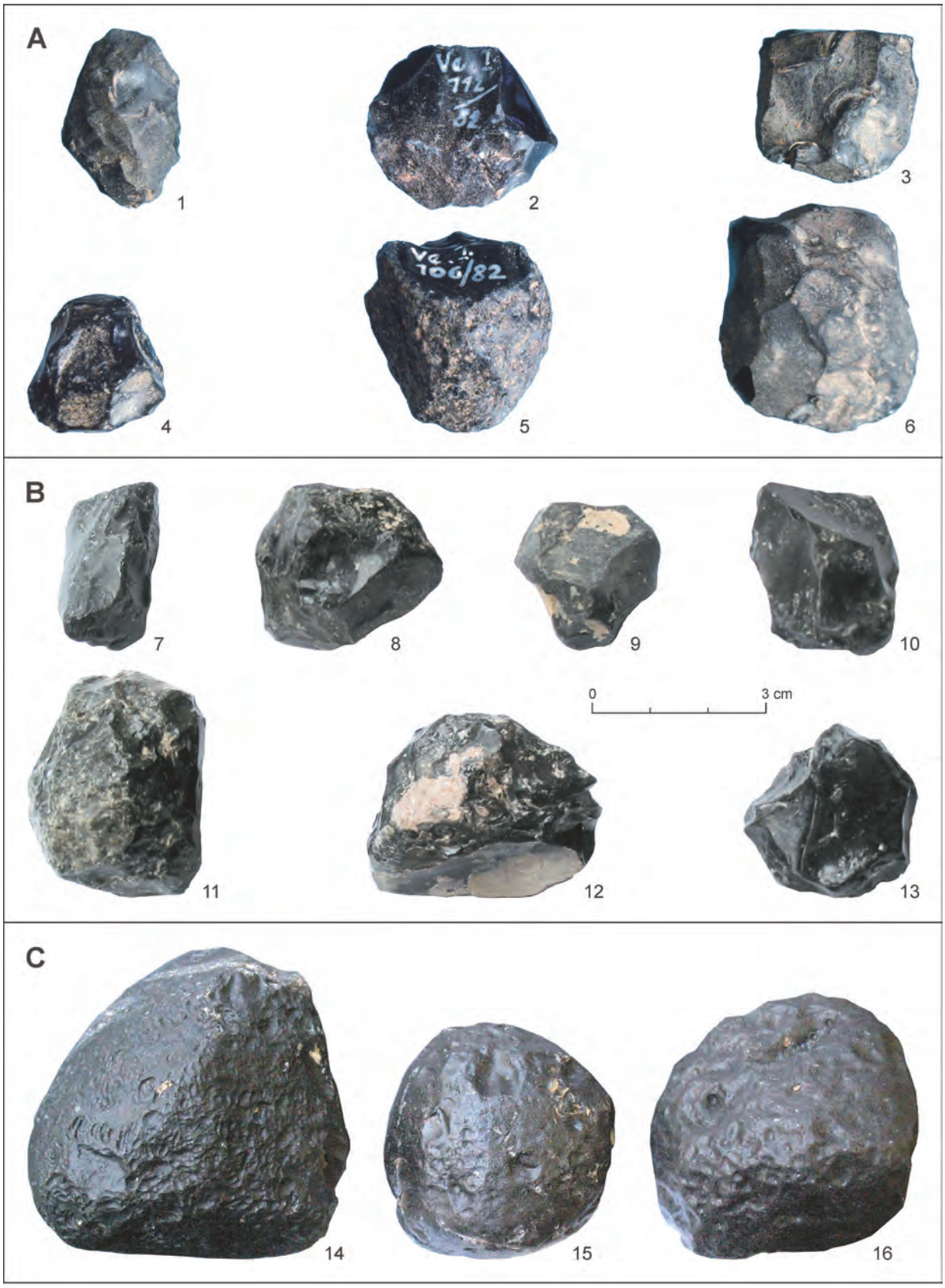


Fig. 4. Obsidian nodules with sculpture. A – Epigravettian site Veľaty I; B – Viničky, site 2 in fig. 2; C – Brehov-Za alejou (Brehov 2; photo by A. Marková and by P. Bačo; after *Bačo et al. 2017,* modified).

teristics was usually evaluated. Therefore, today we cannot say exactly at which archaeological sites the sculpture of obsidian is identical with that observe on the material from Brehov and Cejkov or the one from Viničky. Sculpture of obsidian fragments from the sources near Brehov and Cejkov is distinct (*Přichystal/Škrdla 2014*, 217). However, obsidian with less developed sculpture also occurred at following sites (Fig. 4: C), Brehov-Za alejou (*Bačo et al. 2017*, 219, fig. 18) and Cejkov-Žihľavník (*Bačo et al. 2017*, 219, fig. 16). Obsidian with original sculpture can be collected in Viničky (Fig. 4: B) even today (*Bačo et al. 2017*, 215, fig. 8; 10a). Most obsidians from archaeological sites have distinct sculpture, but the specimens with sculpture of initial working phase occur as well. Comparable sculpture can be seen on obsidian from the Epigravettian site of Veľaty I (Fig. 4: A). Which source does the obsidian used for the production of chipped industry come from? With regard to the amount of obsidian finds at archaeological sites, it is obvious that the sources located in the Zemplín Hills were used. Developed sculpture on obsidians occurs in the currently known sources in Cejkov and Brehov. The majority of obsidians, especially at the sites rich in finds, such as Kašov-upper layer, had been reduced from decorticated cores and, thus, it is difficult to identify where they came from. In the Neolithic in particular, settlement sites surrounded the Zemplín Hills from all sides, and it is difficult to imagine that they would have ignored the sources at Viničky (if they were accessible – and we have no reason not to think so). The amount of currently visible obsidian in Viničky is incomparably larger than the amount of the raw material at the allochthonous occurrence of obsidian nodules in the quaternary sediments at Cejkov and Brehov. Moreover, we cannot exclude possible existence of another source yet unknown. Thus, we think it is very probable that several sources of obsidian near the Zemplín Hills were used in prehistory (*Kaminská 2018*).

Secondary accumulations of obsidian nodules in Cejkov and Brehov, probably from the primary sourcces in Brehov, are now considered the main source (*Bačo et al. 2003*; *2017*, 226; *Bačo/Bačová 2014*; *Přichystal/Škrdla 2014*, 224), and the Viničky was probably only a subordinate source of obsidian.

Palaeolithic

Obsidian was used in the territory of Slovakia since the Upper Palaeolithic. A single tool found at the site of Cejkov-Žihľavník, dated into the Middle Palaeolithic (*Přichystal/Škrdla 2014*, 223), is not considered sufficient evidence of the use of obsidian in the Middle Palaeolithic. Middle Palaeolithic settlement in the vicinity of the Zemplín Hills has not been archaeologically confirmed, and obsidian artefacts have not been discovered at any other Middle Palaeolithic site in Slovakia (Hôrka-Ondrej, Gánovce-Hrádok, Bojnice I and III, etc.). Six artefacts – five flakes and one borer – occurred in layer XIX associated with the Mousterian culture in the Obłazowa cave in Southern Poland (*Valde-Nowak 2003*, 32, table. 2). Obsidian (35 artefacts) was found in the stone industry collection from the Szeletian settlement in Moravany nad Váhom-Dlhá in Western Slovakia (*Nemergut 2010*; *Nemergut/Cheben M./Gregor 2012*), dated to 33,600 ±300 BP (Poz-29011; *Kaminská/Kozłowski/Škrdla 2011*).

The production of chipped lithic industry of the Aurignacian culture, detected at sites in the Košice Basin, was almost exclusively based on the use of limnosilicite coming from the sources in the Slanské Hills (*Kaminská 1991*; *2001*; *2013*). Obsidian represented only a small number of finds in Košice-Barca I, Košice-Barca II, Kechnec I (*Bánesz 1968*) and Čečejovce (*Kaminská 1990*). Most frequently, endscrapers were made of it. Dating of the Aurignacian of the Košická kotlina basin is set to 35.41–28.34 ka BP (*Chu et al. 2018*; *2020*; *Verpoorte 2002*, 326, table 9). In the Eastern Slovak Lowland and in the middle Ondava River Basin, obsidian was only found in small numbers, too. It represented 5.10% of the finds at the site of Nižný Hrabovec I + II and only 4.95% at Nižný Hrabovec III (*Kaminská et al. 2000*). Obsidian was more frequently used (19%) in Tibava (*Bánesz 1960*). According to geochemical analyses, the obsidian came from Hungarian sources labelled as Carpathian group C2, not from Slovakia (*Williams Thorpe/Warren/Nandris 1984*, 195). The distinctly patinated obsidian artefacsts in Tibava include mainly carinated and massive endscrapers (Fig. 5), blades and blade flakes.

The evidence of Aurignacian settlement is absent within the area of the Zemplínske Hills. In the last few years, higher concentration of sites and finds of chipped lithic industry was detected in the area of Čerhov – Veľká Tŕňa. The finds have not been evaluated yet. Only the collection of leaf points from Čerhov and Veľká Tŕňa has been published. The sites are preliminarily assessed as Aurignacian, intervened by the Szeletian culture (*Voľanská 2016*, 13). The leaf points are made of limnosilicite, flint and radiolarite. Most of the collected industry is made of obsidian (*Voľanská 2016*, 10) and can be probably associated with the Neolithic settlement.

Fig. 5. Tibava. Carinated endscrapers made of patinated obsidian. Aurignacian (photo by A. Marková).

In the Eastern Slovak Lowland, the use of obsidian increased most significantly in the middle and late stages of the Upper Palaeolithic, when the surroundings of the Zemplín Hills were inhabited by the hunters-gatherers groups of the Late Gravettian and Epigravettian cultures. Mainly the northern periphery of the Zemplín Hills was settled, in the immediate vicinity of the newly confirmed sources of obsidian of Carpathian group C1a, located west and southwest of Brehov (*Přichystal/Škrdla 2014*). Obsidian artefacts are frequently found in the fields within the cadastral areas of the neighbouring villages, such as Cejkov, Kašov, Zemplínske Jastrabie (*Bánesz 1976*, 241–243), Kysta (*Bánesz 1980*, 34), Hrčeľ, Veľaty (*Kaminská 1995*). The above-mentioned sites surround the Zemplín Hills from northeast and north and are nearer to the sources in the Cejkov – Brehov – Zemplín area. Nevertheless, the finds from Zemplín and Malá Tŕňa are presented in older collections (*Andel 1955*, 146). Absence of other sites on the western side of the Zemplín Hills is probably a result of insufficient research, as shown by increasing number of Upper Palaeolithic sites from the cadastral areas of Veľká Tŕňa and Čerhov (*Voľanská 2016*).

With regard to the amount and the character of the artefacts, stratigraphic information and dating, the sites of Cejkov and Kašov are the most important. In Cejkov, Gravettian and Epigravettian settlement is located on the hilltop and the slopes of Tokaj Hill (Cejkov I–V). Numerous chipped lithic collections from several sites come from the long-term research of *L. Bánesz* (*1960*; *1969*; *1993*; *1996*), as well as from the revision excavations in 2001 (*Kaminská/Tomášková 2004*). On the majority of these sites, obsidian prevails. However, limnosilicite of various provenance and patinated flint from distant sources were also quite frequent. Individual sites in the Cejkov area were being repeatedly re-settled and thus the industry found mainly in the topsoil cannot be accurately dated into individual chronological stages. Sites which were fully excavated and where finds could be dated are few. Raw material composition of the lithic industry points to certain directions of hunter groups' movement in the territory of Eastern Slovakia. The oldest finds come from Cejkov I and III (*Bánesz 1959*), where occurrence of limnosilicite (probably from Hungary) and Volhynian flint from Transcarpathian Ukraine has been recorded. The main settlement of Late Gravettian culture in Cejkov I has been chronologically set by several datings between 24.36–21.50 ka BP (*Kaminská/Tomášková 2004*; *Verpoorte 2002*). Hunters of Late Gravettian culture brought obsidian to the site not only for immediate use but also to have a reserve. During the excavation at Cejkov I in 1969, an accumulation of small obsidian nodules with sculpture was uncovered in Trench II, over an area of 50 x 35 cm (*Bánesz 1974*, fig. 4). They represented an imported raw material and artefacts that were made of it later, in the area of the settlement.

Based on raw material composition, we can estimate the routes of expansion of the culture, especially those going to the north, to the Carpathian passes which were important connection routes connecting the region with the territory of Southern Poland. Late Gravettian settlement was not concentrated only in the Eastern Slovak Lowland, it expanded to areas further to the north, along the Ondava and Topľa River basins. This direction of expansion of the Late Gravettian is documented by the finds of chipped industry from the site of Marhaň (*Valde-Nowak 2008*). Untypical shouldered points occur in the typological composition of the industry and the range of raw materials includes limnosilicite and Volhynian flint, as well as radiolarite.

The sites of Cejkov (*Bánesz 1959*, 770; *1988*) and Kašov I-lower layer (*Bánesz 1969*; *Novák 2002*) are dated to the end of the Late Gravettian. Erratic silicite from Silesia is also represented in the inventories from the sites. A considerable portion of artefacts (49.32%) from the site of Kašov I-lower layer was reduced

from patinated flints (erratic flint from Silesia, Kraków-Jurassic and Volhynian flint). Obsidian artefacts created 33.26% of the collection (*Bánesz 1969*; *Novák 2002*). The lower layer was dated by ^{14}C method to 20,700 ±350 BP (*Bánesz 1993*).

Erratic silicite was probably imported by the groups of Gravettian hunters who migrated from Southern Poland over the Carpathians to Russian flatlands because of the aggravated climatic conditions in the end of the Last Glacial Maximum (*Kozłowski 1986*; *Lengyel 2018*, 148, 149; *Svoboda et al. 2000*, 11; *Wilczyński 2009*, 116). Some of them might have arrived in the Eastern Slovak Lowland and Košice Basin along the Carpathian passes.

West of the Eastern Slovak Lowland, Late Gravettian sites have been recorded. Košice-Barca-Svetlá III is the most significant one. Obsidian occurred there, however, patinated flint prevailed (*Bánesz 1967*).

In the Late Gravettian period, obsidian sporadically occurred also at the sites in Western Slovakia. The finds from the excavations of *J. Bárta* (*1988*) in Trenčianske Bohuslavice included 0.7% of artefacts made of obsidian (*Žaár 2007*). Only a small number of obsidian artefacts was obtained from the excavations of 2008 (*Vlačiky et al. 2013*, 49) and 2017 (*Wilczyński et al. 2020*, 282, table 3). In Nitra-Čermáň I, obsidian was rare (*Kaminská/Kozłowski 2011*).

In the following period of Epigravettian, obsidian prevails at Eastern Slovak sites. At all open-air Epigravettian sites near the Zemplín Hills, obsidian was predominant raw material. It made 81.73% at Kašov I-upper layer (*Bánesz 1969*; *Bánesz et al. 1992*), 47.29% in Hrčeľ-Nad baňou (*Bánesz/Kaminská 1984*), and as much as 69.95% in Hrčeľ-Pivničky (Fig. 6), similarly in Veľaty, 66.45% of artefacts were made of obsidian (*Kaminská 1995*). The upper layer from Kašov I, dated by ^{14}C to 18,600 ±390 BP (*Bánesz 1992*), is one of the richest Epigravettian sites in central Europe. The suggestion to call the Epigravettian industry in the eastern part of Central Europe after the Last Glacial Maximum, by the term of Kašovien (*Bánesz 1990*; *Svoboda/Novák 2004*), encounters a problem, since most of the 43,500 artefacts from the upper layer have been only partially processed (*Bánesz et al. 1992*). At Gravettian and Epigravettian sites, single- and double-platform cores were made of obsidian, mostly the one with sculpture. We have not detected any connections between a certain type of tool and obsidian, but various kinds of retouched tools, such as endscrapers, burins, perforators, blades, points, backed bladelets, etc. were made of obsidian (*Kaminská 2016*).

Obsidian was also found in Western Slovakia, at the Epigravettian site at Nitra III (*Bárta 1980a*; *Kaminská/Nemergut 2014*) and at several open-air settlements in the region of Ipeľ River Basin (Veľká Ves nad Ipľom) in Southern Slovakia (*Bárta/Petrovský-Šichman 1962*).

Contacts with the territoy of Southern Poland in the north continued in the Epigravettian. They are documented by the Polish site of Targowisko 10, where 46 artefacts made of obsidian with sculpture were discovered (3%, which is 250 specimens with chips). The site is classified as Epigravettian, having analogies in Kašov-lower layer with dating around 15,000 BP (*Wilczyński 2009*).

Movement to the north and north-west became more intense in the Epipalaeolithic period. Obsidian has been recorded in the Topľa River Basin, in the village of Soľ (*Šiška 1991a*) or in the region of Upper Zemplín, in the town of Humenné (*Bárta 1985*). In the end of the Palaeolithic, obsidian "travels" even further to the north, to the sites in Southern Poland (*Ginter 1986*; *Sobkowiak-Tabaka et al. 2015*). At Polish sites, obsidian occurs mainly in the Late Palaeolithic, in form of imported cores, blades and tools (*Szeliga 2002*). The use of obsidian in the Late Palaeolithic became more frequent mainly in the north-west regions and in the region of Spiš. It occurs also in the inventories obtained from Epipalaeolithic – Mesolithic sites in Orava (*Bárta 1984*).

As for the Epipalaeolithic in Spiš, the use of obsidian is known from the sites with the Świderian culture, although radiolarite prevails. At the site of Veľký Slavkov-Burich, obsidian artefacts also occurred (*Bárta 1980b*), as well as at the site of Lučivná/Svit-Pod Skalkou (*Soják 1998*; *2002*). There are numerous Epipalaeolithic to Mesolithic sites in the territory of Spiš without exact classification into individual cultures. Chipped lithic industry including obsidian artefacts from older collections (Spišská Belá, Kežmarok, Podhorany, Podolínec, Stará Ľubovňa) were preliminarily evaluated by *L. Bánesz* (*1962*). As far as more recent collections are concerned, obsidian occurred at the sites of Bušovce, Krížová Ves, Spišská Teplice-Brehy (*Soják 2002*). At the site of Smižany-Hradisko I, in the collection of Epipalaeolithic industry comprising of 89 artefacts, obsidian represented 50% of it (*Kaminská/Javorský 1996*). Three obsidian artefacts were discovered in the collection that is considered to be Magdalenian, discovered during the research at Stará Ľubovňa-Pod Štokom II (*Valde-Nowak/Soják/Wąs 2007*).

Fig. 6. Hrčeľ-Pivničky. Obsidian artefacts and cores from the Epigravettian site (photo by A. Marková).

Fig. 7. Košice-Barca I. Mesolithic chipped industry made of obsidian (photo by A. Marková).

Mesolithic

Mesolithic settlements have not been documented evenly in the territory of Slovakia. They create several local concentrations. Mesolithic stone industry in the Eastern Slovak Lowland was found in Čičarovce, where obsidian prevailed (*Kaminská 2019*). In the Košice Basin, at the site of Košice-Barca I (Fig. 7), all artefacts were made of obsidian (*Prošek 1959*). Obsidian occurred also among the finds from the Medvedia cave near Ružín (*Bárta 1990*). In the north of Slovakia, mainly in Spiš, obsidian occurs in unsorted Epipalaeolithic-Mesolithic collections (*Bánesz 1962*). It occurred very sporadically during new excavations at two sites at Spišská Belá (*Soják 2002*; *Valde-Nowak/Soják 2010*). Mesolithic settlement of Southwestern Slovakia, mainly at the sand dunes near Sereď, where obsidian was not used, is most numerous and best studied one (*Bárta 1972*).

Neolithic and Eneolithic

Popularity of obsidian continued in the Neolithic and the Eneolithic. This applies mainly to the Middle Neolithic cultures with good access to the raw material. The groups of the Eastern Linear Pottery culture, settled in the Eastern Slovak Lowland, used obsidian already in the beginning of their existence. The groups of Linear Pottery culture from the Eastern Slovak Lowland obtained obsidian from the sources in the Zemplín Hills gradually, mainly via contact with the Tiszadob and Raškovce groups.

According to the results of current datings, the sites in the Eastern Slovak Lowland are older than those in the Košice Basin. The site of Moravany in the Ondava River Basin is one of them. There, occupancy by all three groups of the Eastern Linear Pottery culture (Proto-Kopčany, Kopčany and Raškovce) dated between 5500 and 5150 BC (*Nowak 2015*, 226) is documented. Obsidian was the main raw material used in all phases of the occupancy, to almost 90% (*Kaczanowska/Kozłowski/Wasilewski 2015*, 172). Individual artefacts represented various phases of obsidian processing – from the imported nodules, through cores, flakes, fragments and chips, to blades and tools. Similarly, obsidian prevailed since the oldest phases of the Eastern Linear Pottery culture, as suggested also by other collections from the sites in the Eastern Slovak Lowland (*Kaczanowska/Kozłowski/Nowak 2013*; *Kozłowski 1997*). Proportions of used obsidian were 90.7% in Zbudza, 96.3% in Slavkovce, 67–90% in Zalužice, 97.6% in Zemplínske Kopčany (*Kaczanowska/Kozłowski 1997*, 220, 221; *Šiška 1989*). 110 obsidian artefacts come from Slavkovce, feature E/88 (Proto-Kopčany phase). They include 34 nodules, one of which was an obsidian nodule with one scar, weighing 2.9 kg (*Kaczanowska/Kozłowski 1997*, 177, table VI-3; fig. VI-1–3). Obsidian represented 91.7% of the raw material composition of the chipped industry from the settlement in Veľké Raškovce (*Vizdal 1973*, 102).

The sites from the late phase of the Eastern Linear Pottery (Raškovce group) and Bükk cultures are usually more frequent in the cadastral areas of many villages in the nearest vicinity of the Zemplín Hills. It is often impossible to categorise the obsidian industry into the groups of the Eastern Linear Pottery culture and the Bükk culture. Malá and Veľká Tŕňa are the sites with high amount of obsidian, as stated by *Š. Janšák* (*1935*, 67–69) and other authors, after sporadic surveys at several places in the cadastral area of the villages (*Chovanec 1999*; *2005*; *Kaminská/Cheben I. 1983*; *Polla 1996*). The cadastral area of the village of Černochov, with Neolithic finds accompanied by obsidian, is located further to the south (*Janšák 1935*, 69–70). As for the density of Neolithic occupancy, similar situation is identified in Bara (*Čaplovič/Gašaj/Olexa 1977*; *Gašaj/Jurečko/Olexa 1980*; *Janšák 1935*, 67–69), Viničky (*Chovanec 1999*; *Janšák 1935*, 70), Zemplín (*Andel 1955*, 146; *Horváthová/Miroššayová 2002*; *Janšák 1935*, 57), and Streda nad Bodrogom (*Janšák 1935*, 75; *Polla 1964*; *Šiška 1979*; *1989*). Similar situation was found on the northeastern and northern sides of the Zemplín Hills, in the cadastral areas of Zemplínske Hradište, Zemplínske Jastrabie, Hraň, Novosad, Kysta, Hrčeľ (*Chovanec 1988*; *2004*; *Kaminská 1987*).

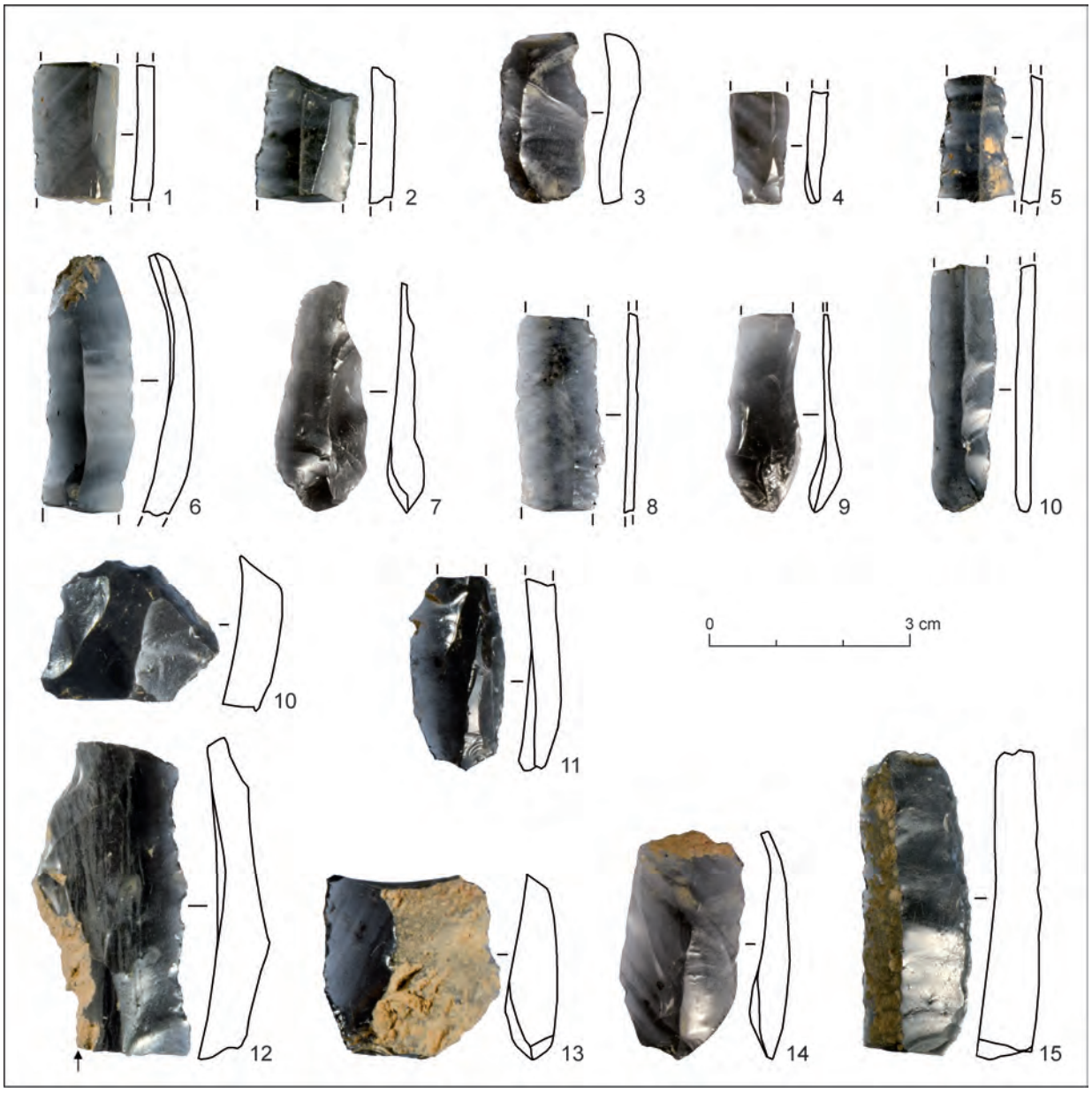


Fig. 8. Košice-Galgovec III, feature 9/97. Eastern Linear Pottery culture, Tiszadob group (photo by A. Marková).

Obsidian was less frequent in the Eastern Linear Pottery culture in the Košice Basin. In the proto-Linear phase at the site of Košice-Červený rak, obsidian was less frequent than limnosilicite (only 29.3%; *Kaminská/Kaczanowska/Kozłowski 2008*, 90, table 1). Obsidian created 36.5% of raw materials in Košice-Barca III and 32.7% in Čečejovce in the following period of Barca III group (*Kozłowski 1989*). Obsidian in the first two groups of the Eastern Linear Pottery culture in the Košice Basin probably comes from Hungarian sources. It is associated with the shift of the occupancy from the territory of Northeastern Hungary along the Hornád River to the areas further to the north (*Csengeri 2018*). Groups of the first farmers brought obsidian from the region of Tokaj. Later, in the Tiszadob group, they started to use obsidian from the exploitation area in the Zemplín Hills. The use of obsidian increased to 36.23% at the site of Košice-Galgovec (Fig. 8). In the following phase of occupancy, the transition phase between the Tiszadob group and the Bükk culture, the proportion of obsidian increased to 63.75% (*Kaminská 2020*, table 20).

In the following Bükk culture, proportion of used obsidian varies at individual sites according to the proximity of the sources of the raw material. Obsidian prevails at the settlements in the Eastern Slovak Lowland and Košice Basin. Obsidian constitutes 96% of artefacts in Zemplínske Kopčany, even though

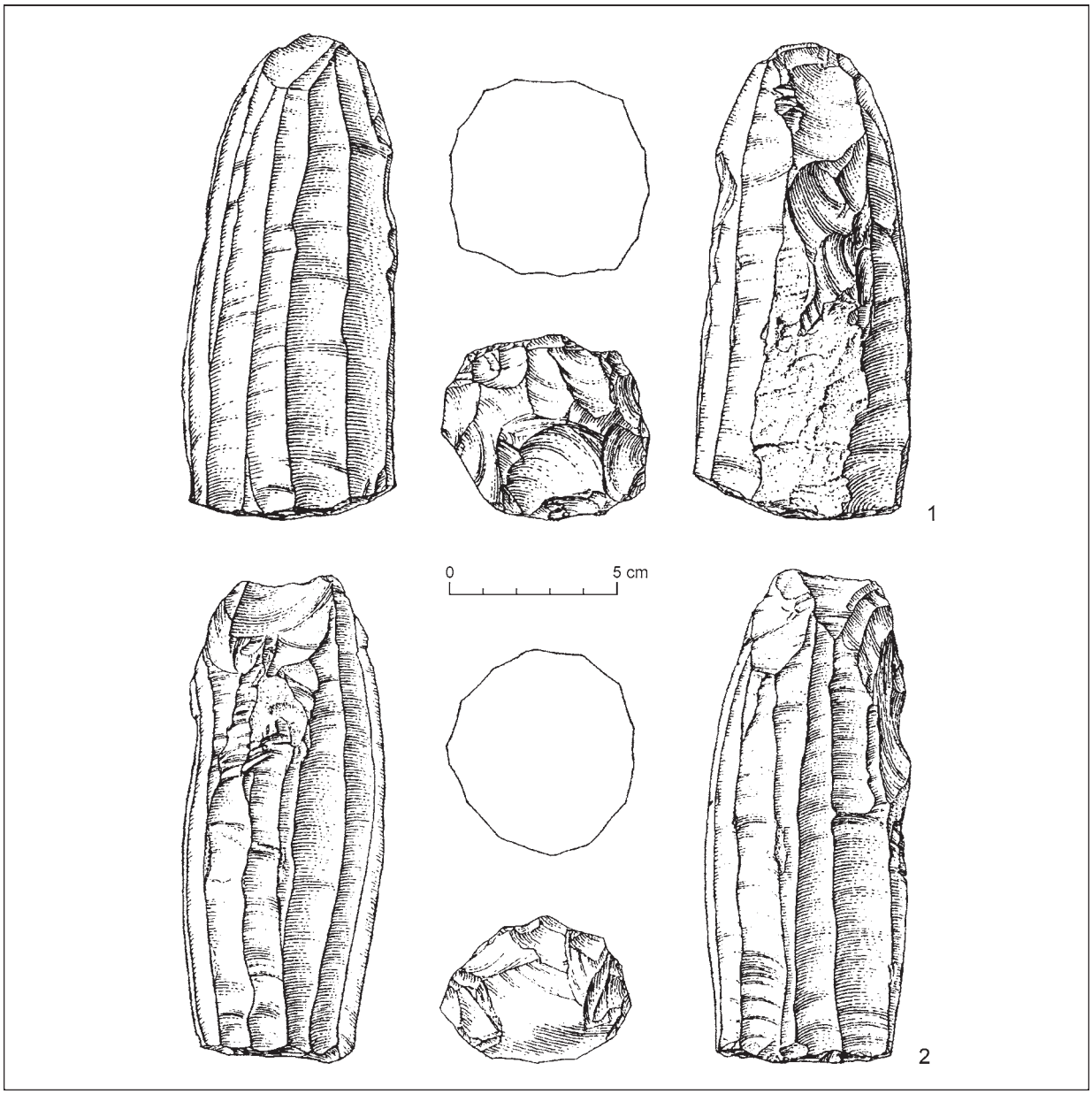


Fig. 9. Kašov-Čepegov I. Blade cores made of obsidian. Bükk culture (after *Bánesz 1991*, modified).

it makes only 25.5% in Šarišské Michaľany, in the region of Šariš (*Kaczanowska/Kozłowski/Šiška 1993*, 42, 43, table 9). 13 pyramidal obsidian cores (Fig. 9) come from Kašov, Čepegov site. Along with them, blades and obsidian flakes as well as sherds of the Bükk culture were found in the same feature (*Šiška 1991b*). *L. Bánesz* (*1991*) interpreted the finds as specialized on-site workshop produced cores which might have beeen an article of further exchange. The obsidian raw material must have been rather large, as the final core's size was 148 x 59 x 50 mm and some blades were 10–12 cm long. According to the new research performed on the finds, it was not a workshop; it was rather an object for producing domestic assemblage (*Allard/Klaric/Hromadová 2017*, fig. 2; 6: 1). Similar situation has been found in Humenné, where the amount of obsidian is 99.47% (*Kaczanowska/Kozłowski 2002*, 83).

Bükk culture in the Košice Basin used obsidian for producing chipped lithic industry more extensively. Obsidian share reached 84.10% at Košice-Galgovec site (*Kaminská 2020*, table 20). It absolutely prevailed in the features of Bükk culture at the neighbouring site of Košice-Červený rak (*Kaminská/Novák 2002*).

Obsidian as a raw material or finished cores "travelled" outside the territory of Eastern Slovakia, as documented by numerous finds. Obsidian cores in the hoard from the Hungarian site of Nyírlugos, dated

to the Middle Neolithic, are of Slovak origin (*Kasztovszky/Biró/Kis 2014*). In the environment of Želiezovce group, obsidian industry occurs in Western Slovakia and Southern Poland. Increasing numbers of sites with finds of obsidians in Western and Central Slovakia were detected in the beginning of the Lengyel culture, when obsidians appear in the Middle Danube region as well (*Šiška 1998*). Later, in individual phases of Lengyel culture, the share of obsidian among the finds from Western Slovakia decreases. In Western Slovakia, obsidian occurred at the site of Nitra-Selenec in Eneolithic Ludanice group, in form of two specially modified artefacts (*Nemergut/Cheben M. 2019*).

Differences in the amounts of obsidian used at various settlements and burial grounds can be observed in the cultures of the Late Neolithic and Early Eneolithic in the Eastern Slovak Lowland. In graves of the Csőszhalom-Čičarovce group in Čičarovce, artefacts made of Volhynian flint prevailed over obsidian artefacts, but the share of obsidian in settlement features was almost 50% (*Vizdal 1980*). At the settlement of Csőszhalom-Oborín group in Hrčeľ, obsidian (74.81%) prevailed over other raw materials (*Kaminská/Pelisiak 1991*).

Eneolithic – Early Bronze Age

In the Eneolithic, even greater difference in number of obsidian industry at the settlements and at the burial grounds is recorded. It is significant in the Tiszapolgár culture, where Volhynian flint was the most frequently used material at the burial grounds at Tibava (*Šiška 1964*) and Veľké Raškovce (*Vizdal 1977*). Nevertheless, artefacts from the settlement at the site of Konopianky in Zemplínske Hradište were made exclusively of obsidian. The chipped industry discovered at Baden culture settlement was also made of obsidian (*Chovanec 1988*).

Interest in obsidian becomes poorer in the end of the Eneolithic. Various kinds of flint of foreign provenance (banded Krzemionki flint from Poland, Volhynian flint from Transcarpathian Ukraine) were preferred to obsidian in the cultures of the Epi-Corded Ware cultural complex (group of the East Slovak Barrow Group in the northern part of Eastern Slovakia; *Budinský-Krička 1991*). At the end of the Eneolithic and in the beginning of the Bronze Age, Nyírség-Zatín culture was spread in the southern part of Eastern Slovakia. Only a few sites have been partly studied, chipped industry being discovered in Čičarovce, with prevailing obsidian blades and flakes (*Kaminská 2010*, 64).

Early Bronze Age

The cultures of the Early Bronze Age used obsidian as raw material only for certain types of tools, such as arrowheads with surface retouch. This type of industry is known from the burials of Košťany culture in Valaliky-Všechsvätých (*Pástor 1962*, 44, pl. VI: 11–13), Valaliky-Košťany (*Pástor 1962*, 40, pl. VI: 8–10), and Košice (*Pástor 1969*). Arrowheads made of other raw materials were discovered also at the settlement and the burial ground of the Otomani culture (*Gancarski 2002*) in Nižná Myšľa. Tools were only sporadically made of lithic raw materials in the cultures of following periods. They were replaced with metal objects, thus, artefacts made of obsidian also occur only sporadically.

CONCLUSION

Technological properties and the appearance of obsidian led to its popularity in the Stone Ages. The use of obsidian, however, is territorially limited and it is associated mainly with the Zemplín Hills. Obsidian was a universal lithic raw material and was used for production of a wide range of artefacts (endscrapers, burins, retouched blades, flakes, cores, etc.). No close association between obsidian and a particular type of tools has been observed in any archaeological culture.

Obsidian occurs in the raw material composition of Aurignacian culture in the Upper Palaeolithic in Eastern Slovakia, but it comes from the Hungarian sources in the territory of Tokaj. After the chipped industry from the cadastral areas of the villages of Čerhov and Veľká Tŕňa is evaluated, we might be able to document the use of obsidian also from the sources in the Zemplín Hills.

Obsidian is the most commonly used material in the Late Gravettian and mainly Epigravettian in Eastern Slovakia, where the sites are located in the vicinity of obsidian sources. The percentage of obsidian used in the assemblages of lithic industries in the Epigravettian reaches more than 80%. Obsidian also plays an important role in the composition of Epipalaeolithic and Mesolithic collections in Spiš. Obsidian prevails in the Mesolithic of the Košice Basin (collection from Košice-Barca I).

In the Neolitic, obsidian prevails in individual phases of Linear Pottery culture in the Eastern Slovak Lowland. It is typical of the Bükk culture in the Eastern Slovak Lowland and in the southern part of the Košice Basin. In the time of existence of Bükk culture, obsidian is maximally spread also in the environment of Middle Neolithic cultures in Western Slovakia. In the end of the Neolithic, in the Eneolithic and the Early Bronze Age, the importance of obsidian diminishes and other raw materials start to prevail.

Translated by Viera Tejbusová

BIBLIOGRAPHY

Allard/Klaric/Hromadová 2017 P. Allard/L. Klaric/B. Hromadová: Obsidian blade debitage at Kašov-Čepegov I (Bükk culture), Slovakia. *Bulgarian e-Journal of Archaeology* 7, 2017, 17–35.

Andel 1955 K. Andel: Výsledky archeologického prieskumu na zemplínsko-užskej nížine v rokoch 1953–1954. In: *Vlastivedný zborník I*. Košice 1955, 144–171.

Bacsó et al. 1995a Z. Bacsó/E. Kaličiaková/M. Košarková/J. Seliga/J. Komoň/Š. Stáňa/I. Zeman/R. Velich/A. Zlinská: *Subvulkanické telesá východného Slovenska, polymetalické, drahokovové, vzácnokovové a ortuťové rudy.* Záverečná správa. Archive of State Geological Institute of Dionýz Štúr. Bratislava 1995. Unpublished.

Bacsó et al. 1995b Z. Bacsó/P. Malachovský/V. Hrinko/M. Repčiak/E. Kaličiaková/M. Košarková/J. Seliga/J. Komoň/Š. Staňa/A. Zlinská: *Brehov-západ.* Záverečná správa. Archive of State Geological Institute of Dionýz Štúr. Bratislava 1995. Unpublished.

Bačo et al. 2003 P. Bačo/P. Baláž/K. Čechovská/J. Derco/R. Fischerová/Ľ. Kovaničová/M. Repčiak/Ľ. Tuček/M. Vancáková: *Obsidiánová industria – prehistorické sídliská Hraň, Cejkov, Zemplín. 45. Fórum pre nerudy. Sprievodca.* Košice – Viničky 2003.

Bačo et al. 2011 P. Bačo/Z. Bačová/P. Konečný/V. Konečný/J. Derco/Z. Péczkay/M. Kováčová: *Extruzívne ryolitové teleso Borsuk pri Viničkách – banské diela.* Záverečná správa. Archive of State Geological Institute of Dionýz Štúr. Bratislava 2011. Unpublished.

Bačo et al. 2017 P. Bačo/Ľ. Kaminská/J. Lexa/Z. Pécskay/Z. Bačová/V. Konečný: Occurrences of Neogene Volcanic Glass in the Eastern Slovakia – Raw Material source for the Stone Industry. *Anthropologie* 55, 2017, 207–230.

Bačo/Bačová 2014 P. Bačo/Z. Bačová: Autochtónne výskyty vulkanických skiel spojené s neogénnym vulkanizmom na východnom Slovensku. In: O. Žaár/M. Gregor (eds.): *3. Geologicko-Paleontologicko-Archeologická Diskusia (GEPAARD). Zborník abstraktov.* Bratislava 2014, 8.

Baňacký et al. 1988 V. Baňacký/M. Elečko/M. Kaličiak/J. Lexa/P. Straka/D. Vass/J. Vozár/A. Vozárová: *Geologická mapa južnej časti Východoslovenskej nížiny a Zemplínskych vrchov 1 : 50 000.* Bratislava 1988.

Bánesz 1959 L. Bánesz: Cejkov II–III, nové paleolitické stanice s obsidiánovou industriou. *Archeologické rozhledy* 11, 1959, 769–780.

Bánesz 1960 L. Bánesz: Die Problematik der paläolithischen Besiedlung in Tibava. *Slovenská archeológia* 8, 1960, 7–58.

Bánesz 1962 L. Bánesz: Nálezy drobnotvarej štiepanej industrie pod Vysokými Tatrami. *Študijné zvesti AÚ SAV* 10, 1962, 5–20.

Bánesz 1967 L. Bánesz: Paleolitické sídliskové objekty z Barce-Svetlej III. *Archeologické rozhledy* 19, 1967, 285–295.

Bánesz 1968 L. Bánesz: *Barca bei Košice. Paläolithische Fundstelle*. Bratislava 1968.

Bánesz 1969 L. Bánesz: Gravettské súvrstvia s obsidiánovou a pazúrikovou industriou v Kašove a Cejkove. *Archeologické rozhledy* 21, 1969, 281–269.

Bánesz 1974 L. Bánesz: Hromadný nález obsidiánovej suroviny na gravettskom sídlisku v Cejkove, okr. Trebišov. *Archeologické rozhledy* 26, 1974, 51–54.

Bánesz 1976 L. Bánesz: Nové paleolitické lokality a nálezy z východného Slovenska. *Archeologické rozhledy* 28, 1976, 241–246.

Bánesz 1980 L. Bánesz: Nové paleolitické nálezy z prieskumov na východnom Slovensku. *AVANS 1978*, 1980, 31–36.

Bánesz 1988 L. Bánesz: Výskumy v okolí Cejkova. *AVANS 1987*, 1988, 29.

Bánesz 1990 L. Bánesz: Súčasná problematika paleolitu východného Slovenska a severovýchodnej časti Karpatskej kotliny. *Historica Carpatica* 21, 1990, 9–19.

Bánesz 1991 L. Bánesz: Neolitická dielňa na výrobu obsidiánovej industrie v Kašove. *Východoslovenský pravek* 3, 1991, 39–68.

Bánesz 1992 L. Bánesz: Prvé absolútne datovanie nálezov z paleolitickej stanice Kašov I metódou ^{14}C. *AVANS 1991*, 1992, 16.

Bánesz 1993 L. Bánesz: K absolútnemu datovaniu paleolitických staníc s obsidiánovou a pazúrikovou industriou v Kašove a Cejkove. *AVANS 1992*, 1993, 22.

Bánesz 1996 L. Bánesz: Predmety umeleckého prejavu z paleolitickej stanice pri Cejkove a Kašove. *Slovenská archeológia* 44, 1996, 7–24.

Bánesz/Kaminská 1984 L. Bánesz/Ľ. Kaminská: Výskum archeologickej lokality v Hrčeli. *Historica Carpatica* 15, 1984, 255–281.

Bánesz et al. 1992 L. Bánesz/J. Hromada/R. Desbrosse/I. Margerand/J. K. Kozłowski/K. Sobczyk/M. Pawlikowski: Le site de plein air du Paléolithique supérieur de Kašov I en Slovaquie orientale. *Slovenská archeológia* 40, 1992, 5–28.

Bárta 1972 J. Bárta: Die mittlere Steinzeit in der Slowakei. *Acta Praehistorica et Archaeologica* 3, 1972, 57–76.

Bárta 1980a J. Bárta: *Významné paleolitické lokality na západnom Slovensku.* Nitra 1980.

Bárta 1980b J. Bárta: Wieki Sławków – pierwsza osada świderskiej kultury na Słowacji. *Acta Archaeologica Carpathica* 20, 1980, 5–17.

Bárta 1984 J. Bárta: Prvé nálezy zo staršej doby kamennej na Orave. *Krásy Slovenska* 11, 1984, 10–15.

Bárta 1985 J. Bárta: *Kľúč k slovenskému praveku?* Magazín Východoslovenských novín Košice z 28. 6. 1985. Košice 1985, 3.

Bárta 1988 J. Bárta: Trenčianske Bohuslavice. Un habitat gravettien en Slovaquie occidentale. *L'Antropologie* 92, 1988, 173–182.

Bárta 1990 J. Bárta: Mezolitickí lovci v Medvedej jaskyni pri Ružíne. *Slovenská archeológia* 38, 1990, 5–30.

Bárta/Petrovský-Šichman 1962 J. Bárta/A. Petrovský-Šichman: Paleolitické nálezy z Ipeľskej kotliny. *Archeologické rozhledy* 14, 1962, 297–308.

Bigazzi et al. 1990 G. Bigazzi/P. Márton/P. Norelli/L. Rozložník: Fission track dating of Carpathian obsidians and provenance identificationn. *Nuclear Tracks and Radiation Measurements* 17, 1990, 391–396.
DOI: https://doi.org/10.1016/1359-0189(90)90062-3

Biró 1984 K. T. Biró: Distribution of obsidian from the Carpathian Sources on Central European Palaeolithic and Mesolithic sites. *Acta Archaeologica Carpathica* 23, 1984, 5–42.

Biró/Kasztovszky 2013 K. T. Biró/Z. Kasztovszky: Obsidian Studies Using Nuclear Techniques in Hungary. *Science for Heritage* 1, 2013, 6–9.

Budinský-Krička 1991 V. Budinský-Krička: K otázke skupiny východoslovenských mohýl. *Východoslovenský pravek* 3, 1991, 96–111.

Csengeri 2018 P. Csengeri: A short report on the research of the Earliest Alföld Linear Pottery Culture in Hernád Valley, North-Eastern Hungary. In: *Valde-Nowak et al. eds. 2018*, 329–336.

Čaplovič/Gašaj/Olexa 1977 D. Čaplovič/D. Gašaj/L. Olexa: Archeologicý prieskum Medzibodrožia a Košickej kotliny. *AVANS 1976*, 1977, 88–99.

Gancarski 2002 J. Gancarski: Kultura Otomani-Füzesabony po północnej stronie Karpat. In: J. Gancarski (ed.): *Między Mykenami a Bałtykiem. Kultura Otomani-Füzesabony.* Krosno – Warszawa 2002, 103–126.

Gašaj/Jurečko/Olexa 1980 D. Gašaj/P. Jurečko/L. Olexa: Výsledky prieskumov v Košickej kotline a na Východoslovenskej nížine. *AVANS 1979*, 1980, 73–79.

Ginter 1986 B. Ginter: Obsidianimporte im Spätpaläolithikum and Mesolithikum in Südpolen. In: B. Chropovský (ed.): *Urgeschichtliche Besiedlung der Ostslowakei in Bezug zu den Nachbargebieten.* Nitra 1986, 71–76.

Horváthová/Miroššayová 2002 E. Horváthová/E. Miroššayová: Nové nálezy z katastra obce Zemplín. *AVANS 2001*, 2002, 65–67.

Chovanec 1988 J. Chovanec: Sídlisko ľudu s bukovohorskou kultúrou v Zemplínskom Hradišti. *AVANS 1987*, 1988, 57–58.

Chovanec 1999 J. Chovanec: Archeologické výskumy a nálezy v južnom Zemplíne 1969–1999. *Múzejníček* 3, 1999, 1–20.

Chovanec 2004 J. Chovanec: Okres Trebišov. In: L. Gačková (zost.): *Archeologické dedičstvo Zemplína. Pravek až včasný stredovek.* Michalovce 2004, 427–570.

Chovanec 2005 J. Chovanec: Archeologické výskumy a nálezy v južnom Zemplíne 2000–2004. *Múzejníček* 4, 2005, 1–20.

Chu et al. 2018 W. Chu/G. Lengyel/Ch. Zeeden/A. Péntek/Ľ. Kaminská/Zs. Mester: Early Upper Paleolithic surface collections from loess-like sediments in the Northern Carpathian Basin. *Quaternary International* 485, 2018, 167–182.
DOI: https://doi.org/10.1016/j.quaint.2017.05.017

Chu et al. 2020 W. Chu/Ľ. Kaminská/N. Klasen/Ch. Zeeden/G. Lengyel: The Chronostratigraphy of the Aurignacian in the Northern Carpathian Basin Based on New Chronometric/Archeological Data from Seňa I (Eastern Slovakia). *Journal of Paleolithic Archaeology* 3, 2020, 77–96.
DOI: https://doi.org/10.1007/s41982-019-00044-2

Ivan 1962 Ľ. Ivan: *Informatívna zpráva (nálezová zpráva) o ložiskách a východzoch perlitov a hornín perlitického typu v južnej časti Zemplínskeho pohoria (Geofond).* Záverečná správa. Archive of State Geological Institute of Dionýz Štúr. Košice 1962. Unpublished.

Ivan 1964 Ľ. Ivan: Geologická pozícia perlitov v južnej časti Zemplínskych vrchov. In: *Zpráva o geologických výskumoch v roku 1963.* Bratislava 1964, 143–145.

Janšák 1935 Š. Janšák: *Praveké sídliská s obsidiánovou industriou na Slovensku.* Bratislava 1935.

Kaczanowska/Kozłowski 1997 M. Kaczanowska/J. K. Kozłowski: Lithic industries. In: J. K. Kozłowski (ed.): *The Early Linear Pottery Culture in Eastern Slovakia.* Kraków 1997, 177–254.

Kaczanowska/Kozłowski 2002 M. Kaczanowska/J. K. Kozłowski: Bükk Culture lithic assemblage from Humenné, Eastern Slovakia. *Študijné zvesti AÚ SAV* 34, 2002, 65–90.

Kaczanowska/Kozłowski/Nowak 2013 M. Kaczanowska/J. K. Kozłowski/M. Nowak: Raw materials of chipped industries at the Eastern Linear Pottery Culture site at Moravany, Eastern Slovakia. In: *Mester ed. 2013*, 111–130.

Kaczanowska/Kozłowski/Šiška 1993 M. Kaczanowska/J. K. Kozłowski/S. Šiška: *Neolithic and Eneolithic chipped stone industries from Šarišské Michaľany, Eastern Slovakia. Linear Pottery, Bükk and Baden Cultures.* Kraków 1993.

Kaczanowska/Kozłowski/Wasilewski 2015 M. Kaczanowska/J. K. Kozłowski/M. Wasilewski: Chipped, ground and polished stone industries at the early neoithic settlement of Moravany. In: J. K. Kozłowski/M. Nowak/M. Vizdal (eds.): *Early farmers of the Eastern Slovak Lowland. The settlement of the Eastern Linear Pottery Culture at Moravany.* Kraków 2015, 163–196.

Kaminská 1987 Ľ. Kaminská: Príspevok k osídleniu Hrčeľa v mladšej a neskorej dobe kamennej. *Archeologické rozhledy* 39, 1987, 481–506.

Kaminská 1990 Ľ. Kaminská: Aurignacké stanice v Čečejovciach. *Archeologické rozhledy* 42, 1990, 3–12.

Kaminská 1991 Ľ. Kaminská: Význam surovinovej základne pre mladopaleolitickú spoločnosť vo východokarpatskej oblasti. *Slovenská archeológia* 39, 1991, 7–58.

Kaminská 1995 Ľ. Kaminská: *Katalóg štiepanej kamennej industrie z Hrčeľa-Pivničiek a Veliat.* Nitra 1995.

Kaminská 2001 Ľ. Kaminská: Die Nutzung von Steinrohmaterialien im Paläolithikum der Slowakei. *Quartär* 51/52, 2001, 81–106.

Kaminská 2010 Ľ. Kaminská: *Čičarovce-Veľká Moľva. Výskum polykultúrneho sídliska*. Nitra 2010.

Kaminská 2013 Ľ. Kaminská: Sources of raw materials and their use in the Palaeolithic of Slovakia. In: *Mester ed. 2013*, 99–110.

Kaminská 2016 Ľ. Kaminská: Gravettian and Epigravettian lithics in Slovakia. *Quaternary International* 406, 2016, 144–165.
DOI: https://doi.org/10.1016/j.quaint.2015.08.083

Kaminská 2018 Ľ. Kaminská: Use of obsidian from the Paleolithic to the Bronze Age in Slovakia. *Archeometriai Műhely* 15, 2018, 197–212.

Kaminská 2019 Ľ. Kaminská: Mezolitické artefakty z Čičaroviec. *AVANS 2014*, 2019, 82–87.

Kaminská 2020 Ľ. Kaminská: *Košice-Galgovec. Osídlenie polohy v strednom neolite.* Nitra 2020.

Kaminská et al. 2000 Ľ. Kaminská/J. K. Kozłowski/B. Kazior/M. Pawlikowski/K. Sobczyk: Long term stability of raw materials procurement systems in the Middle and Upper Palaeolithic of Eastern Slovakia: a case study of the Topľa/Ondava River valleys. *Praehistoria* 1, 2000, 63–81.

Kaminská/Cheben I. 1983 Ľ. Kaminská/I. Cheben: Výsledky prieskumu Východoslovenskej nížiny. *AVANS 1982*, 1983, 128–130.

Kaminská/Ďuďa 1985 Ľ. Kaminská/R. Ďuďa: K otázke významu obsidiánovej suroviny v paleolite Slovenska. *Archeologické rozhledy* 37, 1985, 121–129.

Kaminská/Javorský 1996 Ľ. Kaminská/F. Javorský: Drobnotvará štiepaná kamenná industria zo Smižian. *Študijné zvesti AÚ SAV* 32, 1996, 5–14.

Kaminská/Kaczanowska/Kozłowski 2008 Ľ. Kaminská/M. Kaczanowska/J. K. Kozłowski: Košice-Červený rak and the Körös/Eastern Linear Transition in the Hornád Basin (Eastern Slovakia). *Přehled výzkumů* 49, 2008, 83–91.

Kaminská/Kozłowski 2011 Ľ. Kaminská/J. K. Kozłowski: Nitra I-Čermáň v rámci štruktúry osídlenia gravettienskej kultúry na Slovensku. *Slovenská archeológia* 59, 2011, 1–85.

Kaminská/Kozłowski/Škrdla 2011 Ľ. Kaminská/J. K. Kozłowski/P. Škrdla: New approach to the Szeletian – chronology and cultural variability. *Eurasian Prehistory* 8, 2011, 29–50.

Kaminská/Nemergut 2014 Ľ. Kaminská/A. Nemergut: The Epigravettian chipped stone industrie from Nitra III site (Slovakia). In: K. T. Biró/A. Markó/K. P. Bajnok (eds.): *Eolian scripts new ideas on the lithic world studies in honour of Viola T. Dobosi.* Budapest 2014, 93–119.

Kaminská/Novák 2002 Ľ. Kaminská/M. Novák: Sídliskové nálezy bukovohorskej kultúry v polohe Košice-Červený rak. *AVANS 2001*, 2002, 82, 83.

Kaminská/Pelisiak 1991 Ľ. Kaminská/A. Pelisiak: Štiepaná kamenná industria skupiny Tiszapolgár-Csöszhalom-Oborín z Hrčeľa. *Východoslovenský pravek* 3, 1991, 26–38.

Kaminská/Tomášková 2004 Ľ. Kaminská/S. Tomášková: Time space systematics of Gravettian finds from Cejkov I. In: J. A. Svoboda/L. Sedláčková (eds.): *The Gravettian along the Danube.* Brno 2004, 198–216.

Kasztovszky/Biró/Kis 2014 Z. Kasztovszky/K. T. Biró/Z. Kis: Prompt Gamma Activation Analysis of the Nyírlugos obsidian core depot find. *Journal of Lithic Studies* 1, 2014, 151–163. DOI: https://doi.org/10.2218/jls.v1i1.784

Kohút et al. 2021 M. Kohút/J. A. Westgate/N. J. G. Pearce/P. Bačo: The Carpathian obsidians – contribution to their FT dating and provenance (Zemplín, Slovakia). *Journal of Archaeological Science: Reports* 37, 2021, 102861. DOI: https://doi.org/10.1016/j.jasrep.2021.102861

Kozłowski 1986 J. K. Kozłowski: The Gravettian in Central and Eastern Europe. *Advances World Archaeology* 5, 1986, 131–200.

Kozłowski 1989 J. K. Kozłowski: The lithic industry of the Eastern Linear Pottery Culture in Slovakia. *Slovenská archeológia* 37, 1989, 377–410.

Kozłowski 1997 J. K. Kozłowski: Introduction. In: J. K. Kozłowski (ed.): *The Early Linear Pottery Culture in Eastern Slovakia.* Kraków 1997, 5–6.

Lengyel 2018 G. Lengyel: Lithic analysis of the Middle and Late Upper Plaeolithic in Hungary. *Folia Quaternaria* 86, 2018, 5–157.

Lexa/Kaličiak 2000 J. Lexa/M. Kaličiak: Geotektonic aspects of the Neogene volcanism in Eastern Slovakia. *Mineralia Slovaca* 32, 2000, 205–210.

Mester ed. 2013 Zs. Mester (ed.): *The lithic raw material sources and interregional human contacts in the Northern Carpathian regions*. Kraków – Budapest 2013.

Mišík 1969 M. Mišík: Petrografická príslušnosť silicitov z paleolitických a neolitických artefaktov Slovenska. Acta geologica et geogaphica. Universitatis Comenianae. *Geologica* 18, 1969, 117–135.

Mišík 1975 M. Mišík: Petrograficko-mikropaleontologické kritériá pre zisťovanie proveniencie silicitových nástrojov na Slovensku. *Folia Faultatis Scientiarum Naturalium Univiversitatis Purkynianae Brunensis* 16. *Geologia* 27/10, 1975, 89–107.

Nemergut 2010 A. Nemergut: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bártu z rokov 1963 a 1990. *Slovenská archeológia* 58, 2010, 183–206.

Nemergut/Cheben M. 2019 A. Nemergut/M. Cheben: Unique grinded obsidian finds from Eneolithic site at Nitra-Selenec. In: A. Markó/K. Szilágyi/K. T. Biró (eds.): *International Obsidian Conference: Program Abstracts Field Guide.* Budapest 2019, 47.

Nemergut/Cheben M./Gregor 2012 A. Nemergut/M. Cheben/M. Gregor: Lithic raw material use at the Palaeolithic site of Moravany nad Váhom-Dlhá. *Anthropologie* 50, 2012, 379–390.

Novák 2002 M. Novák: Gravettienske osídlenie spodnej vrstvy Kašova I. *Slovenská archeológia* 50, 2002, 1–52.

Nowak 2015 M. Nowak: Absolute chronology of the settlement of the Eastern Linear Pottery culture at Moravany. In: J. K. Kozłowski/M. Nowak/M. Vizdal (eds.): *Early farmers of the Eastern Linear Pottery culture at Moravany.* Kraków 2015, 215–234.

Pástor 1962 J. Pástor: Pohrebisko z počiatkov doby bronzovej na východnom Slovensku. *Nové obzory* 4, 1962, 37–51.

Pástor 1969 J. Pástor: *Košické pohrebisko.* Košice 1969.

Polla 1964 B. Polla: Neolitické a eneolitické nálezy v Strede nad Bodrogom. *Sborník SNM* 58. *História* 4, 1964, 97–116.

Polla 1996 B. Polla: *Archeológia na Slovensku v minulosti.* Martin 1996.

Prošek 1959 F. Prošek: Mesolitická obsidiánová industrie ze stanice Barca I. *Archeologické rozhledy* 9, 1959, 145–148, 193.

Přichystal/Škrdla 2014 A. Přichystal/P. Škrdla: Kde ležel hlavní zdroj obsidiánu v pravěku střední Evropy? *Slovenská archeológia* 62, 2014, 215–226.

Repčok 1977 I. Repčok: Stopy delenia uránu a možnosti ich využitia pre datovanie na príklade vulkanických skiel. *Západné Karpaty, séria mineralógia, petrografia, geochémia, ložiská* 3, 1977, 175–196.

Repčok/Kaličiak/Bacsó 1988 I. Repčok/M. Kaličiak/Z. Bacsó: Vek niektorých vulkanitov východného Slovenska určený metódou stôp po štiepení uránu. *Západné Karpaty, séria mineralógia, petrografia, geochémia, ložiská* 11, 1988, 75–88.

Sobkowiak-Tabaka et al. 2015 I. Sobkowiak-Tabaka/Zs. Kasztovszky/J. Kabaćinski/K. T. Biró/B. Maróti/K. Gméling: Transcarpathian contacts of the Late Glacial societes of the Polish Lowlands. *Przegląd Archeologiczny* 63, 2015, 5–28.

Soják 1998 M. Soják: Doterajšie výsledky archeologického výskumu na diaľnici v okrese Poprad. In: P. Roth (ed.): *Archeológia v múzeách.* Poprad 1998, 63–82.

Soják 2002 M. Soják: Osídlenie horného Spiša na sklonku staršej doby kamennej. In: J Gancarski (ed.): *Starsza i środkowa epoka kamienia w Karpatach polskich.* Krosno 2002, 255–278.

Svoboda et al. 2000 J. Svoboda/B. Klíma/L. Jarošová/P. Škrdla: The Gravettian in Moravia: climate, behaviour and technological complexity. In: W. Roebroeks/M. Mussil/J. Svoboda/K. Fennema (eds.): *Hunters of the Golden Age. The Mid Upper Palaeolithic of Eurazia 30,000–20,000 BP.* Leiden 2000, 197–217.

Svoboda/Novák 2004 J. A. Svoboda/M. Novák: Eastern Central Europe after the Upper pleniglacial: changing points of observation. *Archäologisches Korrespondenzblatt* 34, 2004, 463–477.

Szeliga 2002 M. Szeliga: Stań badań nad naplywem obsydianu na zemiach polskich w starszej i środkowej epoce kamienia (na tle nalezisk środkowoeuropejskich). In: J. Gancarski (ed.): *Starsza i środkowa epoka kamienia w karpatach polskich.* Krosno 2002, 339–357.

Šalát/Ončáková 1964 J. Šalát/P. Ončáková: *Perlity, ich výskyt, petrochémia a praktické použitie.* Bratislava 1964.

Šiška 1964 S. Šiška: Pohrebisko tiszapolgárskej kultúry v Tibave. *Slovenská archeológia* 12, 1964, 293–356.

Šiška 1979 S. Šiška: Die Bükker Kultur in der Ostslowakischen Tiefebene. *Slovenská archeológia* 27, 1979, 245–290.

Šiška 1989 S. Šiška: *Kultúra s východnou lineárnou keramikou na Slovensku.* Bratislava 1989.

Šiška 1991a S. Šiška: Zisťovací výskum v okolí soľných prameňov v Soli. *AVANS 1989*, Nitra 1991, 98–99.

Šiška 1991b S. Šiška: Keramika a datovanie neolitickej dielne v Kašove. *Východoslovenský pravek* 3, 1991, 69–74.

Šiška 1998 S. Šiška: Obsidián v prostredí spoločenstiev doby kamennej na strednom a západnom Slovensku (Súpis nálezísk). *Východoslovenský pravek* 5, 1998, 63–90.

Valde-Nowak 2003 P. Valde-Nowak: Archaeology. In: P. Valde-Nowak/A. Nadachowski/T. Madeyska (eds.): *Obłazowa cave. Human activity, stratigraphy and palaeoenvironments.* Kraków 2003, 23–80.

Valde-Nowak 2008 P. Valde-Nowak: Paleolityczne zabytky ze stanoviska Marhaň, okr. Bardejov (Słowacja). In: J. Machnik (ed.): *Archeologia i środowisko naturalne Beskidu niskiego w Karpatach. Część II. Kurimská brázda.* Kraków 2008, 139–156.

Valde-Nowak/Soják 2010 P. Valde-Nowak/M. Soják: Contribution to the Mesolithic in the Slovak Carpathians. *Slovenská archeológia* 58, 2010, 1–12.

Valde-Nowak/Soják/Wąs 2007 P. Valde-Nowak/M. Soják/M. Wąs: On the problems of the Late Paleolithic settlement in Northern Slovakia. Example of Stará Ľubovňa site. *Slovenská archeológia* 55, 2007, 1–22.

Valde-Nowak et al. eds. 2018 P. Valde-Nowak/K. Sobczyk/M. Nowak/J. Źrałka (eds.): *Multas Per Gentes et Multa per Saecula*. Kraków 2018.

Verpoorte 2002 A. Verpoorte: Radiocarbon dating the Upper Palaeolithic of Slovakia: results, problems and prospects. *Archäologisches Korrespondenzblatt* 32, 2002, 311–325.

Vizdal 1973 J. Vizdal: *Zemplín v mladšej dobe kamennej.* Košice 1973.

Vizdal 1977 J. Vizdal: *Tiszapolgárske pohrebisko vo Veľkých Raškovciach.* Košice 1977.

Vizdal 1980 J. Vizdal: *Potiská kultúra na Slovensku.* Košice 1980.

Vlačiky et al. 2013 M. Vlačiky/T. Michalík/M. Nývltová Fišáková/D. Nývlt/M. Moravcová/M. Králik/J. Kovanda/K. Péková/A. Přichystal/A. Dohnalová: Gravettian Occupation of the Beckov Gate in Western Slovakia as Viewed from Interdisciplinary Research of the Trenčianske Bohuslavice – Pod Tureckom Site. *Quaternary International* 294, 2013, 41–60.
DOI: https://doi.org/10.1016/j.quaint.2011.09.004

Voľanská 2016 A. Voľanská: Leaf Point finds from Zemplín Hills Area, Eastern Slovakia. *Litikum* 4, 2016, 9–18.

Wilczyński 2009 J. Wilczyński: Targowisko – a new Late Glacial site in Southern Poland. *Eurasian Prehistory* 6, 2009, 95–118.

Wilczyński et al. 2020 J. Wilczyński/O. Žaár/A. Nemergut/B. Kufel-Diakowska/M. Moskal-del Hoyo/P. Mroczek/B. Páll-Gergely/T. Oberc/G. Lengyel: The Upper Palaeolithic at Trenčianske Bohuslavice, Western Carpathians, Slovakia. *Journal of Field Archaeology* 45, 2020, 270–292.
DOI: https://doi.org/10.1080/00934690.2020.1733334

Williams Thorpe/Warren/Nandris 1984 O. Williams-Thorpe/S. E. Warren/J. G. Nandris: The distribution and provenance of archaeological obsidian in Central and Eastern Europe. *Journal of Archaeological Sciences* 11, 1984, 183–212.

Žaár 2007 O. Žaár: *Gravettienska stanica Trenčianskych Bohuslaviciach.* MA. Thesis. Constantine the Philosopher University in Nitra. Faculty of Arts. Nitra 2007. Unpublished.

Využitie obsidiánu v praveku Slovenska

Ľubomíra Kaminská

Súhrn

Obsidián z okolia Zemplínskych vrchov pochádza z primárnych (Viničky) a sekundárnych zdrojov (Brehov a Cejkov). Vo Viničkách sú primárne zdroje obsidiánu z dvoch fáz ryolitového vulkanizmu. Staršiu fázu predstavujú perlitové brekcie s obsidiánom v podloží ryolitového extruzívneho telesa a mladšiu fázu tvoria obsidiány a perlity spojené s intruzívnymi telesami dajkového typu.

V oblasti Brehova a Cejkova boli zistené a overené alochtónne polohy výskytu obsidiánu so skulptúrou. Ich predpokladaným zdrojom by mohla byť poloha silne sklovitého ryodacitu miestami s perlitickým vývojom, zistená v podloží andezitového telesa Veľký vrch, severne od Brehova. Z nej mohli byť obsidiány vyvetrávané a transportované do sekundárnych polôh v okolí, kde sú prekryté viatymi pieskami alebo ílom. Zistené boli v polohe Brehov-Za alejou (Brehov 2) a v polohe Cejkov-Žihľavník. Predstavujú hlavný zdroj suroviny na výrobu obsidiánovej industrie na paleolitických až eneolitických lokalitách.

Obsidián bol najviac využívaný kultúrami, ktoré sídlili na východnom Slovensku v blízkosti jeho zdrojov. V paleolite, v aurignacienskej kultúre, bol obsidián používaný len okrajovo a pochádzal pravdepodobne z maďarských zdrojov. Oveľa väčšie zastúpenie mal obsidián v industriách gravettienu a epigravettienu, najmä na lokalitách v blízkosti Zemplínskych zdrojov. Sporadicky sa vyskytol aj na západnom Slovensku (Trenčianske Bohuslavice, Nitra I-Čermáň, Nitra III). Na Spiši sa obsidián objavuje v kultúre świderien a v iných neskoropaleolitických a mezolitických kultúrach. V Košiciach-Barci bola mezolitická industria štiepaná len z obsidiánu.

V neolite dosiahol najväčšiu prevahu v kultúre s východnou lineárnou keramikou na Východoslovenskej nížine, menej v Košickej kotline. V bukovohorskej kultúre prevažoval na lokalitách Východoslovenskej nížiny aj v Košickej kotline. V ostatných častiach Slovenska sa obsidián najviac rozšíril počas trvania želiezovskej skupiny a lengyelskej kultúry.

Na konci neolitu (skupina Csőszhalom-Čičarovce) a na začiatku eneolitu (tiszapolgárska kultúra) sa obsidiánové artefakty častejšie vyskytli na sídliskách ako v hroboch. Čiastočné používanie obsidiánu pretrvalo na východnom Slovensku až do staršej doby bronzovej (koštianska a otomanská kultúra).

Obr. 1. Mapa okolia Zemplínskych vrchov s autochtónnymi a alochtónnymi zdrojmi obsidiánu, s lokalitami z paleolitu a neolitu. Alochtónne zdroje z Brehova a Cejkova: 1 – Cejkov-Žihľavník; 2 – Brehov-Za alejou (Brehov 2).
Obr. 2. Panoramatický pohľad od juhozápadnej strany na lávový prúd ryolitového telesa Borsuk pri obci Viničky so zdrojmi obsidiánu a perlitov, vrátane vinných pivníc vinárstva Tokaj Viničky; 1–3 – zdroje obsidiánov. Pohľad z juhovýchodu (foto P. Bačo, podľa *Bačo et al. 2017*).
Obr. 3. Výsledky izotopového datovania vulkanických skiel v oblasti Zemplínskych vrchov zoskupené podľa lokalít a typu výskytu (podľa *Bačo et al. 2017*).
Obr. 4. Obsidiánové hľuzy so skulptúrou. A – epigravettienska lokalita Veľaty I; B –Viničky, lokalita 2 na obr. 2; C – Brehov-Za alejou (Brehov 2; foto A. Marková a P. Bačo; podľa *Bačo et al. 2017*, upravené).
Obr. 5. Tibava. Kýlovité škrabadlá z patinovaného obsidiánu. Aurignacien (foto A. Marková).
Obr. 6. Hrčeľ-Pivničky. Obsidiánové nástroje a jadrá z epigravettienskej lokality (foto A. Marková).
Obr. 7. Košice-Barca I. Mezolitická štiepaná industria z obsidiánu (foto A. Marková).
Obr. 8. Košice-Galgovec III, objekt 9/97. Kultúra s východnou lineárnou keramikou, skupina Tiszadob (foto A. Marková).
Obr. 9. Kašov-Čepegov I. Jadrá na čepele z obsidiánu. Bukovohorská kultúra (podľa *Bánesz 1991*, upravené).

doc. PhDr. Ľubomíra Kaminská, DrSc.
Archeologický ústav SAV
Oddelenie pre výskum východného Slovenska
Hrnčiarska 13
SK – 040 01 Košice
kaminska@saske.sk

FOSSILE DIRECTEUR
Multiple perspectives on lithic studies in Central and Eastern Europe
Študijné zvesti Archeologického ústavu SAV – Supplementum 2, 2021, 251–263

CHOCOLATE FLINT OUTCROPS IN THE KRAKÓW-CZĘSTOCHOWA UPLAND

State of knowledge on mining, use and distribution of the raw material and further research perspectives

Magdalena Sudoł-Procyk

DOI: https://doi.org/10.31577/szausav.2021.suppl.2.16

Keywords: Poland, Kraków-Częstochowa Upland, raw material, prehistoric mining, chocolate flint, distribution

Abstract: New data obtained from the central part of the Kraków-Częstochowa Upland cast an interesting light on the issues of the origin of chocolate flint and the ways it was used by prehistoric communities inhabiting the region. Earlier interpretations indicated that the chocolate flint found at prehistoric sites in the Kraków-Częstochowa Upland was imported from the outcrops in the north-eastern part of the Holy Cross Mountains. Identifying the sites of siliceous rocks outcrops, extraction and distribution are extremely important at not only the local but also trans-regional level.

INTRODUCTION

Many varieties of siliceous raw materials can be found in the territory of Poland. Known exclusively from *in situ* outcrops in the Holy Cross Mountains area until recently, chocolate flint is distinctive in terms of its technical and visual features.

The north-eastern margin of the Holy Cross Mountains is the best known and researched area of the occurrence of chocolate flint (e.g. *Krukowski 1923*; *Migaszewski et al. 2006*; *Samsonowicz 1923*; *Schild 1971*). For many years, it has been considered to be the only region where this raw material can be found (*Pieńkowski/Gutowski 2004*). The issues of the extraction and processing of chocolate flint in the north-eastern part of the Holy Cross Mountains are still relevant and studies within the framework of research projects, an excellent example of which are the verifications conducted in chocolate flint mines in Orońsko (Fig. 1: A) since 2016 (*Kerneder-Gubała 2016*; *Kerneder-Gubała et al. 2017*). Recently, attempts have been made at obtaining a set of diagnostic data on various "chocolate" flint in central Poland based on geochemical methods of siliceous rock identification (*Brandl et al. 2016*).

It was concluded that – besides the north-western range – chocolate flint outcrops could be found in the south-western part of the Holy Cross Mountains. Initially, it was rarely mentioned in the literature (*Kutek 1962*; *Migaszewski/Olszewska 2002*; *Migaszewski et al. 2006*) and the existence of chocolate flint in this area was confirmed and described only in the last decade (*Krajcarz/Krajcarz 2009*). These findings provided the ground for further research into the existence of chocolate flint at a larger area than initially assumed, that is on the entire surface of the outcrops of Upper Oxfordian and Lower Kimmeridgian, including in the Kraków-Częstochowa Upland (*Krajcarz et al. 2012a*; *2012b*).

Accurate identification of chocolate flint from the Kraków-Częstochowa Upland, which is macroscopically similar to that known from the Holy Cross Mountains, will allow the verification of the current state of knowledge on the subject of the distribution of this raw material. This will allow assessment of the importance of this area as an important flint production centre exploited in the Palaeolithic, Mesolithic and Neolithic. The results will be important for future research, not only on the Upland itself, but also on other regions located both in Poland and in neighbouring countries, especially for the Moravia (e.g. *Přichystal 2018*; *Valoch 2001*), Bohemia (e.g. *Burgert 2018*; *Mateiciucová 2008*) and Slovakia (e.g. *Kaczanowska 1985*; *Kozłowski 2013*; *Nemergut 2020*; *Soják 2002*).

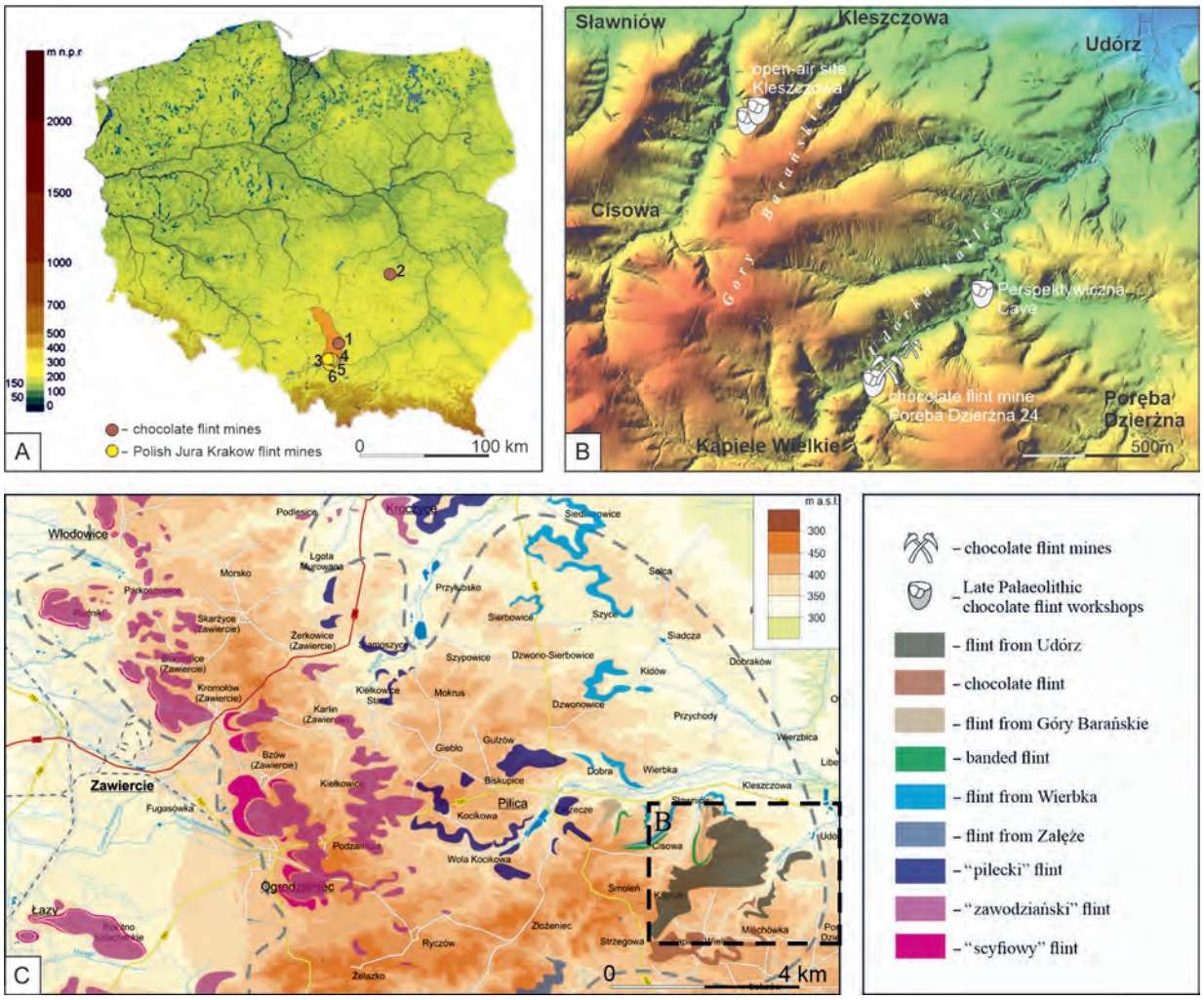


Fig. 1. Location of regions and sites included in the project. A – map of Poland with the selected area Kraków-Częstochowa Upland and sites described in the text (1 – Poręba Dzierżna 24; 2 – Orońsko; 3 – Sąspów; 4 – Bębło; 5 – Zelków; 6 – Mników); B – Udorka Valley region with the location of sites related to exploitation and further processing of chocolate flint (after *Sudoł-Procyk/Krajcarz 2021*, with author changes); C – map of raw materials on the Ryczów Upland (after *Sudoł-Procyk/Cyrek, in press*, with author changes).

CHOCOLATE FLINT OUTCROPS ON THE CENTRAL PART KRAKÓW-CZĘSTOCHOWA UPLAND

In the last decade, in the central part of the Kraków-Częstochowa Upland, the team headed by geologist M. Krajcarz conducted intensive research into finding and documenting siliceous raw materials outcrops there. The studies revealed significant diversification of siliceous raw materials and the existence of new outcrops, particularly the Ryczów Upland. The outcrops of high-quality chocolate flint situated in the Udorka Valley are particularly distinctive (Fig. 1: B, C; *Sudoł-Procyk et al. 2018*).

The Udorka Valley region is densely forested and divided by deep gorges, which makes it difficult to conduct prospective surface surveys. It was only in 2013 that the flint deposits could be precisely localised, whereas anthropogenic pits were discovered in the outcrop area two years later. Flint semi-raw material in the form of flakes and numerous concretions, including initially processed ones that are the remnants of mine workshops dealing in the initial processing of raw materials, were documented in their vicinity, particularly in at the edge of the slope. Conducted in 2018 and 2019, survey studies confirmed that the pits were mines (*Krajcarz/Sudoł-Procyk 2019b*; *Sudoł-Procyk/Krajcarz/Krajcarz 2018*).

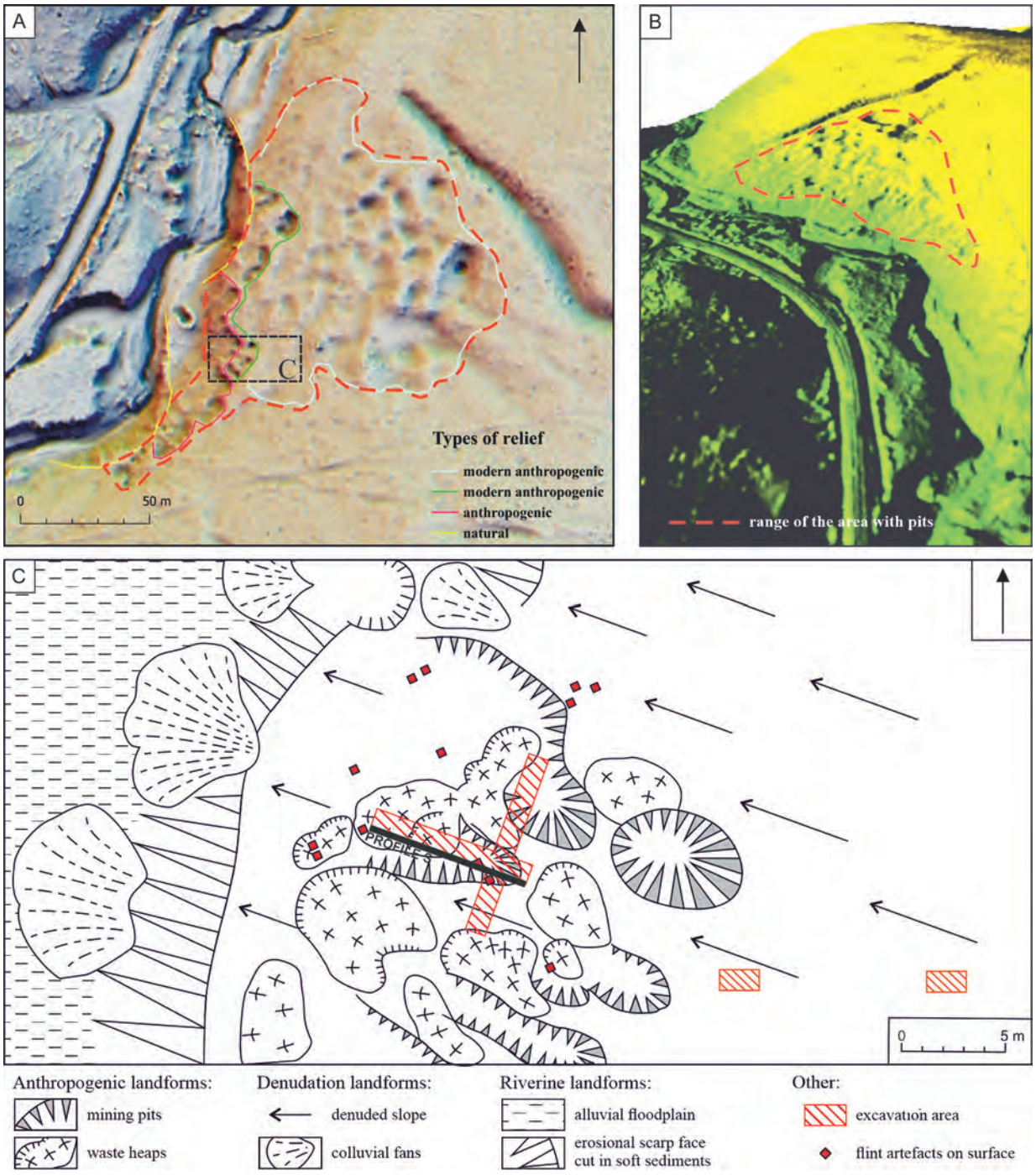
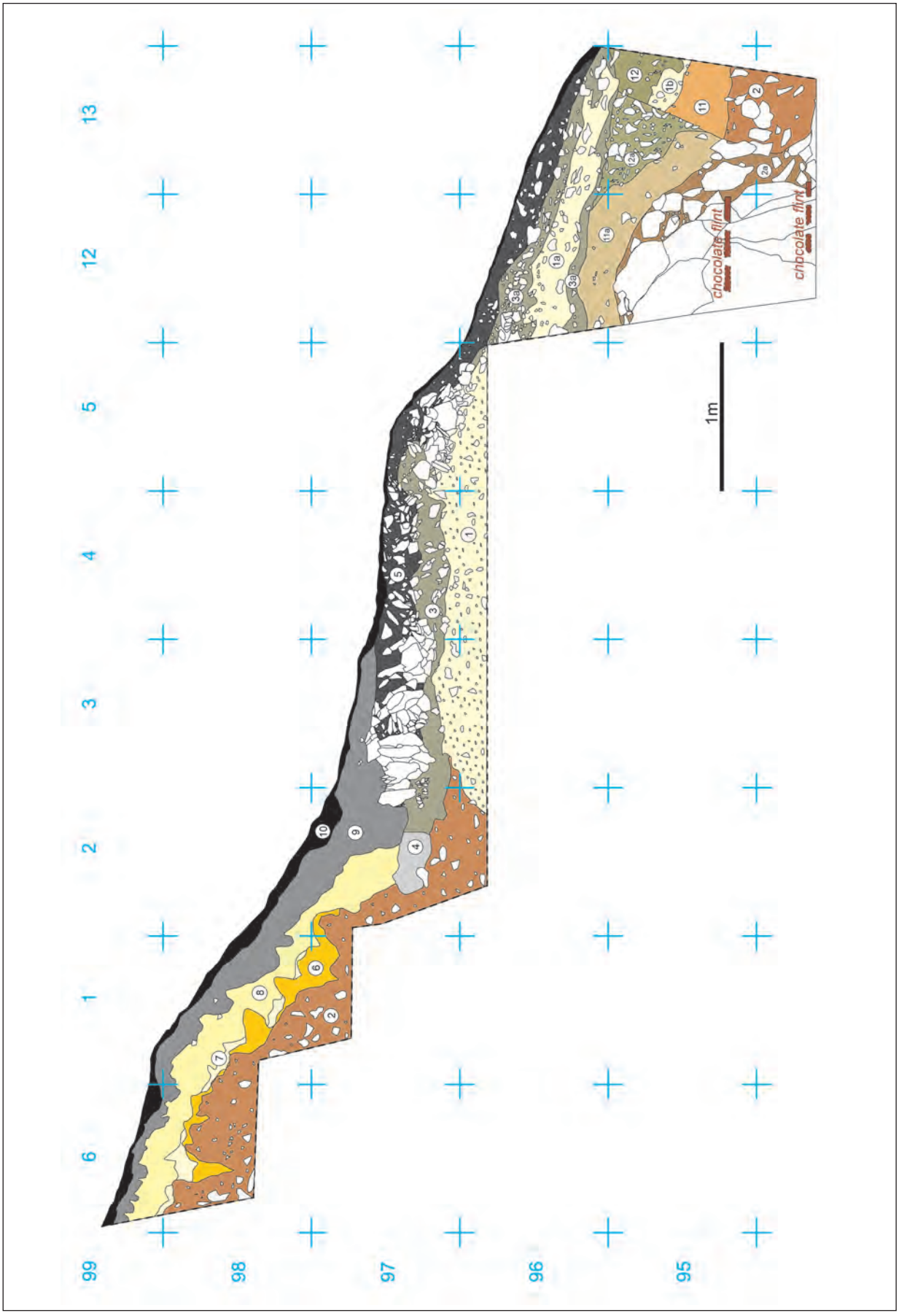


Fig. 2. Poręba Dzierżna 24, com. Wolbrom, małopolskie voiv. A, B – LiDAR photograph displaying an image of outcrops chocolate flint in Udorka Valley and anthropogenic holes around them (after *Sudoł-Procyk et al. 2018* with author changes); C – geomorphology and the progress of archaeological works (after *Krajcarz/Sudoł-Procyk 2019b*, with author changes).

CHOCOLATE FLINT MINE IN THE UDORKA VALLEY

The area of chocolate flint outcrops in the south-eastern part of the Ryczów Upland and newly discovered traces of anthropomorphic pits, which are the remains of prehistoric miners (open-air site Poręba Dzierżna 24; Fig. 1: A), is situated in the Udorka Valley (the region of Poręba Dzierżna village, com. Wolbrom, małopolskie voivodeship; Fig. 1: B).


99
98
97
96
95
6
1
2
3
4
5
12
13
1m
chocolate flint
chocolate flint

An important piece of information is that there are several prehistoric flint mines in the Kraków-Częstochowa Upland, but they are related to another type of raw material – Polish Jura Kraków flint (Polish: krzemień jurajski according to *Ginter/Kozłowski 1969*). These sites are concentrated in the southern part of the area of Jurassic deposits, near the Ojców National Park (Fig. 1: A). They are related to the activities of early Neolithic communities, e.g. Sąspów or Bębło, Kraków district (e.g. *Dzieduszycka-Machnikowa/Lech 1976*), but also with the manufacture of modern gunflints, for example at Zelków or Mników (e.g. *Ginter/Kowalski 1964*; *Werra et al. 2019*).

Before starting excavations, the terrain was subject to investigations carried out by a research team headed by Ph.D. J. Budziszewski, using a method of the Airborne Laser Scanning (ALS; *Sudoł-Procyk et al. 2018*; *Sudoł-Procyk/Krajcarz 2021*).

The LiDAR analysis confirmed a preliminary evaluation of the ground relief around the chocolate flint outcrops (Fig. 2: A, B). At higher elevation, there is a vast area where pits of varied shape and depth occur. This zone ranges up to 100 m away from the valley bottom and covers an area of ca. 0.7 hectares. The higher on the slope, the bigger and deeper are the pits. The features situated below usually have diameters of few meters only. Their relief is so blurred that it is impossible to determine the number of outcrops unambiguously. To the south-west from them, at the edge of the valley, vast niches were recorded, extending over a distance of nearly 100 m. Within them, there are many small pits with diameters of a few meters, which can be described as niches opened towards the valley. This indicates that these forms were shaped through exploitation activities repeated multiple times, though always performed on a small scale. At the lowest altitude, at the very edge of the valley, there were captured two vast erosional niches being a result of bank erosion transforming the channel of the Udorka stream (*Sudoł-Procyk et al. 2018*).

Fig. 4. Poręba Dzierżna 24, com. Wolbrom, małopolskie voiv. Two levels of chocolate flint in the rock (photo by M. Sudoł-Procyk).

In 2018 and 2019, an exploratory survey was carried out (Fig. 2: C). To obtain the most accurate information about the nature of the pits and their stratigraphic relationships with the flint deposit, two trenches along and across the slope were created, with a width of 1 m, perpendicular to each other. Besides, in the higher but flatter area, two small trenches were established (*Krajcarz/Sudoł-Procyk 2019b*).

Fig. 3. Poręba Dzierżna 24, com. Wolbrom, małopolskie voiv. Cross-section (profile S) along the slope in the area of chocolate flint mine in Udorka Valley (after *Krajcarz/Sudoł-Procyk 2019b*). Description of layers: 1 – light gray loam with large amount of weathered fine limestone debris; 1a, 1b – light gray loam with large amount of weathered fine limestone debris (re-deposited material of layer 1?); 2 – orange clay loam with a natural weathered flint concretions; 2a – orange evacuated clay (re-deposited material of layer 2, possibly mixed with material of layer 11a); 3 – dark grayish brown loess with fine limestone debris; 4 – gray loess; 5 – black humiferous sediment with large amount of limestone stabs and limestone debris; 6 – orange loess – Bt horizon of a paleosol with single flint artefacts; 7 – light gray loess – Et horizon of a paleosol, without flint artefacts; 8 – re-deposited yellowish loess – BC horizon of a modern luvisol – a layer with flint artefacts; 8a – yellowish loess similar to layer 8, darker; 9 – black humiferous silt – AE horizon of a modern luvisol, possibly partially re-deposited by colluvial processes; 10 – contemporary litter – O horizon of a modern luvisol; 11 – orange-brown silt with fine limestone debris – a layer with flint artefacts; 11a – orange-brown silt with fine and coarse limestone debris (re-deposited material of layer 11, a backfill of the pit) – single flint products; 12 – gray-brown silty sand with large amount of limestone debris; 12a – gray-brown silty sand strongly with numerous intercalations of light gray silt (similar to layer 1) with large amount of limestone debris, possibly composed of mixed material of layers 12, 3a and 1a (re-deposed layer 12?, a backfill of the pit).

Fig. 5. Poręba Dzierżna 24, com. Wolbrom, małopolskie voiv. Condition of chocolate flint products. A – from the surface; B – from the loess deposits (photo by M. Sudoł-Procyk).

In the zone of the lowest position in relation to the valley bottom, the exploration of sediments was carried out until the limestone bedrock was reached, namely to the depth of ca. 2 m beneath the ground surface (Fig. 3). The profile established at this spot appeared to be extremely interesting since it allowed to capture the very edge of a pit, a mining shaft maybe, which cuts the sediments accumulated on the slope. These sediments were residues of mining heaps and colluvial loess deposits, the latter contained flint artefacts. This indicates a certain chronological relationship: the mining-related features were younger than colluvial processes that had disturbed the loess site with flint assemblage. In the lower part of the trench, two levels of chocolate flint within a solid rock were encountered. Based on the data obtained from this spot, it could be stated that apart from the chocolate flint level within the residual clay, nearby the outcrops, there were at least two other chocolate flint layers within the limestone, spaced at an interval of ca. 0.5 m (Fig. 3; 4; *Krajcarz/Sudoł-Procyk 2019b*).

A great majority of flint artefacts occurred within the redeposited loess sediments in the higher part of the slope (Fig. 3). A cross-section through these sediments obtained in the transverse trench (across the slope) revealed activity of erosion processes and an occurrence of erosional structures, filled up with colluvial loess containing flint material. The material had likely been primarily deposited at the more elevated, flatter region above the pits, and was secondarily relocated downward the slope. What is

of particular importance, the loess sediments were cut by small ice wedge pseudomorphs down to the depth of 0.5 m (Fig. 3). Forms of this type are exclusively associated with cool periglacial climate, which is believed to occur in Poland for the last time during the Younger Dryas. This constitutes a terminus ante quem for flint artefacts lying within those sediments and indicates their Pleistocene chronology (*Sudoł-Procyk/Krajcarz 2021*).

The research revealed the presence of a very large flint material in all trenches. A great majority of flint artefacts were encountered within the redeposited loess sediments recorded in the higher parts of the slope. On a small area, in total, nearly 2000 flint products were discovered. The artefacts lying on the ground surface or slightly below are more or less patinated (Fig. 5: A), which makes them different from those discovered within the deeper loess deposits. The latter is not covered with patina at all (Fig. 5: B).

The most numerous group are flakes (48%), followed by flint processing waste products (29%). Their bulbs are clearly visible, which indicates that they were detached with use of a hard hammer. Most of them come from the stage of initial preparation of cores, based on the occurrence of numerous cortical flakes. There is also a significant number of technical flakes, mostly core-tablets and platform rejuvenation flakes. Noteworthy categories amongst the assemblage are also those associated with natural concretions (8%), concretions with single scars (7%), and cores (5%). Within the group of cores, the forms with crested edges are distinctive; this kind of treatment was determined by a slab-like shape of natural flint concretions. The least numerous are blades (2%) and tools (1%). The latter are considered to represent mining tools, and they include sidescrapers, denticulated and notches pieces, as well as few burins (*Sudoł-Procyk/Krajcarz 2021*). A great majority of them are strongly charred, and in their closest surroundings, a large amount of charcoals was recorded.

During the research, archaeological features were documented in all trenches. These features were filled up with barren loess, in which there are numerous flint products and charcoals.

Raised by the issue of the chronology of the mine chocolate flint in the Udorka Valley are controversies, since the flint materials gathered there so far do not provide a basis for its undisputable dating. Further studies, especially the results of radiocarbon dating, should contribute to more accurate determining of this site chronology. Nevertheless, there is a number of premises indicating that, at least to some extent, human activity at this site can be associated with the Late Palaeolithic (*Sudoł-Procyk 2020*; *Sudoł-Procyk/Krajcarz 2021*). This reasoning is supported by stratigraphic data gathered in the surroundings of the prehistoric mine as well as results of studies conducted at the sites in Kleszczowa and Perspektywiczna Cave (Fig. 1: B; *Sudoł et al. 2016*), revealing a high contribution of chocolate flint and analogous nature of pre-cores and initial cores. Noteworthy is the fact that in the closest neighbourhood of these sites no younger workshops (e.g. Neolithic) were identified, the production of which was based on chocolate flint (*Sudoł-Procyk 2020*).

USE AND DISTRIBUTION OF CHOCOLATE FLINT IN THE KRAKÓW-CZĘSTOCHOWA UPLAND

Chocolate flint is one of the most renowned types of silicite raw materials used in prehistory, which occurs in the territory of Poland (*Budziszewski 2008*). Known and utilized since Middle Palaeolithic (*Cyrek et al. 2010*; *2014*) to Iron Age (*Lech/Lech 1997*), it has a pick of popularity during Late Palaeolithic and is common in the Magdalenian and Swiderian lithic inventories.

In Kraków-Częstochowa Upland sites with inventories of chocolate flint dating back to all periods in prehistory have been recorded in the Upland, mainly in the central and southern parts. The earliest inventories are connected with the Middle Palaeolithic layers of the cultural sequence from the Biśnik Cave (*Cyrek/Sudoł 2008*) and the Ciemna Cave (*Sobczyk/Valde-Nowak 2013*). Besides, single specimens were documented in the Wylotne Shelter (*Sudoł 2013*). A series of siliceous artefacts that can be dated to the late phase of the Middle Palaeolithic and the early phase of the Upper Palaeolithic were registered when the collection of A. Jura and L. Sawicki from the Zwierzyniec 1 site was organised. Chocolate flint occurred in Gravettian inventories discovered at the Kraków-Spadzista site (*Sobczyk 1995*) and Jaksice II site (*Wilczyński/Wojtal 2011*). Chocolate flint from the late glacial period was identified, among others, in Magdalenian workshop sites near Brzoskwinia in the southern part of the Kraków-Częstochowa Upland (*Sobczyk 1993*). Its presence was confirmed at the Epigravettian Targowisko 10 site (*Wilczyński*

2009). Moraines were indicated as a possible source of some flint from this site. Research conducted in recent years in the southern part of the Ryczów Upland contributed to the discovery of sites that confirm the presence of flint outcrops and exploitation. The inventories from the Perspektywiczna Cave in the Udorka Valley and the nearby open site in Kleszczowa support the opinion that local chocolate flint was used in the periods of Upper and Lower Palaeolithic (*Sudoł et al. 2016*; *Sudoł-Procyk et al. 2018*). The use of chocolate flint in the Epipalaeolithic is relatively well confirmed in the inventories of the Swiderian culture at the Kraków-Bieżanów 15 site (*Stefański/Wilczyński 2012*). The presence of chocolate flint in this culture lasted until the late Epipalaeolithic and was recorded, among others, at the Kraków-Kurdwanów 10 site dated to the Boreal (*Roczkalski/Włodarczak 2002*; *Stefański 2017*). Chocolate flint was also found at a Mesolithic site in Glanów (*Zając 2001*).

The fact that chocolate flint can be found in the Neolithic inventories of the Upland is also extremely interesting. Generally, the deposits of this raw material are scarce; nevertheless, considerable amounts were recorded at the border sites in the south of the Upland, e.g. Targowisko 10 and 11 (*Wilczyński 2014*). A significant amount of chocolate flint – considered as an import from the Holy Cross Mountains – was found in the area of Wieliczka Foothills in the communities of Linear Pottery and Malice Cultures. This is extremely interesting because it seems that these communities use mainly local deposits and conduct flint-making activity in deposits. Comprehensive research into the southern part of the Upland and the border areas in terms of the verification of chocolate flint deposits together with a description of the petrological features of the artefacts could explain why so much chocolate flint was recorded in the Neolithic communities that lived in the Wieliczka-Bochnia area and usually processed local flint raw materials.

CONCLUSIONS AND RESEARCH PERSPECTIVES

Chocolate flint-bearing strata both in the Holy Cross Mountain and in Ryczów Upland are close in a stratigraphic sense to the boundary between Oxfordian and Kimmeridgian geological stages (*Pieńkowski/Gutowski 2004*; *Sudoł-Procyk et al. 2018*). Due to a monoclinal structure of Kraków-Częstochowa Upland, the outcrops of the Oxfordian-Kimmeridgian boundary occur close to the north-east edge of the upland (*Krajcarz 2017*; *Krajcarz, in press*). This situation suggests that the outcrops of rocks that may contain chocolate flint are possibly concentrated along the entire eastern edge of the Kraków-Częstochowa Upland (*Krajcarz/Sudoł-Procyk 2019a*). The awareness of the importance of discovering new chocolate flint outcrops and exploitation sites in the Ryczów Upland, resulted in the decision to expand the research area to the entire Kraków-Częstochowa Upland. These works will be possible thanks to the implementation of a five-year grant from the National Science Center, under the title "Chocolate flint on the Kraków-Częstochowa Upland. Mining, use and distribution".

The main objective of the project is a detailed examination of the distribution of chocolate flint deposits throughout the entire Kraków-Częstochowa Upland, in the context of its exploitation sites and the role that this raw material played in particular periods of prehistory.

Raw material identification by method Multi Layered Chert Sourcing Approach (MLA) has successfully been used previously for chert materials from other parts of Europe (*Brandl 2016*; *Brandl et al. 2018*), and therefore it is planned to apply this method to this project.

The answer to the question about the route travelled by a particular flint product (i.e. where the raw material was excavated and what happened to it) is crucial for understanding the mechanisms of human activity in the past. Scheduled research tasks, such as geological mapping of deposits, excavation at the chocolate flint exploitation site (mine) in the Udorka Valley and a thorough archival analysis of inventories based on this raw material, are particularly important for studies on the use of local resources and determining the share of so-called imports in the inventories of prehistorical sites located in the area of the Polish Jura.

The discovery of chocolate flint outcrops in the central part of the Upland and – in the context thereof – the Late Palaeolithic open-air and cave sites and workshops (Fig. 1: B, C), constitutes an important criterion for considering the exploitation of local deposits and their use in particular periods in prehistory. Earlier interpretations indicated that the chocolate flint found at prehistoric sites in the Kraków-Częstochowa Upland was imported from the outcrops in the north-eastern part of the Holy Cross Mountains (*Cyrek/Sudoł 2008*).

An important part of further research will be the accurate identification of other potential chocolate flint extraction sites in the Kraków-Częstochowa Upland and determining their nature and extent. The results will provide ground for future research in the Upland itself and other regions situated in Poland (Silesia, Wielkopolska, Podkarpacie) and abroad (Moravia, Bohemia, Slovakia).

Acknowledgements

The field studies were supported by grants of National Science Centre, Poland, No. 2014/15/D/HS3/01302 and 2018/30/E/HS3/00567. The author thanks for the information on sites related to the use of chocolate flint in the prehistory of the Kraków-Częstochowa Upland, with special thanks to E. Trela-Kieferling and D. Stefański.

Translated by author and Magdalena Kopczyńska

BIBLIOGRAPHY

Brandl 2016 — M. Brandl: The Multi Layered Chert Sourcing Approach (MLA). Analytical Provenance Studies of Silicite Raw Materials. *Archeometriai Műhely* 13, 2016, 145–156.

Brandl et al. 2016 — M. Brandl/Ch. Hauzenberger/M. M. Martinez/P. Filzmoser/D. H. Werra: The Application of the Multi-Layered Chert Sourcing Approach (MLA) for the Characterisation and Differentiation of 'Chocolate Silicites' from the Holy Cross Mountains, South-Central Poland. Archaeologia Austriaca. *Zeitschrift zur Archäologie Europas Journal on the Archaeology of Europe* 100, 2016, 119–149.

Brandl et al. 2018 — M. Brandl/M. M. Martinez/Ch. Hauzenberger/P. Filzmoser/P. Nymoen/N. Mehler: A multi-technique analytical approach to sourcing Scandinavian flint. Provenance of ballast flint from the shipwreck "Leirvigen 1", Norway. *PLoS One* 13, 2018, e0200647. DOI: https://doi.org/10.1371/journal.pone.0200647

Budziszewski 2008 — J. Budziszewski: Stan badań nad występowaniem i pradziejową eksploatacją krzemieni czekoladowych. In: W. Borkowski/J. Libera/B. Sałacińska/S. Sałaciński (eds.): *Studia nad gospodarką surowcami krzemiennymi w Pradziejach. Krzemień czekoladowy w pradziejach*. Studia nad gospodarką surowcami krzemiennymi w pradziejach 7. Warszawa – Lublin 2008, 33–106.

Burgert 2018 — P. Burgert: The Status and the Role of "Chocolate" Silicite in the Bohemian Neolithic. *Archaeologia Polona* 56, 2018, 49–64.

Cyrek/Sudoł 2008 — K. Cyrek/M. Sudoł: Wyroby z krzemienia czekoladowego w środkowopaleolitycznych zespołach kulturowych z J. Biśnik, pow. Olkuski. In: W. Borkowski/J. Libera/B. Sałacińska/S. Sałaciński (eds.): *Studia nad gospodarką surowcami krzemiennymi w Pradziejach. Krzemień czekoladowy w pradziejach.* Studia nad gospodarką surowcami krzemiennymi w pradziejach 7. Warszawa – Lublin 2008, 347–356.

Cyrek et al. 2010 — K. Cyrek/P. Socha/K. Stefaniak/T. Madeyska/J. Mirosław-Grabowska/M. Sudoł/Ł. Czyżewski: Palaeolithic of Biśnik Cave within the environmental background. *Quaternary International* 220, 2010, 5–30. DOI: https://doi.org/10.1016/j.quaint.2009.09.014

Cyrek et al. 2014 — K. Cyrek/M. Sudoł/Ł. Czyżewski/G. Osipowicz/M. Grelowska: Middle Palaeolithic cultural levels from Middle and Late Pleistocene sediments of Biśnik Cave, Poland. *Quaternary International* 326–327, 2014, 20–63. DOI: https://doi.org/10.1016/j.quaint.2013.12.014

Dzieduszycka-Machnikowa/Lech 1976 — A. Dzieduszycka-Machnikowa/J. Lech: *Neolityczne zespoły pracowniane z kopalni krzemienia w Sąspowie.* Wrocław – Warszawa – Kraków – Gdańsk 1976.

Ginter/Kowalski 1964 — B. Ginter/S. Kowalski: Produkcja skałek do broni palnej i jej znaczenie dla poznania krzemieniarstwa czasów przedhistorycznych. *Materiały Archeologiczne* 5, 1964, 83–89.

Ginter/Kozłowski 1969 — B. Ginter/J. K. Kozłowski: *Technika obróbki i typologia wyrobów kamiennych paleolitu i mezolitu.* Kraków 1969.

Kaczanowska 1985 — M. Kaczanowska: *Rohstoffe Technik und Typologie der Neolithischen Feuersteinindustrien im Nordteil des Flussgebietes der Mitteldonau*. Warszawa 1985.

Kerneder-Gubała 2016 — K. Kerneder-Gubała: In Search of the Chocolate Flint Mine in Orońsko (PL1, South. Poland). New Data for Analysis of Exploitation and Use of Flint in North-Western part of Its Outcrops. In: H. Collet/A. Hauzeur (eds.): *Mining and Quarrying. Abstract Book. 7th International Conference in Mons and Spiennes (Belgium).* Spiennes 2016, 27.

Kerneder-Gubała et al. 2017 — K. Kerneder-Gubała/N. Buławka/S. Buławka/M. Szubski: Gis w badaniach powierzchniowych stanowisk górniczych na przykładzie kopalni krzemienia

czekoladowego w Orońsku (gm. Orońsko, pow. szydłowiecki, woj. mazowieckie). *Archeologia Polski* 62, 2017, 7–37.

Kozłowski 2013 J. K. Kozłowski: Raw materials procurement in the Late Gravettian of the Carpathian Basin. In: Z. Mester (ed.): *The lithic raw material sources and interregional human contacts in the Northern Carpathian Basin*. Kraków – Budapest 2013, 63–85.

Krajcarz 2017 M. T. Krajcarz: Mapping the chert deposits on the Polish Jura. In: *Krzemień jurajski w pradziejach, 28–30 września 2017 r. Kraków – Jurassic flint in Prehistory, 28–30 September 2017.* Kraków 2017, 7.

Krajcarz, in press M. T. Krajcarz: Kartowanie pradziejowych złóż krzemienia na Wyżynie Krakowsko-Częstochowskiej. In: *Krzemień jurajski w pradziejach 9*. Warszawa – Kraków, in press.

Krajcarz/Krajcarz 2009 M. T. Krajcarz/M. Krajcarz: The outcrops of jurassic flint raw materials from south-western margin of the Holy Cross Mountains. *Acta Archaeologica Carpathica* 44, 2009, 183–195.

Krajcarz et al. 2012a M. T. Krajcarz/M. Krajcarz/M. Sudoł/K. Cyrek: From far or from near? Map of silicate raw material outcrops around the Biśnik Cave. In: P. Neruda/Z. Nerudová (eds.): *Abstract Book 9th SKAM. Lithic Raw Materials – Phenomena of the Stone Age*. Brno 2012, 15, 16.

Krajcarz et al. 2012b M. T. Krajcarz/M. Krajcarz/M. Sudoł/K. Cyrek: From far or from near? Sources of Kraków-Częstochowa banded and chocolate silicite raw material used during the Stone Age in Biśnik Cave (Southern Poland). *Anthropologie* 50, 2012, 411–425.

Krajcarz/Sudoł-Procyk 2019a M. T. Krajcarz/M. Sudoł-Procyk: The deposits of chocolate flint in Kraków-Częstochowa Upland. In: D. Werra/M. Sudoł-Procyk/A. Jedynak/K. Kaptur/M. T. Krajcarz (eds.): *UISPP Commission on Flint Mining in Pre- and Protohistoric Times "The filint mining studies. Archaeological excavations – extraction methods – chipping floors – distribution of raw materials nad workshop products"*. Program – Abstracts – Field Guide, 19th–21th September 2019. Ostrowiec Świętokrzyski 2019, 13–15.

Krajcarz/Sudoł-Procyk 2019b M. T. Krajcarz/M. Sudoł-Procyk: The mine of chocolate flint in the Udorka Valley (Kraków-Częstochowa Upland), Field Trip Guide. In: D. Werra/M. Sudoł-Procyk/A. Jedynak/K. Kaptur/M. T. Krajcarz (eds.): *UISPP Commission on Flint Mining in Pre- and Protohistoric Times "The filint mining studies. Archaeological excavations – extraction methods – chipping floors – distribution of raw materials nad workshop products"*. Program – Abstracts – Field Guide, 19th–21th September 2019. Ostrowiec Świętokrzyski 2019, 33–37.

Krukowski 1923 S. Krukowski: Sprawozdanie z działalności państwowego konserwatora zabytków przedhistorycznych na okręg kielecki w r. 1922. *Wiadomości archeologiczne* 8, 1923, 64–84.

Kutek 1962 J. Kutek: Cherts and submarine slumps in the Lower Kimmeridgian limestones from the vicinity of Małogoszcz (Central Poland). *Acta Geologica Polonica* 12, 1962, 377–391.

Lech/Lech 1997 H. Lech/J. Lech: Górnictwo krzemienia w epoce brązu i wczesnej epoce żelaza. Badania uroczyska „Zele" w Wierzbicy, woj. Radomskie. In: J. Lech/D. Piotrowska (eds.): *Z badań nad krzemieniarstwem epoki brązu i wczesnej epoki żelaza*. Warszawa 1997, 95–113.

Mateiciucová 2008 I. Mateiciucová: *Talking Stones: The Chipped Stone Industry in Lower Austria and Moravia and the Beginnings of the Neolithic in Central Europe (LBK), 5700–4900).* Dissertationes Archaeologicae Brunenses/Pragensesque 4. Brno 2008.

Migaszewski et al. 2006 Z. M. Migaszewski/A. Gałuszka/T. Durakiewicz/E. Starnawska: Middle Oxfordian – Lower Kimmeridgian chert nodules in the Holy Cross Mountains, South-Central Poland. *Sedimentary Geology* 187, 2006, 11–28.

Migaszewski/Olszewska 2002 Z. M. Migaszewski/B. Olszewska: Sedimentary breccia in the "Głuchowiec" quarry at Małogoszcz (SE Holy Cross Mts) – contribution to the origin of Upper Jurassic cherts in the Holy Cross Mountains. *Przegląd Geologiczny* 50, 2002, 1145–1148.

Nemergut 2020 A. Nemergut: Najnovšie doklady mezolitického osídlenia na Hornej Orave. In: J. Gancarski (ed.): *Epoka kamienia w Krapatach polskich*. Krosno 2020, 83–104.

Pieńkowski/Gutowski 2004 G. Pieńkowski/J. Gutowski: Genesis of the Upper Oxfordian flints in Krzemionki Opatowskie, Poland. *Volumina Jurassica* 2, 2004, 29–36.

Přichystal 2018 A. Přichystal: Artefacts Made from Siliceous Rocks of Polish Origin on Prehistoric Sites in the Czech Republic. *Archaeologia Polona* 56, 2018, 35–48.

Roczkalski/Włodarczak 2002 — B. Roczkalski/P. Włodarczak: Obozowisko późnopaleolityczne w Krakowie-Kurdwanowie (st. 10). In: P. Włodarczak (ed.): *Południowe obejście Krakowa. Materiały z epoki kamienia i z wczesnych okresów epoki brązu*. Kraków 2002, 11–104.

Samsonowicz 1923 — J. Samsonowicz: O złożach krzemieni w utworach jurajskich północnowschodniego zbocza Gór Świętokrzyskich. *Wiadomości archeologiczne* 8, 1923, 17–24.

Schild 1971 — R. Schild: Lokalizacja prehistorycznych punktów eksploatacji krzemienia czekoladowego na północno-wschodnim obrzeżeniu Gór Świętokrzyskich. *Folia Quaternaria* 39, 1971, 1–61.

Sobczyk 1993 — K. Sobczyk: *The Late Palaeolithic Flint Workshops at Brzoskwinia Krzemionki near Kraków*. Kraków 1993.

Sobczyk 1995 — K. Sobczyk: *Osadnictwo wschodniograweckie w dolinie Wisły pod Krakowem*. Kraków 1995.

Sobczyk/Valde-Nowak 2013 — K. Sobczyk/P. Valde-Nowak: Long-distance imports of raw material in the Palaeolithic inventories of the Ciemna Cave (themain chamber sequence). In: Z. Mester (ed.): *The lithic raw material sources and interregional human contacts in the Northern Carpathian regions*. Kraków – Budapest 2013, 53–61.

Soják 2002 — M. Soják: Osídlenie horného Spiša na sklonku staršej doby kamennej. In: J. Garncarski (ed.): *Starsza i środkowa epoka kamienia w Karpatach polskich*. Krosno 2002, 255–278.

Stefański 2017 — D. Stefański: Tanged Point Technocomplex – Swiderian, but what else? New findings from Kraków region, Southern Poland. *Quartär* 64, 2017, 241–264.

Stefański/Wilczyński 2012 — D. Stefański/J. Wilczyński: Extralocal raw materials in the Swiderian culture: case study of Kraków-Bieżanów sites. *Anthropologie* 50, 2012, 427–442.

Sudoł 2013 — M. Sudoł: *Kultura mikocka na ziemiach polskich*. PhD. Thesis. Nicolaus Copernicus University in Toruń. Toruń 2013. Unpublished.

Sudoł et al. 2016 — M. Sudoł/K. Cyrek/M. T. Krajcarz/M. Krajcarz: Around the Biśnik Cave – The area of human penetration during Palaeolithic. *Anthropologie* 44, 2016, 49–68.

Sudoł-Procyk 2020 — M. Sudoł-Procyk: Magdalenian settlement in the south-eastern part of the Ryczów Upland (Polish Jura). New data and the importance of the region. *Anthropologie* 58, 2020, 285–302.

Sudoł-Procyk et al. 2018 — M. Sudoł-Procyk/J. Budziszewski/M. T. Krajcarz/M. Jakubczak/M. Szubski: The chocolate flint mines in the Udorka Valley (Częstochowa Upland) – a preliminary report on the field and lidar surveys. In: D. H. Werra/M. Woźny (eds.): *Between History and Archaeology Papers in honour of J. Lech*. Oxford 2018, 89–102.

Sudoł-Procyk/Cyrek, in press — M. Sudoł-Procyk/K. Cyrek: Krzemienie jurajskie w paleolicie środkowej części Jury Polskiej. In: *Studia nad Gospodarką Surowcami Krzemiennymi w Pradziejach*. Krzemień jurajski w pradziejach 9, in press.

Sudoł-Procyk/Krajcarz 2021 — M. Sudoł-Procyk/M. T. Krajcarz: The use of landscape and georesources at microregional scale during the younger part of the Late Glacial in the south-eastern part of Ryczów Upland (Polish Jura). In: F. Bostyn/F. Giligny/P. Topping (eds.): *From Mines to Users*: *Production and Procurement Systems of Siliceous Rocks in the European Neolithic and Bronze Age*. Oxford 2021, 16–30.

Sudoł-Procyk/Krajcarz/Krajcarz 2018 — M. Sudoł-Procyk/M. T. Krajcarz/M. Krajcarz: The use of landscape and georesources at microregional scale during Late Glacial and Early Holocene – the case study of Udorka Valley (Polish Jura). In: F. Bostyn/F. Giligny/P. Topping (eds.): *Book of abstracts. 18th UISPP World Congress 4–9 june 2018*. Paris 2018, 2376–2377.

Valoch 2001 — K. Valoch: Das Magdalénien in Mähren. 130 Jahre Forschung. *Jahrbuch des Römisch- Germanischen Zentralmuseums* 48, 2001, 103–159.

Werra et al. 2019 — D. H. Werra/M. Woźny/M. Brandl/Ch. Hauzenberger: History of research and flint exploitation in Zelków (South Poland) – gunflint workshop – the use and meaning of flint in modern times. *Anthropologica et Præhistorica* 128 (2017), 2019, 57–69.

Wilczyński 2009 — J. Wilczyński: Targowisko – a new Late Glacial site in south. Poland. *Eurasian Prehistory* 6, 2009, 96–118.

Wilczyński 2014 — J. Wilczyński: Paleolityczne oraz mezolityczne wyroby kamienne ze stan. 10, 11 w Targowisku, pow. wielicki. In: A. Zastawny (ed.): *Via Archaeologica. Źródła z badań wykopaliskowych na trasie autostrady A4 w Małopolsce. Targowisko, stan. 10, 11, osadnictwo z epoki kamienia*. Kraków 2014, 21–62.

Wilczyński/Wojtal 2011 — J. Wilczyński/P. Wojtal: Jaksice II – a new Gravettian site in south. Poland. *Přehled výzkumů* 52, 2011, 37–41.

Zając 2001 — M. Zając: Zabytki mezolityczne w zbiorach Muzeum Archeologicznego w Krakowie i ich znaczenie dla poznania mezolitu strefy wyżynnej w Polsce. *Materiały archeologiczne* 32, 2001, 19–37.

Wychodnie krzemienia czekoladowego na Wyżynie Krakowsko-Częstochowskiej

Stan wiedzy nad wydobywaniem, użytkowaniem i dystrybucją surowca oraz perspektywy badawcze

Magdalena Sudoł-Procyk

Streszczenie

Z terenu Polski wyróżniającym się pod kątem walorów technicznych jak i wizualnych surowcem jest krzemień czekoladowy. Do niedawna znany był wyłącznie z wychodni *in situ* w NE rejonie Gór Świętokrzyskich. W ostatnich latach poza tą strefą Gór Świętokrzyskich, krzemień czekoladowy został stwierdzony także w ich SW części. Te ustalenia dały przesłanki do dalszych badań, nad występowaniem krzemienia czekoladowego w szerszym zakresie niż pierwotnie uważano, tzn. na całej powierzchni wychodni skał górnego Oksfordu i dolnego Kimerydu, włączając Wyżynę Krakowsko-Częstochowską. Wyjątkowo interesujący okazał się rejon SE części Wyżyny Częstochowskiej, gdzie ujawniono duże zróżnicowanie surowców krzemiennych z wyróżniającymi się na ich tle wychodniami wysokiej jakości krzemienia czekoladowego zlokalizowanymi w rejonie Doliny Udorki.

Badania w Dolinie Udorki doprowadziły do odkrycia w rejonie wychodni krzemienia czekoladowego dołów o charakterze antropogenicznym (stan. Poręba Dzierżna 24, gm. Wolbrom, woj. małopolskie). W 2018 i 2019 roku przeprowadzono badania sondażowe, które potwierdziły obecność szybów o charakterze górniczym, dochodzących do złóż krzemienia czekoladowego w skale. Dotychczasowe badania wykazały, że większość wyrobów krzemiennych wystąpiła w redeponowanych osadach lessowych.

Dalsze badania na stanowisku, zwłaszcza wyniki datowań radiowęglowych oraz OSL, powinny przyczynić się do dokładniejszego określenia chronologii tego miejsca. Na podstawie dotychczas pozyskanych danych (stratygraficznych, techno-typologicznych i porównawczych), można wnioskować, że przynajmniej w pewnym stopniu działalność człowieka na stanowisku może być związana z późnym paleolitem i mezolitem. Na uwagę zasługuje fakt, że w najbliższym sąsiedztwie zidentyfikowano schyłkowopaleolityczne i mezolityczne pracownie oparte na krzemieniu czekoladowym (np. Kleszczowa, Jaskinia Perspektywiczna), natomiast zupełnie brak młodszych (np. neolitycznych).

Świadomość rangi odkrycia nowych wychodni krzemienia czekoladowego i miejsc eksploatacji surowca w Dolinie Udorki, zaowocowała decyzją o rozszerzeniu obszaru badań na całą Wyżynę Krakowsko-Częstochowską, w ramach pięcioletniego grantu finansowanego przez Narodowe Centrum Nauki pt. „Krzemień Czekoladowy na Wyżynie Krakowsko-Częstochowskiej. Wydobywanie, użytkowanie i dystrybucja". Zaplanowane zadania badawcze, takie jak mapowanie geologiczne złóż, badania kopalni oraz analiza archiwalnych inwentarzy opartych na krzemieniu czekoladowym, są szczególnie istotne dla badań nad wykorzystaniem lokalnych zasobów tego surowca oraz określeniu udziału tzw. importu w inwentarzach prehistorycznych stanowisk położonych w Polsce, jak i zagranicą (Morawy, Czechy, Słowacja).

Ryc. 1. Lokalizacja regionów i stanowisk objętych projektem. A – mapa Polski z zaznaczonym obszarem Wyżyny Krakowsko-Częstochowskiej i stanowiskami opisanymi w tekście (1 – Poręba Dzierżna 24; 2 – Orońsko; 3 – Sąspów; 4 – Bębło; 5 – Zelków; 6 – Mników); B – rejon Doliny Udorki z lokalizacją stanowisk związanych z eksploatacją i dalszą obróbką krzemienia czekoladowego (za *Sudoł-Procyk/Krajcarz 2021*, ze zmianami); C – mapa surowców na Wyżynie Ryczowskiej (za *Sudoł-Procyk/Cyrek, in press*, ze zmianami).

Ryc. 2. Poręba Dzierżna 24, gm. Wolbrom, woj. małopolskie. A, B – zdjęcie LiDAR przedstawiające wychodnie krzemienia czekoladowego w Dolinie Udorki i antropogeniczne zagłębienia na ich obszarze (za *Sudoł-Procyk et al. 2018* ze zmianami); C – geomorfologia i zasięg prac archeologicznych (za *Krajcarz/Sudoł-Procyk 2019b*, ze zmianami).

Ryc. 3. Poręba Dzierżna 24, gm. Wolbrom, woj. małopolskie. Przekrój wzdłuż dolnej części stoku (profil S) na obszarze kopalni krzemienia czekoladowego w Dolinie Udorki (za *Krajcarz/Sudoł-Procyk 2019b*). Opis warstw: 1 – jasnoszary osad ilasty z dużą ilością zwietrzałego drobnego gruzu wapiennego; 1a, 1b – jasnoszary osad ilasty z dużą ilością zwietrzałego drobnego gruzu wapiennego (redeponowana warstwa 1?); 2 – pomarańczowa glina ilasta z naturalnymi zwietrzałymi konkrecjami krzemiennymi; 2a – pomarańczowa glina (redeponowana warstwa 2, ewentualnie zmieszana z warstwą 11a); 3 – ciemnoszarobrązowy less z drobnymi kawałkami wapienia; 4 – szary

less; 5 – czarny osad próchniczny z dużą ilością płyt i okruchów wapiennych; 6 – pomarańczowy less (poziom Bt gleby kopalnej), bez artefaktów krzemiennych; 7 – jasnoszary less (poziom Et gleby kopalnej), z wyrobami krzemiennymi; 8 – żółtawy less redeponowany (poziom BC współczesnej gleby), z artefaktami krzemiennymi; 8a – żółtawy less zbliżony do warstwy 8, ciemniejszy; 9 – ciemnoszary próchniczny osad pylasty (horyzont AE współczesnej gleby), prawdopodobnie częściowo redeponowany procesami koluwialnymi; 10 – humus (poziom O współczesnej gleby); 11 – pomarańczowo-brązowy pył z drobnymi kawałkami wapienia, warstwa z artefaktami krzemiennymi; 11a – pomarańczowo-brunatny pył z drobnymi i grubymi kawałkami wapiennia (redeponowana warstwa 11, zasypisko wkopu), pojedyncze wyroby krzemienne; 12 – szarobrązowy piasek pylasty z dużą zawartością gruzu wapiennego; 12a – szarobrązowy piasek pylasty z licznymi wtrąceniami jasnoszarego pyłu (podobnie jak w warstwie 1), z dużą ilością rumoszu wapiennego, być może zbudowany z mieszanego materiału warstw 12, 3a i 1a (redeponowana warstwa 12, zasypisko wkopu).

Ryc. 4. Poręba Dzierżna 24, gm. Wolbrom, woj. małopolskie. Dwa poziomy krzemienia czekoladowego w skale (foto M. Sudoł-Procyk).

Ryc. 5. Poręba Dzierżna 24, gm. Wolbrom, woj. małopolskie. Stan zachowania wyrobów z krzemienia czekoladowego. A – na powierzchni; B – z osadów lessowych (foto M. Sudoł-Procyk).

Magdalena Sudoł-Procyk, Ph.D.
Department of Environmental Archeology & Human Paleoecology
Institute of Archaeology, Faculty of History
Nicolaus Copernicus University in Toruń
Szosa Bydgoska 44/48
PL – 87-100 Toruń
sudol@umk.pl

ISSN 0560-2793